SINAMICS S120

Commissioning Manual 11/2009





SIEMENS

SINAMICS

S120 SINAMICS S120 Commissioning Manual

Commissioning Manual

Preface

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Applies to: Firmware Version 4.3 SP1

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 product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation for the specific task, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

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

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Disclaimer of Liability

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

Siemens AG Industry Sector Postfach 48 48 90026 NÜRNBERG GERMANY Order number: 6SL3097-4AF00-0BP0 (P) 02/2010

Preface

SINAMICS documentation

The SINAMICS documentation is organized in two parts:

- General documentation/Catalogs
- Manufacturer/service documentation

A current overview of the documentation in the available languages is provided on the Internet:

http://www.siemens.com/motioncontrol

Select the menu items "Support" --> "Technical Documentation" --> "Overview of Publications."

The Internet version of DOConCD (DOConWEB) is available on the Internet:

http://www.automation.siemens.com/doconweb

Information on the range of training courses and FAQs (Frequently Asked Questions) are available on the Internet:

http://www.siemens.com/motioncontrol

Select the menu item "Support".

Usage phases and their tools/documents (as an example)

| Usage phase | Document/tool |
|------------------------|--|
| Orientation | SINAMICS S Sales Documentation |
| Planning/configuration | SIZER Configuration Tool |
| | Configuration Manuals, Motors |
| Deciding/ordering | SINAMICS S Catalogs |
| Installation/assembly | SINAMICS S120 Manual for Control Units and Additional System Components |
| | SINAMICS S120 Manual for Booksize Power Units |
| | SINAMICS S120 Manual for Chassis Power Units |
| | SINAMICS S120 Manual for AC Drives |
| Commissioning | STARTER parameterization and commissioning tool |
| | SINAMICS S120 Getting Started |
| | SINAMICS S120 Commissioning Manual |
| | SINAMICS S120 CANopen Commissioning Manual |
| | SINAMICS S120 Function Manual |
| | SINAMICS S120/S150 List Manual |
| Usage/operation | SINAMICS S120 Commissioning Manual |
| | SINAMICS S120/S150 List Manual |

 Table 1
 Usage phases and the available documents/tools

| Usage phase | Document/tool |
|-----------------------|------------------------------------|
| Maintenance/servicing | SINAMICS S120 Commissioning Manual |
| | SINAMICS S120/S150 List Manual |
| References | SINAMICS S120/S150 List Manual |

Target group

This documentation is intended for machine manufacturers, commissioning engineers, and service personnel who use the SINAMICS S drive system.

Benefits

The Commissioning Manual describes all the information, procedures and operational instructions required for commissioning and servicing SINAMICS S120.

Search tools

The following guides are provided to help you locate information in this manual:

- 1. Contents
- 2. List of abbreviations
- 3. Index

Standard scope

The scope of the functionality described in this document may differ from the scope of the functionality of the drive system that is actually supplied.

- It may be possible for other functions not described in this documentation to be executed in the drive system. However, no claim can be made regarding the availability of these functions when the equipment is first supplied or in the event of servicing.
- Functions that are not available in a particular product version of the drive system may be described in the documentation. The functionality of the supplied drive system should only be taken from the ordering documentation.
- Extensions or changes made by the machine manufacturer must be documented by the machine manufacturer.

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

Technical Support

If you have any questions, please contact us on the following hotline:

| | Europe/Africa |
|----------|--|
| Phone | +49 180 5050 - 222 |
| Fax | +49 180 5050 - 223 |
| Internet | http://www.siemens.de/automation/support-request |

| | America |
|--------|------------------------------------|
| Phone | +1 423 262 2522 |
| Fax | +1 423 262 2200 |
| E-mail | mailto:techsupport.sea@siemens.com |

| | Asia/Pacific |
|--------|--|
| Phone | +86 1064 757 575 |
| Fax | +86 1064 747 474 |
| E-mail | mailto:support.asia.automation@siemens.com |

Note

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

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

Calls are subject to charge (e.g. € 0.14/min from fixed lines within Germany).

Tariffs of other phone providers may differ.

Questions on the manual

If you have any questions (suggestions, corrections) regarding this documentation, please fax or e-mail us at:

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

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

Internet address for SINAMICS

http://www.siemens.com/sinamics

Notation

The following notation and abbreviations are used in this documentation:

Notation for parameters (examples):

- p0918 Adjustable parameter 918
- r1024 Visualization parameter 1024
- p1070[1] Adjustable parameter 1070, index 1
- p2098[1].3 Adjustable parameter 2098, index 1, bit 3
- p0099[0...3] Adjustable parameter 99, indices 0 to 3
- r0945[2](3) Visualization parameter 945, index 2 of drive object 3
- p0795.4 Adjustable parameter 795, bit 4

Notation for faults and alarms (examples):

- F12345 Fault 12345
- A67890 Alarm 67890

ESD Notes

Electrostatic sensitive devices (ESD) are single components, integrated circuits or devices that can be damaged by electrostatic fields or electrostatic discharges.

Regulations for the ESD handling:

During the handling of electronic components, pay attention to the grounding of the person, workplace and packaging!

Electronic components may be touched by persons only when

- these persons are grounded using an ESD bracelet, or
- these persons in ESD areas with a conducting floor wear ESD shoes or ESD grounding straps.

Electronic components should be touched only when this is unavoidable. The touching is permitted only on the front panel or on the circuit board edge.

Electronic components must not be brought into contact with plastics or clothing made of artificial fibers.

Electronic components may only be placed on conducting surfaces (table with ESD coating, conducting ESD foamed material, ESD packing bag, ESD transport container).

Electronic components may not be placed near display units, monitors or televisions (minimum distance from the screen > 10 cm).

Measurements must only be taken on boards when the measuring instrument is grounded (via protective conductors, for example) or the measuring probe is briefly discharged before measurements are taken with an isolated measuring device (for example, touching a bare metal housing).

Safety notices



- The successful and safe operation of this equipment and motors is dependent on professional transport, storage, installation and mounting as well as careful operations, service and maintenance.
- Information and data from the catalogs and quotations also apply to special versions of the equipment and motors.
- In addition to the danger and warning information provided in the technical customer documentation, the applicable national, local, and plant-specific regulations and requirements must be taken into account.
- Only protective extra-low voltages (PELV) that comply with EN60204-1 may be connected to all connections and terminals between 0 and 48 V.

- The motors can have surface temperatures of over +80 °C.
- This is why temperature-sensitive components, e.g. cables or electronic components must not be in contact with or attached to the motor.
- When connecting up cables, please ensure that they
 - are not damaged
 - are not subject to tensile stress
 - cannot be touched by rotating components.

- As part of routine tests, SINAMICS devices with three-phase motors undergo a voltage test in accordance with IEC 61800. Before the voltage test is performed on the electrical equipment of industrial machines to EN 60204-1, Section 18.4, all connectors of SINAMICS devices must be disconnected/withdrawn to prevent the equipment from being damaged.
- Motors should be connected up according to the circuit diagram provided otherwise they may be destroyed.

Terminals for pulse inhibit (EP terminals)

The Safe Torque Off (STO) safety function **must** be parameterized in order to use the pulse inhibit terminals at the Motor Modules, booksize, booksize compact, chassis and Cabinet Modules and at the Power Modules, chassis and blocksize. (Safety Integrated Basic Functions or Extended Functions)

Here, the procedure is described in the FHS and FH1 Function Manuals.

Note

When operated in dry areas, SINAMICS devices with three-phase motors conform to Low-Voltage Directive 2006/95/EC.

Preface

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Preparations for Commissioning

Before commissioning observe the conditions described in this chapter.

- The preconditions for commissioning must be fulfilled (in the next chapter)
- The relevant checklist must have been worked through
- The BUS components required for communication must be wired up
- DRIVE-CLiQ wiring rules must be complied with (refer to the examples)
- ON-OFF drive responses

1.1 Requirements for commissioning

1.1 Requirements for commissioning

The following are necessary for commissioning a SINAMICS S drive system:

- STARTER commissioning tool
- An interface, e.g. PROFIBUS, CANbus, PROFINET or serial
- Completely wired-up drive line-up (see the Manual)

The following diagram shows a sample configuration with booksize and chassis components.



Figure 1-1 Component configuration (example)

1.2 Check lists to commission SINAMICS S

Checklist (1) for commissioning booksize power units

The following checklist must be carefully observed. Read the safety instructions in the Manuals before starting any work.

Table 1-1 Checklist for commissioning (booksize)

| Check | ОК |
|--|----|
| Are the environmental conditions in the permitted range? | |
| Is the component firmly attached to the fixing points provided? | |
| Is the specified air flow for cooling the devices ensured? | |
| Have the ventilation clearances for the components been observed? | |
| Is the memory card correctly inserted in the Control Unit? | |
| Are all necessary components of the configured drive line-up available, installed and connected? | |
| Do the temperature monitoring circuits fulfill the specifications of protective separation according to DIN EN 61800-5-1? | |
| Have the DRIVE-CLiQ topology rules been observed? | |
| Have the line-side and motor-side power cables been dimensioned and routed in accordance with the environmental and routing conditions? | |
| Have the maximum permissible cable lengths between the frequency converter and the motor (depending on the type of cables used) been observed? | |
| Have the power cables been properly connected to the component terminals with the specified torque? | |
| Have all of the remaining screws been tightened to the specified torque? | |
| Has all wiring work been successfully completed? | |
| Are all connectors correctly plugged in and screwed in place? | |
| Have all the covers for the DC link been closed and latched into place? | |
| Have the screens been correctly connected through a large surface area? | |

Checklist (2) for commissioning chassis power units

The following checklist must be carefully observed. Read the safety instructions in the Manuals before starting any work.

Table 1-2 Checklist for commissioning (chassis)

| Activity | ОК |
|---|----|
| Are the environmental conditions in the permitted range? | |
| Are the components correctly installed in the cabinets? | |
| Is the specified air flow for cooling the devices ensured? | |
| Is an air short-circuit between the air inlet and outlet for the chassis components prevented by the installation arrangements? | |
| Have the ventilation clearances for the components been observed? | |
| Is the memory card correctly inserted in the Control Unit? | |

1.2 Check lists to commission SINAMICS S

| Activity | ОК |
|---|----|
| Are all necessary components of the configured drive line-up available, installed and connected? | |
| Do the temperature monitoring circuits fulfill the specifications of protective separation according to DIN EN 61800-5-1? | |
| Have the DRIVE-CLiQ topology rules been observed? | |
| Have the line-side and motor-side power cables been dimensioned and routed in accordance with the environmental and routing conditions? | |
| Have the maximum permissible cable lengths between the frequency converter and the motor (depending on the type of cables used) been observed? | |
| Is the ground for the motors directly connected to the ground for the Motor Modules (shortest distance)? | |
| Are the motors connected with shielded power cables? | |
| Are the power cable shields connected as closely as possible to the terminal box across a wide area? | |
| Have the power cables been properly connected to the component terminals with the specified torque? | |
| Have all of the remaining screws been tightened to the specified torque? | |
| Has the total power of the DC busbar been dimensioned sufficiently? | |
| Has the busbar/wiring for the DC connection between the infeed and the Motor Modules been dimensioned sufficiently with regard to the load and installation conditions? | |
| Are the cables between the low-voltage switchgear and the power unit protected with line fuses? Line protection ⁽¹⁾ should be taken into account. | |
| Have measures been taken to relieve strain on the cables? | |
| For external auxiliary infeed: Have the cables for the auxiliary infeed been connected according to the Manual? | |
| Have the control cables been connected in accordance with the required interface configuration and the shield applied? | |
| Have the digital and analog signals been routed with separate cables? | |
| Has the distance from power cables been observed? | |
| Has the cabinet been properly grounded at the points provided? | |
| Has the connection voltage for the fans in the chassis components been adapted accordingly to the supply voltages? | |
| For operation on non-grounded supply systems: Has the connection bracket for the interference suppression on the infeeds been removed? | |
| Is the period from the date of manufacture to initial commissioning or the downtime of the power components less than two years ⁽²⁾ ? | |
| Is the drive operated by higher-level controller/control room? | |

Checklist (3) for commissioning blocksize Power Modules

The following checklist must be carefully observed. Read the safety instructions in the Manuals before starting any work.

| Table 1- 3 | Check list for | commissioning | blocksize |
|------------|----------------|---------------|-----------|
|------------|----------------|---------------|-----------|

| Check | ОК |
|--|----|
| Are the environmental conditions in the permitted range? | |
| Is the component firmly attached to the fixing points provided? | |
| Is the specified air flow for cooling the devices ensured? | |
| Have the ventilation clearances for the components been observed? | |
| Is the memory card correctly inserted in the Control Unit? | |
| Are all necessary components of the configured drive line-up available, installed and connected? | |
| Do the temperature monitoring circuits fulfill the specifications of protective separation according to DIN EN 61800-5-1? | |
| Have the line-side and motor-side power cables been dimensioned and routed in accordance with the environmental and routing conditions? | |
| Have the maximum permissible cable lengths between the frequency converter and the motor (depending on the type of cables used) been observed? | |
| Have the power cables been properly connected to the component terminals with the specified torque? | |
| Have all of the remaining screws been tightened to the specified torque? | |
| Has all wiring work been successfully completed? | |
| Are all connectors correctly plugged in and screwed in place? | |
| Have the screens been correctly connected through a large surface area? | |

⁽¹⁾ Combined fuses are recommended for conductor and semi-conductor protection (VDE 636, Part 10 and Part 40 / EN 60269-4). For information about the relevant fuses, see the catalog.

⁽²⁾ If the downtime period is longer than two years, the DC link capacitors must be reformed (see the "Maintenance and Servicing" chapter in the Manual). If the downtime period is less than two years, reforming is not necessary. The cabinet rating plate can be used to ascertain the date of manufacture.

1.3 PROFIBUS components

1.3 PROFIBUS components

We recommend the following components for communication via PROFIBUS:

- 1. Communication modules if PG/PC interface via the PROFIBUS interface
 - CP5511 (PROFIBUS connection via PCMCIA card in the notebook as programming device)

PROFIBUS card CP5511 permits a maximum of 10 slave connections to be established. For large projects (many CUs) with several drive units - and therefore more than 10 PROFIBUS slaves - problems can be encountered when STARTER goes online with the notebook.

Remedy: Replace interface card CP5511 with a CP5512 interface card or via menu item "Select target system/target devices..." only select the drive units that you actually want to work with.

- CP5512 (PROFIBUS connection via CARDBUS)

Configuration: PCMCIA type 2 card + adapter with 9-pin SUB-D socket for connection to PROFIBUS.

For MS Windows 2000/XP Professional and PCMCIA 32 only

Order No.: 6GK1551-2AA00

- CP5611 A2 (PROFIBUS connection via short PCI card)

Configuration: Short PCI card with 9-pin SUB-D socket for connection to PROFIBUS. Not for Windows 95/98SE

Order No.: 6GK1561-1AA01

- CP5613 A2 (PROFIBUS connection via short PCI card)

Configuration: Short PCI card with 9-pin SUB-D socket for connection to PROFIBUS.

Order No.: 6GK1561-3AA01

- CP5711 (PROFIBUS connection via USB port (USB V2.0))
 Configuration: USB port (USB V2.0) + adapter with 9-pin SUB-D socket connector to connect to PROFIBUS.
 Used with driver SIMATIC Net PC Software Edition 2008 + SP2
 Order No.: 6GK1571-1AA00
- 2. Connecting cable
 - between: CP 5xxx ↔ PROFIBUS

Order No.: 6ES7901-4BD00-0XA0

- MPI cable (SIMATIC S7)

Order No.: 6ES7901-0BF00-0AA0

Cable lengths

| Table 1-4 | Permissible P | ROFIBUS | cable length: | s |
|-----------|---------------|-----------|---------------|---|
| | | 1.01.1000 | ouble longin | - |

| Baud rate [bit/s] | Max. cable length [m] |
|-------------------|-----------------------|
| 9.6 k to 187.5 k | 1000 |
| 500 k | 400 |
| 1.5 M | 200 |
| 3 to 12 M | 100 |

1.4 PROFINET components

We recommend the following components for communication via PROFINET:

1. Communication modules if PG/PC interface via the PROFINET interface

Note

A standard Ethernet interface can be used for pure commissioning with STARTER. The CBE20 supports all Ethernet cables (crossover cable and Ethernet cable).

2. Recommended connecting cable

- Industrial Ethernet FC TP Standard Cable GP 2 x 2 (up to max. 100 m)
 Standard bus cable with rigid conductors and a special design for fast installation
 Order No.: 6XV1840-2AH10
- Industrial Ethernet FC TP Flexible Cable GP 2 x 2 (up to max. 85 m)
 Order No.: 6XV1870–2B
- Industrial Ethernet FC Trailing Cable GP 2 x 2 (up to max. 85 m)
 Order No.: 6XV1870–2D
- Industrial Ethernet FC Trailing Cable 2 x 2 (up to max. 85 m)
 Order No.: 6XV1840–3AH10
- Industrial Ethernet FC Marine Cable 2 x 2 (up to max. 85 m)
 Order No.: 6XV1840–4AH10

3. Recommended connectors

 Industrial Ethernet FC RJ45 Plug 145 for Control Unit Order No.: 6GK1901-1BB30-0Ax0 1.5 Connection via serial interface

1.5 Connection via serial interface

Prerequisites

There must be a serial interface (COM) on the PC from which the connection is to be made.

Connecting cable

A zero modem cable is required to connect the serial interfaces of the PG/PC to the SINAMICS S120.

Settings

1. In the STARTER, go to **Project > Set PG/PC interface** and select the **Serial cable (PPI)** interface.

If this interface is not in the selection list, you will first have to add it using Select.

1.5 Connection via serial interface

Note

If the interface cannot be added to the selection menu, the driver for the serial interface has to be installed. This is located under the following path on the STARTER CD: \installation\starter\starter\Disk1\SerialCable_PPI\

The STARTER must not be active while the driver is being installed.

2. Enter the following settings. The "0" address and the transmission rate (e.g. 19.2 kbit/s) are important here.

| Set PG/PC Interface | × | |
|--|---|---------------------|
| Access Path Access Point of the Application: | | |
| S70NLINE (STEP 7)> Serial cable(I (Standard for STEP 7) Interface Parameter Assignment Used: | | |
| Serial cable(PPI) | Properties | |
| PC Adapter(PROFIBUS) PC COM-Port (USS) Serial cable(PPI) | PPI Local Connection Station Parameters | 0 <u>*</u> 1s • |
| OK | Network Parameters Advanced PPI Multiple Master Network Transmission <u>B</u> ate: <u>H</u> ighest Station Address: | 19.2 kbps 💌 15 💌 |
| | OK Default | Cancel Help |

Figure 1-2 Setting the interface

3. The Control Unit's PPI address is pre-set to "3" in the factory.

4. Also set the bus address to "3" during set-up, or under "properties" in the drive unit context menu.

| P | roject Wizard | Starter | | | | | × |
|---|---------------|-----------------------------|------------|---|---|---------------|---|
| | Introduction | 1. Create new project | PG/ inl | 2. 'PC - Set terface | 3. Insert drives | 4. Summary | |
| | Preview | | | Please ente Drive unit Device: Type: Version: Bus addr. Name: | r the drive unit Sinamics G150 2.4x : 3 Drive_unit | data: | |
| | | | | Sinamic | s tutorial | Insert | |
| | | < | (Back | Continu | ie > | Cancel | |

Figure 1-3 Setting the bus address

5. A null modem cable must be used to connect the PC (COM interface) to the Control Unit. This interface must not be switched.

1.6 Rules for wiring with DRIVE-CLiQ

Rules apply for wiring components with DRIVE-CLiQ. A distinction is made between **binding DRIVE-CLiQ rules**, which **must** be unconditionally observed and **recommended rules**, which**should** then be maintained so that the topology, generated offline in STARTER, no longer has to be changed.

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

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

Below you will find the binding wiring rules and some other recommendations as well as a few sample topologies for DRIVE-CLiQ wiring.

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

If the actual topology does not match the topology created offline by STARTER, the offline topology must be changed accordingly before it is downloaded.

1.6.1 General rules from CU320-2

DRIVE-CLiQ rules

The wiring rules below apply to standard cycle times (servo 125 μ s, vector 400 μ s). For cycle times that are shorter than the corresponding standard cycle times, additional restrictions apply due to the computing power of the CU (configuration via the SIZER tool).

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

- A maximum of 8 DRIVE-CLiQ nodes can be connected in one row. A row is always seen from the perspective of the Control Unit.
- A maximum of 24 nodes can be connected to one DRIVE-CLiQ line at a Control Unit.
- A maximum of 12 V/f (or 6 servo/vector) drives + infeed module + supplementary module are permitted.
- Ring wiring is not permitted.
- Components must not be double-wired.



Figure 1-4 Example: DRIVE-CLiQ line at terminal X103 of a Control Unit

- The TM54F must not be operated on the same DRIVE-CLiQ line as Motor Modules.
- The Terminal Modules TM15, TM17 and TM41 have faster sample cycles than the TM31 and TM54F. For this reason, the two Terminal Module groups must be connected to separate DRIVE-CLiQ lines.
- Only one Line Module can be connected to a Control Unit. Further Line Modules may be connected in parallel to this Line Module.
- If using chassis design components, no more than one Smart Line Module and one Basic Line Module may be jointly operated on one Control Unit (mixed operation on a DRIVE-CLiQ line).
- The default sampling times may be changed.
- A maximum of 12 Motor Modules can be connected to the CU320-2.

- Mixed operation (servo with vector V/f control) is possible.
- One servo axis corresponds to 2 V/f axes
- During mixed operation of servo and vector V/f control, separate DRIVE-CLiQ lines must be used for Motor Modules (mixed operation is not permissible on Double Motor Modules).
- For V/f control, more than 4 nodes can only be connected to one DRIVE-CLiQ line of the Control Unit.
- A maximum of 9 encoders can be connected.
- A maximum of 8 Terminal Modules can be connected to the CU320-2.
- The Active Line Module booksize and Motor Modules booksize
 - can be connected to one DRIVE-CLiQ line in **servo** mode.
 - must be connected to separate DRIVE-CLiQ lines in **vector** mode.
- The Line Module (chassis) (Active Line, Basic Line, Smart Line) and the Motor Modules (chassis) must be connected to separate DRIVE-CLiQ lines.
- Motor Modules in chassis format with different current controller cycles must be connected to separate DRIVE-CLiQ lines. For this reason, chassis Motor Modules and booksize Motor Modules must be connected to separate DRIVE-CLiQ lines.
- A maximum of 2 VSM may be connected to a Line Module.
- The Voltage Sensing Module (VSM) should be connected to a free DRIVE-CLiQ port of the corresponding Active Line Module / Motor Module (due to automatic assignment of the VSM).
- The sampling times (p0115[0] and p4099) of all components that are connected to a DRIVE-CLiQ line must be divisible by one another with an integer result. If the current controller sampling time on a DO has to be changed to another pattern that does not match the other DOs on the DRIVE-CLiQ line, the following options are available:
 - Reconnect the DO to a separate DRIVE-CLiQ line.
 - Also change the current controller sampling time and the sampling time of the inputs/outputs of the DOs not involved so that they again fit into the time grid.
- For supplementary telegrams at DRIVE-CliQ (e.g. Safety Extended, spindle sensor systems, diagnostic telegrams), the drives must distributed across various PORTS.
- For integrated platforms, a IDC(FW2.x) / SoC2 (FW4.x) combination is NOT permitted.

Note

A Double Motor Module, a DMC20, a TM54F and a CUA32 each correspond to two DRIVE-CLiQ participants. This also applies to Double Motor Modules, of which just one drive is configured.

Note

You can call up the "Topology" screen in STARTER to change and/or check the DRIVE-CLiQ topology for each drive unit.

Note

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

Recommended rules

- The DRIVE-CLiQ cable from the Control Unit must be connected to X200 on the first booksize power unit or X400 on the first chassis power unit.
- The DRIVE-CLiQ connections between the power units must each be connected from interface X201 to X200/from X401 to X400 on the follow-on component.
- A Power Module with the CUA31 should be connected to the end of the DRIVE-CLiQ line.



Figure 1-5 Example: DRIVE-CLiQ line

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

| Table 1- 5 | Connecting the motor encoder via DRIVE-CLiC |
|------------|---|
|------------|---|

| Component | Connecting the motor encoder via DRIVE-CLiQ |
|------------------------------|---|
| Single Motor Module booksize | X202 |
| Double Motor Module booksize | Motor connection X1: Encoder at X202Motor connection X2: Encoder at X203 |
| Single Motor Module chassis | X402 |
| Power Module blocksize | CUA31: Encoder at X202 |
| Power Module chassis | X402 |

Note

If an additional encoder is connected to a Motor Module, it is assigned to this drive as encoder 2 in the automatic configuration.



Figure 1-6 Example of a topology with VSM for chassis components

Table 1-6 VSM connection

| Design | Component | VSM connection |
|-----------|--------------------|--------------------------------|
| Booksize | Active Line Module | X102 at the Control Unit |
| Chassis | Active Line Module | X402 at the Active Line Module |
| Blocksize | Power Modules | The VSM is not supported. |

Note

Booksize format

The VSM must be connected to a separate DRIVE-CLiQ interface on the Control Unit.

- Only one final node should ever be connected to free DRIVE-CLiQ ports of components within a DRIVE-CLiQ line (e.g. Motor Modules wired in series), for example, one Sensor Module or one Terminal Module, without forwarding to additional components.
- If possible, Terminal Modules and Sensor Modules of direct measuring systems should not be connected to the DRIVE-CLiQ line of Motor Modules but rather to free DRIVE-CLiQ ports of the Control Unit.

1.6.2 Sample wiring for vector drives

Drive line-up comprising three Motor Modules (chassis) with identical pulse frequencies or vector (booksize)

Motor Modules (chassis) with identical pulse frequencies or vector (booksize) can be connected to a DRIVE-CLiQ interface on the Control Unit.

In the following diagram, three Motor Modules are connected to interface X101.

Note

This topology does not match the topology created offline by STARTER and must be changed.



Figure 1-7 Drive line-up (chassis) with identical pulse frequencies

Drive line-up comprising four Motor Modules (chassis) with different pulse frequencies

Motor Modules with different pulse frequencies must be connected to different DRIVE-CLiQ interfaces on the Control Unit.

In the following diagram, two Motor Modules (400 V, output \leq 250 kW, pulse frequency 2 kHz) are connected to interface X101 and two Motor Modules (400 V, output > 250 kW, pulse frequency 1.25 kHz) are connected to interface X102.

Note

This topology does not match the topology created offline by STARTER and must be changed.



Figure 1-8 Drive line-up (chassis) with different pulse frequencies

1.6.3 Sample wiring of Vector drives connected in parallel

Drive line-up with two parallel-connected Line Modules and Motor Modules (chassis) of the same type

Parallel-connected Line Modules (chassis) and Motor Modules (chassis) of the same type can be connected to a DRIVE-CLiQ interface of the Control Unit.

In the following diagram, two Active Line Modules and two Motor Modules are connected to the X100 and X101 interface.

For further information on parallel connection, see the chapter "Parallel connection of power units" in this Function Manual.

Note

This topology does not match the topology created offline by STARTER and must be changed.



Figure 1-9 Drive line-up with parallel-connected power units (chassis)

1.6.4 Sample wiring: Power Modules

Blocksize



Figure 1-10 Wiring example for Power Modules Blocksize

Chassis



Figure 1-11 Wiring example for Power Modules Chassis

1.6.5 Changing the offline topology in STARTER

The device topology can be changed in STARTER by moving the components in the topology tree.



Table 1-7 Example: changing the DRIVE-CLiQ topology
1.6.6 Sample wiring for servo drives

The following diagram shows the maximum number of controllable servo drives and extra components. The sampling times of individual system components are:

- Active Line Module: p0115[0] = 250 µs
- Motor Modules: p0115[0] = 125 µs
- Terminal Module/Terminal Board p4099 = 1 ms



Figure 1-12 Sample servo topology

1.6.7 Wiring example for vector V/f drives

The following diagram shows the maximum number of controllable vector V/f drives and extra components. The sampling times of individual system components are:

- Active Line Module: p0115[0] = 250 μs
- Motor Modules: p0115[0] = 125 μs
- Terminal Module/Terminal Board p4099 = 1 ms
- Max. 12 axes can be controlled in V/f mode



Figure 1-13 Topology example for vector V/f control

1.6.8 Notes on the number of controllable drives

1.6.8.1 Introduction

The number and type of controlled drives and the extra activated functions on a Control Unit can be scaled by configuring the firmware. The maximum possible functionality depends on the computing power of the Control Unit used and may be checked in each case using the SIZER projecting tool.

1.6.8.2 Number of controllable drives

The following specifications provide a rough guide to the potential drive numbers for each Control Unit CU320-2 DP as a function of the current and speed controller clock cycles or the sampling times of the frequency/voltage channel with vector V/f control.

Note

The following information is valid for power units of booksize and chassis format.

The maximum number of drives is reduced by one in each case when blocksize power units are used.

Servo control

- Servo without extra function modules (e.g. setpoint channel): PROFIBUS DP cycle ≥1 ms
 - 6 drives (sampling times: Current controller 125 μs / speed controller 125 μs / TM 250 μs), of which max. 3 induction motors or
 - 3 drives (sampling times: Current controller 62.5 μs / speed controller 62.5 μs / TM 250 μs), also induction motors
 - 5 drives, all induction motors (sampling times: Current controller 125 μs / speed controller 125 μs / TM 250 $\mu s)$
 - 6/5 motor measuring systems (with 6 drives/with 5 drives)
 - 6/3 direct measuring systems (125 µs / 62.5 µs current controller cycle)
 - 1 Terminal Module TM31 or 1 Terminal Board TB30 with 1 ms sampling time
 - 1 Active Line Module with 250 µs sampling time without Voltage Sensing Module
- Servo without extra function modules (e.g. setpoint channel): 500 µs and ≤ PROFIBUS DP cycle < 1 ms, valid for integrated SINAMICS drives for SIMOTION and SINUMERIK
 - 6 drives (sampling times: Current controller 125 µs / speed controller 125 µs), of which max. 2 induction motors or 3 drives (sampling times: Current controller 62.5 µs / speed controller 62.5 µs), also induction motors
 - Remaining modules as above
- Servo with CBE20 function module: PROFINET IO bus cycle time ≥ 1 ms
 - 6 drives (sampling times: Current controller 125 μs / speed controller 125 μs), of which max. 2 induction motors or
 2 drive (sampling times: current controller 62.5 μs / speed controller 62.5 μs), induction motor also possible
 - 6 motor measuring systems
 - 3 direct measuring systems
 - 1 Terminal Module TM31 or 1 Terminal Board TB30 with 1 ms sampling time
 - 1 Active Line Module with 250 µs sampling time without Voltage Sensing Module

- Servo with CBE20 function module: 500 µs ≤ PROFINET IO bus cycle time < 1 ms
 - 4 drives (sampling times: Current controller 125 μs / speed controller 125 μs), of which max. 2 induction motors or
 2 drive (sampling times: current controller 62.5 μs / speed controller 62.5 μs), induction motor also possible
 - Remaining modules as above
- Servo with EPOS function module
 - 4 drives (sampling times: current controller 125 μs / speed controller 125 μs / position controller 1 ms / positioning 4 ms)
 - 6 motor measuring systems
 - 1 Active Line Module with 250 µs sampling time without Voltage Sensing Module

Vector control (cycles for EPOS: Position controller cycle = 1 ms / IPO cycle = 4 ms)

- Vector without additional function modules
 - 3 drives (sampling times: Current controller 250 μs / speed controller 1000 μs / TM 250 $\mu s)$
 - 5 drives (sampling times: Current controller 400 μs / speed controller 1600 μs / TM 1600 $\mu s)$
 - 6 drives (sampling times: Current controller 500 μs / speed controller 2000 μs / TM 2000 μs)
- Vector with function module basic positioner (EPOS)
 - 3 drives (sampling times: Current controller 250 µs / speed controller 1000 µs)
 - 6 drives (sampling times: Current controller 500 μs / speed controller 2000 μs)

Vector control with V/f

without additional function modules

• 12 drives (sampling times: Speed controller 500 μs / TM 250 μs)

The details for the vector drives include:

- 1 Active Line Module with 250 µs (also applies to Chassis)
- 1 motor encoder per drive (not with vector V/f control)
- 1 Terminal Module TM31 or 1 Terminal Board TB30 with 1 ms sampling time

Mixed operation

- Mixed operation, servo
 - Mixed operation, servo 62.5 µs / servo 125 µs is permissible (current controller)
 - Mixed operation, servo 125 μs / servo 250 μs is permissible (current controller)
 - Other combinations of servo mixed operation are not permissible
- Mixed operation, vector
 - Mixed operation, vector 250 µs / vector 500 µs is permissible (current controller)
 - Other combinations of vector mixed operation are not permissible

- Mixed operation vector and vector V/f control
 - 2 drives (sampling times: current controller 250 μs / speed controller 1000 μs)
 - 4 drives (sampling times: current controller 500 µs / speed controller 2000 µs)
- Mixed operation of servo and vector V/f control 5 drives with the following sampling times:
 - Servo: Current controller 125 µs / speed controller 125 µs
 - Vector V/f control: Speed setting 500 µs

Note

Possible restrictions

For TM54F, TM41, TM15 and TM17 High Feature, restrictions are possible regarding the number of axes.

1.6.8.3 Using additional functions

Using EPOS

Taking into account the necessary reserves, according to the standard setting in the following table, up to 6 axes can be installed with the supplementary EPOS function:

| Current controller | Speed controller | EPOS | Axes |
|--------------------|------------------|---------|------|
| 125 µs | 125 µs | 4000 µs | 4 |
| 250 µs | 250 µs | 4000 µs | 5 |
| 250 µs | 250 µs | 8000 µs | 6 |

CU320-2 controller cycles under EPOS

Using DCC

The remaining computation times of the utilizationlevel that customers can use can be 100% freely allocated.

For a quantity structure of up to 6 axes (servo or vector), DCC is permissible as long as the remaining computation time of the standard functions in p9976 remains available; this means either by eliminating some standard features (such as the setpoint channel, DSC, TMs, TB) or by using just a few DCC blocks or only DCC blocks in extremely slow time slices.

Using Safety Integrated Extended Functions

You must carefully observe the following rules when using Safety Integrated Extended Functions:

- Maximum of 6 servo axes for default cycle time settings (monitoring cycle: 12 ms; current controller cycle: ≥ 125 µs).
- Of which a maximum of 4 servo axes in a DRIVE-CLiQ line.
- Maximum of 6 vector axes with default cycle time settings (monitoring cycle: 12 ms; current controller cycle: ≥ 250 µs).
- The TM54F must be directly connected to the CU using DRIVE-CLiQ. Motor Modules or infeed must not be connected to a TM54F.
- A Double Motor Module, a DMC20, a TM54F and a CUA32 each correspond to two DRIVE-CLiQ participants.

Additional supplementary functions

Additional supplementary functions / options, which are not included in the basic scope, can mean that the number of axes must be reduced (however, this is not mandatory).

The functions can be:

- Additional DO encoder
- Use of speed/torque feedforward control (splines)
- >0: TM15 / TM17 / TM41 / > 3 TM31
- Use of OA applications (Open Architecture)
- Extended torque control / kT estimator
- Use of APL (advanced position control: Oscillation damping, load mechanical system)
- Use of DSC (Dynamic Servo Control), splines
- More than 1 ALM
- Use of CUA (if the first components in the Topo (due to PS-IF SD))
- Use of an extended brake control
- Use of a technology controller

1.6.8.4 Optimizing DRIVE CLiQ

Symmetrical distribution for control cycles 62.5 μs and 32.5 μs

For faster computation times of the main CU, the drives must be distributed across the DRIVE-CLiQ connections as follows:

- PORT X100: Infeed, axes 2,4,6...
- PORT X101: Axes 1,3,5,...

Axes 1,2,3,4,5,6,... are intended to signify the sequence of the drive controllers.

The advantage of this arrangement is that 2 measured values are always received in parallel at the CU.

1.7 Powering-up/powering-down the drive system

Powering up the infeed



Figure 1-14 Powering up the infeed

Powering up the drive



Figure 1-15 Powering up the drive

Off responses

- OFF1
 - n_set = 0 is input immediately to brake the drive along the deceleration ramp (p1121).
 - When zero speed is detected, the motor holding brake (if parameterized) is closed (p1215). The pulses are suppressed when the brake application time (p1217) expires. Zero speed is detected if the actual speed drops below the threshold (p1226) or if the monitoring time (p1227) started when the speed setpoint ≤ speed threshold (p1226) has expired.

- OFF2
 - Instantaneous pulse suppression, the drive "coasts" to a standstill.
 - The motor holding brake (if parameterized) is closed immediately.
 - Switching on inhibited is activated.
- OFF3
 - n_set=0 is input immediately to brake the drive along the OFF3 deceleration ramp (p1135).
 - When zero speed is detected, the motor holding brake (if parameterized) is closed. The pulses are suppressed when the brake application time (p1217) expires. Zero speed is detected if the actual speed drops below the threshold (p1226) or if the monitoring time (p1227) started when the speed setpoint ≤ speed threshold (p1226) has expired.
 - Switching on inhibited is activated.

Control and status messages

| Signal name | Internal control word | Binector input | PROFdrive/Siemens telegram 1 352 |
|------------------|-----------------------|----------------------------------|-------------------------------------|
| 0 = OFF1 | STWA.00 STWAE.00 | p0840 ON/OFF1 | STW1.0 |
| 0 = OFF2 | STWA.01 STWAE.01 | p0844 1st OFF2 p0845 2nd OFF2 | STW1.1 |
| 0 = OFF3 | STWA.02 | p0848 1st OFF3 p0849 2nd OFF3 | STW1.2 |
| Enable operation | STWA.03 STWAE.03 | p0852 Enable operation | STW1.3 |

Table 1-8 Power-on/power-off control

| Table 1- 9 | Switch-in/switch-out status signal |
|------------|------------------------------------|
|------------|------------------------------------|

| Signal name | Internal status word | Parameter | PROFdrive/Siemens telegram 1 352 |
|------------------------|----------------------|-----------|-------------------------------------|
| Ready for switching on | ZSWA.00 ZSWAE.00 | r0899.0 | ZSW1.0 |
| Ready for operation | ZSWA.01 ZSWAE.01 | r0899.1 | ZSW1.1 |
| Operation enabled | ZSWA.02 ZSWAE.02 | r0899.2 | ZSW1.2 |
| Pulse inhibit | ZSWA.06 ZSWAE.06 | r0899.6 | ZSW1.6 |
| Pulses enabled | ZSWA.11 | r0899.11 | ZSW2.10 ¹⁾ |

¹⁾ only available in Interface Mode p2038 = 0

Function diagrams (see SINAMICS S120/S150 List Manual)

- 2610 Sequence control sequencer
- 2634 Missing enable signals, line contactor control
- 8732 Basic Infeed sequencer
- 8832 Smart Infeed sequencer
- 8932 Active Infeed sequencer

2.1 Procedure when commissioning

Once the basic requirements have been met, commissioning can proceed in the following steps:

Table 2-1 Commissioning

| Step | Activity |
|------|--|
| 1 | Create project with STARTER. |
| 2 | Configure the drive unit in STARTER. |
| 3 | Save the project in STARTER. |
| 4 | Go online with the target device in STARTER. |
| 5 | Load the project to the target device. |
| 6 | The motor starts to run. |

Note

If motors with a DRIVE-CLiQ interface are used, all motor and encoder data should be saved in a non-volatile manner for spare part usage of the Sensor Module on the motor via p4692 = 1 (for more information, see Function Manual).

2.1.1 Safety guidelines

A hazardous voltage will be present in all components for a further five minutes after the system has been shutdown.

Note the information on the component!

A project with Safety Integrated can be generated offline; an acceptance test must be carried out when commissioning, which is only possible online.

Note

The design guidelines and safety information in the Manuals must be carefully observed (refer to the documentation SINAMICS S120, Manual GH1).

CAUTION

In STARTER, after the changeover of the axis type via p9302/p9502 and subsequent POWER ON, the units that depend on the axis type are only updated after a project upload.

2.2 STARTER commissioning tool

Brief description

The STARTER commissioning tool is used to commission drive units from the SINAMICS product family.

STARTER can be used for the following:

- Commissioning
- Testing (via the control panel)
- Drive optimization
- Diagnostics

System prerequisites

The system requirements for STARTER can be found in the "Readme" file in the STARTER installation directory.

2.2.1 Important STARTER functions

Description

STARTER supports the following tools for managing the project:

- Restoring the factory settings
- Commissioning Wizard
- · Configuring and parameterizing a drive
- Creating and copying data sets
- Loading from the PG/PC into the target device
- Copy RAM to ROM
- Loading from the target device into the PG/PC
- Displaying toolbars

Restoring the factory settings

You can use this function to set all the parameters in the working memory of the Control Unit to the factory settings. To ensure that the data on the memory card is also reset to the factory settings, choose the "Copy from RAM to ROM" function.

This function can be activated as follows:

- Right-click Drive unit -> Target system -> Restore factory settings
- Drive unit grayed out -> "Restore factory settings" button

For more information about STARTER, see Getting Started for SINAMICS S120.

Creating and copying data sets (offline)

Drive and command data sets (DDS and CDS) can be added in the drive's configuration screen. For this, the appropriate buttons must be pressed. Before data sets are copied, all the wiring needed for both data sets should be completed.

Download to target device

You can use this function to load the current STARTER project to the Control Unit. To start, a consistency check is made for the project; if inconsistencies are detected, then the associated messages are output. You must resolve these inconsistencies before loading. If no inconsistencies are detected, then the data is loaded into the work memory of the Control Unit and then a reset is initiated.

This function can be activated as follows:

- Right-click Drive unit -> Target system -> Load to target system
- Drive unit grayed out -> "Load to target system" button
- "ONLINE/OFFLINE comparison" screen -> "Load to PG/PC" button
- Project to all drive units simultaneously:
 "Load project to target system" button, menu Project -> Load to target system

Copy RAM to ROM

You can use this function to save volatile Control Unit data to the non-volatile memory (memory card). This ensures that the data is still available after the 24 V Control Unit supply has been switched off.

This function can be activated as follows:

Extras -> Setting -> Download -> Activate "Copy from RAM to ROM"

This means that every time data is loaded to the target system by choosing "Load project to target system", the data is stored in the non-volatile memory.

- Right-click Drive unit -> Target system -> Copy from RAM to ROM
- Drive unit grayed out -> "Copy from RAM to ROM" button

Load to PG/PC

You can use this function to load the current Control Unit project to STARTER. This function can be activated as follows:

- Right-click Drive unit -> Target system -> Load to PG/PC
- Drive unit grayed out -> "Load to PG" button
- "ONLINE/OFFLINE comparison" screen -> "Load to PG" button

Displaying toolbars

The toolbars can be activated by choosing View -> Toolbars (checkmark).

For more information about data sets, refer to the Principles chapter in the FH1 Function Manual.

2.2.2 Activating online operation: STARTER via PROFIBUS

Description

The following options are available for online operation via PROFIBUS:

• Online operation via PROFIBUS

STARTER via PROFIBUS (example with two CU320-2)



Figure 2-1 STARTER via PROFIBUS 4.3

Settings in STARTER for direct online connection via PROFIBUS

The following settings are required in STARTER for communication via PROFIBUS:

• Tools -> Set PG/PC Interface...

Add/remove interfaces

• Extras -> Set PG/PC interface... -> Properties

Activate/deactivate "PG/PC is the only master on the bus".

Note

- Baud rate
 - Connect STARTER to an operational PROFIBUS: STARTER automatically detects the baud rate used by SINAMICS for PROFIBUS.
 - Switching the STARTER for commissioning: The Control Unit automatically detects the baud rate set in STARTER.
- PROFIBUS addresses

The PROFIBUS addresses for the individual drive units must be specified in the project and must match the address settings on the devices.

2.2.3 Activating online operation: STARTER via Ethernet

Description

The Control Unit can be commissioning using PG/PC via the integrated Ethernet Interface. This interface is provided for commissioning purposes only and cannot be used to control the drive in operation. Routing in conjunction with a possibly inserted CBE20 expansion card is not possible.

Preconditions

- STARTER from version 4.1.5 or higher
- Latest version of the PST initialization tool (Primary Setup Tool)

The Primary Setup Tool is available on the STARTER CD or it can be downloaded free of charge from the Internet:

http://support.automation.siemens.com/WW/view/en/19440762

STARTER via Ethernet (example)



Figure 2-2 STARTER via Ethernet (example)

Procedure for establishing online operation via Ethernet

- 1. Installing the Ethernet interface in the PG/PC according to the manufacturer's specifications
- 2. Setting the IP address in Windows XP.

The PG/PC is assigned a free IP address here (e.g. 169.254.11.1). The factory setting of the internal Ethernet interface X127 of the Control Unit is 192.254.11.22.

- 3. Setting the online interface in STARTER.
- 4. Assigning the IP address and the name via STARTER or PST (node initialization).

The Ethernet interface must be initialized so that the STARTER can establish communication. Selecting online mode in STARTER.

Setting the IP address in Windows XP

On your desktop, right-click "Network environment" -> Properties -> double-click on the network card and choose -> Properties -> Internet Protocol (TCP/IP) -> Properties -> Enter the IP addresses and the subnet mask.

| IP-Einstellungen können automatisch zu Netzwerk diese Funktion unterstützt. W den Netzwerkadministrator, um die geeig beziehen. | igewiesen werden, wenn das enden Sie sich andernfalls an gneten IP-Einstellungen zu |
|--|---|
| 🔘 IP-Adresse automatisch beziehen | |
| 📀 Folgende IP-Adresse verwenden: | |
| IP-Adresse: | 169.254.11.1 |
| Subnetzmaske: | 255.255.0.0 |
| Standardgateway: | |
| ODNS-Serveradresse automatisch b | eziehen |
| 💿 Folgende DNS-Serveradressen ve | rwenden: |
| Bevorzugter DNS-Server: | |
| Alternativer DNS-Server: | (18 8) 1 2 |
| | Erweitert |

Figure 2-3 Internet Protocol (TCP/IP) properties

Settings in STARTER

In STARTER, communication via Ethernet should be set as follows (the Ethernet interface that we use in this example has the designation Realtek RTL8139):

Tools -> Set PG/PC Interface...

| PG/PC-Schnittstelle einstellen | |
|---|-------------------------|
| | |
| Zugangspunkt der Applikation: | |
| S70NLINE (STEP 7)> TCP/IP(Auto) | -> Realtek RTL8139 Fa 💌 |
| (Standard für STEP 7) | |
| Benutzte Schnittstellenparametrierung: | |
| TCP/IP(Auto) -> Realtek RTL8139 Family | Eigenschaften |
| 🕎 TCP/IP -> VMware Virtual Etherne. 🔼 | Diagnose |
| TCP/IP(Auto) -> Atheros AR5006EI | |
| TCP/IP(Auto) -> Marvell Yukon 888 | Kopieren |
| TLP/IP(Auto) -> Realtek R1L8139 | Löschen |
| (Parametrierung für den IE-PG-Zugang Ihres NDIS-CPs mit TCP/IP Protokoll (RFC-1006)) | |
| Schnittstellen | |
| Hinzufügen/Entfernen: | Auswählen |
| ОК | Abbrechen Hilfe |

Figure 2-4 Setting the PG/PC Interface

| Eigenschaf | ten - Antriebe (online) | × |
|--|-----------------------------------|-----------------|
| Allgemein | Adressen Baugruppe | |
| Baugruppe Steckplatz Zielstation | enträger: 🚺 🐳 : 2 📑 : Cokal | |
| Ar | C Über Netzübergang z | u erreichen |
| Тур | Adresse | |
| IP | 169.254.11.22 | |
| | | |
| ОК | | Abbrechen Hilfe |

Right-click Drive unit -> Target device -> Online access -> Module address

Figure 2-5 Setting online access

Assigning the IP address and the name

Note

ST (Structured Text) conventions must be satisfied for the name assignment of IO devices in Ethernet (SINAMICS components). The names must be unique within Ethernet. The characters "-" and "." are not permitted in the name of an IO device.

Assignment with the PST initialization tool

You can use the PST initialization tool (Primary Setup Tool) to assign an IP address and a name to the Ethernet interface.

- Connect the PG/PC and CU 320-2 using an Ethernet cable.
- Switch on the Control Unit.
- Start the Primary Setup Tool (on the STARTER CD).
- Settings -> Network card -> Select the network card
- Network -> Search (or F5)
- Select the Ethernet device -> Module -> Assign name -> Enter the station name -> OK
- Module -> Load
- Network -> Search (or F5)
- Select "Int. Ethernet interface" under the Ethernet device -> Assign IP address -> Enter the IP address (factory setting 169.254.11.22) -> Enter the subnet mask (255.255.0.0). The subnet masks must match before STARTER can be run.
- Module -> Load

Note

The IP address and device name for the Control Unit are stored on the memory card (non-volatile).

Assignment with STARTER, "Accessible nodes" function

Use the STARTER to assign an IP address and a name to the Ethernet interface.

- Connect the PG/PC and the Control Unit using an Ethernet cable.
- Switch on the Control Unit.
- Open STARTER.
- Either create a new project or open an existing one
- A search is performed for available nodes in Ethernet via Project -> Accessible nodes or the "Accessible nodes" button.
- The SINAMICS drive object is detected and displayed as a bus node with IP address 192.254.11.22 and without name.
- Mark the bus node entry and select the displayed menu item "Edit Ethernet node" with the right mouse button.
- In the following "Edit Ethernet node" screen, enter the device name for the Ethernet interface and click the "Assign name" button. For the IP configuration, enter the subnet mask (255.255.0.0). Then click the "Assign IP configuration" button and close the mask.

- The "Update (F5)" button displays the IP address and name in the entry for the bus node. If not, close the "Accessible nodes" screen and perform another search for accessible nodes.
- If the Ethernet interface is displayed as bus node, mark the entry and click the "Accept" button.
- The SINAMICS drive is displayed as drive object in the project tree.
- Further configurations can be performed for the drive object.
- Click "Connect to target system" and load the project to the Control Unit's memory card with Target system -> Load -> To target device.

Note

The IP address and device name for the Control Unit are stored on the memory card (non-volatile).

Parameterizing the interface using the expert list

Assign the "Name of Station" using parameter p8900

- Assign the "IP Address of Station" using parameter p8901 (factory setting 192.254.11.22)
- Assign the "Default Gateway of Station" using parameter p8902 (factory setting 0.0.0.0)
- Assign the "Subnet Mask of Station" using parameter p8903 (factory setting 255.255.0.0)
- Activate the configuration with p8905=1
- Activate the configuration and save with p8905=2

2.2.4 Activating online operation: STARTER via PROFINET IO

Description

Online operation with PROFINET IO is implemented using TCP/IP.

Preconditions

- STARTER from version 4.1.5 or higher
- Latest version of the initialization tool PST (Primary Setup Tool)
 The Primary Setup Tool is available on the STARTER CD or it can be downloaded free of charge from the Internet:

http://support.automation.siemens.com/WW/view/en/19440762

STARTER via PROFINET IO (example)



Figure 2-6 STARTER via PROFINET (example)

Procedure for activating online mode with PROFINET

1. Setting the IP address in Windows XP

The PG/PC is assigned a fixed, free IP address here.

- 2. Settings in STARTER
- Assigning the IP address and the name via PST (node initialization) or STARTER The PROFINET interface must be given a name so that the STARTER can establish communication.
- 4. Selecting online mode in STARTER.

Setting the IP address in Windows XP

On your desktop, right-click "Network environment" -> Properties -> double-click Network card -> Properties -> Select Internet Protocol (TCP/IP) -> Properties -> Enter the freely-assignable addresses

| P-Einstellungen können automatisch etzwerk diese Funktion unterstützt. N en Netzwerkadministrator, um die ge eziehen. | zugewiesen werden, wenn das Wenden Sie sich andernfalls an eigneten IP-Einstellungen zu |
|--|---|
| 🔘 IP-Adresse automatisch bezieher | n |
| Folgende IP-Adresse verwenden | c |
| IP-Adresse: | 169.254.11.1 |
| Subnetzmaske: | 255.255.0.0 |
| Standardgateway: | |
| C\DNS.Serveradresse automatisch | hazishan |
| Folgende DNS-Serveradressen v | /erwenden: |
| Bevorzugter DNS-Server: | |
| | |
| Alternativer DMC Conver | |

Figure 2-7 Internet Protocol (TCP/IP) properties

Settings in STARTER

The following settings are required in STARTER for communication via PROFINET:

• Tools -> Set PG/PC Interface...

| PG/PC-Schnittstelle einstellen | |
|---|------------------------|
| Zugriffsweg LLDP | |
| Zugangspunkt der Applikation: | |
| S70NLINE (STEP 7)> TCP/IP(Auto) -> | 🛛 Realtek RTL8139 Fa 🕶 |
| (Standard für STEP 7) | |
| Benutzte Schnittstellenparametrierung: | |
| TCP/IP(Auto) -> Realtek RTL8139 Family | Eigenschaften |
| 🕮 TCP/IP -> VMware Virtual Etherne. 📥 | Diagnose |
| ICP/IP(Auto) -> Atheros AR5006E1 | Kopieren |
| E TCP/IP(Auto) -> Realtek RTL8139 | Löschen |
| | |
| (Parametrierung für den IE-PG-Zugang Ihres NDIS-CPs mit TCP/IP Protokoll (RFC-1006)) | |
| Schnittstellen | |
| Hinzufügen/Entfernen: | Auswählen |
| ОК | Abbrechen Hilfe |

Figure 2-8 Setting the PG/PC Interface

• Right-click Drive unit -> Target device -> Online access -> Module address

| Eigenschaf | ten - Antriebe (onlin | ne) | | |
|---|--|-----------------------|-----------|-------|
| Allgemein Baugruppe Steckplatz Zielstation | Adressen Baugruppe | übergang zu erreichen | | |
| Ar Typ IP | nschluß an Zielstation Adresse 169.254.11.22 | | | |
| ОК |] | | Abbrechen | Hilfe |

Figure 2-9 Setting online access

Assigning the IP address and the name

Note

ST (Structured Text) conventions must be satisfied for the name assignment of IO devices in PROFINET (SINAMICS components). The names must be unique within PROFINET. The characters "-" and "." are not permitted in the name of an IO device.

Assignment with the PST initialization tool

You can use the PST (Primary Setup Tool) to assign an IP address and a name to the PROFINET interface (e.g. CBE20).

- Connect the direct Ethernet cable from the PG/PC to the PROFINET interface.
- Switch on the Control Unit.
- Start the Primary Setup Tool (on the STARTER CD).
- Settings -> Network card -> Select the network card
- Network -> Search (or F5)
- Select the PROFINET device -> Module -> Assign name -> Enter the station name -> OK

- Module -> Load
- Network -> Search (or F5)
- Select "Ind. Ethernet interface" branch under the PROFINET device -> Assign IP address
 -> Enter the IP address (e.g. 169.254.11.22) -> Enter the subnet mask (e.g. 255.255.0.0)

The subnet masks must match before STARTER can be run.

Module -> Load

Note

The IP address and device name for the Control Unit are stored on the memory card (non-volatile).

Assignment with STARTER, "Accessible nodes" function

Use the STARTER to assign an IP address and a name to the PROFINET interface (e.g. CBE20).

- Connect the direct Ethernet cable from the PG/PC to the PROFINET interface.
- Switch on the Control Unit.
- Open STARTER.
- A search is performed for available nodes in PROFINET via Project -> Accessible nodes or the "Accessible nodes" button.
- The SINAMICS drive object with CBE20 is detected and displayed as a bus node with IP address 0.0.0.0 and without name.
- Mark the bus node entry and select the displayed menu item "Edit Ethernet node" with the right mouse button.
- In the following "Edit Ethernet node" screen, enter the device name for the PROFINET interface and click the "Assign name" button. Enter the IP address (e.g. 192.168.0.2) in the IP configuration and specify the subnet screen (e.g. 255.255.255.0). Then click the "Assign IP configuration" button. Close the screen.
- The "Update (F5)" button displays the IP address and name in the entry for the bus node. If not, close the "Accessible nodes" screen and perform another search for accessible nodes.
- If the PROFINET interface is displayed as bus node, mark the entry and click the "Accept" button.
- The SINAMICS drive with CBE20 is displayed as drive object in the project tree.
- Further configurations can be performed for the drive object.
- Click "Connect to target system" and load the project to the Control Unit's memory card with Target system -> Load -> To target device.

Note

The IP address and device name for the Control Unit are stored on the memory card (non-volatile).

2.3 Basic Operator Panel 20 (BOP20)

Product Brief

The Basic Operator Panel 20 (BOP20) is a basic operator panel with six keys and a 2-line display unit with background lighting. The BOP20 can be plugged onto the SINAMICS Control Unit and operated.

The following functions are possible using BOP20

- Input and changing parameters
- Display of operating modes, parameters and alarms
- Display and acknowledgement of faults
- Powering-up/powering-down while commissioning
- Simulation of a motorized potentiometer

You will find information on the operation in the next chapter

2.3.1 Operation with BOP20 (Basic Operator Panel 20)

2.3.1.1 General information about the BOP20

The BOP20 can be used to switch on and switch off drives during the commissioning phase as well as display and modify parameters. Faults can be diagnosed as well as acknowledged.

The BOP20 is snapped onto the Control Unit. To do this, the blanking cover must be removed (for additional notes on installation, see the Manual).

Overview of displays and keys



Figure 2-10 Overview of displays and keys

2.3 Basic Operator Panel 20 (BOP20)

Information on the displays

Table 2-2 LED

| Display | Meaning |
|-----------------|--|
| top left | The active drive object of the BOP is displayed here. |
| 2 positions | The displays and key operations always refer to this drive object. |
| RUN | Lit if at least one drive in the drive line-up is in the RUN state (in operation). |
| | RUN is also displayed via bit r0899.2 of the drive. |
| top right | The following is displayed in this field: |
| 2 positions | More than 6 digits: Characters that are still present but are invisible (e.g. "r2" —> 2 characters to the right are invisible, "L1" —> 1 character to the left is invisible) |
| | Faults: Selects/displays other drives with faults |
| | Designation of BICO inputs (bi, ci) |
| | Designation of BICO outputs (bo, co) |
| | • Source object of a BICO interconnection to a drive object different than the active one. |
| S | Is lit (bright) if at least one parameter was changed and the value was not transferred into the non-volatile memory. |
| Р | Is lit (bright) if, for a parameter, the value only becomes effective after pressing the P key. |
| С | Is lit (bright) if at least one parameter was changed and the calculation for consistent data management has still not been initiated. |
| Below, 6 digits | Displays, e.g. parameters, indices, faults and alarms. |

Information on the keys

Table 2-3 Keys

| Key | Name | Meaning |
|-----|-----------|---|
| | ON | Powering up the drives for which the command "ON/OFF1" should come from the BOP. |
| | | Binector output r0019.0 is set using this key. |
| Ô | OFF | Powering down the drives for which the commands "ON/OFF1", "OFF2" or "OFF3" should come from the BOP. |
| | | The binector outputs r0019.0, .1 and .2 are simultaneously reset when this key is pressed. After the key has been released, binector outputs r0019.1 and .2 are again set to a "1" signal. |
| | | Note : The effectiveness of these keys can be defined by appropriately parameterizing the BICO (e.g. using these keys it is possible to simultaneously control all of the existing drives). |
| FN | Functions | The significance of these keys depends on the actual display. |
| | | Note: The effectiveness of this key to acknowledge faults can be defined using the appropriate BiCo parameterization. |

Commissioning

2.3 Basic Operator Panel 20 (BOP20)

| Key | Name | Meaning |
|-----|------------|--|
| Ρ | Parameters | The significance of these keys depends on the actual display. |
| | | If this key is pressed for 3 s, the "Copy RAM to ROM" function is executed. The "S" displayed on the BOP disappears. |
| | Raise | The keys depend on the current display and are used to either raise or lower values. |
| | Lower | |

BOP20 functions

Table 2-4 Functions

| Name | Description |
|-------------------------|---|
| Backlighting | The backlighting can be set using p0007 in such a way that it switches itself off automatically after the set time if no actions are carried out. |
| Changeover active drive | From the BOP perspective the active drive is defined using p0008 or using the keys "FN" and "Arrow up". |
| Units | The units are not displayed on the BOP. |
| Access level | The access level for the BOP is defined using p0003. |
| | The higher the access level, the more parameters can be selected using the BOP. |
| Parameter filter | Using the parameter filter in p0004, the available parameters can be filtered corresponding to their particular function. |
| Selecting the operating | Actual values and setpoints are displayed on the operating display. |
| display | The operating display can be set using p0006. |
| User parameter list | Using the user parameter list in p0013, parameters can be selected for access. |
| Unplug while voltage is | The BOP can be withdrawn and inserted under voltage. |
| present | The ON and OFF keys have a function. |
| | When withdrawing, the drives are stopped. |
| | Once the BOP has been inserted, the drives must be switched on again. |
| | ON and OFF keys have no function |
| | Withdrawing and inserting has no effect on the drives. |
| Actuating keys | The following applies to the "P" and "FN" keys: |
| | • When used in a combination with another key, "P" or "FN" must be pressed first and then the other key. |

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2.3 Basic Operator Panel 20 (BOP20)

Overview of important parameters (see SINAMICS S120/S150 List Manual)

All drive objects

- p0005 BOP operating display selection
- p0006 BOP operating display mode
- p0013 BOP user-defined list
- p0971 Drive object, save parameters

Drive object, Control Unit

- r0002 Control Unit status display
- p0003 BOP access level
- p0004 BOP display filter
- p0007 BOP background lighting
- p0008 BOP drive object selection
- p0009 Device commissioning, parameter filter
- p0011 BOP password input (p0013)
- p0012 BOP password confirmation (p0013)
- r0019 CO/BO: Control word, BOP
- p0977 Save all parameters

Other drive objects (e.g. Servo, Vector, Infeed, TM41 etc.)

- p0010 Commissioning parameter filter
- 2.3.1.2 Displays and using the BOP20

Features

- Operating display
- Changing the active drive object
- Displaying/changing parameters
- Displaying/acknowledging faults and alarms
- Controlling the drive using the BOP20

Operating display

The operating display for each drive object can be set using p0005 and p0006. Using the operating display, you can change into the parameter display or to another drive object. The following functions are possible:

- Changing the active drive object
 - Press key "FN" and "Arrow up" -> the drive object number at the top left flashes
 - Select the required drive object using the arrow keys
 - Acknowledge using the "P" key
- Parameter display
 - Press the "P" key.
 - The required parameters can be selected using the arrow keys.
 - Press the "FN" key -> parameter r0000 is displayed
 - Press the "P" key -> changes back to the operating display

2.3 Basic Operator Panel 20 (BOP20)

Parameter display

The parameters are selected in the BOP20 using the number. The parameter display is reached from the operating display by pressing the "P" key. Parameters can be searched for using the arrow keys. The parameter value is displayed by pressing the "P" key again. You can toggle between the drive objects by simultaneously pressing the keys "FN" and the arrow keys. You can toggle between r0000 and the parameter that was last displayed by pressing the "FN" key in the parameter display.



1) You can switch between r0000 and the parameter that was last displayed by pressing the Fn key in the parameter display.

Figure 2-11 Parameter display

2.3 Basic Operator Panel 20 (BOP20)

Value display

To switch from the parameter display to the value display, press the "P" key. In the value display, the values of the adjustable parameters can be increased and decreased using the arrow. The cursor can be selected using the "FN" key.





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2.3 Basic Operator Panel 20 (BOP20)

Example: Changing a parameter

Precondition: The appropriate access level is set (for this particular example, p0003 = 3).



Figure 2-13 Example: Changing p0013[4] from 0 to 300

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2.3 Basic Operator Panel 20 (BOP20)

Example: Changing binector and connector input parameters



For the binector input p0840[0] (OFF1) of drive object 2 binector output r0019.0 of the Control Unit (drive object 1) is interconnected.

Figure 2-14 Example: Changing indexed binector parameters

2.3 Basic Operator Panel 20 (BOP20)

2.3.1.3 Fault and alarm displays

Displaying faults



Figure 2-15 Faults

Displaying alarms




2.3 Basic Operator Panel 20 (BOP20)

2.3.1.4 Controlling the drive using the BOP20

Description

When commissioning the drive, it can be controlled via the BOP20. A control word is available on the Control Unit drive object (r0019) for this purpose, which can be interconnected with the appropriate binector inputs of e.g. the drive.

The interconnections do not function if a standard PROFIdrive telegram was selected as its interconnection cannot be disconnected.

| Table 2- 5 | BOP20 control word |
|------------|--------------------|
|------------|--------------------|

| Bit (r0019) | Name | Example, interconnection parameters |
|-------------|---------------------------------|-------------------------------------|
| 0 | ON / OFF (OFF1) | p0840 |
| 1 | No coast down/coast down (OFF2) | p0844 |
| 2 | No fast stop/fast stop (OFF3) | p0848 |

Note:

For simple commissioning, only bit 0 should be interconnected. When interconnecting bits 0 \dots 2, then the system is powered-down according to the following priority: OFF2, OFF3, OFF1.

| 7 | Acknowledge fault (0 -> 1) | p2102 |
|----|--------------------------------|-------|
| 13 | Motorized potentiometer, raise | p1035 |
| 14 | Motorized potentiometer, lower | p1036 |

2.3.2 Important functions via BOP20

Description

Using the BOP20, the following functions can be executed via parameters that support you when handling projects:

- Restoring the factory settings
- Copy RAM to ROM
- Identification via LED
- Acknowledging faults

Restoring the factory settings

The factory setting of the complete device can be established in the drive object CU.

- p0009 = 30
- p0976 = 1

2.3 Basic Operator Panel 20 (BOP20)

Copy RAM to ROM

You can initiate the saving of all parameters to the non-volatile memory (memory card) in the drive object CU:

- Press the P key for 3 seconds,
- p0009 = 0

or

p0977 = 1

NOTICE

This parameter is not accepted if an identification run (e.g. motor identification) has been selected on a drive.

Identification via LED

The main component of a drive object (e.g. Motor Module) can be identified using the index of p0124. The "Ready" LED on the component starts to flash. The index matches the index in p0107. The drive object type can be identified via this parameter.

On the drive objects, the components can also be identified via the following parameters:

- p0124 Power unit detection via LED
- p0144 Voltage Sensing Module detection via LED
- p0144 Sensor Module detection via LED

Acknowledging faults

To acknowledge all the faults that have been rectified, press the Fn key.

2.4 Creating a project in STARTER

2.4.1 Creating a project offline

To create a project offline, you need the PROFIBUS address, the device type, e.g. SINAMICS S120, and the device version, e.g. firmware version 4.3.

Table 2-6 Example of a sequence for creating a project in STARTER

| | What to do? | How to do it? | Comment |
|----|----------------------|--|---|
| 1. | Create a new project | Operator action: Menu "Project"> New User projects: Projects already in the target directory Name: Project_1 (can be freely selected) Type: Project Storage location (path): Default (can be set as required) | The project is created offline and loaded to the target system when configuration is complete. |
| | | New Project User projects Name Storage path Image: project_1 Project Storage location C:\Siemens\Step7\S7proj Browse OK Cancel Help | |
| 2. | Add individual drive | Operator action: > Double-click "Add individual drive unit". Device type: SINAMICS S120 (can be selected) Device version: 4.3 (can be selected) Address type: PROFIBUS/USS/PPI (can be selected) Bus address: 37 (can be selected) | Information about the bus address: The PROFIBUS address of the Control Unit must be set for initial commissioning. Using the rotary coding switches on the Control Unit, the address can be set to a value between 1 and 126 and read via p0918. If the coding switches are at "0" (factory setting), the value can be alternatively set between 1 and 126 using p0918. |

2.4 Creating a project in STARTER

| | What to do? | How to do it? | C | omment |
|----|---------------------------|---|---|-----------------|
| | E-B project_1 | Einzelantriebsgerät einfügen Allgemein Antriebsgerät/Busadresse Gerätefamilie: S Gerät: S Gerät: S Geräteausprägung: I Ausprägung I CU310 DP I CU320 I CU320-2 DP I | SINAMICS SINAMICS S120 Bestell-Nr. SSL3 040-0LA00-0Axx SSL3 040-0LA01-0Axx SSL3 040-0MA00-0Axx SSL3 040-1MA00-0Axx | |
| | | Version: 4 Onlinezugang: F Adresse: 3 Steckplatz: | 1.3 • PROFIBUS • 17 • 2 • | |
| | | | Abbrechen Hilfe | |
| 3. | Configure the drive unit. | Once you have created the project, yo sections provide some examples. | ou have to configure the drive unit | . The following |

2.4 Creating a project in STARTER

2.4.2 Searching for a drive unit online

To search for a drive unit online, the drive unit and the PG/PC must be connected via PROFIBUS/PROFINET.

Table 2-7 Sequence for searching for a drive unit in STARTER (example)

| | What to do? | How to do it? | | |
|-----|-------------------------|---|--|--|
| 1. | Create a new project | Operator action: Menu "Project"> New with Wizard Click "Find drive unit online". | | |
| | | Project Wizard Starter | | |
| | | Introduction 1. Create new project 2. PG/PC - Set interface 3. Unset drive units 4. Summary | | |
| | | Arrange drive units offline Find drive units online Open existing project (offline) Image: Display Wizard during start Cancel | | |
| 1.1 | Enter the project data. | Project name: Project_1 (can be freely selected) Author: Any Comment: Any | | |
| | | Project Wizard Starter | | |
| | | Introduction 1. Create new project 2. PG/PC - Set interface 3. Unsert drive units 4. | | |
| | | Please enter the project data: Project_1 Autho: Storage loc: C:\Siemens\Step7\S7proj Comment: < Back | | |
| 2. | Set up the PG/PC | Here, you can set up the PG/PC interface by clicking "Change and test". | | |

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2.4 Creating a project in STARTER

| | What to do? | How to do it? |
|----|---------------|---|
| | interface | Project Wizard Starter |
| | | 1. 2. 3. 4. Introduction Create new project PG/PC - Set interface Insert drive units Summary |
| | | |
| | | Set interface: CP5511(PROFIBUS) |
| | | Change and test |
| | | < Back Continue > Cancel |
| 3. | Insert drives | Here, you can search for nodes that have been accessed. |
| | | Project Wizard Starter |
| | | 1. 2. 3. 4. Introduction Create PG/PC - Set new project Insert drive interface Summary |
| | | Preview Project_1 SINAMICS_S120_CU320 Refresh view |
| | | < Back Continue > Cancel |

2.4 Creating a project in STARTER

| | What to do? | How to do it? |
|----|---------------------------|---|
| 4. | What to do? Summary | How to do it? You have now created the project. -> Click "Complete". Project Wizard Starter Introduction 1 2 1 2 PG/PC - Set Introduction Create PG/PC - Set Insert drive Summary The following settings have been selected: Project name: Project_1 Storage location: C:\Siemens\Step7\S7proj Interface: CP5511(PR0FIBUS) Drive units: |
| | | SINAMICS_S120_CU320 (SINAMICS_S120 CU320 , A |
| 5. | Configure the drive unit. | Once you have created the project, you have to configure the drive unit. The following sections provide some examples. |

2.4.3 Searching for nodes that can be accessed

To search for a drive unit online, the drive unit and the PG/PC must be connected via PROFIBUS or PROFINET. The interface must be set correctly in STARTER.

2.5 Initial commissioning using servo (booksize) as an example

2.5 Initial commissioning using servo (booksize) as an example

The example provided in this section explains all the configuration and parameter settings, as well as the tests that are required for initial commissioning. Commissioning is carried out using the STARTER commissioning tool.

Requirements for commissioning

- 1. The commissioning requirements have been met according to Section 1.1.
- 2. The checklist for commissioning (Table 1-1 or 1-2 from Section 1.1) has been filled out and the points ticked off.
- 3. STARTER is installed and activated.
 - --> see the "Readme" file on the STARTER installation CD.
- 4. The power supply (24 V DC) is switched on.

2.5.1 Task

1. Commission a drive system with the following components:

| Table 2- 8 | Component overview |
|------------|--------------------|
| | - |

| Designation | Component | Order number | | | |
|--------------------------------|---|--------------------|--|--|--|
| Closed-loop control and infeed | | | | | |
| Control Unit 1 | Control Unit 320-2 | 6SL3040-1MA00-0AA0 | | | |
| Active Line Module 1 | Active Line Module 16 kW | 6SL3130-7TE21-6AAx | | | |
| Line filter package 16 kW | Line filter and line reactor | 6SL3000-0FE21-6AAx | | | |
| Drive 1 | | | | | |
| Motor Module 1 | Single Motor Module 9 A | 6SL3120-1TE21-0AAx | | | |
| Sensor Module 1.1 | SMC20 | 6SL3055-0AA00-5BAx | | | |
| Motor 1 | Synchronous motor | 1FK7061–7AF7x–xxxx | | | |
| Motor encoder 1 | Incremental encoder sin/cos C/D 1 Vpp 2048 p/r | 1FK7xxx–xxxxx–xAxx | | | |
| Sensor Module 1.2 | SMC20 | 6SL3055-0AA00-5BAx | | | |
| External encoder | Incremental encoder sin/cos 1 Vpp 4096 p/r | - | | | |
| Drive 2 | | | | | |
| Motor Module 2 | Single Motor Module 18 A | 6SL3120-1TE21-8AAx | | | |
| Motor 2 | Induction motor | 1PH7103–xNGxx–xLxx | | | |
| Sensor Module 2 | SMC20 | 6SL3055-0AA00-5BAx | | | |
| Motor encoder 2 | Incremental encoder sin/cos 1 Vpp 2048 p/r | 1PH7xxx-xMxxx-xxxx | | | |

1. The enable signals for the infeed and the two drives must be transmitted via PROFIBUS.

2.5 Initial commissioning using servo (booksize) as an example

- Telegram for the Active Line Module
- Telegram 370 Infeed, 1 word
- Telegram for drive 1
- Standard telegram 4: Speed control, 2 position encoders
- Enable signals for drive 2
- Standard telegram 3: Speed control, 1 position encoder

Note

For more information on the telegram types, see "Communication via PROFIBUS" or refer to the SINAMICS S120/S150 List Manual.

2.5 Initial commissioning using servo (booksize) as an example

2.5.2 Component wiring (example)

The following diagram shows a possible component configuration and wiring option. The DRIVE-CLiQ wiring is highlighted in bold.



Figure 2-17 Component wiring (example)

For more information on wiring and connecting the encoder system, see Manual.

2.5 Initial commissioning using servo (booksize) as an example

2.5.3 Signal flow for commissioning example



Figure 2-18 Signal flow for initial commissioning example (servo; part 1)

2.5 Initial commissioning using servo (booksize) as an example



Figure 2-19 Signal flow for initial commissioning example (servo; part 2)

2.5 Initial commissioning using servo (booksize) as an example

2.5.4 Commissioning with Starter (example)

The table below describes the steps for commissioning with STARTER.

Table 2-9 Sequence for commissioning with STARTER (example)

| | What to do? | How to do it? | Comment | | |
|---|---|--|---|--|--|
| 1. | Automatic | Operator action: | - | | |
| | configuration | -> "Project" -> "Connect to target system" | | | |
| | | -> Double-click "Automatic configuration". | | | |
| | | -> Follow the instructions provided in the wizard. | | | |
| Note | : | | | | |
| Whe confi the c beer com com | When the factory setting is p7826 = 1, the firmware is automatically updated to the status on the memory card when a configured DRIVE-CLiQ component is first booted. This may take several minutes and is indicated by the READY-LED on the corresponding components flashing green/red and the Control Unit flashing orange (0.5 Hz). Once all updates have been completed, the READY-LED on the Control Unit flashes orange at 2 Hz and the corresponding READY-LED on the components flashes green/red at 2 Hz. For the firmware to be activated, a POWER ON must be carried out for the components | | | | |
| 2. | Configure the infeed | The infeed must be configured. | - | | |
| | | Name of infeed -> Double-click "Configuration" -> Click "Wizard" | | | |
| 2.1 | Infeed wizard | The wizard displays the data determined automatically from the electronic rating plate. | If the line environment or DC link components are | | |
| | | You can now set the line/DC link identification. | changed, line/DC link | | |
| | | The device supply voltage must be entered; the rated line frequency is automatically determined by the firmware. | repeated. | | |
| | | "Line filter available" must be active. | | | |
| | | With a booksize infeed, one of up to three line filter types can be selected in the offered menu when this option is activated. | | | |
| | | With a chassis infeed, only one AIM line filter suitable for the infeed is automatically added with the above option. | | | |
| | | PROFIBUS telegram type 370 must be installed. | | | |
| | | Then the configuration for the infeed is completed. | | | |
| 3. | Configuring drives | The drives must be configured individually. | - | | |
| | | -> "Drives" -> Drive name -> Double-click "Configuration" -> Click "Configure DDS" | | | |
| 3.1 | Control structure | You can activate the function modules. | - | | |
| | | You can select the control type. | | | |
| 3.2 | Power unit | The wizard displays the data determined automatically from the electronic rating plate. | - | | |
| Caul If the drive | Caution If the infeed is controlled by a different Control Unit, the "Ready" signal for the infeed r0863.0 must be interconnected with drive parameter p0864 "Infeed ready" via a digital input/output. If this is not taken into account, the infeed may be | | | | |

drive parameter damaged.

2.5 Initial commissioning using servo (booksize) as an example

| | What to do? | How to do it? | Comment |
|---|-----------------------|--|--|
| 3.3 | Motor | The name of the motor (e.g. equipment marking) can be entered. Select standard motor from list: Yes Select the motor type (see rating plate). | You can select a standard motor from the motor list or you can enter the motor data manually. You can then select the motor type. |
| 3.4 | Motor brakes | Here, you can configure the brake and activate the "Extended brake control" function module. | For more information, see the Function Manual. |
| 3.5 | Motor data | You can enter the motor data on the rating plate here. Induction motors (rotary): If known, mechanical data for the motor and drive train can be entered. Synchronous motors (rotary, permanent-magnet) If known, the data for a PE spindle can be entered. | If you do not enter any mechanical data, it is estimated on the basis of the data on the rating plate. The equivalent circuit diagram data is also estimated on the basis of the data on the rating plate or determined by means of automatic motor data identification. |
| 3.6 | Encoder | Motor encoder (encoder 1): Choose standard encoder from list: Yes Select "2048, 1 Vpp, A/B C/D R" External encoder (encoder 2): rotary: Yes Measuring system: "incremental sinusoidal/cosinusoidal" Resolution: "4096" Zero mark: "No zero marker" | If you are using an encoder that is not in the list, you can also enter the data manually. |
| 3.7 | Process data exchange | PROFIBUS telegram type 4 (drive 1) and 3 (drive 2) must be selected. | - |
| 3.8 | Drive functions | Here, after entering the motor data the technological application can be selected. | Your choice of application influences the calculation for the open-loop/closed-loop control parameters. |
| 3.9 | Summary | The drive data can be copied to the clipboard for plant documentation purposes and then added to a text program, for example. | - |
| Note The reference parameters and limit values can be protected from being automatically overwritten in the STARTER by p0340 = 1: Drive -> Configuration-> Reference parameters / blocked list tab. | | | |
| 4. | Line contactor | Line contactor p0728.8 = 1 Set DI/DO as output p0738 =863.1 Line contactor ON p0860 = 723.9 Line contactor, feedback signal | The line contactor must be controlled by the infeed_1 drive object. See function diagram [8934] In the function> Line contactor control screen, you can check that the interconnection is correct. |

2.5 Initial commissioning using servo (booksize) as an example

| | What to do? | How to do it? | Comment |
|----|--|---|--|
| | Control_Unit Control_Unit Solution Configuration Control logic Solution Solution | Isolated digital inputs Bidirectional digital inputs/outputs Measuring sockets X122 Invert output 7 Input 7 Input 1 Infeed, r863: Bit 1, C0/B0: Driv 8 Input 1 Infeed, r863: Bit 1, C0/B0: Driv | Optimize view / simulation mode |
| 5. | Save the parameters on the device | Connect with target system (go online) Target system -> Download to target device Target system -> Copy from RAM to ROM (save the data on the memory card) | Position cursor on drive unit (SINAMICS S120) and right- click. |
| 6. | The motor starts to run. | The drives can be started via the control panel in STARTER. Once the pulses for the infeed have been enabled the line/DC link identification will be activated and carried out. The infeed then switches to operational mode. | For more information about the control panel, see Getting Started. The control panel supplies the control word 1 (STW1) and speed setpoint 1 (NSOLL). For more information about line/DC link identification, see the SINAMICS S120 Function Manual. |

STARTER diagnosis options

Under "Component" -> Diagnosis -> Control/status words

- Control/status words
- Status parameters
- Missing enable signals

2.6 Initial commissioning using vector (booksize) as an example

2.6 Initial commissioning using vector (booksize) as an example

The example provided in this section explains all the configuration and parameter settings as well as the tests that are required for initial commissioning. Commissioning is carried out using the STARTER commissioning tool.

Requirements for commissioning

- 1. The commissioning requirements have been met according to Section 1.1.
- 2. The checklist for commissioning (Table 1-1 or 1-2 from Section 1.1) has been filled out and the points ticked off.
- 3. STARTER is installed and ready to run.
 - --> see the "Readme" file on the STARTER installation CD.
- 4. The electronics power supply (24 V DC) is switched on.

2.6.1 Task

1. Commission a drive system with the following components:

| Designation | Component | Order number | | | |
|--------------------------------|------------------------------|--------------------|--|--|--|
| Closed-loop control and infeed | | | | | |
| Control Unit | Control Unit 320-2 | 6SL3040-1MA00-0AA0 | | | |
| Smart Line Module | Smart Line Module 10 kW | 6SL3130-6AE21-0AAx | | | |
| Line filter package 10 kW | Line filter and line reactor | 6SL3130-0GE21-0AAx | | | |
| Drive 1 | | | | | |
| Motor Module | Single Motor Module 5 A | 6SL3120-1TE15-0AAx | | | |
| Motor | Induction motor | 1LA | | | |
| Drive 2 | | | | | |
| Motor Module | Single Motor Module 5 A | 6SL3120-1TE15-0AAx | | | |
| Motor | Induction motor | 1LA | | | |

Table 2- 10Component overview

1. The enable signals for the infeed and the drive should be realized via terminals.

2.6 Initial commissioning using vector (booksize) as an example

2.6.2 Component wiring (example)

The following diagram shows a possible component configuration and wiring option. The DRIVE-CLiQ wiring is highlighted in bold.



Figure 2-20 Component wiring (example)

For more information on wiring and connecting the encoder system, see Manual.

2.6 Initial commissioning using vector (booksize) as an example



2.6.3 Signal flow for commissioning example

Figure 2-21 Signal flow for initial commissioning example (booksize; vector)

2.6.4 Commissioning with STARTER (example)

The table below describes the steps for commissioning the example with STARTER.

| Table 2- 11 | Sequence for commissioning with STARTER (exam | nple) |
|-------------|---|-------|
|-------------|---|-------|

| | What to do? | How to do it? | Comment |
|-------|---------------|--|---------|
| 1. | Automatic | Operator action: | |
| | configuration | -> "Project" -> "Connect to target system" | |
| | | -> Double-click "Automatic configuration" | |
| | | -> Follow the instructions provided in the wizard. | |
| N1.1. | | | |

Note:

When the factory setting is p7826 = 1, the firmware is automatically updated to the status on the memory card when a configured DRIVE-CLiQ component is first booted. This may take several minutes and is indicated by the READY-LED on the corresponding components flashing green/red and the Control Unit flashing orange (0.5 Hz). Once all updates have been completed, the READY-LED on the Control Unit flashes orange at 2 Hz and the corresponding READY-LED on the components flashes green/red at 2 Hz. For the firmware to be activated, a POWER ON must be carried out for the components.

2.6 Initial commissioning using vector (booksize) as an example

| | What to do? | How to do it? | Comment |
|-------------------------|---|---|---|
| 2. | Configuring drives | The drives must be configured individually. | |
| | | -> "Drives" -> Drive name -> Double-click "Configuration" -> Click "Configure DDS" | |
| 2.1 | Control structure | You can activate the function modules. | |
| | | You can select the control type. | |
| 2.2 | Power unit | The wizard displays the data determined automatically from the electronic rating plate. | Caution If a sine-wave filter is connected, it must be activated here to prevent it from being destroyed. |
| 2.3 | BICO power unit | Infeed in operation | |
| | | Control Unit: r0722.4 (digital input 4) | |
| Cautio | on | | |
| If the p0864 dama | infeed is controlled fro l "infeed ready" of the ged. | om another Control Unit, then the ready signal of the infeed must be drive through a digital input/output. If this is not taken into account | e connected to parameter , the infeed may be |
| 2.4 | Drive setting | You can select the motor standard (IEC/NEMA) and power unit application (duty cycles). | |
| 2.5 | Motor | The name of the motor (e.g. equipment marking) can be entered. | You can select a standard |
| | | Enter motor data: Yes | motor from the list of |
| | | Select motor type "1LAx". | motors or you can enter the motor data yourself manually. You can then select the motor type. |
| 2.6 | Motor data | You can enter the motor data from the rating plate here. | If you do not enter any |
| | | If known, mechanical data for the motor and drive train can be entered. | mechanical data, it is estimated on the basis of the data on the rating plate |
| | | Equivalent circuit diagram data: No | The equivalent circuit diagram data is also estimated on the basis of the data on the rating plate or determined by means of automatic motor data identification. |
| 2.7 | Motor brake | Here, you can configure the brake and activate the "Extended brake control" function module. | For further information see Function Manual. |
| 2.8 | Encoder | The encoder must be deselected in this example. | If you are using an encoder that is not in the list, you can also enter the data. |

2.6 Initial commissioning using vector (booksize) as an example

| | What to do? | How to do it? | Comment |
|------------|---|--|---|
| 2.9 | Drive functions | You can choose the application and motor identification here. Motor identification: "1" | Your choice of application influences the calculation for the open-loop/closed- loop control parameters. When the pulses are enabled, a one-off |
| | | | out. Current flows through the motor which means that it can align itself by up to a quarter of a revolution. Once the measurement is complete, optimization with rotating motor is carried out the next time the pulses are enabled. |
| 2.10 | Important parameters | You must enter important parameters in accordance with the relevant application. | |
| | | drive train. | |
| 2.11 | Summary | The drive data can be copied to the clipboard for system documentation purposes and then pasted into a word processing program, for example. | |
| Note | | | |
| The report | eference parameters a = 1. In the STARTER | and limit values in the STARTER can be protected from being autor 8. you will find this under Drive -> Configuration-> Reference param | natically overwritten by neters / blocked list tab. |
| 3. | Enable signals and BICO interconnections | The enable signals for the infeed and the two drives must be realized via the digital inputs on the Control Unit. | |
| 3.1 | Line contactor | Line contactor | The line contactor must be |
| | | p0728.8 = 1 Set DI/DO as output | controlled by the |
| | | p0738 = 863.1 Activate line contactor | The inputs/outputs are |
| | | p0860 = 723.9 Line contactor, feedback signal | located on the Control Unit. See the function diagram [8934] |
| | 🖻 🔤 Control_Unit | Isolated digital inputs Bidirectional digital inputs/outputs Measuring sockets | |
| | Insert DCC char Configuration Control logic Inputs/outputs | X122 PI 8 Input Invert output F PI 9 Input Input Invert output F PI 9 Input Input Invert output F PI 9 Input Invert output Invert | Optimize view / simulation mode |
| 3.2 | Enable Motor | Enable signals for the Motor Module (drive_1) | See function diagram |
| | Module | p0840 = 722.0 ON/OFF1 | [2501] |
| | | p0844 = 722.1 1st OFF2 | |
| | | p0845 = 1 2nd OFF2 | |
| | | p0848 = 722.2 1st OFF3 | |
| | | p0849 = 1 2nd OFF3 | |
| | | p0852 = 722.3 Enable operation | |

2.6 Initial commissioning using vector (booksize) as an example

| | What to do? | How to do it? | Comment |
|-----|---|---|--|
| | Drive_1 Drive navigator Drive navigator Onliguration Ocontrol logic Open-loop/closed-loop cont Drive navisioning Ormissioning Ormunication Diagnostics Ontrol/status words Ontrol/status words Interconnections | BI/CI BD/CD Control_Unit, r722: Bit 0, CD/B0: CU digital inputs, status: : DI 0 [X122.1/X121.1] (0 Control_Unit, r722: Bit 1, CO/B0: CU digital inputs, status: : DI 1 [X122.2/X121.2] (1 Control_Unit, r722: Bit 2, CO/B0: CU digital inputs, status: : DI 2 [X122.3/X121.3] (1 Control_Unit, r722: Bit 2, CO/B0: CU digital inputs, status: : DI 2 [X122.3/X121.3] (1 Control_Unit, r722: Bit 3, CO/B0: CU digital inputs, status: : DI 3 [X122.4/X121.4] (1 | p840[0], BI: ON/OFF1 p840[1], BI: ON/OFF1 p844[0], BI: 1. OFF2 p844[1], BI: 1. OFF2 p845[0], BI: 2. OFF2 p845[1], BI: 2. OFF2 p848[0], BI: 1. OFF3 p848[1], BI: 1. OFF3 p849[0], BI: 2. OFF3 p849[1], BI: 2. OFF3 p852[0], BI: Enable operation p852[1], BI: Enable operation |
| 3.3 | Ramp-function generator generator Drive_1 Drive_1 Drive navigator Configuration Configuration Control logic Dep-loop/closed-loop contr Sopen-loop/closed-loop contr Dep-loop/closed-loop control Dep-loop/closed-loop control Dep-loop control Dep-loop/closed-loop control Dep-loop control | Ramp-function generator p1140 = 1 Ramp-function generator enable p1141 = 1 Ramp-function generator start p1142 = 1 Enable setpoint | See function diagram [3060] [40[0], BI: Enables the ramp-function generator [40[1], BI: Enables the ramp-function generator [41[0], BI: Start ramp-function generator [41[1], BI: Start ramp-function generator [42[1], BI: Enable speed setpoint [42[1], BI: Enable speed setpoint |
| 3.4 | Setpoint Drive_1 Drive navigator Configuration Configuration Setpoint Channel Motor potentiomet Fixed setpoints | Specify setpoint p1001 = 40 Fixed setpoint 1 Fixed setpoints Fixed setpoint interconnection Fixed value 1 40.000 RPM P1070[0], CI: | See function diagram [3010] Main setpoint |

2.6 Initial commissioning using vector (booksize) as an example

| | What to do? | How to do it? | Comment |
|---|-----------------------------------|--|---|
| 4 | Save the parameters on the device | Connect target system (go online) Target device -> Load to target device Target device -> Copy from RAM to ROM | Position cursor on drive unit (SINAMICS S120) and right-click. |
| 5 | The motor starts to run. | The drives can be started via the control panel in STARTER. Line/DC link identification will be carried out once the pulses for the infeed have been enabled and line/DC link identification has been activated. The infeed then switches to operational mode. Once the pulses are enabled, a one-off motor data identification run (if activated) is carried out. When the pulses are enabled again, optimization with a rotating motor (if activated) is carried out. | For more information about the control panel, see Getting Started. During motor identification, a current flows through the motor, which means that it can align itself by up to a quarter of a revolution. For more information about line/DC link/motor identification, see the Function Manual. |

STARTER diagnosis options

Under "Component" -> Diagnosis -> Control/status words

- Control/status words
- Status parameters
- Missing enable signals

The example provided in this section explains all the configuration and parameter settings as well as the tests that are required for initial commissioning. Commissioning is carried out using the STARTER commissioning tool.

Requirements for commissioning

- 1. The commissioning requirements have been met according to Section 1.1.
- 2. The check list for commissioning (Table 1-1 or 1-2 from Section 1.1) has been filled out and the points complied with.
- 3. STARTER is installed and ready to run.
 - --> see the "Readme" file on the STARTER installation CD.
- 4. The electronics power supply (24 V DC) is switched on.

2.7.1 Task

1. Commission a drive system with the following components:

| Table 2- 12 | Component overview |
|-------------|--------------------|
|-------------|--------------------|

| Designation | Component | Order number | | | | |
|------------------------------|--|---|--|--|--|--|
| Closed-loop control and infe | Closed-loop control and infeed | | | | | |
| Control Unit | Control Unit 320-2 | 6SL3040-1MA00-0AA0 | | | | |
| Active Line Module | Active Line Module 380 kW / 400 V | 6SL3330-7TE36-1AAx | | | | |
| Active Interface Module | Active Interface Module | 6SL3300-7TE38-4AAx | | | | |
| Drive 1 | | | | | | |
| Motor Module | Motor Module 380 A | 6SL3320-1TE33-8AAx | | | | |
| Motor | Induction motorWithout brakeWith encoder | Type: 1LA8 rated voltage = 400 V rated current = 345 A rated power = 200 kW rated power factor = 0.86 rated frequency = 50.00 Hz rated speed = 989 rpm cooling type = natural cooling HTL encoder, 1024 p/r, A/B, R | | | | |

2.7 Initial commissioning using vector (chassis) as an example

| Designation | Component | Order number |
|--------------|--|---|
| Drive 2 | | |
| Motor Module | Motor Module 380 A | 6SL3320-1TE33-8AAx |
| Motor | Induction motorWithout brakeWith encoder | Type: 1LA8 rated voltage = 400 V rated current = 345 A rated power = 200 kW rated power factor = 0.86 rated frequency = 50.00 Hz rated speed = 989 rpm cooling type = natural cooling HTL encoder, 1024 p/r, A/B, R |

1. The enable signals for the infeed and the drive should be realized via terminals.

2.7.2 Component wiring (example)

The following diagram shows a possible component configuration and wiring option. The DRIVE-CLiQ wiring is highlighted in bold.



Figure 2-22 Component wiring (example)

For more information on wiring and connecting the encoder system, see Manual.



2.7.3 Signal flow for commissioning example

Figure 2-23 Signal flow from initial commissioning example (chassis)

2.7.4 Commissioning with STARTER (example)

The table below describes the steps for commissioning the example with STARTER.

Table 2-13 Sequence for commissioning with STARTER (example)

| | What to do? | How to do it? | Comment |
|--|----------------------------|---|--|
| 1. | Automatic configuration | Operator action: -> "Project"> "Connect to target system" -> Double-click "Automatic configuration" -> Follow the instructions provided in the wizard. STARTER then automatically switches to offline mode. | The DRIVE-CLiQ topology is determined and the electronic rating plates are read. The data is then transferred to STARTER. The next steps are carried out offline. |
| Note: When the factory setting is p7826 = 1, the firmware is automatically updated to the statu configured DRIVE-CLiQ component is first booted. This may take a few minutes and is the corresponding components flashing green/red and the Control Unit flashing orange been completed, the READY-LED on the Control Unit flashes orange at 2 Hz and the components flashes green/red at 2 Hz. For the firmware to be activated, a POWER ON components. | | | tus on the memory card when a indicated by the READY-LED on e (0.5 Hz). Once all updates have corresponding READY-LED on the N must be carried out for the |
| 2. | Configure the infeed | The infeed must be configured. Name of infeed -> Double-click "Configuration" -> Click "Wizard" | |
| 2.1 | Infeed wizard | The wizard displays the data determined automatically from the electronic rating plate. You can now set the line/DC link identification. The device supply voltage must be entered; the rated line frequency is automatically determined/specified for this by the firmware. "Line filter available" must be active. With a booksize infeed, one of up to three line filter types can be selected in the offered menu when this option is activated. With a chassis infeed, only one AIM line filter suitable for the infeed is automatically added with the above option | If the network environment or components in the DC link change, the line/DC link identification should be carried out again. |
| | | PROFIBUS telegram type 370 must be installed. This completes the configuration for the infeed. | |
| 3. | Configuring drives | The drives must be configured individually. -> "Drives" -> Drive name -> Double-click "Configuration" -> Click "Configure DDS" | |
| 3.1 | Control structure | You can activate the function modules. You can select the control type. | |

2.7 Initial commissioning using vector (chassis) as an example

| | What to do? | How to do it? | Comment | |
|--|----------------------|--|--|--|
| 3.2 | Power unit | The wizard displays the data determined automatically from the electronic rating plate. | Caution If a sine-wave filter is connected, then it must be activated here as otherwise it could be destroyed! | |
| Caution If the infeed is controlled by a different Control Unit, the "Ready" signal for the infeed r0863.0 must be interconnect drive parameter p0864 "Infeed ready" via a digital input/output. If this is not taken into account, the infeed may be damaged. | | | | |
| 3.3 | Drive setting | You can select the motor standard (IEC/NEMA) and power unit application (duty cycles). | | |
| 3.4 | Motor | The name of the motor (e.g. equipment marking) can be entered. Enter motor data: Yes Select motor type "1LA8" | You can select a standard motor from the list of motors or you can enter the motor data yourself. You can then select the motor type. | |
| 3.5 | Motor data | You can enter the motor data on the rating plate here. If known, mechanical data for the motor and drive train can be entered. Equivalent circuit diagram data: No | If you do not enter any mechanical data, it is estimated on the basis of the data on the rating plate. The equivalent circuit diagram data is also estimated on the basis of the data on the rating plate or determined by means of automatic motor data identification. | |
| 3.6 | Motor brake | Here, you can configure the brake and activate the "Extended brake control" function module. | For more information, see the Function Manual. | |
| 3.7 | Encoder | Choose standard encoder from list: Yes Choose "1024 HTL A/B R to X521/X531". | If you are using an encoder that is not in the list, you can also enter the data. | |
| 3.8 | Drive functions | You can choose the application and motor identification here. Motor identification: "1" | Your choice of application influences the calculation for the open-loop/closed-loop control parameters. When the pulses are enabled, a one-off identification run is carried out. Current flows through the motor which means that it can align itself by up to a quarter of a revolution. Once the measurement is complete, optimization with rotating motor is carried out the next time the pulses are enabled. | |
| 3.9 | Important parameters | You must enter important parameters in accordance with the relevant application. Note, for example, the general mechanical conditions for the drive train. | | |

2.7 Initial commissioning using vector (chassis) as an example

| | What to do? How to do it? Commen | | Comment | | | | |
|-------------|--|---|--|--|--|--|--|
| 3.10 | Summary | The drive data can be copied to the clipboard for plant documentation purposes and then added to a text program, for example. | | | | | |
| Note | Note | | | | | | |
| The reposed | eference parameters and = 1. In the STARTER, yo | limit values in the STARTER can be protected from bein ou will find this under Drive -> Configuration-> Reference | ng automatically overwritten by e parameters / blocked list tab. | | | | |
| 4. | Enable signals and BICO interconnections | The enable signals for the infeed and the two drives must be realized via the digital inputs on the Control Unit. | Note: If an Active Line Module is installed, the same signal source must not be used to enable both the infeed and the drive. | | | | |
| 4.1 | Active Line Module | Enable signals for the Active Line Module | See function diagram [8920] | | | | |
| | | p0840 = 722.4 ON/OFF1 | | | | | |
| | | p0844 = 722.5 OFF2 | | | | | |
| | | p0852 = 722.6 Enable operation | | | | | |
| | i → Infeed insert DCC charts · > Configuration · > Control logic · → Functions · → Communication · → Diagnostics · > Control/status wor · > Interconnections | BI/CI B0/CO CU_S_037, r722: Bit 4, CO/B0: CU digital inputs, status: : DI 4 (X132.1) (1=Hi CU_S_037, r722: Bit 5, CO/B0: CU digital inputs, status: : DI 5 (X132.2) (1=Hi CU_S_037, r722: Bit 6, CO/B0: CU digital inputs, status: : DI 6 (X132.3) (1=Hi CU_S_037, r722: Bit 6, CO/B0: CU digital inputs, status: : DI 6 (X132.3) (1=Hi CU_S_037, r722: Bit 6, CO/B0: CU digital inputs, status: : DI 6 (X132.3) (1=Hi CU_S_037, r722: Bit 6, CO/B0: CU digital inputs, status: : DI 6 (X132.3) (1=Hi CU_S_037, r722: Bit 6, CO/B0: CU digital inputs, status: : DI 6 (X132.3) (1=Hi CU_S_037, r722: Bit 6, CO/B0: CU digital inputs, status: : DI 6 (X132.3) (1=Hi CU_S_037, r722: Bit 6, CO/B0: CU digital inputs, status: : DI 6 (X132.3) (1=Hi CU_S_037, r722: Bit 6, CO/B0: CU digital inputs, status: : DI 6 (X132.3) (1=Hi CU_S_037, r722: Bit 6, CO/B0: CU digital inputs, status: : DI 6 (X132.3) (1=Hi CU_S_037, r722: Bit 6, CO/B0: CU digital inputs, status: : DI 6 (X132.3) (1=Hi CU_S_037, r722: Bit 6, CO/B0: CU digital inputs, status: : DI 6 (X132.3) (1=Hi CU_S_037, r722: Bit 6, CO/B0: CU digital inputs, status: : DI 6 (X132.3) (1=Hi CU_S_037, r722: Bit 6, CO/B0: CU digital inputs, status: : DI 6 (X132.3) (1=Hi CU_S_037, r722: Bit 6, CO/B0: CU digital inputs, status: : DI 6 (X132.3) (1=Hi CU_S_037, r722: Bit 6, CO/B0: CU digital inputs, status: : DI 6 (X132.3) (1=Hi CU_S_037, r722: Bit 6, CO/B0: CU digital inputs, status: : DI 6 (X132.3) (1=Hi CU_S_037, r722: Bit 6, CO/B0: CU digital inputs, status: : DI 6 (X132.3) (1=Hi CU_S_037, r722: Bit 6, CO/B0: CU digital inputs, status: : DI 6 (X132.3) (1=Hi CU_S_037, r722: Bit 6, CO/B0: CU digital inputs, status: : DI 6 (X132.3) (1=Hi CU_S_037, r722: Bit 6, CO/B0: CU digital inputs, status: : DI 6 (X132.3) (1=Hi CU_S_037, r722: Bit 6, CO/B0: CU digital inputs, status: : DI 6 (X132.3) (1=Hi CU_S_037, r722: Bit 6, CO/B0: CU digital inputs, status: : DI 6 (X132.3) (1=Hi CU_S_037, r722: Bit 6, CO/B0: CU digital inputs, status: : DI 6 (X132.3) (1=Hi CU_S_037, r722: Bit 6, CO/B0: CU digital inputs, status: : | igh / 1 | | | | |
| 4.2 | Enable Motor Module | Enable signals for the Motor Module (drive_1) | See function diagram [2501] | | | | |
| | | p0840 = 722.0 ON/OFF1 | | | | | |
| | | p0844 = 722.1 1st OFF2 | | | | | |
| | | p0845 = 1 2nd OFF2 | | | | | |
| | | p0848 = 722.2 1st OFF3 | | | | | |
| | | p0849 = 1 2nd OFF3 | | | | | |
| | | p0852 = 722.3 Enable operation | | | | | |
| | ÷ 4 = | p0864 = 863.0 Infeed operation | | | | | |
| | | BI/CI BU/CU Control_Unit, r722: Bit 0, CO/B0: CU digital inputs, status: : DI 0 (X122.1/) 0 Control_Unit, r722: Bit 1, CO/B0: CU digital inputs, status: : DI 1 (X122.2/) 1 Control_Unit, r722: Bit 2, CO/B0: CU digital inputs, status: : DI 2 (X122.3/) 1 Control_Unit, r722: Bit 2, CO/B0: CU digital inputs, status: : DI 2 (X122.3/) 1 Control_Unit, r722: Bit 3, CO/B0: CU digital inputs, status: : DI 3 (X122.4/) 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | X121.1) (p840[0], Bi: ON/OFF1 p840[1], Bi: ON/OFF1 x121.2) (p844[0], Bi: 1. OFF2 p844[1], Bi: 1. OFF2 p845[0], Bi: 2. OFF2 p845[1], Bi: 2. OFF2 x121.3) (p848[0], Bi: 1. OFF3 p848[1], Bi: 1. OFF3 p848[1], Bi: 1. OFF3 p849[0], Bi: 2. OFF3 p849[0], Bi: 2. OFF3 p849[0], Bi: 2. OFF3 p849[0], Bi: 2. OFF3 p849[1], Bi: 2. OFF3 p849[1], Bi: 2. OFF3 p849[1], Bi: 2. OFF3 p849[1], Bi: 2. OFF3 p852[0], Bi: Enable operation p852[1], Bi: Enable operation | | | | |

2.7 Initial commissioning using vector (chassis) as an example

| | What to do? How to do it? | | Comment | |
|-----|---|---|--|--|
| 4.3 | Ramp-function | Ramp-function generator | See function diagram [3060] | |
| | generator | p1140 = 1 Ramp-function generator enable | | |
| | | p1141 = 1 Ramp-function generator start | | |
| | | p1142 = 1 Enable setpoint | | |
| | Brive_1 Insert DCC charts Drive navigator Configuration Control logic Sourcol logic Perform A control logic P | BI/CL BD/CD | p1140[0], BI: Enables the ramp-function generator p1140[1], BI: Enables the ramp-function generator p1141[0], BI: Start ramp-function generator p1141[1], BI: Start ramp-function generator p1142[0], BI: Enable speed setpoint p1142[1], BI: Enable speed setpoint | |
| 4.4 | Setpoint | Specify setpoint p1001 = 0 Fixed setpoint 1 p1002 = 40 Fixed setpoint 2 p1020 = r0722 Fixed speed setpoint selection r1024 = p1070 Fixed setpoint active | A setpoint of 0 (0 signal) or 40 (1 signal) is defaulted via digital input 7. This setpoint is then applied to the main setpoint p1070. See function diagram [3010] | |
| | Drive_1 Insert DCC charts Drive navigator Configuration Control logic Setpoint Channel Motor potentiometa Fixed setpoints | Fixed setpoints Bit 0 Bit 1 0 Bit 2 0 Bit 3 0 Bit 4 0 Bit 3 0 Bit 3 0 Bit 3 0 Bit 4 0 Bit 3 0 Bit 3 0 Bit 4 0 Bit 3 0 Bit 1 0 Bit 2 0 Bit 3 0 Bit 1 0 Bit 2 0 Bit 3 0 Bit 1 <td< th=""><th>0.000 RPM Fixed value effective p1070[0], CI: Main setpoint</th></td<> | 0.000 RPM Fixed value effective p1070[0], CI: Main setpoint | |
| 5. | Load parameters to device | Connect with target system (go online) Target device -> Load to target device | Position cursor on drive unit and right-click. | |

2.7 Initial commissioning using vector (chassis) as an example

| | What to do? | How to do it? | Comment |
|----|---|--|--|
| 6. | Motor temperature | Thermistor selection: via Motor Module (11) Temperature sensor type: KTY84 (2) Response to overtemperature: alarm and fault (no reduction of I_{max}) Fault message for thermistor failure: ON Deceleration time: 0.100 s Alarm threshold: 120.0° C Fault threshold: 155.0° C | |
| | Drive_1 Insert DCC charts Drive navigator Configuration Control logic Setpoint Channel Setpoint Channel P Setpoint Channel P Setpoint Channel Setpoint Channel D Setpoint Channel Setpoint Channel D Setpoint Channel Setpoint Channel D Setpoint Channel Setpoint C | Motor temperature Thermistor selection Temperature sensor via encoder 1 (1) Thermistor type KTY84 (2) Response with overtemperature Warning and fault (reduction of Imax) Fault message for a thermistor failure Yes Fault message delay time 0.100 \$ | |
| | | 29.9 °C Enc. module | |
| 7. | Save the parameters on the device | Target device -> Copy from RAM to ROM | Position cursor on drive unit and right-click. |
| 8. | The motor starts to run. | The drives can be started via the control panel in STARTER. Line/DC link identification will be carried out once the pulses for the infeed have been enabled and line/DC link identification has been activated. The infeed then switches to operational mode. When the pulses are enabled, a one-off motor data identification run (if activated) is carried out. When the pulses are enabled again, optimization with a rotating motor (if activated) is carried out. | For more information about the control panel, see Getting Started. During motor identification, a current flows through the motor, which means that it can align itself by up to a quarter of a revolution. For more information about line/DC link/motor identification, see the SINAMICS S120 Function Manual. |

Diagnostics parameters (see the SINAMICS S120/S150 List Manual)

- r0002 Infeed/drive operating display
- r0046 Missing enable signals (for more information, see "Diagnostics")

2.8 Commissioning for the first time using as an example Vector AC DRIVE with BOP20

2.8 Commissioning for the first time using as an example Vector AC DRIVE with BOP20

The example provided in this section explains all the configuration and parameter settings as well as the tests that are required for initial commissioning. Commissioning is performed using the BOP20.

Requirements for commissioning

- 1. The commissioning requirements have been met according to Section 1.1.
- 2. The check list for commissioning (Table 1-1 or 1-2 from Section 1.1) has been filled out and the points complied with.

2.8.1 Task

1. A drive unit is to be commissioned (operating mode vector, closed-loop speed control), without DRIVE-CLiQ and without speed encoder with the following components:

| Designation | Component | Order number | | |
|----------------------|---|--------------------|--|--|
| Closed-loop control | | | | |
| Control Unit | Control Unit 320-2 | 6SL3040-1MA00-0AA0 | | |
| Control Unit Adapter | CUA31 | 6SL3040-0PA00-0AA1 | | |
| Operator Panel | Basic Operator Panel BOP20 | 6SL3055-0AA00-4BAx | | |
| Infeed and drive | | | | |
| Power Module | Power Module 340 | 6SL3210-1SB14-xxxx | | |
| Motor | Induction motor (without DRIVE-CLiQ interface) | 1LA7 | | |

Table 2-14 Component overview

2. Commissioning is performed using the BOP20.

3. The function keys on the BOP20 must be parameterized so that the ON/OFF signal and speed settings can be defined via these keys.

2.8 Commissioning for the first time using as an example Vector AC DRIVE with BOP20

2.8.2 Component wiring (example)

The following diagram shows a possible component configuration and wiring option.



Figure 2-24 Component wiring (example)

For more information on wiring, see Manual.

2.8 Commissioning for the first time using as an example Vector AC DRIVE with BOP20

2.8.3 Quick commissioning using the BOP (example)

Table 2-15 Quick commissioning for a vector drive without a DRIVE-CLiQ interface

| | Procedure | Description | Factory setting | | | |
|--|--|--|--|--|--|--|
| Restor | Restore the drive to the factory setting: | | | | | |
| 1. | p0009 = 30 | - 30 Device commissioning parameter filter * | | | | |
| | | 0 Ready | - | | | |
| | | 1 Device configuration | - | | | |
| | | 30 Parameter reset | - | | | |
| 2. | p0976 = 1 | Reset and load all parameters | 0 | | | |
| | | 0 Not active | | | | |
| | | 1 Start restoring all parameters to their factory settings | | | | |
| Wait a 1, p09 Note: | pprox. 15 sec. Who 76 to 0. | en ready, the BOP display shows = 35 and the RDY-LED is green. P0009 is automa | tically set to | | | |
| As soc | on as the RDY-LED |) is green again, the factory setting has been completed and commissioning can sta | rt. | | | |
| 3. | p0009 = 1 | Device commissioning parameter filter * | 1 | | | |
| | | 0 Ready | - | | | |
| | | 1 Device configuration | - | | | |
| | | 30 Parameter reset | | | | |
| 4. | p0097 = 2 | Select drive object type * | 0 | | | |
| | | 0 No selection | - | | | |
| | | 1 Drive object type SERVO | - | | | |
| | | 2 Drive object type VECTOR | | | | |
| 5. | p0009 = 0 | Device commissioning parameter filter * | 1 | | | |
| | | 0 Ready | - | | | |
| | | 1 Device configuration | | | | |
| Note: Wait a press f has be The dr | pprox. 10 sec. The the "p" until the dis en completed. Ala ive parameters are | basic configuration is saved once the RDY lights green. In order to transfer this state play flashes. When the flashing stops, the RDY changes from orange to green and t rm A07991 indicates that the motor identification function has been activated at drive e entered: | te into ROM, he transfer e DO 2. | | | |
| 6. | DO = 2 | Select drive object (DO) = 2 (= VECTOR) | 1 | | | |
| | | 1 Expert list of the CU | | | | |
| | | 2 Expert list of the drive | | | | |
| | | To select a drive object (DO), simultaneously press the Fn key and the arrow up key. | | | | |
| 7 | $p_{0010} = 1$ | Prive commissioning percenter filter * | 1 | | | |
| 1. | p0010 – 1 | | | | | |
| | | 1 Quick commissioning | - | | | |
| 1 | 1 | I I QUICK COMMISSIONING | 1 | | | |

2.8 Commissioning for the first time using as an example Vector AC DRIVE with BOP20

| | Procedure | | Description | Factory setting | |
|-----------------------------|--|----------------------------------|---|-----------------|--|
| 8. | p0100 = 0 | IEC/NEMA motor standard | | | |
| | - | 0 IEC m | 0 IEC motor (SI units, e.g. kW) | | |
| | | Prese | Preset: | | |
| | | Rated | Rated motor frequency (p0310): 50 Hz | | |
| | | Speci | fication of the power factor cos φ (p0308) | | |
| | | 1 NEMA | 1 NEMA motor (US units, e.g. hp) | | |
| | | Preset: | | | |
| | | Speci | fication of the efficiency (p0310): 60 Hz | | |
| | | Note [.] | | | |
| | | When p0100 | is changed, all the rated motor parameters are reset. | | |
| 9. | p030X[0] = | Rated motor | data [MDS] | - | |
| | | Only when p | 0300 < 100 (third-party motor) | | |
| | | Enter the rate | ed motor data in accordance with the rating plate, e.g. | | |
| | | p0304[0] | Rated motor voltage [MDS] | | |
| | | p0305[0] | Rated motor current [MDS] | | |
| | | p0307[0] | Rated motor output [MDS] | | |
| | | p0308[0] | Rated motor power factor [MDS] (only when p0100 = 0) | | |
| | | p0309[0] | Rated motor efficiency [MDS] (only when p0100 = 1) | | |
| | | p0310[0] | Rated motor frequency [MDS] | | |
| | | p0311[0] | Rated motor speed [MDS] | | |
| | | p0335[0] | Motor cooling type [MDS] * | | |
| | | | 0: Natural cooling | | |
| | | | 1: Forced cooling | | |
| | | | 2 Water cooling | | |
| 10. | p1900 = 2 | Motor data id | entification and rotating measurement* | 2 | |
| | | 0 | Inhibited | | |
| | | 1 | Motor data identification for rotating motor | | |
| | | 2 | Motor data identification for a stationary motor | | |
| | | Message A0 | 7991 is displayed, motor identification was activated. | | |
| Dange During be fully | r motor identificatio / operational during | n, the drive ma g commissioni | ay cause the motor to move. The EMERGENCY OFF functions must ng. To protect the machines and personnel, the relevant safety | | |
| regula | tions must be obse | rved. | | | |
| Opera | tion is configured: | | | | |
| 11. | p0010 = 0 | Drive, comm | Drive, commissioning parameter filter * | | |
| | | 0 | Ready | | |
| | | 1 | Quick commissioning | | |
| RDY is | s lit red, fault F0708 | 35 signals that | a control parameter has been changed. | | |
| 12. | 2. p0840[0] = BI: ON/OFF1 [CDS] | | | 0 | |
| | 10019.0(DO 1) | Sets the sign | al source for STW1.0 (ON/OFF1) | | |
| | Interconnection with r0019.000 of the drive object Control Unit (DO 1) | | | | |
| | | Effect: Signa | I ON/OFF1 from the BOP | | |

2.8 Commissioning for the first time using as an example Vector AC DRIVE with BOP20

| | Procedure | Description | Factory setting | | |
|--|---|---|-----------------|--|--|
| 13. | p1035[0] = | BI: Motor potentiometer setpoint higher [CDS] | 0 | | |
| | r0019.0013 | Sets the signal source to increase the setpoint for the motorized potentiometer | | | |
| | (DO 1) | Interconnection with r0019.013 of the drive object Control Unit (DO 1) | | | |
| | | Effect: Signal, motorized potentiometer setpoint higher from BOP | | | |
| 14. | p1036[0] = | BI: Motor potentiometer setpoint lower [CDS] | 0 | | |
| | r0019.0014 | Sets the signal source to reduce the setpoint for the motorized potentiometer | | | |
| | (DO 1) | Interconnection with r0019.014 of the drive object Control Unit (DO 1) Effect: Signal, motorized potentiometer lower setpoint from BOP | | | |
| 15. | p1070[0] = | CI: Main setpoint [CDS] | 0 | | |
| | r1050 (DO 63) | Sets the signal source for speed setpoint 1 of the speed controller. | | | |
| | | Interconnection with r1050.000 to the separate drive object (DO 63) Effect: Motorized potentiometer supplies the speed setpoint | | | |
| 16. | "FN", then press "P". The display indicates 41, press "O", the display jumps to 31. | | | | |
| 17. | Start the motor id | entification with "I". The drive switches off again after approx. 5 sec. the display goes | back to 41. | | |
| 18. | 31 is displayed again after pressing "O", the drive is now ready. The drive is switched on by pressing "I", the motor accelerates by pressing the "arrow up" key. | | | | |
| 19. | Save all parameters | Press the P key for approx. 5 sec until the display flashes. | | | |
| * These parameters offer more setting options than the ones described here. For further setting options see SINAMICS S120/S150 List Manual | | | | | |
| [CDS] Parameter depends on command data sets (CDS). Data set 0 is preset. [DDS] Parameter depends on drive data sets (DDS). Data set 0 is preset. [MDS] Parameter depends on motor data sets (MDS). Data set 0 is preset. BI binector input BO binector output CI connector input | | | | | |
| CI con CO co | CI connector input CO connector output | | | | |
2.9 Initial commissioning using as an example servo AC DRIVE with BOP20

2.9 Initial commissioning using as an example servo AC DRIVE with BOP20

The example provided in this section explains all the configuration and parameter settings, as well as the tests that are required for initial commissioning. Commissioning is performed using the BOP20.

Requirements for commissioning

- 1. The commissioning requirements have been met according to Section 1.1.
- 2. The relevant check list for commissioning, Table 1-1, 1-2 or 1-3 from Chapter 1.2, has been filled out and the points complied with.

2.9.1 Task

1. A drive unit should be commissioned (operating mode servo, closed-loop speed control) with the following components:

| Designation | Component | Order number |
|------------------------------|---|--------------------|
| Closed-loop control | | |
| Control Unit | Control Unit 320-2 | 6SL3040-1MA00-0AA0 |
| Control Unit Adapter | CUA31 | 6SL3040-0PA00-0AA1 |
| Operator Panel | Basic Operator Panel 20 (BOP20) | 6SL3055-0AA00-4BAx |
| Infeed and drive | | |
| Power Module | Power Module 340 | 6SL3210-xxxx-xxxx |
| Motor | Synchronous motor with DRIVE- CLiQ interface | 1FK7061–7AF7x–xAxx |
| Motor encoder via DRIVE-CLiQ | Incremental encoder sin/cos C/D 1 Vpp 2048 p/r | 1FK7xxx-xxxxx-xAxx |

Table 2-16 Component overview

1. Commissioning is performed using the BOP20.

2. The Basic Operator Panel (BOP) should be parameterized so that the ON/OFF signal and the speed setpoints are entered using the function keys.

2.9 Initial commissioning using as an example servo AC DRIVE with BOP20

2.9.2 Component wiring (example)

The following diagram shows a possible component configuration and wiring option.



Figure 2-25 Component wiring with integrated Sensor Module (example)

For more information on wiring and connecting the encoder system, see Manual.

2.9.3 Quick commissioning using the BOP (example)

| Table 2- 17 | Quick commissioning of a servo drive with a DRIVE-CLiQ interface |
|-------------|--|
| | |

| | Procedure | | Description | Factory setting |
|-----------------|-------------------|----------|--|-----------------|
| Note: Before | commissioning for | r the fi | st time, in the drive mode DO = 1, the drive is restored to the factory setting. | |
| 1. | p0009 = 30 | Devic | e commissioning parameter filter | 1 |
| | | 0 | Ready | |
| | | 1 | Device configuration | |
| | | 30 | Parameter reset | |

2.9 Initial commissioning using as an example servo AC DRIVE with BOP20

| | Procedure | Description | Factory setting |
|----------------------------|--|---|-----------------|
| 2. | p0976 = 1 | Reset and load all parameters | 0 |
| | | 0 Not active | |
| | | 1 Start restoring all parameters to their factory settings | ┦ |
| Note: | | | |
| As soo | in as the RDY-LED |) is green again, the factory setting has been established and commissioning can s | tart. |
| 3. | p0003 = 3 | Access levels | 1 |
| | | 1 Standard | |
| | | 2 Extended | 7 |
| | | 3 Expert | 7 |
| 4. | p0009 = 1 | Device commissioning parameter filter * | 1 |
| | | 0 Ready | 7 |
| | | 1 Device configuration | 7 |
| | | 30 Parameter reset | <u>ا</u> |
| 5. | p0097 = 1 | Select drive object type * | 0 |
| | | 0 No selection | 7 |
| | | 1 Drive object type SERVO | 7 |
| | | 2 Drive object type VECTOR | <u>ا</u> |
| 6. | 6. p0009 = 0 Device commissioning parameter filter * | 1 | |
| | | 0 Ready | 7 |
| | | 1 Device configuration | 7 |
| | | 30 Parameter reset | ┦ |
| Note: For the The ex | firmware to be ac tended setpoint ch | tivated, a POWER ON must be carried out for the components. nannel must be opened for motorized potentiometer simulation with p0108[1] = H01 | 04 |
| 7. | p0009 = 2 | Device commissioning parameter filter * | 1 |
| | | 0 Ready | |
| | | 1 Device configuration | |
| | | 2 Defining the drive type / drive options | |
| | | 30 Parameter reset | ┦ |
| 8. | p0108[1] = | Drive object, function module * | H0000 |
| | H0104 | Bit 2 Closed-loop speed/torque control | |
| | | Bit 8 Extended setpoint channel | ┨ |
| 9. | p0009 = 0 | Device commissioning parameter filter * | 1 |
| | | 0 Ready | |
| | | 1 Device configuration | |
| | | 30 Parameter reset | 7 |
| Note: | | | |

Wait until the RDY-LED changes from orange to green. To save the setting in the ROM, press about 5 seconds on the "P" key until the BOP display flashes, then wait until flashing has stopped. The drive is now prepared.

2.9 Initial commissioning using as an example servo AC DRIVE with BOP20

| | Procedure | Description | Factory setting |
|--|--|--|-----------------|
| 10. | DO = 2 | Select drive object (DO) 2 (= SERVO) | 1 |
| | | 1 Expert list of the CU | |
| | | 2 Expert list of the servo drive | |
| | | To select a drive object (DO), simultaneously press the Fn key and the "Arrow up" key. | |
| | | The selected drive object is displayed at the top left. | |
| 11. | p0840[0] = | BI: ON/OFF1 [CDS] | 0 |
| | r0019.0(DO 1) | Sets the signal source for STW1.0 (ON/OFF1) | |
| | | Interconnection with r0019.0 of the drive object Control Unit (DO 1) | |
| | | Effect: Signal ON/OFF1 from the BOP | |
| 12. | p1035[0] = | BI: Motor potentiometer setpoint higher [CDS] | 0 |
| | r0019.0013 | Sets the signal source to increase the setpoint for the motorized potentiometer | |
| | (DO 1) | Interconnection with r0019.13 of the drive object Control Unit (DO 1) | |
| | | Effect: Signal, motorized potentiometer setpoint higher from BOP | |
| 13. | p1036[0] = | BI: Motor potentiometer setpoint lower [CDS] | 0 |
| | r0019.0014 | Sets the signal source to reduce the setpoint for the motorized potentiometer | |
| | (DO 1) | Interconnection with r0019.14 of the drive object Control Unit (DO 1) | |
| | | Effect: Signal, motorized potentiometer lower setpoint from BOP | |
| 14. | p1037 = 6.000 | Max. speed, setpoint potentiometer | 0.000 |
| 15. | p1070[0] = | CI: Main setpoint [CDS] | 1024 |
| | r1050 (DO 63) | Sets the signal source for speed setpoint 1 of the speed controller. | |
| | | Interconnecting to r1050 on its own drive object (DO 63) | |
| | | Effect: Motorized potentiometer supplies the speed setpoint | |
| 16. | p0006 = 0 | BOP operating display mode* | 4 |
| | | 0 Operation -> r0021, otherwise r0020 <-> r0021 | |
| | | 1 Operation -> r0021, otherwise r0020 | |
| | | 2 Operation -> p0005, otherwise p0005 <-> r0020 | |
| | | 3 Operation -> r0002, otherwise r0002 <-> r0020 | |
| | | 4 p0005 | |
| "FN", t | hen press "P", the | display in DO = 2 displays 31. | |
| 17. | Save all parameters | Press the "P" key for approx. 5 sec, 41 is displayed. After pressing the "O" key, the o jumps to 31 - and the drive is now ready. 10 is displayed in DO = 1. | display |
| * Thes SINAN | e parameters offer /ICS S120/S150 Li | r more setting options than the ones described here. For further setting options see ist Manual | |
| [CDS] [DDS] BI bine BO bir CI con CO co | Parameter depend Parameter depend ector input nector output nector input nnector output | ds on command data sets (CDS). Data set 0 is preset. ds on drive data sets (DDS). Data set 0 is preset. | |

2.10 Commissioning of power units connected in parallel

2.10 Commissioning of power units connected in parallel

During commissioning, power units connected in parallel are treated like a power unit on the line or motor side. With parallel connection, the parameter display for the actual values changes only slightly. Suitable "total values" are derived from the individual values of the power units.

For parallel connection only

- chassis type infeeds
- chassis type Motor Modules in vector control mode

may be used.

During first commissioning of power units the parallel connection is activated using the wizard in STARTER. You can also select parallel connection as an option (see following diagrams) when choosing the power unit (infeed and/or Motor Module).

Parallel connection of infeeds in STARTER

| Option module | Infeed: Infeed |
|---|--|
| Insert meed Infeed Infeed Infeed PROFIBUS process da Insert drive Summary | Line/DC-link identification at first switch-on Caution: The determined values are stored safely against power loss. If the power supply or the DC link (removal/adding of devices) of the drive line-up is subsequently changed, an identification must be performed again. |
| | Device connection voltage: 400 V 3-phase AC 50-60 Hz |
| <u> </u> | Line filter available AIM F 400 V 132 kW 160 kW (6SL3300-7TE32-6Ax0) (10) |
| | Parallel connection infeed (6SL3330-7TE32-1AAx - 132 kW) Number of parallel modules: 3 |
| | Voltage sensing module available Number of VSMs: 3 |
| <u></u> | I Braking Module external |
| | Master/Slave |
| | < <u>B</u> ack <u>N</u> ext> <u>C</u> ancel <u>H</u> elp |

Figure 2-26 Example of parallel connection of 3 Active Line Modules (chassis type)

2.10 Commissioning of power units connected in parallel

You need to specify the number of infeeds to be connected in parallel in the appropriate field (maximum 8 infeeds).

You can also choose possible Master/Slave functions for the Active Line Modules using an option on this screen (see chapter "Master/slave function for infeeds").

The line filter is offered as an option, depending on the infeed. An Active Interface Module (AIM) with integrated line filter is required to operate an "Active Line Module" (ALM). We recommend external line filters to operate the "Basic Line Module" (BLM) and "Smart Line Module" (SLM) infeeds.

Parallel connection of Motor Modules in STARTER

| | Power_unit | |
|---|--|---|
| ✓Infeed ✓Infeed drive object ✓PROFIBUS process | Order no. 6SL3320-1TE32-1AAx | Code number 14501 |
| Insert drive Drive properties Control structure Power_unit Fower_unit supplem Drive setting Motor Motor holding brake Encoder Drive functions | No filter/choke Sinusoidal filter Output choke dV/dt filter with VPL Parallel connection | Caution: If a sinusoidal filter is used, it must be selected. Otherwise the sinusoidal filter will be destroyed! |
| | _ // • | |
| | | |

Figure 2-27 Example of parallel connection of 3 Motor Modules (chassis type, vector control)

You need to specify the number of Motor Modules to be connected in parallel in the appropriate field (maximum 8 Motor Modules).

2.10 Commissioning of power units connected in parallel

NOTICE

For parallel connection, SIEMENS only enables the operation of a maximum of 8 power units connected in parallel (for a maximum of 4 infeeds and a maximum of 4 Motor Modules). The user is responsible for additional configurations.

Configuration of parallel connections using parameters

From the point of view of a higher-level PLC, the parallel connection of infeeds behaves like the activation of a single infeed, with the running total outputs of the individual infeeds.

A connection via PROFIdrive telegrams permits the power units to be individually activated and their status queried using parameter services from a higher-level controller. Infeeds may also be activated using the appropriate control and status words. These are documented in the chapter "Communication by PROFIdrive" in /FH1/: SINAMICS S120 Drive Functions Function Manual.

Power units should only be activated and deactivated if an error occurs, that is when a power unit fails and must be exchanged. This approach is unsuitable for variable power control, as the drive line-up control parameters need to be recalculated after every firmware change, for instance when the drive line-up is commissioned. Optimal, highly dynamic control behavior of the drive line-up can only be ensured by recalculation.

The power units can be monitored and parameterized individually:

via the individual parameters p0125..p0128, p0895, r7000, p7001ff:

- Parameter p0125[0...n] "activate/deactivate power unit components" permits targeted activation or deactivation of a power unit in the topology (choice via the topology number).
- With p0895[0...n] BI: power unit components, a power unit is activated or deactivated using an interconnected digital input (BI).
- The number of currently active power units connected in parallel can be displayed by parameter r7000.
- After an error or exchange of units, parameter p7001[0...n] (Par_circuit enable power units) allows targeted activation or deactivation of connected power units.

You can still cancel alarms in this state (due to overtemperatures for example). Individual power units cannot be disabled for motors with separate winding systems (p7003 = 1). p7001 is reset automatically if a power unit is deactivated with p0125 or p0895.

- You can use parameter r7002[0..n] to query whether the pulse in a power unit is inhibited or enabled.
- Parameters r7050[0..n], r7051[0..n] and r7052[0..n] can be used to display the circuit currents for U, V, W on the power units.
- Overload states and various temperature states in the power units can be displayed with parameters from r7200[0..n] onwards.

Parallel connection is indicated with a "P" in front of the value shown on the parameter value display.

You can find out more about other parameters relevant for the operation and parameterization of power units in the literature /LH1/: SINAMICS S120/S150 List Manual from parameter r7002ff or p0125 onwards.

Parallel connection with one or two Control Units

If an infeed is deactivated, the pre-charging must be able to charge the rest of the infeeds in the DC link. E.g. the pre-charging time is doubled when only one infeed is available instead of previously two infeeds in parallel. If possible, the infeeds should be dimensioned such that one infeed, or with redundant interconnection (2 CUs), one subsystem is able to pre-charge the whole DC link.

The connected capacitance should not be too large. However, pre-charging double an infeed's rated capacitance (one of two infeeds previously out of operation) will work with no problems.

Pre-charging contactor monitoring

To monitor pre-charging contactors (for infeed failure), auxiliary terminal blocks must be retrospectively connected to the pre-charging contactors.

The following diagram shows the basic concept of interconnection:

Pre-charging



Additional terminal blocks for pre-charging contactors

Figure 2-28 Pre-charging monitoring

The contactor states are monitored using the logic blocks "free blocks" in the SINAMICS drive. If one of the contactors does not pick up, an external fault message is generated.

Operating state of power units connected in parallel

Fault messages and alarms from A05000ff or F05000ff onwards indicate errors in a power unit.

Power unit faults are stored in the fault buffer in the appropriate Control Unit and can be read as a fault value using parameter r0949 (interpreted decimally). This fault value corresponds to the drive object number in the drive line-up topology. The number of the fault occurring is stored in parameter r0945.

The power unit's operating state (infeed or Motor Module) is displayed via both front LEDs on the corresponding Communication Board Interface (CBI).

You can identify the power unit for a particular drive using parameter p0124[0...n] "Power unit detection via LED". During p0124 = 1, the LED READY on the power unit concerned flashes green/orange or red/orange at 2 Hz. For parallel connections the parameter index is assigned to one power unit in each case.

Configuration of power units connected in parallel

Information on the hardware configuration and wiring the power units is provided in the Manual /GH3/ SINAMICS S120 Manual GH3 Power Units.

You can find information on configuration in "SINAMICS Configuration Manual G130, G150, S120 Chassis, S120 Cabinet Modules, S150". The installation of power units within a control cabinet with Line Connection Modules is also described there.

2.11 Learn devices

2.11 Learn devices

Description

Using a software update, the "learning devices" function amends an existing STARTER (from version V4.1 SP2) with knowledge of later drive firmware versions.

The update is implemented with a SINAMICS Support Package (SSP) from the current STARTER version 4.1 SP2. In STARTER, equipment descriptions are added to without changing the code or newly installing STARTER, and without the drive being physically available.

A SINAMICS Support Package must be installed if SINAMICS STARTER versions need to be supported that are not covered by STARTER version 4.1 SP2. You can download SINAMICS Support Packages on the Internet from the eSupport and Product Support pages. The existence of new SSPs in Product Support will be announced when a new SINAMICS version is released for delivery.

SSP (SINAMICS Support Package)

An SSP contains only description files of the devices and drive objects. By installing an SSP, new drive objects and devices can be added to an existing STARTER installation, without changing its program code.

After installation, all the functions of the new SINAMICS version can be configured with the expert list. All screens and wizards are also available for all the functions compatible with the previous version.

SSP content:

- New drive objects
- New device versions
- New and changed parameters in the expert list
- New and changed faults, alarms and messages
- New and changed sequence parameterizations
- Expansions of the component catalog (new motors, encoders, DRIVE-CLiQ components)
- Expansion of the configuration catalog (SD)
- Changed online help files (parameter help, function diagrams)

Installation

All SSPs released for a STARTER version may be installed in any order.

The SINAMICS Support Packages installed are displayed in SIMATIC/Product notes/Installed software under "Components" as "SINAMICS Support Package", and on the Info dialog.

If a new STARTER version has been created and delivered, this STARTER contains all SSPs released up until the present time, or is compatible with them.

Compatible SSPs can also be installed on top if repairs are necessary, without functional changes.

STARTER should not be running during SSP installation. The installation program should be started and run through. Only once the installation is finished and STARTER has been called up again, can you now configure the newly installed SINAMICS versions offline and operate them online (via "Accessible nodes" for example).

2.12 Selection and configuration of encoders

Encoder selection

For SINAMICS drives there are three possibilities of selecting the encoder using STARTER:

1. Evaluating the motor and encoder data via a DRIVE-CLiQ interface.

The encoder is automatically identified by setting the parameter p0400 = 10000 or 10100, i.e. all of the motor and encoder data required for the configuration are read out of the encoder. For p0400 = 10100, the identification time is not limited.

- Select a standard encoder from a list (also possible via the motor order number for encoder 1/motor encoder). Every encoder type on the list has a code number (see SINAMICS S120/S150 List Manual), that can also be assigned using parameter p0400 (encoder type selection).
- 3. Manually entering user-defined encoder data. The user himself can configure the encoder using the encoder-specific STARTER screens.

The encoders can also be configured on their own using parameters (parameter p0400ff).

| Encoder type | | Encoder code | Encoder evaluation procedure | Evaluation module |
|------------------------------|----------------------------------|--------------------------------------|--|--------------------------------|
| Resolver | Incremental rotary | 1001 1002 1003 1004 | Resolver 1-speed Resolver 2-speed Resolver 3-speed Resolver 4-speed | SMC10, SMI10 |
| Encoder with sin/cos 1Vpp | Incremental encoder rotary | 2001 2002 2003 2005 2010 | 2048, 1 Vpp, A/B C/D R 2048, 1 Vpp, A/B R 256, 1 Vpp, A/B R 512, 1 Vpp, A/B R 18000, 1 Vpp, A/B R distance-coded | SMC20, SMI20, SME20, SME120 |
| EnDat encoder | Absolute value rotary | 2051 2052 2053 2054 2055 | 2048, 1 Vpp, A/B, EnDat, multiturn 4096 32, 1 Vpp, A/B, EnDat, multiturn 4096 512, 1 Vpp, A/B, EnDat, multiturn 4096 16, 1 Vpp, A/B, EnDat, multiturn 4096 2048, 1 Vpp, A/B, EnDat, singleturn | SMC20, SMI20, SME25 |

Table 2-18 Assigning encoder type, encoder code and evaluation modules for standard encoders

2.12 Selection and configuration of encoders

| Encoder type | | Encoder code | Encoder evaluation procedure | Evaluation module |
|-------------------------------------|--------------------------------------|--|--|--------------------------------|
| SSI encoder with sin/cos 1Vpp | Absolute value rotary | 2081 2082 2083 2084 | 2048, 1 Vpp, A/B, SSI, singleturn 2048, 1 Vpp, A/B, SSI, multiturn 4096 2048, 1 Vpp, A/B, SSI, singleturn, error bit 2048, 1 Vpp, A/B, SSI, multiturn 4096, error bit | SMC20, SMI20, SME25, SME125 |
| Linear encoder | Incremental linear | 2110 2111 2112 2151 | 4000 nm, 1 Vpp, A/B R distance-coded 20000 nm, 1 Vpp, A/B R distance-coded 40000 nm, 1 Vpp, A/B R distance-coded 16000 nm, 1 Vpp, A/B, EnDat, resolution 100 nm | SMC20, SMI20, SME20 |
| | Absolute value linear | 2151 | 16000 nm, 1 Vpp, A/B, EnDat, resolution 100 nm | SMC20, SMI20, SME25 |
| HTL/TTL encoders | Incremental right angle rotary | 3001 3002 3003 3005 3006 3007 3008 3009 3011 3020 | 1024 HTL A/B R 1024 TTL A/B R 2048 HTL A/B R 1024 HTL A/B 1024 TTL A/B 2048 HTL A/B 2048 TTL A/B 1024 HTL A/B unipolar 2048 HTL A/B unipolar 2048 TTL A/B R, with Sense | SMC30 |
| SSI encoder absolute | Absolute value rotary | 3081 3082 | SSI, singleturn, 24 V SSI, multiturn 4096, 24 V Not for motor control, only as a direct measurement system | SMC20, SMI20, SME25, SME125 |
| SSI encoder absolute HTL | Absolute value rotary | 3090 | 4096, HTL, A/B, SSI, singleturn | SMC30 |
| DRIVE-CLiQ encoder | Absolute rotary value | 202 242 204 244 | Abs., singleturn 20 bit abs., singleturn 24 Bit abs., multiturn 12 bit, singleturn 20 bit) abs., multiturn 12 bit, singleturn 24 bit) | - |
| SIMAG H2 | Incremental encoder rotary | 2002 2003 2004 2005 2006 2007 2008 | 2048, 1 Vpp, A/B R 256, 1 Vpp, A/B R 400, 1 Vpp, A/B R 512, 1 Vpp, A/B R 192, 1 Vpp, A/B R 480, 1 Vpp, A/B R 800, 1 Vpp, A/B R | SMC20, SMI20, SME20 |

Encoder configuration

You can configure the encoders using a screen in STARTER.

1. If you mark the appropriate checkbox option, encoders with a DRIVE-CLiQ interface are automatically identified on the encoder configuration screen.

| nfiguration - SINAMICS_ | 5120_CU320 - Encoder | |
|--|--|------------|
| | | |
| Option module | Drive: Drive_1, DDS 0, MDS 0 | |
| ✓Insert infeed | | |
| ✓Infeed configuration | Which encoder do you want to use? | |
| ✓Inteed | E Encoder 1 E Encoder 2 E | Encoder 2 |
| | M proder T I proder 2 I | Encoder 2 |
| Insert drive | Encoder 1 | |
| Drive properties | | 1 |
| Control structure | Encoder name: Motor | |
| ✓Power_unit | , | |
| Power unit supplem | Encoder evaluation: Integrate encoder evaluation | tion |
| ✓Drive setting | | |
| Motor | | |
| Encoder | | |
| Drive functions | | |
| | | |
| | Encoder type U | ode number |
| | Identity encoder (waiting) | 100 |
| 11 A A A A A A A A A A A A A A A A A A | | |
| dia | | |
| | | |
| | | |
| 25 | | |
| | | |
| | | |
| | , | |
| | | Details |
| | | |
| | | |
| | | |
| | < Back Next > Cano | el Help |
| | | |

Figure 2-29 Identifying DRIVE-CLiQ encoders

2. You can select standard encoders from a list. The encoder 1/motor encoder can also be selected and configured at the same time using the motor order number.

| Insert infeed | | | | |
|----------------------------------|----------------------|---|-------------|-----------------|
| ✓Inteed contiguration | Which encoder do you | want to use? | | |
| Infeed drive object | Encoder 1 | Encoder 2 | Enco | oder <u>3</u> |
| Insert drive | Encoder 1 Encoder | 2 | | |
| Control structure | Encoder name: | Encoder_2 | | |
| Power_unit Power unit supplem | Encoder evaluation: | SMx | | |
| Drive setting | | C Encoder with Drive | e-CliQ inte | aface |
| Motor holding brake | | 🗖 Read enco | ider agair | |
| Encoder | | Select standard encoder from list | Vja n | notor order no. |
| | | C Enter data | [| Encoder data |
| | Encoder type | | Code n | umber 🔺 |
| 101 | No encoder | | 0 | |
| | DRIVE-CLiQ encod | er AS20, singleturn | 202 | _ |
| | DRIVE-CLIQ encod | er AM2U, multiturn er AS24. singleturn | 204 | |
| 6-11 | DBIVE-CLiQ encod | er AM24, singletum er AM24, multitum | 242 | |
| and | Resolver 1 speed | | 1001 | |
| | Resolver 2 speed | | 1002 | |
| | Resolver 3 speed | | 1003 | _ |
| | riesorver 4 speed | | 1004 | <u> </u> |
| | | | | Details |
| | | | | |

Figure 2-30 Standard encoder option

When configuring the drive you can select the standard encoders offered by Siemens from a list under "encoder". When the encoder type is chosen, all necessary parameterizations are simultaneously and automatically transferred into the encoder configuration. The standard encoder type and the corresponding evaluation modules are shown in the above table.

| Insert infeed | | | | |
|-------------------------|----------------------|----------------------|-------------------|-------|
| ✓Infeed | Which encoder do you | want to use? | | |
| Infeed drive object | Encoder 1 | Encoder 2 | Encoder 3 | |
| Insert drive | Encoder 1 Encoder | 2 | | |
| Control structure | Encoder name: | Encoder_2 | | |
| Power_unit_supplem | Encoder evaluation: | SMx | | |
| ☑Drive setting | | C Encoder with Drive | ve-CliQ interface | |
| Motor | | E Read enco | der anain | |
| Motor holding brake | | C Calcol deadard | and allows | 1 |
| Encoder Drive functions | | encoder from list | Via motor orde | r no. |
| <u> </u> | | Enter data | Encoder | data |
| | Encoder type | | Code number | - |
| 151 | No encoder | | 0 | |
| 442 | DRIVE-CLiQ encod | ler AS20, singleturn | 202 | - |
| Callar | DRIVE-CLiQ encod | ler AS24, sinaleturn | 242 | |
| S-1 | DRIVE-CLiQ encod | ler AM24, multiturn | 244 | |
| and V | Resolver 1 speed | | 1001 | |
| | Resolver 2 speed | | 1002 | |
| | Resolver 3 speed | | 1003 | |
| | Hesolver 4 speed | | 1004 | - |
| | | | Date | 1 |
| | | | Deta | 118 |
| | 12 | | | |

1. The user can also configure the connected encoders specifically, using the STARTER screens.

Figure 2-31 User-defined encoder option

For this select the option "Enter data" and press the "Encoder data" button.

The following screen appears:

| Encoder Data | | × |
|--|--------------------------|------|
| Encoder Data Encoder type Encoder type Linear Measuring system: No encoder Resolver Incremental sine/cosine Absolute EnDat protocol Incremental HTL/TTL Absolute SSI protocol Absolute SSI protocol sin/cos | | X |
| | <u>OK</u> <u>C</u> ancel | Help |

Figure 2-32 Rotary encoder types

You can choose between "rotary" and "linear" encoders on this screen. For rotary encoders, the following encoder types can be configured:

- Resolver
- Incremental encoder with sin/cos signal
- Absolute encoder with EnDat protocol
- Incremental encoder with HTL/TTL signal
- Absolute encoder with SSI protocol
- Absolute encoder with SSI protocol and HTL/TTL signal
- Absolute encoder with SSI protocol and sin/cos signal

| Encoder Data | × |
|--|------|
| Encoder type | |
| C <u>R</u> otary | |
| C Linear | |
| Measuring system: | |
| No encoder | |
| No encoder | |
| Absolute EnDat protocol Incremental sine/cosine | |
| Incremental HTL/TTL Abade to SSI protocol | |
| Absolute SSI protocol HTL/TTL | |
| Absolute SSI protocol sin/cos | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| <u>OK</u> <u>Cancel</u> | lelp |
| | |

The linear encoder screen offers the following encoder types:

Figure 2-33 Linear encoder types

For linear encoders, you can configure the following encoder types:

- Absolute encoder with EnDat protocol
- Incremental encoder with sin/cos signal
- Incremental encoder with HTL/TTL signal
- Absolute encoder with SSI protocol
- Absolute encoder with SSI protocol and HTL/TTL signal
- Absolute encoder with SSI protocol and sin/cos signal

The encoder-specific screens for both rotary and linear encoder types are self-explanatory and so will not be presented in more detail here.

The following describes the commissioning and exchange of an encoder, using the DRIVE-CLiQ encoder as an example.

Encoders with a DRIVE-CLiQ interface

Encoder evaluation units with DRIVE-CLiQ interface are available in different versions, e.g.

- as Sensor Module Cabinet-Mounted (SMCx) for rail mounting,
- as Sensor Module External (SMEx) to be incorporated the feeder cable,
- as Sensor Module Integrated (SMI), mounted on the motor, or
- as DRIVE-CLiQ Module Integrated (DQI), integrated in the motor.

A temperature sensor at the DRIVE-CLiQ encoder to detect the motor temperature is connected in the factory.

Support with STARTER version

STARTER V4.1.5 supports an encoder with DRIVE-CLiQ interface. Further order numbers (MLFBs) are available for the corresponding DRIVE-CLiQ motors in the encoder overview.

The motor order number is used for SMI or DQI motor.

When configuring a motor with DRIVE-CLiQ interface, a distinction is not made between SMI motors and DQI motors.

Note

Restrictions for SMI/DQI motors

The DRIVE-CLiQ encoder integrated in the motors is only available as absolute encoder.

Exchanging a motor with encoder and DRIVE-CLiQ interface for a motor with SMI or DQI module is only possible by changing the parameter assignments or making the appropriate operator actions. The same behavior from a functional perspective is no longer given, if the encoder

- is different in its measuring principle and resolution.
- is used in an application where the evaluation requires a zero mark (for example for referencing purposes). The encoder with DRIVE-CLiQ interface itself does not deliver a separate zero mark, as an absolute encoder is definitely involved. So in these applications (and/or in the superimposed controls) the changed behavior must be selected.
- should be used on an axis with SINAMICS Safety Integrated Extended Functions or SINUMERIK Safety Integrated. This is because a lower resolution of the redundant position value (POS2) results in lower positional accuracy (SOS Safe Operating Stop) and a lower maximum speed (SLS Safely Limited Speed). check again

A new commissioning test and, if necessary, new configuration must be carried out for activated SINAMICS Safety Integrated Extended Functions or SINUMERIK Safety Integrated.

Commissioning encoders with a DRIVE-CLiQ interface

For DRIVE-CLiQ encoders, the properties of a rotary-type absolute encoder are identified with the following CU parameters:

- p0404[0..n] Encoder configuration active
- p0408[0..n] Rotary encoder pulse number
- p0421[0..n] Absolute encoder rotary multiturn resolution
- p0423[0..n] Absolute encoder rotary singleturn resolution

This data is pre-assigned according to the preset codes in p0400 (encoder type selection) from the encoder lists. Parameters p0404, p0408, p0421 and p0423 are checked by the CU during booting.

Alternatively the data can be read out from the encoder with the setting p0400 = 10000 or p0400 = 10100 (identify encoder). If the encoder data read out matches a known encoder type, this code is entered in p0400 using the CU software. Otherwise the general code p0400 = 10050 (encoder with EnDat interface identified) will be entered.

A DRIVE-CLiQ encoder is identified by the parameter p0404.10 = 1.

For DRIVE-CLiQ encoders, encoder codes are defined respectively for parameter p0400 (see SINAMICS S120/S150 List Manual and above table). If the CU software identifies a DRIVE-CLiQ encoder type for which no code is stored, during identification it enters the code p0400 = 10051 (DRIVE-CLiQ encoder identified).

The data is also automatically identified if a DRIVE-CLiQ encoder is found during automatic commissioning. During identification, the CU reads out the values for p0404, p0421 and p0423 from the DRIVE-CLiQ encoder. The CU uses this data to find out the contents of p0400. The newly defined codes are not stored in the DRIVE-CLiQ encoder.

Exchange of the DRIVE-CLiQ encoder

There is already a spare parts concept for existing SMI motors. The motor and encoder data stored in SMI-EPROM are backed up on the memory card, and if the SMI should fail at the end customer the data can be imported into an "empty" SMI spare part (see literature /FH1/: SINAMICS S120 Function Manual Drive Functions).

This spare parts concept is also applicable for the DRIVE-CLiQ Module Integrated (DQI). Contrary to the SMI encoder, only the motor data is backed up and imported again if spare parts are required. It is not necessary (or possible) to transfer the encoder data.

2.13 Commissioning linear motors (servo)

2.13 Commissioning linear motors (servo)

2.13.1 General information on commissioning linear motors

Before commissioning motors, the following questions must be answered:

• Have all of the prerequisites for commissioning been met and were the points on the commissioning checklist checked, see Chapter "Checklists to commission SINAMICS S?

Detailed information on linear motors, encoders and power connection, configuring and mounting are provided in: Configuration Manual for Linear Motors 1FN3 or 1FN6

Terminology for rotary and linear drives

| Terminology for rotary drives | Terminology for linear drives |
|-------------------------------|-------------------------------|
| Speed | Velocity |
| Torque | Force |
| Stator | Primary section |
| Rotor | Secondary section |
| Rotor | Secondary section |
| Direction of rotation | Direction |
| Pulse number | Grid spacing |
| Rotate | Run |

Checks in the no-current state

The following checks can be made:

- 1. Linear motor
- What linear motor is used?
 IFN _____
- Is the motor already mounted and ready to be powered up?
- If a cooling circuit is being used, is it functional?
- 1. Mechanical system
- Is the axis easy to move over the complete traversing range?
- Does the air gap between the primary and secondary section and the mounting dimensions correspond to the motor manufacturer's data?
- Hanging (suspended) axis: If weight equalizing is used for the axis is this functioning?
- Brake: If a brake is being used, is it correctly controlled (see the SINAMICS S120 Function Manual)?

2.13 Commissioning linear motors (servo)

- Traversing range limiting: Are the mechanical end stops available and tightly bolted to both ends of the traversing path?
- Are the moving feeder cables correctly routed in a cable drag assembly?
- 1. Measuring system
- Which measuring system is being used?

Absolute or incremental? abs incr

Grid spacing ____ µm

Zero marks (number and position) _____

Where is the positive drive direction?
 Where is the positive counting direction of the measuring system?

Invert (p0410)? yes / no

- 1. Wiring
- Power unit (connect UVW, phase sequence, clockwise rotating field)
- Protective conductor connected?
- Shield connected?
- Temperature monitoring circuits: Are the cables connected to the terminal block of the shield connecting plate?
 - Temperature sensor (Temp-F): The temperature sensor (Temp-F) can be used to carry out an absolute measurement of the mean winding temperature.
 - Overtemperature switch (Temp-S):
 The overtemperature trip circuit (Temp-S) enables each individual motor phase winding to be digitally monitored for an overtemperature condition.

The circuits of Temp-F and Temp-S neither have "protective separation" between each other nor to the power circuits in accordance with IEC 61800-5-1.

For this reason, SELV/PELV circuits must not be used and no connection to a SELV/PELV circuit must be established either.

See also the Configuration Manual for Linear Motors 1FN3 or 1FN6.

- Temperature sensor evaluation
- Alternatively, temperature monitoring with SME12x, (description in chapter "thermal motor protection")
- Encoder system connection Is the encoder system connected correctly to SINAMICS?

2.13 Commissioning linear motors (servo)

2.13.2 Commissioning: Linear motor with one primary section

Commissioning with STARTER

Linear drives can achieve significantly higher rates of acceleration and velocities than conventional drives.

The traversing range must always be kept clear in order to avoid any potential danger for man or machine.

Commissioning the motor with STARTER

1. Selecting the motor type

You can select a standard motor from the list of motors. You can enter the motor data for third-party motors manually. The number of parallel primary sections (p0306) must be entered.

| Motor | Configure the motor: | | |
|---------------------|----------------------|---|------------------|
| Motor holding brake | Motor name: | fotor | |
| Encoder | | | 10 have face |
| Summary | , | Motor with DRIVE-CI | LIU Interface |
| | | Head out mot | or again |
| | (| Select standard motor | or from list |
| | (| Enter motor <u>d</u> ata | |
| | Motor type: | 403] 1FN3 synchronou | s motor (linear) |
| | Motor selection: | | |
| | Order no. | Maximum speed | Maximum force |
| | 1FN3100-3WE0x-xxxx | 497 m/min | 1650 N |
| | 1FN3100-4NC8x-xxxx | 305 m/min | 2040 N |
| 4 · · · | 1FN3100-4WC0x-xxxx | 297 m/min | 2200 N |
| | 1FN3100-4W/E0x-xxxx | 497 m/min | 2200 N |
| | 1FN3100-5WC0x-xxxx | 255 m/min | 2750 N |
| | 1FN3150-1KC7x-xxxx | 493 m/min | 1030 N |
| | 1FN3150-1NC2x-xxxx | 234 m/min | 770 N |
| | 1FN3150-1WC0x-xxxx | 321 m/min | 825 N |
| 2:21 | 1FN3150-1WE0x-xxxx | 605 m/min | 825 N |
| A PARTY ANENS | 1FN3150-2KC7x-xxxx | 491 m/min | 2060 N |
| SIE | 1FN3150-2NB8x-xxxx | 201 m/min | 1530 N |
| | 1FN3150-2WC0x-xxxx | 282 m/min | 1650 N |
| | 1FN3150-3KC7x-xxxx | 490 m/min | 3100 N |
| | 1EN3150-3NC7x-xxxx | 292 m/min | 2300 N |
| | • | | • |
| | Parallel motor co | nnection | Number: 1 |

Figure 2-34 STARTER screen, linear motor selection 1FN3

2.13 Commissioning linear motors (servo)

2. Enter motor data

The following motor data must be entered for third-party motors:

| Parameter | Description | Comment |
|-----------|---------------------------------|---------|
| p0305 | Rated motor current | - |
| p0311 | Motor rated velocity | - |
| p0315 | Motor pole pair width | - |
| p0316 | Motor force constant | - |
| p0322 | Motor velocity, maximum | - |
| p0323 | Maximum motor current | - |
| p0338 | Motor limit current | - |
| p0341 | Motor weight | - |
| p0350 | Motor stator resistance, cold | - |
| p0356 | Motor stator leakage inductance | - |

Table 2- 20 Motor data

 Table 2- 21
 Optionally, further motor data (linear synchronous motor) can be entered for third-party motors:

| Parameter | Description | Comment |
|-----------|--|---------|
| p0312 | Rated motor force | - |
| p0317 | Motor voltage constant | - |
| p0318 | Motor stall current | - |
| p0319 | Motor stall force | - |
| p0320 | Rated motor magnetizing current | - |
| p0326 | Stall torque correction factor | - |
| p0329 | Pole position identification current | - |
| p0348 | Speed at start of field weakening | - |
| p0353 | Motor series inductance | - |
| p0391 | Current controller adaptation, lower application point | - |
| p0392 | Current controller adaptation, upper application point | - |
| p0393 | Current controller adaptation, P gain, scaling upper | |

1. User-defined encoder data

2.13 Commissioning linear motors (servo)

| Encoder type | Incremental tracks | б им | |
|--|--|---|------|
| Measuring system: Incremental sine/cosine Encoder evaluation: SMx | Zero marks Configuration: One zero mark | Ref. mar <u>k</u> | 0 mm |
| | Synchronization Coarse synchronization: C Non <u>e</u> C <u>P</u> ole position ident. C <u>H</u> all sensors | Fine synchronization: C <u>N</u> one | ks |
| | | | |

With linear motors, the encoder is configured in the "User-defined encoder data" screen.

Figure 2-35 Encoder data screen in STARTER

When linear motors are configured for the first time, the commutation angle offset (p0431) must be adjusted. For more information about the commutation angle offset and pole position identification (servo), see the Function Manual S120, servo control chapter.

2.13.3 Commissioning: Linear motor with several identical primary sections

General information

If you are sure that the EMF of more than one motor has the same relative phase position to another, the connecting cables can be connected in parallel and operated from one drive.

Linear motors, which are connected in parallel, are commissioned, based on the commissioning of a single linear motor. The number of parallel-connected primary sections is entered in the "Motor" screen (p0306) when the drive is configured in STARTER.

The linear motors are connected individually in sequence to the drive, and are commissioned as a single motor (1FNx ...). The angular commutation offset is automatically determined and noted for each motor. Finally, the measured angular commutation offset of the motors are compared with each other.

If the difference between the angular commutation offset is less than 10 degrees (electrical), all the motors can be connected to the drive in parallel and commissioned as a parallel configuration of n linear motors (e.g. 2 • 1FN3xxx).

Note

Only identical linear motors (the same forces, winding types, secondary section types and air gap) may be connected in parallel. (The order number of the primary sections to be connected in parallel must be identical, including the winding direction and/or primary section length.)

If linear motors in an axis are connected in parallel, the position of the primary sections with respect to one another and to the secondary sections must exhibit a specific grid, in order to achieve a matching electrical phase position.

For more information see: /PJLM/ Configuration Manual for Linear Motors 1FN3 or 1FN6

Temperature sensor and electrical wiring

The temperature sensors can be evaluated, for example, as follows:

- Temperature sensor
 - Motor 1: Evaluated via the drive
 - Motor n: not connected (short-circuited and connected to the PE)
- Temperature switch
 - Motor 1 to n: Evaluation via a PLC

See also: /PJLM/ Configuration Manual for Linear Motors 1FN3 or 1FN6

∕!∖warning

When connecting up the temperature monitoring circuits, carefully observe the specifications relating to protective separation according to DIN EN 50178.

See also: /PJLM/ Configuration Manual for Linear Motors 1FN3 or 1FN6

2.13 Commissioning linear motors (servo)

2.13.4 Thermal motor protection

Description

Two independent monitoring circuits are available for the 1FN3, 1FN6 primary sections for thermal motor protection. Temperature measurements for thermal motor protection can also be carried out using sensor modules from the SME12x series.

The absolute average winding temperature can be measured using the temperature sensor (Temp-F) comprising a temperature sensor (KTY 84).

The overtemperature shutdown circuit (Temp-S) allows each individual motor phase winding to be digitally monitored for an overtemperature condition.

The two independent temperature circuits Temp-F and Temp-S can be used for motor protection, either separately or together. At least one Temp_S must be used for the motor overtemperature protection.

The circuit and connection system for Temp-F and Temp-S are described in detail in the Configuration Manual; linear motors 1FN3 or 1FN6.

The SME12x (Sensor Module External) is a device with connectors enabling the connection of various sensors of a direct drive (WMS, Hall sensors, temperature sensors). The output of the SME12x is connected to SINAMICS drive systems via DRIVE-CLiQ. The requirements regarding protective separation in accordance with EN 61800-5-1 are fulfilled by the electrical isolation between the voltage circuits for power and sensors. The SME 12x therefore fulfills the following functions:

- All signal lines can be connected close to the motor.
- Temperature sensors can be fully evaluated:
 - Thermal motor protection through evaluation of Temp-S
 - Display of the temperature curve via evaluation of Temp-F
- The drive system evaluates the temperature.

There are two variants of SME12x:

- SME120 for incremental position measurement systems
- SME125 for absolute position measurement systems

You will find further information on the SME12x in the SINAMICS S120 Manual, Control Units and Additional System Components, in the chapter Encoder System Connection.

The circuits of Temp-F and Temp-S neither have "protective separation" between each other nor to the power circuits in accordance with VDE 0160/EN 50178.

2.13 Commissioning linear motors (servo)

∕!∖DANGER

Temp-S must be connected for thermal motor protection; it is not permissible not to connect Temp-S!

Temp-F can be optionally connected to a measuring device for commissioning and testing.

For regular operation, the Temp-F connections should be short-circuited and connected to PE.

Note

The temperature sensor (Temp-F) only evaluates the winding temperature of one phase in the primary section. The phases in the synchronous motor are, however, loaded to different degrees with the result that, in the worst case, the phases that are not measured have higher temperatures.

Note

If protection by electrical separation is provided, Temp-F must not be connected to a Sensor Module in the SINAMICS drive system without the use of a suitable protection module.

When handling and connecting Temp-F, it must be assumed that when the drive is powered up, there are hazardous voltages at the terminals on the motor side and at the Temp-F connecting cable. This means that the drive must always be disconnected to ensure that it really is in a no-voltage condition.

Note

If protection by electrical separation is provided, Temp-S must not be connected to the PLC or Sensor Module in the SINAMICS drive system without the use of a thermistor motor protection (3RN1013-1BW10) or a suitable protection module.

When handling and connecting Temp-F, it must be assumed, that when the drive is powered up, there are hazardous voltages at the terminals on the motor side and at the Temp-F connecting cable. This means that the drive must always be disconnected to ensure that it really is in a no-voltage condition.

Evaluating the temperature sensors

See also: Configuration Manual for Linear Motors 1FN3 or 1FN6.

2.13 Commissioning linear motors (servo)

2.13.5 Measuring system

Determining the control sense

The control sense of an axis is correct if the positive direction of the drive (= clockwise rotating field U, V, W) coincides with the positive counting direction of the measuring system.

Note

The data to determine the drive direction is only valid for Siemens motors (1FNx motors).

If the positive direction of the drive and positive counting direction of the measuring system do not match, the actual speed value (P0410.0) must be inverted when the drive is commissioned.

The control sense can also be checked by first parameterizing the drive, and then manually moving it, with the enable signals inhibited (switched out).

If the axis is moved in the positive direction, the actual speed value must also count in the positive direction.

Determining the drive direction

The direction of the drive is positive if the primary section moves relative to the secondary section in the opposite direction to the cable outlet direction.



Figure 2-36 Determining the positive direction of the drive

Determining the counting direction of the measuring system

The counting direction is determined depending on the measuring system.

2.13 Commissioning linear motors (servo)

Measuring systems from Heidenhain

Note

The counting direction of the measuring system is positive, if the distance between the sensor head and rating plate increases.





Measuring systems from Renishaw (e.g. RGH22B)

As the reference mark for the Renishaw RGH22B has a direction-dependent position, with control cables BID and DIR, the encoder must be parameterized, so that the reference mark is only output in one direction.

The direction (positive/negative) depends on the geometrical arrangement at the machine and the reference point approach direction.

| Signal | Cable color | Circular connector 12-pin | Connected to | | |
|--------|-------------|------------------------------|---------------------------------------|----------------------------------|--|
| | | | +5 V | 0 V | |
| BID | Black | Pin 9 | Reference marks in both directions | Reference marks in one direction | |
| DIR | Orange | Pin 7 | Positive directions | Negative direction | |
| +5 V | Brown | Pin 12 | | | |
| 0 V | White | Pin 10 | | | |

Table 2-22 Overview of signals

The counting direction of the measuring system is positive if the sensor head moves relative to the gold band in the cable outlet direction.



Figure 2-38 Determining the counting direction for measuring systems from Renishaw

Note

If the sensor head is mechanically connected to the primary section, the cable outlet direction must be different. Otherwise, invert the actual value.

2.13 Commissioning linear motors (servo)

2.13.6 Checking the linear motor by taking measurements

Why make measurements?

If the linear motor was commissioned according to the relevant instructions, and unexplained fault messages still occur, then all of the signals must be checked using an oscilloscope.

Checking the phase sequence U-V-W

For primary sections connected in parallel, the EMF_U from motor 1 must be in phase with the EMF_U from motor 2. The same is true for EMF_V and EMF_W. It is absolutely necessary that this is checked by making the appropriate measurements.

Taking the necessary measurements

- Disconnect the drive line-up from the power supply.
- Notice: Wait until the DC link has been discharged!
- Disconnect the power cables from the drive. Disconnect any primary components connected in parallel.
- Form an artificial neutral point using 1 kOhm resistors.



Figure 2-39 Configuration for taking the measurements

For a positive traversing direction, the phase sequence must be U-V-W. The direction of the drive is positive if the primary section moves relative to the secondary section in the opposite direction to the cable outlet direction.

2.13 Commissioning linear motors (servo)



Figure 2-40 The positive direction of the drive (clockwise rotating field)

Determining the commutation angle using an oscilloscope

Once the oscilloscope has been connected, the drive must first pass the zero mark so that fine synchronization can be carried out.

The angular, commutation offset can be determined by measuring the EMF and normalized electrical pole position via an analog output.



Figure 2-41 Oscillogram

Definition of channels (Ch1 ... Ch4):

- Ch1 EMF phase U to neutral point
- Ch2: EMF phase V to neutral point
- Ch3: EMF phase W to neutral point
- Ch4: Normalized electrical angular pole position via analog output

2.14 Notes on commissioning SSI encoders



Figure 2-42 Setting of the measuring socket T0 on CU320

When the drive is synchronized, the difference between the EMF/phase U and the electrical rotor position is a maximum of 10° .

If the difference is greater, the commutation angle offset must be adjusted.

2.14 Notes on commissioning SSI encoders

Using error bits

The number and position of error bits may vary for SSI encoders. In the event of faults, error codes may even sometimes be transferred within the position information.

It is therefore essential that you assess all the error bits present (see below for parameterization and limitations) as otherwise an error code may be interpreted as position information if faults are present.

Hardware requirements

- SMC20 Sensor Module Cabinet-Mounted
- SME25 Sensor Module External
- SMC30 Sensor Module Cabinet-Mounted
- CU320-2 Control Unit

2.14 Notes on commissioning SSI encoders

Types of encoder that can be connected

| Table 2-23 | Overview of encoder types that can be connected depending on the SIEMENS evaluation modu | ıle |
|------------|--|-----|
| | | |

| Encoder evaluation through module | Incremental tracks | Absolute position | Power supply for encoder | SSI baud rate | Remarks |
|---|--------------------------|----------------------------------|--------------------------|---------------|---|
| SMC20 | sin/cos, 1 Vpp | SSI not cyclic 1) | 5 V | 100 kHz | - |
| SME25 | sin/cos, 1 Vpp | SSI not cyclic ¹⁾ | 5 V | 100 kHz | SME25 is only suited to direct measuring systems |
| SMC30 | Square or | SSI not cyclic ^{1), 3)} | 5 V or 24 V | 100-250 kHz | - |
| | no incremental tracks | SSI, cyclic ²⁾ | | | |

¹⁾ "not cyclic" means that the absolute position is only read when initializing the Sensor Module, after which the position is only calculated by the incremental tracks.

²⁾ "cyclic" means that the absolute position is read permanently (usually in the PROFIBUS or position controller cycle) and the position (X_IST1) formed from this.

3) the SSI protocol is cyclically read-out for the plausibility checks

Note

Only encoders that support a transfer rate of 100 kHz and that have a high level in idle state may be used.

The monoflop time should be parameterized such that it is greater than or equal to the specified monoflop time of the encoder. This must lie in the range between $15 - 30 \ \mu s$.

The level during the monoflop time must be low.

Ramp-up time of the encoder

In order to ensure that correct sensor data is received, the encoder evaluation module checks, after its own ramp-up, whether the connected encoder has also ramped up.

To do this, the SINAMICS converter system proceeds as follows:

- After the power supply is switched on at the encoder, no signals are evaluated for a waiting period of 800 ms.
- After the waiting period has expired, clock signals are applied to the clock cable and the response of the data line observed. As long as the encoder has not ramped up, the encoder holds the data line permanently in the idle state (as a rule "high"). It is expected that the encoder has completed its own ramp-up by this time.
- If the encoder has not ramped up after approx. 10 seconds, the encoder evaluation module signals a timeout error.

2.14 Notes on commissioning SSI encoders

The waiting period starts again when:

- The 5 V power supply is applied to the encoder.
- Switchover to 24 V power supply after completed ramp-up of the encoder evaluation in accordance with the parameterized voltage level.

Note

There is a serial ramp-up (evaluation -> encoder) with the corresponding ramp-up times after every disconnection and connection of the encoder.

Note

An external supply of the encoder with 24 V is permitted.

Parameterization

Predefined encoders

Several predefined SSI encoders are available for commissioning. These can be selected from the STARTER's commissioning screens.

User-defined encoders

If there are no predefined entries for the encoder used, user-defined encoder data can be entered on screens using the commissioning wizard.

Special settings

• Error bits (special case, several error bits)

If an SSI encoder has several error bits, the evaluation is activated in the list of experts as follows using parameter p0434[x]:

Value = dcba
ba: Position of error bit in protocol (0 ... 63)
c: Level (0: Low level 1: High level)
d: Status of evaluation (0: Off, 1: On with 1 error bit, 2: On with 2 error bits ... 9: On with 9 error bits)
The following applies in the event of several error bits:
The position specified under ba and the other bits are assigned in ascending order.
The level set under c applies to all error bits.
Example:
p0434 = 1013
--> The evaluation is activated and the error bit is in position 13 and a low level.
p0434 = 1113
--> The evaluation is activated and the error bit is in position 13 and high level.
p0434 = 2124
--> The evaluation is activated and the 2 error bits are as of position 24 and high level

2.14 Notes on commissioning SSI encoders

• Fine resolution p0418 and p0419

In order to make full use of the entire traversing range of the absolute encoder, the position information, including fine resolution, must not exceed 32 bits.

Example:

An SSI encoder without incremental tracks is used. The encoder has a singleturn resolution of 16 bits and a multiturn resolution of 14 bits. The absolute position's resolution is therefore 30 bits.

Consequently, only a fine resolution of two bits can be set. Parameters p0418[x] and p0419[x] in the list of experts should therefore be set to the value 2.

Diagnostics

Example 1

An SSI encoder without incremental tracks is used. The encoder has a singleturn resolution of 16 bits and a multiturn resolution of 14 bits. The fine resolution p0418[x] and p0419[x] is set to the value 2. In parameter r0482[x] (X_IST1), the product is formed from "pulses per revolution" and fine resolution p0418[x]. If using SSI encoders without incremental tracks, the number of pulses and singleturn resolution are identical. In our example, the actual position value X_IST1 (r0482[x]) must therefore have changed after an encoder resolution by the value singleturn resolution * fine resolution = $2^{16} * 2^{2} = 262144$.

Example 2

An SSI encoder with incremental tracks is used. In this case, incorrect SSI protocol settings can be seen, e.g. by the fact that once the system has been switched on a different absolute position is indicated from that before it was last deactivated.

The absolute position X_IST2 (r0483[x]) must be considered by way of a check. Following PROFIdrive, however, just one value is displayed in this parameter if bit 13 (request absolute value in cycles) is set to the value 1 in the encoder control word p0480[x].

This bit can be set, e.g. with the aid of the binector-connector converter.

Once switched on, the SSI encoder is now turned a few revolutions. Once switched off and on again, the absolute position of X_IST2 (r0483[x]) must indicate an unchanged value. Only minor deviations may occur in the fine resolution area.

2.15 Notes on the commissioning of a 2-pole resolver as absolute encoder

2.15 Notes on the commissioning of a 2-pole resolver as absolute encoder

Description

You can use 2-pole (1 pole pair) resolvers as singleturn absolute encoders. The absolute encoder position actual value is provided in Gn_XIST2 (r0483[x]).

Actual position value format

The factory setting for the fine resolution of Gn_XIST1 differs from the fine resolution in Gn_XIST2 (p0418 = 11, p0419 = 9). This may cause a slight displacement of the encoder position after switching the drive unit off/on.

Therefore, when using a 2-pole resolver as an absolute encoder, we recommend that the fine resolution for Gn_XIST1 (p0418) is set the same as the fine resolution for Gn_XIST2 (p0419), e.g. p0418 = p0419 = 11.

2-pole resolvers are automatically entered in the PROFIdrive profile (r0979) as singleturn absolute encoders.

Position tracking

You can also activate position tracking for a 2-pole resolver. Please note, however, that the resolver may not be moved more than half an encoder revolution (pole width) when switched off. The activation and configuration of the position tracking is described in the chapter "Position tracking".

EPOS - absolute encoder adjustment

If the 2-pole resolver is used as an absolute encoder for basic positioning (EPOS), the absolute encoder adjustment must be performed:

- via STARTER (Basic positioner → Referencing) or
- via the expert list.

To do this, set reference point coordinate p2599 to the value corresponding to the mechanical system and request the adjustment with p2507 = 2.

You will then need to back up the data from RAM to ROM.
Commissioning

2.16 Temperature sensors for SINAMICS components

The following table provides an overview of the SINAMICS drive system components available with temperature sensor connections.

Safe electrical separation of the temperature sensors

Only temperature sensors that meet the safety isolation specifications contained in EN 61800-5-1 may be connected to terminals "+Temp" and "-Temp". If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), a Sensor Module External (SME120 or SME125) must be used. If these instructions are not complied with, there is a risk of electric shock!

| Table 2- 24 | Temperature sensor connections for SINAMICS components |
|-------------|--|
|-------------|--|

| Module | Interface | Pin | Signal name | Technical specifications |
|--------------------|--|----------|-----------------|--|
| SMC10/SMC20 | X520 (sub D) | 13 25 | +Temp - Temp | Temperature sensor KTY84-1C130 / PTC |
| SMC30 | X520 (sub D) Temperature channel 2 | 1 8 | +Temp - Temp | Temperature sensor KTY84-1C130 / PTC / bimetallic- element switch with NC contact |
| | X531 (terminal) Temperature channel 1 | 3 4 | - Temp +Temp | Temperature sensor KTY84-1C130 / PTC / bimetallic- element switch with NC contact |
| CUA31 | X210 (terminal) | 1 2 | +Temp - Temp | Temperature sensor KTY84–1C130 / PTC |
| CUA32 | X210 (terminal) Temperature channel 2 | 1 2 | +Temp - Temp | Temperature sensor KTY84-1C130 / PTC / bimetallic- element switch with NC contact |
| | X220 (sub D) Temperature channel 1 | 1 8 | +Temp - Temp | Temperature sensor KTY84-1C130 / PTC / bimetallic- element switch with NC contact |
| ТМ31 | X522 (terminal) | 7 8 | +Temp - Temp | Temperature sensor KTY84–1C130 / PTC |
| SME20 | Measuring system interface | 7 9 | - Temp +Temp | Temperature sensor KTY84-1C130 / PTC connection cable order number 6FX8002-2CA88- xxxx necessary ¹⁾ |
| SME120 / SME125 | X200 (connector) Temperature channel 2 | 1 2 | - Temp +Temp | Temperature sensor KTY84-1C130 / PTC / bimetallic- element switch with NC contact |
| | X200 (connector) Temperature channel 3 | 3 4 | +Temp - Temp | Temperature sensor KTY84-1C130 / PTC / bimetallic- element switch with NC contact |

2.16 Temperature sensors for SINAMICS components

| Module | Interface | Pin | Signal name | Technical specifications |
|--------------------|--|------------------|------------------------------------|--|
| | X200 (connector) Temperature channel 4 | 5 6 | +Temp - Temp | Temperature sensor KTY84-1C130 / PTC / bimetallic- element switch with NC contact |
| Active Line Module | X21 (terminal) | 1 2 | +Temp - Temp | Active Line Module temperature sensor Temperature switch type: bimetallic-element switch with NC contact |
| Basic Line Module | X21 (terminal) | 1 2 | +Temp - Temp | Basic Line Module temperature sensor Temperature switch type: bimetallic-element switch with NC contact |
| Motor Module | X21/X22 (terminal) The following applies to chassis: X41 (terminal) | 1 2 4 3 | +Temp - Temp +Temp - Temp | Temperature sensor KTY84–1C130 / PTC Bimetallic switch with NC contact: Alarm and timer (only for temperature evaluation via MM) A PT100 temperature sensor can |
| | | | | also be evaluated with a DAC-CIM module. |

¹⁾ Cable for connection to direct measurement systems: Order number 6FXx002-2CB54-xxxx

Commissioning information

The index [0..n] used in the following identifies either the motor data set or the encoder data set.

SMC10/SMC20

You can use the STARTER screen (\signals and monitoring \ motor temperature) to parameterize the motor temperature evaluation via SUB-D socket X520.

SMC30 (from Order No. 6SL3055-0AA00-5CA2)

In addition to temperature evaluation via terminal X531 (temperature channel 1), this module also has temperature evaluation at SUB-D socket X520 (temperature channel 2).

At the default setting (p0600 = 1 "Temperature via encoder 1" and p0601 = 2 "KTY") the temperature is evaluated via the first temperature channel. The temperature sensor is connected to terminal X531 on the SMC30. The temperature is shown via r0035.

The parameterization of the motor temperature evaluation via the sub D socket X520 must be performed in the expert list as follows:

- p0600[0..n]: Selection of the encoder (1, 2 or 3) to which the SMC30, that is used for the temperature evaluation, is assigned (n = motor data set).
- p0601[0..n] = 10 (evaluation via several temperature channels), n = motor data set.
- p4601[0..n]: Select the temperature sensor type for temperature channel 2 (depends on encoder data set n, not motor data set).

Note

With several encoders, the index [n] of the relevant encoder / encoder data set, via which the temperature evaluation is performed, must be used.

The temperature is displayed in parameter r4620[1] (temperature channel 2). For multiple temperature channels (use of temperature channels 1 and 2 on SMC30), parameter r0035 shows the maximum temperature.

Example:

A KTY temperature sensor is connected at the sub D socket X520 on the SMC30 of Encoder 1.

This is parameterized via:

• p0600[0..n] = 1 / p0601[0..n] = 10 / p4601[0..n] = 20

Both temperature channels (X520 and X531) can be used at the same time. In addition to the above parameterization, the sensor type of the temperature sensor connected at terminal X531 must be entered in p4600[0..n]. The maximum value is then generated for the motor temperature and displayed in r0035.

Note

With several encoders, the index [n] of the relevant encoder / encoder data set, via which the temperature evaluation is performed, must be used.

CUA31

The parameterization of the temperature evaluation via terminal X210 can be performed using the STARTER screen (\Signals and monitoring \ Motor temperature). "Temperature sensor via Motor Module (11)" should be selected in the "Temperature sensor selection" field. The temperature of the sensor is displayed in r0035.

CUA32

The parameterization of the temperature evaluation via terminal X210 or sub D socket X220 is performed using two temperature channels.

p0600 = 11: Temperature sensor via Motor Module

For the SINAMICS S120 AC Drive (AC/AC) and if Control Unit Adapter CUA31/CUA32 is used, the temperature sensor connection is on the adapter (X210).

TM31

With Terminal Module TM31, the sensor type used is set via p4100 and the temperature signal interconnected via r4105.

2.16 Temperature sensors for SINAMICS components

SME20

The evaluation of KTY or PTC temperature sensors can be parameterized using the STARTER screen (\Signals and monitoring \ Motor temperature):

- Temperature sensor selection (≜ p0600[0..n]): Selection of the source to which the SME module is assigned (temperature sensor via encoder (1, 2 or 3), temperature sensor via BICO interconnections or temperature sensor via Motor Module)
- Temperature sensor type (≜ p0601[0..n]): Sets the sensor type for motor temperature monitoring.

| B Projekt_1121 | Motor temperature | |
|--|--|-------------------|
| Insert single drive unit SINAMICS S120 CU320 | Temperature sensor via encoder 1 (1) | - |
| > Overview | Themistor type | |
| > Configuration | KTY84 (2) | * |
| E > Topology | Response with overtemperature | |
| E Contro Crit | Warning and fault (reduction of Imax) | |
| E Dinput/output components | Fault message for a thermistor failure | _ |
| E- Drives | Yes | |
| insert drive | 5 . A | |
| Antrieb_1 | Fault message delay time 10,100 + | |
| Prive pavigator | | |
| -> Configuration | | |
| -> Control logic | 0.0 °C | |
| B ≫ Setpoint channel | Enc. module | |
| Open-loop/closed- | | |
| Prunctions Messages and mon | lim | O-Warring message |
| -> Speed message | | <u>+</u> |
| -> Motor temperal | 1000 | 0 |
| Commissioning | 1,000 | |
| Communication | | |
| Interpretation → Diagnostics | | |
| | 1 | F |
| | | |
| | | |

Figure 2-43 Selection of temperature sensor for SME20 modules

SME120/SME125

For modules with several temperature sensor connections (SME Modules), the temperature sensor is selected depending on encoder data set n via parameters p4601[0..n]..p4603[0..n]. A maximum of three motor temperature sensors can be evaluated simultaneously via terminal X200.

The parameterization of the motor temperature evaluation via terminal X200 must be performed in the expert list as follows:

- p0600[0..n]: Selection of the encoder (1, 2 or 3) to which the SME Module, that is used for the temperature evaluation, is assigned (n = motor data set).
- p0601[0..n] = 10 (evaluation via several temperature channels), n = motor data set.
- p4601[0..n]-p4603[0..n]: Select the temperature sensor type of temperature channel 2-4, depending on encoder data set n.
 Only temperature channels 2-4 are available at terminal X200.
- Parameter r4620[0...3] Motor temperatures SME is used to display the current temperatures in the motor, measured via an SME120 or SME125. The indices mean:
 - [1] = SME temperature channel 2 / motor temperature sensor 2
 - [2] = SME temperature channel 3 / motor temperature sensor 3
 - [3] = SME temperature channel 4 / motor temperature sensor 4

Diagnostics parameter r0458[0...2] Sensor Module properties

Index [0...2]: Encoder 1...encoder 3

Parameter r0458 allows the following properties to be queried at the temperature sensor modules:

| Bit | Feature |
|-----|--|
| 02 | Temperature sensor connection present |
| 03 | Connection for PTC for motors with DRIVE-CLiQ also present |
| 04 | Module temperature available |
| 08 | Evaluation set up across several temperature channels |

Selection of several temperature channels $p4601 \dots p4603$ is only possible, for example, when parameter p0601 = 10 is set. This can be checked using the entry r0458.8 = 1.

You can find further information on parameter r0458 in: /LH1/ SINAMICS S 120/S150 List Manual.

Active Line Module, Basic Line Module

Parameter p0601 "Motor temperature sensor type" enables the setting for the sensor type for the temperature measurement at input X21. The measured value is displayed in r0035.

Faults and alarms

F07011 drive: Motor overtemperature

KTY sensor:

The motor temperature has exceeded the fault threshold (p0605) or the timer stage (p0606) after the alarm threshold was exceeded (p0604) has expired. This results in the reaction parameterized in p0610.

PTC sensor:

The response threshold of 1650 Ohm was exceeded and the timer stage (p0606) has expired.

This results in the reaction parameterized in p0610.

If an SME Module is used (p0601 = 10), parameter r949 displays the number of the sensor channel that has triggered the message.

A07015 drive: Motor temperature sensor alarm

A fault was detected when evaluating the temperature sensor set in p0600 and p0601.

With the fault, the time is started in p0607. If the fault is still present after this time has expired, then fault F07016 is output, however, at the earliest 0.2 s after alarm A07015.

If an SME Module is used (p0601 = 10), parameter r2124 displays the number of the sensor channel that has triggered the message.

2.16 Temperature sensors for SINAMICS components

F07016 drive: Motor temperature sensor fault

An error was detected when evaluating the temperature sensor set in p0600 and p0601.

If alarm A07015 is present, the time in p0607 is started. If the fault is still present after this time has expired, then fault F07016 is output; 1 s after alarm A07015 at the earliest, however.

If an SME Module is used (p0601 = 10), parameter r949 displays the number of the sensor channel that has triggered the message.

Function diagrams (see SINAMICS S120/S150 List Manual)

• 8016 Signals and monitoring - Thermal monitoring of motor

Overview of important parameters (refer to the SINAMICS S120/S150 List Manual)

- r0035 Motor temperature
- p0600[0..n] Motor temperature sensor for monitoring
- p0601[0..n] Motor temperature sensor type
- p0601 Motor temperature sensor type
- p0603 CI: Motor temperature signal source
- p0604[0...n] Motor overtemperature alarm threshold
- p0605[0...n] Motor overtemperature fault threshold
- p0606[0...n] Motor overtemperature timer stage
- p0607[0...n] Temperature sensor fault timer stage
- p0610[0...n] Motor overtemperature reaction
- p4100 TM31 temperature evaluation sensor type
- r4105 CO: TM31 temperature evaluation actual value
- p460x[0...n] Motor temperature sensor (x+1) sensor type, x = 0..3
- r0458[0...2] Sensor Module properties
- r4620[0...3] Motor temperatures SME / Mot Temp SME, n = channel 1-4

This chapter describes the following diagnostic features of the SINAMICS S drive system:

- Diagnostics via LEDs
- Diagnostics via STARTER
- Diagnostic buffer
- Fault and alarm messages

3.1 Diagnostics via LEDs

3.1.1 LEDs when the Control Unit is booted

The individual states when booting are indicated by means of the LEDs on the Control Unit.

- The duration of the individual statuses varies.
- If an error occurs, booting is aborted and the cause of the error is indicated via the LEDs. **Remedy:** Insert the appropriate CompactFlash card with the correct software and parameterization.
- Once the unit has been successfully booted, all the LEDs are switched off briefly.
- Once the unit has been booted, the LEDs are driven via the loaded software.

The description of the LEDs after booting applies.

Control Unit - behavior of the LEDs while booting

| Table 3-1 Lo | ad software 1 |
|--------------|---------------|
|--------------|---------------|

| LED | | | | Status | Comment |
|----------|-----|-----|-----|--------|---|
| RDY | DP1 | OPT | MOD | | |
| red | red | red | off | Reset | _ |
| red 2 Hz | red | red | off | error | Memory card not inserted or Load software 2 has not been installed on the memory card or is defective. |

3.1 Diagnostics via LEDs

| LED | | | | Status | Comment |
|-----|------------|-----|-----|--------------------|---|
| RDY | DP1 | OPT | MOD | | |
| off | red | red | off | Loaded | _ |
| off | Orange | red | off | Running | - |
| off | red 2 Hz | red | off | error file | Software on the memory card is incomplete or defective. |
| off | red 0.5 Hz | red | off | error crc | CRC invalid. |
| off | off | red | off | Firmware loaded | - |

Table 3-2 Load software 2

Table 3-3 Firmware

| LED | | | | Status | Comment |
|-------------|-----|-----|-----|--------------|------------------------------|
| RDY | DP1 | OPT | MOD | | |
| off | off | off | off | initializing | - |
| alternating | | | | Running | refer to the following table |

3.1.2 LEDs after the Control Unit has booted

Behavior of the LEDs after booting

| Table 3- 4 | Control Unit - Description of the LEDs after booting |
|------------|--|
|------------|--|

| LED | Color | Status | Description, cause | Remedy |
|-------------|---------------------------|--|---|--|
| RDY (READY) | - | OFF | Electronics power supply is missing or outside permissible tolerance range. | - |
| | Green Continuous light | | The component is ready and cyclic DRIVE-CLiQ communication takes place or the Control Unit waits for initial commissioning. | - |
| | | 2 Hz flashing light | Writing to the memory card. | - |
| | Red Continuous light | At least one fault is present in this component. | Remedy and acknowledge fault | |
| | | 2 Hz flashing light | Boot error | Make sure that the memory card has been inserted properly Replace the memory card Replace Control Unit Carry out a POWER ON |
| | Green/ red | 0.5 Hz flashing light | Control Unit is ready for operation. However there are no software licenses. | Obtain licenses |

Diagnostics

| LED | Color | Status | Description, cause | Remedy |
|--|---------------------------------------|-----------------------------|---|--|
| | Orange | Continuous light | System booting and DRIVE-CLiQ communication is being established. | - |
| | | 0.5 Hz flashing light | Updating the firmware of the DRIVE-CLiQ components | - |
| | | 2 Hz flashing light | Firmware update is complete for components. Wait for POWER ON for the components in question. | Turn POWER ON for the components in question |
| | Green/ orange or red/ orange | 1 Hz flashing light | Detection of the components via LED is activated (p0124[0]). Note: Both options depend on the LED status when activated via p0124[0] = 1. | - |
| DP1 PROFIdrive cyclic operation | - | Off | Cyclic communication is not (yet) running. Note: The PROFIdrive is ready for communication when the Control Unit is ready for operation (see RDY LED). | - |
| | Green | Continuous light | Cyclic communication is taking place. | - |
| | | 0.5 Hz flashing light | Full cyclic communication has not yet taken place. Possible causes: The controller is not transferring any setpoints. During isochronous operation, no global control (GC) or a faulty global control (GC) is transferred by the controller. | _ |
| | Red | Continuous light | Cyclic communication has been interrupted. | Remedy fault |
| | Orange | 2 Hz flashing light | Firmware CRC error. | Make sure that the memory card has been inserted properly Replace the memory card Replace Control Unit Carry out a POWER ON |
| OPT (OPTION) | _ | Off | Electronics power supply missing, is outside permissible tolerance range, component is not ready for operation, Option Board is not available, no associated drive object has been created, | _ |
| | Green | Continuous light | Option board is ready. | - |
| | | 0.5 Hz flashing light | Depends on the option board used. | - |
| | Red | Continuous light | There is at least one fault of this component. The Option Board is not ready (e.g. after switching on). | Remedy and acknowledge fault |
| MOD | - | Off | Reserved | _ |

3.1 Diagnostics via LEDs

3.1.3 Active Line Module

| Table 3- 5 | Active Line Module - description of the LEDs |
|------------|--|
| Table 3- 3 | Active Line Module - description of the LEDS |

| Status | | Description, cause | Remedy |
|------------------------|----------------|--|------------------------------|
| Ready (H200) | DC link (H201) | | |
| off | off | Electronics power supply is missing or outside permissible tolerance range. | _ |
| Green | off | The component is ready for operation and cyclic DRIVE- CLiQ communication is taking place. | - |
| | Orange | The component is ready for operation and cyclic DRIVE- CLiQ communication is taking place. The DC link voltage is present. | - |
| | Red | The component is ready for operation and cyclic DRIVE- CLiQ communication is taking place. The DC link voltage is too high. | Check line voltage |
| Orange | Orange | DRIVE-CLiQ communication is being established. | - |
| Red | _ | At least one fault is present in this component. Note: The LED is activated regardless of whether the corresponding messages have been reconfigured. | Remedy and acknowledge fault |
| Green/ red (0.5 Hz) | - | Firmware is being downloaded. | _ |
| Green/red (2 Hz) | - | Firmware download is complete. Wait for POWER ON. | Carry out a POWER ON |
| Green/orange | - | Component detection via LED is activated (p0124). | - |
| or Red/orange | | Note: Both options depend on the LED status when component recognition is activated via p0124 = 1. | |

Hazardous DC link voltages may be present at any time regardless of the status of the "DC link" LED.

3.1.4 Basic Line Module

Table 3- 6 Basic Line Module - description of the LEDs

| Status | | Description, cause | Remedy |
|----------------------------------|----------------|--|-------------------------------|
| Ready (H200) | DC link (H201) | | |
| off | off | Electronics power supply is missing or outside permissible tolerance range. | - |
| Green | off | The component is ready for operation and cyclic DRIVE- CLiQ communication is taking place. | - |
| | Orange | The component is ready for operation and cyclic DRIVE- CLiQ communication is taking place. The DC link voltage is present. | - |
| | Red | The component is ready for operation and cyclic DRIVE- CLiQ communication is taking place. The DC link voltage is too high. | Check the line voltage. |
| Orange | Orange | DRIVE-CLiQ communication is being established. | - |
| Red | _ | At least one fault is present in this component. Note: The LED is activated regardless of whether the corresponding messages have been reconfigured. | Remedy and acknowledge fault. |
| Green/ red (0.5 Hz) | - | Firmware is being downloaded. | - |
| Green/red (2 Hz) | - | Firmware download is complete. Wait for POWER ON. | Carry out a POWER ON |
| Green/orange or Red/orange | - | Component detection via LED is activated (p0124). Note: Both options depend on the LED status when component recognition is activated via p0124 = 1. | - |

Hazardous DC link voltages may be present at any time regardless of the status of the "DC link" LED.

3.1 Diagnostics via LEDs

3.1.5 Smart Line Modules 5 kW and 10 kW

| LED | Color | State | Description, cause | Remedy |
|---------|--------|------------|--|---|
| READY | - | OFF | Electronics power supply is missing or outside permissible tolerance range. | - |
| | Green | Continuous | Component is ready to operate. | - |
| | Yellow | Continuous | Pre-charging not yet complete. bypass relay dropped out EP terminals not supplied with 24 VDC. | - |
| | Red | Continuous | Overtemperature Overcurrent switch-off | Diagnostics fault (via output terminals) and acknowledge it (via input terminal) |
| DC LINK | - | OFF | Electronics power supply is missing or outside permissible tolerance range. | - |
| | Yellow | Continuous | DC-link voltage within permissible tolerance range. | - |
| | Red | Continuous | DC-link voltage outside permissible tolerance range. Line supply fault. | Check the line voltage. |

Table 3-7 5 kW and 10 kW Smart Line Modules – description of the LEDs

| Δ | |
|-----|--------|
| ∕!∖ | DANGER |

Hazardous DC-link voltages may be present at any time regardless of the state of the "DC link" LED.

3.1.6 Smart Line Modules 16 kW and 36 kW

| Table 3- 8 | Smart Line M | /odule > ² | 16 kW - 1 | description | of the | I FDs |
|------------|--------------|-----------------------|-----------|-------------|--------|-------|
| | Smart Line N | nouule = | | uescription | | |

| S | tate | Description, cause | Remedy |
|-----------------------|----------------|--|------------------------------|
| Ready (H200) | DC link (H201) | | |
| OFF | OFF | Electronics power supply is missing or outside permissible tolerance range. | _ |
| Green | OFF | The component is ready for operation and cyclic DRIVE- CLiQ communication is taking place. | _ |
| | Orange | The component is ready for operation and cyclic DRIVE- CLiQ communication is taking place. The DC-link voltage is present. | - |
| | Red | The component is ready for operation and cyclic DRIVE- CLiQ communication is taking place. The DC-link voltage is too high. | Check the line voltage. |
| Orange | Orange | DRIVE-CLiQ communication is being established. | - |
| Red | - | At least one fault is present in this component. Note: The LED is activated regardless of whether the corresponding messages have been reconfigured. | Remedy and acknowledge fault |
| Green/Red (0.5 Hz) | - | Firmware is being downloaded. | _ |
| Green/Red (2 Hz) | - | Firmware download is complete. Waiting for POWER ON. | Carry out a POWER ON |
| Green/Orange | - | Component detection via LED is activated (p0124). | - |
| or Red/Orange | | Note: Both options depend on the LED status when component recognition is activated via p0124 = 1. | |

Hazardous DC-link voltages may be present at any time regardless of the state of the "DC link" LED.

3.1 Diagnostics via LEDs

3.1.7 Single Motor Module / Double Motor Module / Power Module

| Status | | Description, cause | Remedy |
|----------------------------------|----------------|--|---------------------------------|
| Ready (H200) | DC link (H201) | | |
| OFF | OFF | Electronics power supply is missing or outside permissible tolerance range. | _ |
| Green | OFF | The component is ready for operation and cyclic DRIVE- CLiQ communication is taking place. | - |
| | Orange | The component is ready for operation and cyclic DRIVE- CLiQ communication is taking place. The DC link voltage is present. | _ |
| | Red | The component is ready for operation and cyclic DRIVE- CLiQ communication is taking place. The DC link voltage is too high. | Check supply voltage |
| Orange | Orange | DRIVE-CLiQ communication is being established. | - |
| Red | _ | At least one fault is present in this component. Note: The LED is activated regardless of whether the corresponding messages have been reconfigured. | Remedy and acknowledge fault |
| Green/red (0.5 Hz) | - | Firmware is being downloaded. | _ |
| Green/red (2 Hz) | - | Firmware download is complete. Wait for POWER ON. | Carry out a POWER ON |
| Green/orange or Red/orange | - | Component detection via LED is activated (p0124). Note: Both options depend on the LED status when component recognition is activated via p0124 = 1. | - |

Table 3-9 Single Motor Module / Double Motor Module / Power Module - description of the LEDs

Hazardous DC link voltages may be present at any time regardless of the status of the "DC link" LED.

3.1.8 Braking Module Booksize

| Table 3- 10 | Braking Module Booksize – description of the LEDs |
|-------------|---|
| | Braking Module Booksize – description of the LEDS |

| LED | Color | Status | Description, cause | Remedy | |
|---------|---|------------|--|--|--|
| READY | - | off | Electronics power supply is missing or outside permissible tolerance range. | - | |
| | | | Component deactivated via terminal. | | |
| | Green Continuous Component is ready to operate. | | | | |
| | Red | Continuous | Overtemperature Overcurrent switch-off I ² t monitoring activated Ground fault/short-circuit. Note: In the event of an overtemperature, the error cannot be acknowledged until a cooling time has elapsed. | Diagnose fault (via output terminals) and acknowledge it (via input terminal) | |
| DC LINK | - | off | Electronics power supply is missing or outside permissible tolerance range. Component not active. | _ | |
| | Green | Flashing | Component active (DC link discharge via braking resistor in progress). | - | |

3.1.9 Control Supply Module

| Table 3- 11 | Control Supply Module - description of the LEDs |
|-------------|---|
|-------------|---|

| LED | Color | Status | Description, cause | Remedy |
|---------|--------|------------|---|--------|
| READY | - | off | Electronics power supply is missing or outside permissible tolerance range. | - |
| | Green | Continuous | Component is ready to operate. | - |
| DC LINK | - | off | Electronics power supply is missing or outside permissible tolerance range. | - |
| | Orange | Continuous | DC link voltage within permissible tolerance range. | - |
| | Red | Continuous | DC link voltage outside permissible tolerance range. | - |

3.1.10 Sensor Module Cabinet SMC10 / SMC20

| Table 3- 12 | Sensor Module | Cabinet 10 / 20 | (SMC10 / SMC20) | - description of the LEDs |
|-------------|---------------|-----------------|-----------------|---------------------------|
|-------------|---------------|-----------------|-----------------|---------------------------|

| LED | Color | Status | Description, cause | Remedy |
|--------------|--------|------------|---|--------|
| RDY READY | - | off | Electronics power supply is missing or outside permissible tolerance range. | - |
| | Green | Continuous | The component is ready for operation and cyclic DRIVE- CLiQ communication is taking place. | - |
| | Orange | Continuous | DRIVE-CLiQ communication is being established. | - |

3.1 Diagnostics via LEDs

| LED | Color | Status | Description, cause | Remedy |
|-----|--|-----------------------------|---|------------------------------|
| | Red | Continuous | At least one fault is present in this component. Note: LED is driven irrespective of the corresponding messages being reconfigured. | Remedy and acknowledge fault |
| | Green/ red | 0.5 Hz flashing light | Firmware is being downloaded. | - |
| | | 2 Hz flashing light | Firmware download is complete. Wait for POWER ON | Carry out a POWER ON |
| | Green/ orange or Red/ orange | Flashing light | Component recognition via LED is activated (p0144) Note: Both options depend on the LED status when component recognition is activated via p0144 = 1. | _ |

3.1.11 Sensor Module Cabinet SMC30

Table 3-13 Sensor Module Cabinet SMC30 – description of the LEDs

| LED | Color | Status | Description, cause | Remedy |
|--------------|--|-----------------------------|--|---------------------------------|
| RDY READY | - | Off | Electronics power supply is missing or outside permissible tolerance range. | - |
| | Green | Continuous light | The component is ready for operation and cyclic DRIVE- CLiQ communication is taking place. | - |
| | Orange | Continuous light | DRIVE-CLiQ communication is being established. | - |
| | Red | Continuous light | At least one fault is present in this component. Note: The LED is activated regardless of whether the corresponding messages have been reconfigured. | Remedy and acknowledge fault |
| | Green/ red | 0.5 Hz flashing light | Firmware is being downloaded. | - |
| | Green/ red | 2 Hz flashing light | Firmware download is complete. Wait for POWER ON. | Carry out a POWER ON |
| | Green/ orange or Red/ orange | Flashing light | Component recognition via LED is activated (p0144). Note: Both options depend on the LED status when component recognition is activated via p0144 = 1. | - |

| LED | Color | Status | Description, cause | Remedy |
|-----------|--------|---------------------|--|--------|
| OUT > 5 V | - | Off | Electronics power supply is missing or outside permissible tolerance range. Power supply \leq 5 V. | - |
| | Orange | Continuous light | Electronics power supply for encoder system available. Power supply > 5 V. | - |
| | | | Important: Make sure that the connected encoder can be operated with a 24 V power supply. If an encoder that is designed for a 5 V supply is operated with a 24 V supply, this can destroy the encoder electronics. | |

3.1.12 Terminal Module TM15

| Table 3-14 Terminal Module TM15 - description | i of LEDs |
|---|-----------|
|---|-----------|

| LED | Color | State | Description, cause | Remedy |
|-------|--|--------------------|--|------------------------------|
| READY | - | OFF | Electronics power supply is missing or outside permissible tolerance range. | - |
| | Green | Continuous | The component is ready for operation and cyclic DRIVE- CLiQ communication is taking place. | - |
| | Orange | Continuous | DRIVE-CLiQ communication is being established. | - |
| | Red | Continuous | At least one fault is present in this component. Note: The LED is activated regardless of whether the corresponding messages have been reconfigured. | Remedy and acknowledge fault |
| | Green/r ed | Flashing 0.5 Hz | Firmware is being downloaded. | - |
| | | Flashing 2 Hz | Firmware download is complete. Wait for POWER ON | Carry out a POWER ON |
| | Green/ orange or Red/ orange | Flashing | Component recognition via LED is activated (p0154). Note: Both options depend on the LED status when component recognition is activated via p0154 = 1. | - |

3.1 Diagnostics via LEDs

3.1.13 Terminal Module TM31

| LED | Color | State | Description, cause | Remedy |
|-------|--|--------------------|--|------------------------------|
| READY | - | OFF | Electronics power supply is missing or outside permissible tolerance range. | - |
| | Green | Continuous | The component is ready for operation and cyclic DRIVE- CLiQ communication is taking place. | - |
| | Orange | Continuous | DRIVE-CLiQ communication is being established. | - |
| | Red | Continuous | At least one fault is present in this component. Note: The LED is activated regardless of whether the corresponding messages have been reconfigured. | Remedy and acknowledge fault |
| | Green/ red | Flashing 0.5 Hz | Firmware is being downloaded. | - |
| | | Flashing 2 Hz | Firmware download is complete. Wait for POWER ON | Carry out a POWER ON |
| | Green/ orange or Red/ orange | Flashing | Component recognition via LED is activated (p0154). Note: Both options depend on the LED status when component recognition is activated via p0154 = 1. | - |

Table 3-15 Terminal Module TM31 - description of LEDs

3.1.14 Terminal Module TM41

| Table 3- 16 | Terminal Module | TM41 - description | on of LEDs |
|-------------|-----------------|--------------------|------------|
|-------------|-----------------|--------------------|------------|

| LED | Color | Status | Description, cause | Remedy |
|-------|--|-----------------------------|--|---------------------------------|
| READY | - | Off | Electronics power supply is missing or outside permissible tolerance range. | - |
| | Green | Continuous light | The component is ready for operation and cyclic DRIVE- CLiQ communication is taking place. | - |
| | Orange | Continuous light | DRIVE-CLiQ communication is being established. | - |
| | Red | Continuous light | At least one fault is present in this component. Note: The LED is activated regardless of whether the corresponding messages have been reconfigured. | Remedy and acknowledge fault |
| | Green/ red | 0.5 Hz flashing light | Firmware is being downloaded. | - |
| | | 2 Hz flashing light | Firmware download is complete. Wait for POWER ON. | Carry out a POWER ON |
| | Green/ orange or Red/ orange | Flashing light | Component recognition via LED is activated (p0154). Note: Both options depend on the LED status when component recognition is activated via p0154 = 1. | - |

Diagnostics

3.1 Diagnostics via LEDs

| LED | Color | Status | Description, cause | Remedy |
|----------|-------|---------------------|--|--------|
| Z pulses | - | Off | Zero marker found; wait for zero marker output; OR component switched off. | - |
| | Red | Continuous light | Zero mark not enabled or zero mark search. | - |
| | Green | Continuous light | Stopped at zero mark. | - |
| | | Flashing light | Zero mark is output at each virtual revolution. | - |

3.1.15 Terminal Module TM54F

| Table 3- 17 | Terminal Module TM54E - description of | of LEDs |
|-------------|--|---------|
| | | |

| LED | Color | | Status | Description, cause | Remedy |
|----------------------------------|--------------------------|-----------------|--------------------------|--|------------------------------|
| READY | Υ - | | Off | Electronics power supply is missing or outside permissible tolerance range. | - |
| | Green | | Continuous light | The component is ready for operation and cyclic DRIVE- CLiQ communication is taking place. | - |
| | Orange | | Continuous light | DRIVE-CLiQ communication is being established. | - |
| | Red | | Continuous light | At least one fault is present in this component. Note: The LED is activated regardless of whether the corresponding messages have been reconfigured. | Remedy and acknowledge fault |
| | Green/ree | ł | 0.5 Hz flashing light | Firmware is being downloaded. | - |
| | | | 2 Hz flashing light | Firmware download is complete. Wait for POWER ON | Carry out a POWER ON |
| Green/orange or Red/orange | | ange ge | Flashing light | Component recognition via LED is activated (p0154). Note: Both options depend on the LED status when component recognition is activated via p0154 = 1. | - |
| L1+, L2+, | - | | ON | The controllable sensor power supply is functioning fault- free. | - |
| | Red | | Continuous light | There is a fault in the controllable sensor power supply. | - |
| L3+ | - | | ON | Sensor power supply is functioning fault-free. | |
| | Red | | Continuous light | There is a fault in the sensor power supply. | |
| Fail-safe in | e inputs / double inputs | | | | |
| F_DI z | LED | LED | | | _ |
| (input x, (x+1)+, (x+1)-) | x - - | x+1 Red - | Cont. light – | NC contact / NC contact ¹ : ($z = 09$, $x = 0, 2,18$) Different signal states at input x and x+1 No signal at input x and no signal at input x+1 | |
| | - | Red - | Cont. light – | NC contact / NO contact ¹ : ($z = 09$, $x = 0, 2,18$) Same signal states at input x and x+1 No signal at input x and a signal at input x+1 | |

3.1 Diagnostics via LEDs

| LED | Co | or | Status | Description, cause | Remedy |
|---|-------------------|---------------------|---------------------|---|--------|
| | LED x Green | LED x+1 Green | Cont. light | NC contact / NC contact ¹ : ($z = 09$, $x = 0, 2,18$) A signal at input x and a signal at input x+1 | - |
| | Green | Green | Cont. light | NC contact / NO contact ¹ : ($z = 09$, $x = 0, 2,18$) A signal at input x and no signal at input x+1 | |
| ¹⁾ Inputs x+1 (DI 1+, 3+, 19+) can be set individually via parameter p10040. p10040 = 0: Input x+1 ist NC contact. p10040 = 1: Input x+1 is NO contact. Factory setting: p10040 = 0 for all inputs x+1. | | | | | |
| Single digita | al inputs, n | ot fail-saf | e | | |
| DI x | _ | | Off | No signal at digital input x (x = 2023) | _ |
| | Green | | Cont. light | Signal at digital input x | _ |
| Fail-safe dig | gital output | s with as | sociated readba | ack channel | |
| F_DO y (0+3+, 03-) | Green | | Continuous light | Output y (y=0 3) carries a signal | _ |
| Readback input DI 2y for output $F_DO y (y = 03)$ at test stop. The state of the LEDs also depends on the type of external circuit. | | | | | |
| DI 2y | - | | Off | One of the two output lines y+ or y- or both lines of output y carry a signal | - |
| | Green | | Cont. light | Both output lines y+ and y- carry no signal | - |

3.1.16 Communication Board CAN (CBC10)

| Table 3- 18 | Communication Board | CAN CBC10 - Description | of the LEDs |
|-------------|---------------------|-------------------------|-------------|
| | | | |

| LED | Color | Status | Description, cause | Remedy |
|----------------------------|-------|----------------|---|---------------------------------------|
| OPT on the Control Unit | - | OFF | Electronics power supply is missing or outside permissible tolerance range. | - |
| | | | Communication Board either defective or not inserted. | |
| | Green | Cont. light | OPERATIONAL | - |
| | | Flashing light | PREOPERATIONAL | - |
| | | | No PDO communication possible | |
| | | Single flash | STOPPED | |
| | | | Only NMT communication possible | |
| | Red | Continuous | BUS OFF | Check baud rate |
| | | light | | Check cabling |
| | | Single flash | ERROR PASSIVE MODE | Check baud rate |
| | | | The error counter for "error passive" has reached the value 127. After the SINAMICS drive system was booted no further active CAN component was on the bus. | Check cabling |
| | | Double flash | Error Control Event, a Guard Event has occurred | Check connection to CANopen master |

3.1.17 Communication Board Ethernet CBE20

| LED | Color | Status | Description, cause | Remedy |
|----------------------------|--------|---------------------|--|--------|
| Link port | - | Off | Electronics power supply is missing or outside permissible tolerance range. | - |
| | Green | Continuous light | A different device is connected to port x and a physical connection exists. | - |
| Activity port | - | Off | Electronics power supply is missing or outside permissible tolerance range. | - |
| | Yellow | Continuous light | Data is being received or sent at port x. | - |
| Fault | - | Off | If the Link Port LED is green: | - |
| | | | The CBE20 is operating normally, data is being exchanged with the configured IO Controller | |
| | Red | Flashing | The response monitoring interval has elapsed. | - |
| | | | Communications is interrupted. | |
| | | | The IP address is incorrect. | |
| | | | Incorrect or no configuration. | |
| | | | Incorrect parameter settings. | |
| | | | Incorrect or missing device name. | |
| | | | IO Controller not connected/switched off, although an Ethernet connection has been established | |
| | | | • Other CBE20 errors | |
| | | | | |
| | | Continuous | CBE20 bus error | - |
| | | light | No physical connection to a subnet/switch. | |
| | | | Incorrect transmission rate | |
| | | | Full duplex transmission is not activated. | |
| Sync | - | Off | If the Link Port LED is green: | - |
| | | | Control Unit task system is not synchronized with the IRT | |
| | | | clock. An internal substitute clock is generated. | |
| | Green | Flashing | The Control Unit task system has synchronized with the | - |
| | | light | IRT clock cycle and data is being exchanged. | |
| | | Continuous light | Task system and MC-PLL have synchronized with the IRT clock. | - |
| OPT on the Control Unit | - | OFF | Electronics power supply is missing or outside permissible tolerance range. | - |
| | | | Communication Board either defective or not inserted. | |
| | Green | Continuous light | Communication Board is ready and cyclic communication is taking place. | - |
| | | 0.5 Hz | The Communication Board is ready, but cyclic | - |
| | | flashing | communication is not yet taking place. | |
| | | light | Possible causes: | |
| | | | At least one fault is present. | |
| | | | Communication is being established. | |

Table 3-19 Communication Board Ethernet CBE20 – description of the LEDs

3.1 Diagnostics via LEDs

| LED | Color | Status | Description, cause | Remedy |
|-----|--------|-----------------------------|---|---|
| | Red | Continuous light | Cyclic communication via PROFINET has not yet been established. However, non-cyclic communications are possible. SINAMICS waits for a parameterizing/configuring telegram | - |
| | | 0.5 Hz flashing light | The firmware has not been successfully downloaded to the CBE20 (error). Possible causes: The CBE20 is defective. The memory card for the Control Unit is defective. In this state CBE20 cannot be used. | _ |
| | | 2.5 Hz flashing light | Communication between the Control Unit and CBE20 is faulty. Possible causes: • Board was withdrawn after booting. • The board is defective | Correctly insert the board, if required, replace. |
| | Orange | 2.5 Hz flashing light | Firmware is being downloaded. | _ |

3.1.18 Voltage Sensing Module VSM10

| Table 3- 20 | Voltage Sensing Module | VSM10 – description of LEDs |
|-------------|------------------------|-----------------------------|
|-------------|------------------------|-----------------------------|

| LED | Color | State | Description, cause | Remedy |
|-------|--|--------------------|---|---------------------------------|
| READY | - | OFF | Electronics power supply is missing or outside permissible tolerance range. | _ |
| | Green | Continuous | The component is ready for operation and cyclic DRIVE- CLiQ communication is taking place. | - |
| | Orange | Continuous | DRIVE-CLiQ communication is being established. | - |
| | Red | Continuous | At least one fault is present in this component. Note: The LED is activated regardless of whether the corresponding messages have been reconfigured. | Remedy and acknowledge fault |
| | Green/ red | Flashing 0.5 Hz | Firmware is being downloaded. | - |
| | | Flashing 2 Hz | Firmware download is complete. Wait for POWER ON | Carry out a POWER ON |
| | Green/ orange or Red/ orange | Flashing | Component recognition via LED is activated (p0144) Note: Both options depend on the LED status when component recognition is activated via p0144 = 1. | - |

3.1.19 DRIVE-CLiQ Hub Module DMC20

| LED | Color | State | Description, cause | Remedy |
|-------|--|--------------------|--|------------------------------|
| READY | - | OFF | Electronics power supply is missing or outside permissible tolerance range. | - |
| | Green | Continuous | The component is ready for operation and cyclic DRIVE- CLiQ communication is taking place. | _ |
| | Orange | Continuous | DRIVE-CLiQ communication is being established. | - |
| | Red | Continuous | At least one fault is present in this component. Note: The LED is activated regardless of whether the corresponding messages have been reconfigured. | Remedy and acknowledge fault |
| | Green/ red | Flashing 0.5 Hz | Firmware is being downloaded. | - |
| | | Flashing 2 Hz | Firmware download is complete. Wait for POWER ON | Carry out a POWER ON |
| | Green/ orange or Red/ orange | Flashing | Component recognition via LED is activated (p0154). Note: Both options depend on the LED status when component recognition is activated via p0154 = 1. | - |

Table 3- 21 DRIVE-CLiQ Hub Module DMC20 – description of the LEDs

3.2 Diagnostics via STARTER

3.2 Diagnostics via STARTER

Description

The diagnostic functions support commissioning and service personnel during commissioning, troubleshooting, diagnostics and service activities.

General information

Prerequisites: Online operation of STARTER.

The following diagnostic functions are available in STARTER:

- Specifying signals with the ramp-function generator
- Signal recording with the trace function
- Analyzing the control response with the measuring function
- Outputting voltage signals for external measuring devices via test sockets

3.2.1 Function generator

Description

The ramp-function generator can be used, for example, for the following tasks:

- To measure and optimize control loops.
- To compare the dynamic response of coupled drives.
- To specify a simple traversing profile without a traversing program.

The ramp-function generator can be used to generate different signal shapes.

In the connector output operating mode (r4818), the output signal can be injected into the control loop via the BICO interconnection.

In servo operation and depending on the mode set, this setpoint can also be injected into the control structure as a current setpoint, disturbing torque, or speed setpoint, for example. The impact of superimposed control loops is automatically suppressed.

Parameterizing and operating the ramp-function generator

The ramp-function generator is parameterized and operated via the parameterization and commissioning tool STARTER.



Figure 3-1 "Ramp-function generator" initial screen

Note

Please refer to the online help for more information about parameterizing and operation.

Properties

- Concurrent injection to several drives possible.
- The following parameterizable signal shapes can be set:
 - Square-wave
 - Staircase
 - Triangular
 - Sinusoidal
 - PRBS (pseudo random binary signal, white noise)
- An offset is possible for each signal. The ramp-up to the offset is parameterizable. Signal generation begins after the ramp-up to the offset.

3.2 Diagnostics via STARTER

- Restriction of the output signal to the minimum and maximum value settable.
- Operating modes of the ramp-function generator for servo and vector
 - Connector output
- Operating modes of the ramp-function generator (servo only)
 - Current setpoint downstream of filter (current setpoint filter)
 - Disturbing torque (downstream of current setpoint filter)
 - Speed setpoint downstream of filter (speed setpoint filter)
 - Current setpoint upstream of filter (current setpoint filter)
 - Speed setpoint upstream of filter (speed setpoint filter)

Injection points of the ramp-function generator



Figure 3-2 Injection points of the ramp-function generator

Further signal shapes

Further signal shapes can be parameterized.

Example:

The "triangular" signal form can be parameterized with "upper limitation" to produce a triangle with no peak.



Figure 3-3 "Triangular" signal without peak

Starting/stopping the ramp-function generator



To start the ramp-function generator:

- 1. Establish the preconditions for starting the ramp-function generator:
 - Click the button:



- Select the "Function generator" tab.

or

- In the project field, under Drives, call \rightarrow Drives_xy \rightarrow Commissioning \rightarrow Function generator with a double click.
- 2. Select the operating mode, e.g. speed setpoint after the filter
- 3. Select the drive, e.g. Drive_01
- 4. Set the signal waveform e.g. rectangular
- 5. Click on the "Assume control priority!" button
- 6. Accept "Sign-of-life monitoring" (master control button turns yellow)
- 7. Click on the green button "Drive on"
- 8. Start the ramp-function generator ("Start FctGen" button)
- 9. After reading, confirm the "Caution" note with "yes"

To stop the measuring function:

- 1. "Stop FctGen" button
- 2. The drive can also be stopped by pressing the red "Drive off" button.

Parameterization

The "Function generator" parameterizing screen is selected using the following symbol in the function bar in the STARTER commissioning tool:



Figure 3-4

3-4 STARTER icon for "trace function/ramp-function generator"

3.2 Diagnostics via STARTER

3.2.2 Trace function

Description

The trace function can be used to record measured values over a defined period depending on trigger conditions.

Parameterizing and using the trace function

The trace function is parameterized and operated via the parameterization and commissioning tool STARTER.

| | Nr | Aktiv | Signal | Kommentar |
|-----|----------|----------------|-----------------------|---|
| 1 | 1 | ~ | Servo.r63 | Servo.r63: Drehzahlistwert nach Istwertglättung |
| 1 | 2 | ~ | Servo.r62 | Servo.r62: Drehzahlsollwert nach Filter |
| -1 | 3 | - | Servo.r64 | Servo.r64: Drehzahlregler Regeldifferenz |
| - 1 | 4 | - | Servo.r60 | Servo.r60: Drehzahlsollwert vor Sollwertfilter |
| - 1 | 5 | ~ | Servo.r63 | Servo.r63: Drehzahlistwert nach Istwertglättung |
| -1 | 6 | | Servo.r62 | Servo.r62: Drehzahlsollwert nach Filter |
| -1 | 7 | | Servo.r64 | Servo.r64: Drehzahlregler Regeldifferenz |
| | 8 | | Servo.r60 | Servo.r60: Drehzahlsollwert vor Sollwertfilter |
| ſ | ieräteta | akt: aktor: | 4.000 ms [SINAMICS_S | 120_CU310_DP] |
| | Tra | cetakt: | 4.000 ms | Aufzeichnungsdauer: TUU.UUU ms |



The device cycle clock display flashes 3 times at around 1 Hz when the time slice is changed from < 4 ms to \geq 4 ms (see description under "Properties").

Note

Please refer to the online help for more information about parameterizing and operation.

Properties

- Up to 8 recording channels for each recorder
 When more than 4 channels per single trace are used, the trace's device clock cycle is switched automatically from 0.125 ms (0.250 ms for vector control) to 4 ms. This action ensures that the CU320's performance is not influenced too strongly by the trace.
- Up to 4 recording channels per trace
- Device clock cycles of SINAMICS S120 trace for single traces: 4 channels: 0.125 ms (Servo)/0.250 ms (Vector) 8 channels: 4 ms (Servo/Vector)
- Two independent trace recorders per Control Unit
- Endless trace
 After the last trace parameter has been written, the drive automatically starts writing to
 the trace memory from the beginning again (ring buffer function).
 Device clock cycle of SINAMICS S120 trace for endless trace:
 4 channels: 0.125 ms (Servo)/0.250 ms (Vector)
 8 channels: 4 ms (Servo/Vector)
 The time slice 4 ms may not be available due to the system condition. In this case the
 next higher time slice is used.
- Triggering
 - Without triggering (recording immediately after start)
 - Triggering on signal with edge or on level
 - Trigger delay and pretrigger possible
- STARTER parameterization and commissioning tool
 - Automatic or adjustable scaling of display axes
 - Signal measurement via cursor
- Settable trace cycle: Integer multiples of the basic sampling time
- Averaging the trace values
 - If a float value with a clock cycle slower than the device cycle clock is recorded, then the values recorded will not be averaged. This is obtained using parameter p4724. Parameter p4724[0...1] "Trace averaging in time range" is at "0" in the default setting. Index "0" and "1" stand for both the trace recorders each with 8 channels. If the values recorded should be averaged, parameter p4724 should be set to "1".

Parameterization

The "trace function" parameter screen is selected via the following icon in the toolbar of the STARTER commissioning tool.



Figure 3-6

-6 STARTER icon for "trace function/ramp-function generator"

3.2 Diagnostics via STARTER

3.2.3 Measuring function

Description

The measuring function is used for optimizing the drive controller. By parameterizing the measuring function, the impact of superimposed control loops can be suppressed selectively and the dynamic response of the individual drives analyzed. The ramp-function generator and trace function are linked for this purpose. The control loop is supplied with the ramp-function generator signal at a given point (e.g. speed setpoint) and recorded by the trace function at another (e.g. speed actual value). The trace function is parameterized automatically when the measuring function is parameterized. Specific predefined operating modes for the trace function are used for this purpose.

Parameterizing and using the measuring function

The measuring function is parameterized and operated via the parameterization and commissioning tool STARTER.



Figure 3-7 "Measuring function" initial screen

Note

Please refer to the online help for more information about parameterizing and operation.

Properties

- Measuring functions
 - Current controller setpoint change (downstream of the current setpoint filter)
 - Current controller reference frequency response (downstream of the current setpoint filter)
 - Speed controller setpoint change (downstream of the speed setpoint filter)
 - Speed controller disturbance step change (fault downstream of the current setpoint filter)
 - Speed controller reference frequency response (downstream of the speed setpoint filter)
 - Speed controller reference frequency response (upstream of the speed setpoint filter)
 - Speed controller interference frequency response (fault downstream of the current setpoint filter)
 - Speed controller path (excitation downstream of current setpoint filter)

Starting/stopping the measuring function

With the corresponding measuring function parameter settings (e.g. offset), the motor can "drift" and travel to its end stop.

The movement of the drive is not monitored while the measuring function is active.

To start the measuring function:

- 1. Ensure that the prerequisites for starting the measuring function are fulfilled.
 - Activate the control board.

Drives -> Drive_x -> Commissioning -> Control board

- Switch on the drive.

Control board -> Activate enable signals -> Switch on

- 2. Select the drive (as control board).
- 3. Set the measuring function.
 - e.g. current controller setpoint change
- 4. Load the settings to the target system ("Download parameterization" button).
- 5. Start the ramp-function generator ("Start measuring function" button)

To stop the measuring function:

• "Stop measuring function" button

3.2 Diagnostics via STARTER

Parameterization

The "measuring function" parameter screen is selected via the following icon in the toolbar of the STARTER commissioning tool:



Figure 3-8 STARTER icon for "Measuring function"

3.2.4 Measuring sockets

Description

The measuring sockets are used to output analog signals. Any interconnectable signal can be output to any measuring socket on the Control Unit.

CAUTION

The measuring sockets should be used for commissioning and servicing purposes only.

The measurements may only be carried out by properly trained specialist personnel.



Figure 3-9 Arrangement of the measuring sockets on the CU320 Control Unit

3.2 Diagnostics via STARTER

Parameterizing and using the measuring sockets



The measuring sockets are parameterized and operated via the STARTER parameterization and commissioning tool.



Note

Please refer to the online help for more information about parameterizing and operation.

Properties

| ٠ | Resolution | 8-bit |
|---|---------------|----------------|
| ٠ | Voltage range | 0 V to +4.98 V |

Measuring cycle

Depends on the measuring signal (e.g. actual speed value in speed controller cycle 125 $\mu s)$

Short-circuit-proof Parameterizable scaling Adjustable offset Adjustable limitation

3.2 Diagnostics via STARTER

Signal chart for measuring sockets



Figure 3-11 Signal chart for measuring sockets

Which signal can be output via measuring sockets?

The signal to be output via a measuring socket is specified by parameterizing the connector input p0771[0...2].

Important measuring signals (examples)

| r0060 | CO: Speed setpoint before speed setpoint filter |
|-----------|---|
| r0063 | CO: Actual speed value |
| r0069[02] | CO: Phase currents actual value |
| r0075 | CO: Field-generating current setpoint |
| r0076 | CO: Field-generating actual current |
| r0077 | CO: Torque-generating current setpoint |
| r0078 | CO: Torque-generating actual current |

Scaling

Scaling specifies how the measuring signal is processed. A straight line with 2 points must be defined for this purpose.

Example:

x1 / y1 = 0.0% / 2.49 V x2 / y2 = 100.0% / 4.98 V (default setting)

- 0.0% is mapped onto 2.49 V

- 100.0% is mapped onto 4.98 V

- 100.0% is mapped onto 0.00 V

Offset

The offset is applied additively to the signal to be output. The signal to be output can thus be displayed within the measuring range.

Limitation

Limitation on

If signals are output outside the permissible measuring range, the signal is limited to 4.98 V or to 0V.

Limitation off

The output of signals outside the permissible measuring range causes a signal overflow. In the event of an overflow, the signal jumps from 0 V to 4.98 V or from 4.98 to 0 V.

Example of a measurement

Assumption:

The actual speed (r0063) is to be output for a drive via measuring socket T1.

How do you do it?

- 1. Connect and set the measuring device.
- 2. Interconnect the signal (e.g. STARTER).

Interconnect the connector input (CI) belonging to the measuring socket with the desired connector output (CO).

CI: p0771[1] = CO: r0063

3. Parameterize the signal characteristic (scaling, offset, limitation).

Function diagrams (see SINAMICS S120/S150 List Manual)

8134 measuring sockets

Overview of important parameters (refer to the SINAMICS S120/S150 List Manual)

Adjustable parameters

- p0771[0...2] CI: Measuring sockets signal source
- p0777[0...2] Measuring sockets characteristic value x1
- P0778[0...2] Measuring sockets characteristic value y1
- p0779[0...2] Measuring sockets characteristic value x2
- p0780[0...2] Measuring sockets characteristic value y2
- p0783[0...2] Measuring sockets offset
- p0784[0...2] Measuring sockets limit on/off

Display parameters

- r0772[0...2] Measuring sockets output signal
- r0774[0...2] Measuring sockets output voltage
- r0786[0...2] Measuring sockets normalization per volt

3.3 Diagnostic buffer

Description

A diagnostic buffer mechanism has already been implemented in the SIMATIC S7 environment. It can record important operational events in the automation system as a kind of log book (restriction: The availability of the diagnostics buffer mechanism is also dependent on the hardware release of the Control Unit. The mechanism is available with hardware release E or higher. For other hardware releases, a message will inform you that the diagnostics buffer cannot be read.

The diagnostic buffer is in the non-volatile memory, so data written to it can be read out for subsequent analysis of a malfunction (including pre-history).

The essential events recorded in the buffer are:

- Faults
- Important changes to the boot status (end status) and partial booting of DOs
- Commissioning procedures
- State change of PROFIBUS/PROFINET communication
- Exceptions

The entries in the diagnostic buffer can be called up via the drive unit properties (symbol in project navigator --> right mouse-click) under the menu option Target device --> Device diagnostics.

Note

STEP7 Full version

The STARTER device diagnostics function is displayed only when you have installed the full version of STEP7.

Events recorded by the diagnostic buffer

The following list shows the entries defined for SINAMICS drive units. Additional information is marked with <>.

Faults

An entry is defined for each possible DO number. The fault code and fault value are entered in the additional information.

Example:

Fault DO 5: Fault code 1005 fault value 0x30012

Alarms are not recorded in the diagnostic buffer. Propagated faults (faults which are signaled to all DOs) are only stored in the diagnostic buffer once.
Booting procedures and booting status changes

In principle, only start and completion are recorded for booting procedures. Booting status (see r3988) are only recorded when an end status arises that can only be exited by user action (r3988 = 1, 10, 200, 250, 325, 370, 800). Booting statuses and booting status changes are:

- POWER ON
- Error in booting (r3988 = 1)
- Fatal error in booting (r3988 = 10)
- Waiting for first commissioning (r3988 = 200)
- Topology error in booting (r3988 = 250)
- Waiting for entry of drive type (r3988 = 325)
- Waiting until p0009 = 0 is set (r3988 = 370)
- Boot status r3988 = <state at which 670 or 680> reached
- Booting finished, cyclic operation
- Reason for new boot < 0 = Internal reason; 1 = Warm start; 2 = Booting from saved data; 3 = Booting after download>
- Drive reset via p0972 = <Mode>
- Partial booting DO started <DO number>
- Partial booting DO <DO number> finished

Commissioning procedures

- Device commissioning: New status p0009 = <new value p0009>
- Commissioning DO <DO number>: New status p0010 = <new value p0010>
- Ram2Rom DO <0 for all DOs> started
- Ram2Rom DO <0 for all DOs> completed
- Project download started
- DO <DO_Number> deactivated
- DO <DO_Number> reactivated
- Component <Component number> deactivated
- Component <Component number> reactivated
- Power Off/ Power On required after firmware update (DO <DO number> Component < Component number >)
- DO <DO-No> deactivated and not available
- Component <component number> deactivated and not available

Communication (PROFIBUS, PROFINET, ...)

- PZD <IF1 or IF2> cyclic data exchange started
- PZD <IF1 or IF2> cyclic data exchange completed
- Changeover to UTC time for operating hours count status <Days> <Milliseconds>
- Time correction (correct) by <correction value> seconds

Exceptions

Exceptions can be taken from the crash diagnostics already available in the new boot run. The exceptions are always entered into the diagnostic buffer first, even before the entry "POWER ON".

- Data Abort Exception Address: <Content Program Counter>
- Floating Point Exception Address: <Content Program Counter>
- Prefetch Abort Exception Address: <Content Program Counter>
- Exception type <Type coding> Info: <Info depends on type>

Treatment of the time stamp

After successful time synchronization (in cyclic operation), the UTC time is used as a time stamp. Up until this time (POWER ON and switching to UTC time) the operating hours counter is used for all entries. The UTC time is entered for following entries.

3.4 Diagnostics of uncommissioned axes

Description

To be able to identify uncommissioned drive objects of the classes "Infeeds", "Motor Module", "SERVO" and "VECTOR", there is an operating display in parameter r0002.

- r0002 "Infeed operating display" = 35: Carry out the first start-up
- r0002 "Drive operating display" = 35: Carry out the first start-up

The parameter r0002 "drive operating display" = 35 is then displayed when p3998[D]=0 is in any data set. Parameter p3998 specifies whether the first commissioning of the drive is still to be carried out (0 = yes, 2 = no).

Parameter p3998 is set to the value 2 when the calculation of the motor and control parameters for all data sets has been completed without errors (see r3925 bit0=1) and the encoder selection p0400 is not on 10100 (encoder identification).

The limitation that all drive data sets (DDS) must be commissioned in order to exit commissioning is ensured by checking the parameters involved (see also F07080 in the SINAMICS S120/S150 List Manual).

Infeeds

An infeed (Active Line Modules, Basic Line Modules or Smart Line Modules with DRIVE-CLiQ) is considered commissioned when the line voltage and line frequency have been parameterized with appropriate values. A basic setting of 50 Hz or 60 Hz is expected for the line frequency.

The line voltage p0210 may need to be adjusted to the existing power supply.

To leave the state r0002 "Infeed operating display" = 35, set parameter p3900 "completion of quick commissioning" to the value 3, after any necessary adjustment to the line voltage.

For a 400V unit, for example, the voltage p0210 is always initialized with 400 V. Although it is possible to switch on with all power supplies from 380V to 480V, operation is not optimal and alarm messages appear (see SINAMICS S120/S150 List Manual).

If the unit is not being used with a 400V power supply, the rated voltage p0210 should be adjusted. This can also be done after the first time the unit is switched on, by setting p0010=1.

3.4 Diagnostics of uncommissioned axes

Motor Module SERVO and VECTOR

A drive is considered commissioned when valid data fills the relevant motor and encoder data sets in every drive data set (DDS) assigned to it:

- Motor data sets (MDS): p0131, p0300, p0301 etc. (see SINAMICS S120/S150 List Manual)
- Encoder data sets (EDS): p0141, p0142, p0400 etc. (see SINAMICS S120/S150 List Manual)

After parameterizing the motor and encoder data via quick commissioning $(p0010 = 1 \rightarrow 0)$ use p3900 "completion of quick commissioning" > 0 to exit.

If commissioning should not be run using quick commissioning, the motor data should be entered via p0010 = 3 (p0340[0...n] "Automatic calculation of motor/control parameters" =1) after entering the rating plate data, and after that the encoder data entered via p0010 = 4.

If the above conditions are not met, in r0002 of the drive concerned the value r0002 = 35: "Carry out first commissioning" is shown.

It is not taken into account whether BICO sources like, for example:

- p0840 "BI: ON/OFF1" or
- p0864 "BI: Infeed operation"

needed for switching on (pulse enable) have already been parameterized or are still at the value 0.

If, after commissioning all DDSs, parameter p0010 is set once more to a value greater than 0, in r0002 the value r0002 = 46: "Switching on inhibited - exit the commissioning mode (p0009, p0010)" will be displayed.

The drive has been commissioned, but no pulse can be enabled.

Note on p0010 = 1 (quick commissioning):

Quick commissioning with p3900 > 0 (when p0010 = 1) works for all DDSs where motor and encoder data have been entered.

This means that if quick commissioning is carried out a second or third time (or more), previously calculated and possibly user-adjusted data will be overwritten or recalculated.

For this reason we recommend carrying out any subsequent commissioning of a certain DDS (e.g. changing the motor), specifically using p0010 = 3 and p0010 = 4 instead of p0010 = 1.

3.4 Diagnostics of uncommissioned axes

Example

The image below shows a diagram of the diagnostic performance of uncommissioned infeeds and drives. A configuration with one power unit (DO2) and respectively two DDSs, MDSs and EDSs has been assumed. DO1 represents the CU.

The unit has already been commissioned.

The number of data sets and the components assigned to the DO2 have already been entered and the data set allocated.



Figure 3-12 Diagnostics of uncommissioned axes

3.5 Fault and alarm messages

3.5 Fault and alarm messages

3.5.1 General information about faults and alarms

Description

The errors and states detected by the individual components of the drive system are indicated by messages.

The messages are categorized into faults and alarms.

Note

The individual faults and alarms are described in the SINAMICS S120/S150 List Manual in the chapter "Faults and Alarms". Function diagrams for the fault buffer, alarm buffer, fault trigger and fault configuration are also contained in the Section "Function diagrams" -> "Faults and alarms".

Properties of faults and alarms

- Faults
 - Are identified by Fxxxx.
 - Can lead to a fault reaction.
 - Must be acknowledged once the cause has been remedied.
 - Status via Control Unit and LED RDY.
 - Status via PROFIBUS status signal ZSW1.3 (fault active).
 - Entry in the fault buffer.
- Alarms (code A56789)
 - Are identified by Axxxxx.
 - Have no further effect on the drive.
 - The alarms are automatically reset once the cause has been remedied. No acknowledgement is required.
 - Status via PROFIBUS status signal ZSW1.7 (alarm active).
 - Entry in the alarm buffer.
- · General properties of faults and alarms
 - Can be configured (e.g. change fault to alarm, fault reaction).
 - Triggering on selected messages possible.
 - Initiation of messages possible via an external signal.

Acknowledgement of faults

The list of faults and alarms specifies how each fault is acknowledged after the cause has been remedied.

- 1. Acknowledgement of faults by "POWER ON"
 - Switch the drive on/off (POWER ON)
 - Press the RESET button on the Control Unit
- 2. Acknowledgement of faults by "IMMEDIATE"
 - Via PROFIBUS control signal

STW1.7 (reset fault memory): 0/1 edge

Set STW1.0 (ON/OFF1) = "0" and "1"

- Via external input signal

Binector input and interconnection with digital input

p2103 = "Requested signal source"

p2104 = "Requested signal source"

p2105 = "Requested signal source"

Across all of the drive objects (DO) of a Control Unit

p2102 = "Requested signal source"

- 3. Acknowledge faults with "PULSE INHIBIT"
 - The fault can only be acknowledged with a pulse inhibit (r0899.11 = 0).
 - The same possibilities are available for acknowledging as described under acknowledge IMMEDIATELY.

Note

The drive cannot resume operation until all active faults have been acknowledged.

3.5 Fault and alarm messages

3.5.2 Buffer for faults and alarms

Note

A fault and alarm buffer is provided for each drive. The drive and device-specific messages are entered in this buffer.

The contents of the fault buffer are saved to non-volatile memory when the Control Unit is powered down, i.e. the fault buffer history is still available when the unit is powered up again.

NOTICE

The entry in the fault/alarm buffer is made after a delay. For this reason, the fault/alarm buffer should not be read until a change in the buffer is also recognized (r0944, r2121) after "Fault active"/"Alarm active" is output.

Fault buffer

Faults which occur are entered in the fault buffer as follows:



Figure 3-13 Structure of the fault buffer

Properties of the fault buffer

- A new fault incident encompasses one or more faults and is entered in "Current fault incident".
- The entries are arranged in the buffer according to the time at which they occurred.
- If a new fault incident occurs, the fault buffer is reorganized. The history is recorded in "Acknowledged fault incident" 1 to 7.
- If the cause of at least one fault in "Current fault incident" is remedied and acknowledged, the fault buffer is reorganized. Faults that have not been remedied remain in "Current fault incident".
- If "Current fault incident" contains eight faults and a new fault occurs, the fault in the parameters in index 7 is overwritten by the new fault.
- r0944 is incremented each time the fault buffer changes.
- A fault value (r0949) can be output for a fault. The fault value is used to diagnose the fault more accurately; please refer to the fault description for details of the meaning.

Clearing the fault buffer

• The fault buffer is reset as follows: p0952 = 0

Alarm buffer, alarm history

The alarm buffer comprises the alarm code, the alarm value and the alarm time (received, resolved). The alarm history occupies the last indices ([8...63]) of the parameter.



| Alarm 1 (most recent) | r2122[8] | r2124 [8] [l32] r2134[8] [Float] | r2123[8] [ms] r2145[8] [d] | r2125[8] [ms] r2146[8] [d] |
|--------------------------|-----------|---------------------------------------|---------------------------------|---------------------------------|
| Alarm 2 | r2122[9] | r2124 [9] [l32] r2134[9] [Float] | r2123[9] [ms] r2145[9] [d] | r2125[9] [ms] r2146[9] [d] |
| • | | • | • | |
| • | | • | | |
| • | | | • | |
| Alarm 56 (oldest) | r2122[63] | r2124 [63] [l32] r2134[63] [Float] | r2123[63] [ms] r2145[63] [d] | r2125[63] [ms] r2146[63] [d] |

Figure 3-14 Structure of alarm buffer

3.5 Fault and alarm messages

Alarms that occur are entered in the alarm buffer as follows:

A maximum of 64 alarms are displayed in the alarm buffer:

- Index 0 .. 6: The first 7 alarms are displayed.
- Index 7: The most recent alarm is displayed.

A maximum of 56 alarms are displayed in the alarm history:

- Index 8: The most recent alarm is displayed.
- Index 9.. 63: The first 55 alarms are displayed.

Properties of the alarm buffer/alarm history:

- The arrangement in the alarm buffer is made after the time that they occurred from 7 to 0. • In the alarm history, this is from 8 to 63.
- If 8 alarms have been entered into the alarm buffer, and a new alarm is received, then the alarms that have been resolved are transferred into the alarm history.
- r2121 is incremented each time the alarm buffer changes.
- An alarm value (r2124) can be output for an alarm. The alarm value is used to diagnose the alarm more accurately; please refer to the alarm description for details of the meaning.

Deleting the alarm buffer, index [0...7]:

The alarm buffer index [0...7] is reset as follows: p2111 = 0

. .

3.5.3 Configuring messages

The properties of the faults and alarms in the drive system are permanently defined.

The following can be configured for some of the messages within a permanently defined framework for the drive system:

| Change message type (example) | | |
|---------------------------------|---------------|--|
| Select message | Set message | e type |
| p2118[5] = 1001 | p2119[5] | = 1: Fault (F) |
| | | = 2: Alarm (A) |
| | | = 3: No message (N) |
| Change fault reaction (example) | | |
| Select message | Set fault res | ponse |
| p2100[3] = 1002 | p2101[3] | = 0: None |
| | | = 1: OFF1 |
| | | = 2: OFF2 |
| | | = 3: OFF3 |
| | | = 4: STOP1 (available soon) |
| | | = 5: STOP2 |
| | | = 6: IASC/DC brake Internal armature short-circuit braking or DC brake |
| | | = 7: ENCODER (p0491) |

Change acknowledgement (example)

| Select message | Set acknowledgement | |
|-----------------|---------------------|--------------------|
| p2126[4] = 1003 | p2127[4] | = 1: POWER ON |
| | | = 2: IMMEDIATELY |
| | | = 3: PULSE INHIBIT |
| | | |

Note

If BICO interconnections exist between drive objects, all interconnected objects must be configured.

- Example: •
 - The TM31 has BICO interconnections with drives 1 and 2, and F35207 is to be reconfigured as an alarm.
 - p2118[n] = 35207 and p2119[n] = 2
 - This must be set for TM31 and drives 1/2.

Note

Only those messages which are listed in the indexed parameters can be changed as desired. All other message settings retain their factory settings or are reset to the factory settings.

Examples:

- In the case of messages listed via p2128[0...19], the message type can be changed. The factory setting is set for all other messages.
- The fault response of fault F12345 has been changed via p2100[n]. The factory settings are to be restored.

- p2100[n] = 0

3.5 Fault and alarm messages

Triggering on messages (example)

| Select message | Trigger signal |
|-----------------|----------------|
| p2128[0] = 1001 | BO: r2129.0 |
| or | |
| p2128[1] = 1002 | BO: r2129.1 |

Note

The value from CO: r2129 can be used as group trigger.

CO: r2129 = 0 No selected message has been output.

CO: r2129 > 0 Group trigger. At least one selected message has been output.

The individual binector outputs BO: r2129 should be investigated.

Triggering messages externally

If the appropriate binector input is interconnected with an input signal, fault 1, 2 or 3 or alarm 1, 2 or 3 can be triggered via an external input signal.

Once an external fault (1 to 3) has been triggered on the Control Unit drive object, this fault is also present on all associated drive objects. If one of these external faults is triggered on a different drive object, it is only present on that particular drive object.

| BI: p2106 | > External fault 1 | —> F07860(A) |
|-----------|---------------------|--------------|
| BI: p2107 | —> External fault 2 | —> F07861(A) |
| BI: p2108 | —> External fault 3 | —> F07862(A) |
| BI: p2112 | —> External alarm 1 | > A07850(F) |
| BI: p2116 | —> External alarm 2 | > A07851(F) |
| BI: p2117 | —> External alarm 3 | > A07852(F) |

Note

An external fault or alarm is triggered by a 1/0 signal.

An external fault and alarm do not usually mean that an internal drive message has been generated. The cause of an external fault and warning should, therefore, be remedied outside the drive.

3.5.4 Parameters and function diagrams for faults and alarms

Function diagrams (see SINAMICS S120/S150 List Manual)

- 1710 Overview diagram monitoring functions, faults, alarms
- 8060 Faults and alarms fault buffer
- 8065 Faults and alarms alarm buffer
- 8070 Faults and alarms fault/alarm trigger word r2129
- 8075 Faults and alarms fault/alarm configuration

Overview of important parameters (refer to the SINAMICS S120/S150 List Manual)

- r0944 Counter for fault buffer changes
- p0952 Fault counter
- p2100[0...19] Fault code for fault reaction selection
- r2139 Status word for faults

3.5.5 Forwarding of faults

Forwarding of CU faults

When faults are triggered on the drive object of the CU, it is always assumed that central functions of the drive unit are affected. For this reason, these faults are not only signaled on the drive object of the CU, but may also be forwarded to all other drive objects (propagation). The fault reaction affects the drive object of the CU and all other drive objects. This behavior also applies to the faults set in a DCC chart on the CU with the aid of DCB STM.

A fault that is set on the drive object of the CU must be acknowledged on all drive objects to which this fault was forwarded. In this way, the fault is then automatically acknowledged on the drive object of the CU. Alternatively all faults of all drive objects can also be acknowledged on the CU.

Alarms are not forwarded to other drive objects by the CU.

Forwarding of faults due to BICO interconnections

If two or more drive objects are connected via BICO interconnections, faults of drive objects of the type CU, TB30, DMC20, TM31, TM15, TM17, TM15DIDO, TM54F_MA, TM54F_SL and CU_LINK are forwarded to drive objects of the type AFE, AFEMV, DFEMV, SIC, BIC, SERVO, VECTOR, VECTOR_MV, VECTOR_GL, VECTOR_SL and TM41. There is no forwarding of faults within these two groups of drive object types.

This behavior also applies to the faults set in a DCC chart on the above drive object types with the aid of DCB STM.

3.5 Fault and alarm messages

3.5.6 Alarm classes

Fault and alarm classes

There are differentiated alarm messages in the cyclic telegrams between the former alarm classes "Alarm" and "Fault".

The alarm classes have been extended to give 3 additional levels of alarm between the "pure" alarm and the fault.

The function permits higher-level control (SIMATIC, SIMOTION, SINUMERIK, etc.) to have different control reactions to alarm messages from the drive.

The new statuses act as alarms for the drive, therefore there is NO immediate reaction from the drive (like for the former level "alarm").

Information on alarm classes are described in status word ZSW2 at bit positions bit 5 - 6 (for SINAMICS) or bit 11-12 (SIMODRIVE 611) (see also "ZSW2" in the chapter "Cyclic Communication" for PROFIdrive communication in /FH1/SINAMICS S120 Function Manual Drive Functions).

ZSW2: Valid for SINAMICS Interface Mode p2038=0 (function diagram 2454)

Bit 5 - 6 Alarm classes alarms

- = 0: Alarm (former alarm level)
- = 1: Alarm class A alarms
- = 2: Alarm class B alarms
- = 3: Alarm class C alarms

ZSW2: Valid for SIMODRIVE 611 Interface Mode p2038=1 (function diagram 2453)

Bit 11 - 12 Alarm classes alarms

- = 0: Alarm (former alarm level)
- = 1: Alarm class A alarms
- = 2: Alarm class B alarms
- = 3: Alarm class C alarms

These attributes for differentiating the alarms are implicitly assigned to the appropriate alarm numbers. The reaction to the existing alarm classes in the alarm is defined by the user program in the higher-level control.

Diagnostics

3.6 Troubleshooting for encoders

Explanations of the alarm classes

- Alarm class A: Drive operation currently not limited
 - e.g. alarm when measurement systems inactive
 - no limitation on current movement
 - Prevent possible switching to the defective measuring system
- Alarm class B: Time-limited operation
 - e.g. prewarning temperature: without further action the drive may need to be switched off
 - after a timer stage -> additional fault
 - after exceeding a switch-off threshold -> additional fault
- Alarm class C: Functionally limited operation
 - e.g. reduced voltage/current/torque/speed limits (i2t)
 - e.g. continue with reduced accuracy / resolution
 - e.g. continue without encoder

3.6 Troubleshooting for encoders

If an encoder fault is present, it can be acknowledged separately according to encoder channels in a PROFIdrive telegram via the encoder interface (Gn_STW.15) or the drive interface of the appropriate DO.

Sample configuration: 2-encoder system

- Encoder G1 motor measurement system
- Encoder G2 direct measurement system

Case considered:

All encoders signal encoder faults.

- The errors are entered in the encoder interface, and from there into the encoder channel n of the PROFIDRIVE telegram. Bit15 is set as the encoder status word (Gn_ZSW.15=1).
- The faults are forwarded to the drive DO.

3.6 Troubleshooting for encoders

- The motor measurement system faults set the drive DO to fault (ZSW1 bit3), the faults are additionally signaled via the drive interface. An entry is made in fault buffer p0945. The parameterized fault reaction is initiated internally.
- The direct measurement system faults are readdressed as alarms via the appropriate • drive DO and signaled via the drive interface (ZSW1 bit7). An entry is made in alarm buffer r2122.

No drive reactions are initiated.



PROFIDRIVE telegram

Figure 3-15 Encoder troubleshooting

Alarm A:

The alarm is canceled immediately, if the encoder fault was able to be acknowledged. Fault F:

The fault remains on the drive DO until it is acknowledged via the cyclic interface.

Cyclic acknowledgment

Acknowledgment using the encoder interface (Gn_STW.15)

The following responses are possible:

 If no more faults are present, the encoder is set to fault free and the fault bit in the encoder interface is acknowledged. The evaluation modules indicate RDY LED=green after acknowledgement.

This behavior is valid for all encoders connected to the encoder interface, irrespective of the measurement system type (motor or direct).

• If the fault is still present, or other faults are, the acknowledgment is not successful; the highest priority fault (can be the same or another fault entry) is transmitted via the encoder interface.

The evaluation modules indicate RDY LED=red continuously. This behavior is valid for all encoders connected to the encoder interface, irrespective of the measurement system type (motor or direct).

 The drive DO is not recorded via the encoder interface. Faults set in the drive DO remain, the drive will not even start with the meanwhile fault-free encoder. The drive DO must also be acknowledged via the drive interface (fault memory RESET).

Note

The possibility to acknowledge directly via the encoder interface is especially important in the event that "free encoder assignment" is used.

If an encoder on the drive side is assigned a certain drive X, but on the NC side a completely different axis Y, then such parameterized coupling with the fault memory reset (acknowledge drive) is not completely solvable. Drive X, waiting for a fault memory reset, does not receive one from the NC, but a completely different drive Y receives it, and cannot carry it out.

Acknowledgment using the drive interface (STW1.7 (cyclic) or p3981(acyclic))

The following responses are possible:

- If no more errors are present, the encoder is set to fault free and the fault bit in the drive interface is acknowledged. The evaluation modules indicate RDY LED=green. Acknowledgment takes place on all encoders that are logically assigned to the drive.
- If the fault is still present, or other errors are, the acknowledgment is not successful; the next, highest priority fault is transmitted via the drive interface and also via the affected encoder interface.
- The evaluation modules indicate RDY LED=red continuously.
- The encoder interfaces of the assigned encoders are NOT reset by acknowledgement at the drive interface; the set faults remain.
- The encoder interfaces must also be acknowledged via the corresponding encoder control word Gn_STW.15.

Diagnostics

3.6 Troubleshooting for encoders

A.1 Availability of hardware components

| No. | HW component | Order number | Version | Revisions |
|-----|-------------------------|--|---------|------------------|
| 1 | AC Drive (CU320, PM340) | refer to the Catalog | | new |
| 2 | SMC30 | 6SL3055-0AA00-5CA1 | | with SSI support |
| 3 | DMC20 | 6SL3055-0AA00-6AAx | | new |
| 4 | TM41 | 6SL3055-0AA00-3PAx | | new |
| 5 | SME120 SME125 | 6SL3055-0AA00-5JAx 6SL3055-0AA00-5KAx | | new |
| 6 | BOP20 | 6SL3055-0AA00-4BAx | | new |
| 7 | CUA31 | 6SL3040-0PA00-0AAx | | new |

Table A-1 Hardware components available as of 03.2006

Table A-2 Hardware components available as of 08.2007

| No. | HW component | Order number | Version | Revisions |
|-----|--|--------------------|---------|-----------|
| 1 | TM54F | 6SL3055-0AA00-3BAx | | new |
| 2 | Active Interface Module (booksize) | 6SL3100-0BExx-xABx | | new |
| 3 | Basic Line Module (booksize) | 6SL3130-1TExx-0AAx | | new |
| 4 | DRIVE-CLiQ encoder | 6FX2001-5xDxx-0AAx | | new |
| 5 | CUA31 Suitable for Safety Extended Functions PROFIsafe (dbSI1) and TM54 (dbSI2) | 6SL3040-0PA00-0AA1 | | new |
| 6 | CUA32 | 6SL3040-0PA01-0AAx | | new |
| 7 | SMC30 (30 mm wide) | 6SL3055-0AA00-5CA2 | | new |

Table A-3 Hardware components available as of 10.2008

| No. | HW component | Order number | Version | Revisions |
|-----|---|--------------------|---------|-----------|
| 1 | TM31 | 6SL3055-0AA00-3AA1 | | new |
| 2 | TM41 | 6SL3055-0AA00-3PA1 | | new |
| 3 | DME20 | 6SL3055-0AA00-6ABx | | new |
| 4 | SMC20 (30 mm wide) | 6SL3055-0AA00-5BA2 | | new |
| 5 | Active Interface Module booksize 16 kW | 6SL3100-0BE21-6ABx | | new |

Commissioning Manual Commissioning Manual, (IH1), 11/2009, 6SL3097-4AF00-0BP0 A.1 Availability of hardware components

| No. | HW component | Order number | Version | Revisions |
|-----|--|--|---------|-----------|
| 6 | Active Interface Module booksize 36 kW | 6SL3100-0BE23-6ABx | | new |
| 7 | Smart Line Modules booksize compact | 6SL3430-6TE21-6AAx | | new |
| 8 | Motor Modules booksize compact | 6SL3420-1TE13-0AAx 6SL3420-1TE15-0AAx 6SL3420-1TE21-0AAx 6SL3420-1TE21-8AAx 6SL3420-2TE11-0AAx 6SL3420-2TE13-0AAx 6SL3420-2TE15-0AAx | | new |
| 9 | Power Modules blocksize liquid cooled | 6SL3215-1SE23-0AAx 6SL3215-1SE26-0AAx 6SL3215-1SE27-5UAx 6SL3215-1SE31-0UAx 6SL3215-1SE31-1UAx 6SL3215-1SE31-1UAx 6SL3215-1SE31-8UAx | | new |
| 10 | Reinforced DC link busbars for 50 mm components | 6SL3162-2DB00-0AAx | | new |
| 11 | Reinforced DC link busbars for 100 mm components | 6SL3162-2DD00-0AAx | | new |

Table A-4 Hardware components available as of 11.2009

| No. | HW component | Order number | Version | Revisions |
|-----|--------------|--------------------|---------|-----------|
| 1 | CU320-2 DP | 6SL3040-1MA00-0AA0 | | new |
| 2 | TM120 | 6SL3055-0AA00-3KA0 | | new |
| 3 | SMC10 (30mm) | 6SL3055-0AA00-5AA0 | | new |

A.2 List of abbreviations

Note:

The following list of abbreviations includes all abbreviations and their meanings used in the entire SINAMICS user documentation.

| Abbreviation | Source of abbreviation | Meaning |
|--------------|--|--|
| Α | | |
| A | Alarm | Alarm |
| AC | Alternating Current | Alternating current |
| ADC | Analog Digital Converter | Analog digital converter |
| AI | Analog Input | Analog input |
| AIM | Active Interface Module | Active Interface Module |
| ALM | Active Line Module | Active Line Module |
| AO | Analog Output | Analog output |
| AOP | Advanced Operator Panel | Advanced Operator Panel |
| APC | Advanced Positioning Control | Advanced Positioning Control |
| AR | Automatic Restart | Automatic restart |
| ASC | Armature Short Circuit | Armature short circuit |
| ASCII | American Standard Code for Information Interchange | American standard code for information interchange |
| ASM | Induction motor | Induction motor |
| В | | |
| OC | Operating Condition | Operating condition |
| BERO | - | Contactless proximity switch |
| BI | Binector Input | Binector input |
| BIA | Germany's Institute for Occupational Safety and Health | Germany's Institute for Occupational Safety and Health |
| BICO | Binector Connector Technology | Binector connector technology |
| BLM | Basic Line Module | Basic Line Module |
| во | Binector Output | Binector output |
| BOP | Basic Operator Panel | Basic Operator Panel |

| Abbreviation | Source of abbreviation | Meaning |
|--------------|--------------------------------------|--|
| С | | |
| С | Capacitance | Capacitance |
| C | - | Safety message |
| CAN | Controller Area Network | Serial bus system |
| CBC | Communication Board CAN | Communication board CAN |
| CD | Compact Disc | Compact Disc |
| CDS | Command Data Set | Command data set |
| CF Card | CompactFlash Card | CompactFlash Card |
| CI | Connector Input | Connector input |
| CLC | Clearance Control | Clearance control |
| CNC | Computer Numerical Control | Computer numerical control |
| СО | Connector Output | Connector output |
| CO/BO | Connector Output/Binector Output | Connector/binector output |
| COB ID | CAN Object Identification | CAN Object identification |
| СОМ | Common contact of a changeover relay | Center contact of a changeover contact |
| COMM | Commissioning | Commissioning |
| CP | Communication Processor | Communication processor |
| CPU | Central Processing Unit | Central processing unit |
| CRC | Cyclic Redundancy Check | Cyclic redundancy check |
| CSM | Control Supply Module | Control Supply Module |
| CU | Control Unit | Control Unit |
| CUA | Control Unit Adapter | Control Unit Adapter |
| CUD | Control Unit DC MASTER | Control Unit DC MASTER |
| D | | |
| DAC | Digital Analog Converter | Digital analog converter |
| DC | Direct Current | DC current |
| DCB | Drive Control Block | Drive Control Block |
| DCC | Drive Control Chart | Drive Control Chart |
| DCC | Data Cross Check | Crosswise data comparison |
| DCN | Direct Current Negative | DC current negative |
| DCP | Direct Current Positive | DC current positive |
| DDS | Drive Data Set | Drive data set |
| DI | Digital Input | Digital input |
| DI/DO | Digital Input/Digital Output | Digital input/output bidirectional |
| DMC | DRIVE-CLiQ Hub Module Cabinet | DRIVE-CLiQ Hub Module Cabinet |
| DME | DRIVE-CLiQ Hub Module External | DRIVE-CLiQ Hub Module External |
| DO | Digital Output | Digital output |
| DO | Drive Object | Drive object |
| DP | Decentralized Peripherals | Distributed IOs |
| DPRAM | Dual Ported Random Access Memory | Memory with dual access ports |

Appendix A.2 List of abbreviations

| Abbreviation | Source of abbreviation | Meaning |
|--------------|--------------------------------------|--------------------------------------|
| DRAM | Dynamic Random Access Memory | Dynamic memory |
| DRIVE-CLiQ | Drive Component Link with IQ | Drive Component Link with IQ |
| DSC | Dynamic Servo Control | Dynamic Servo Control |
| E | | |
| EASC | External Armature Short Circuit | External armature short circuit |
| EDS | Encoder Data Set | Encoder data set |
| ESD | Electrostatic Sensitive Devices | Electrostatic sensitive devices |
| ELCB | Earth Leakage Circuit Breaker | Earth leakage circuit breaker |
| ELP | Earth Leakage Protection | Earth leakage protection |
| EMC | Electromagnetic Compatibility | Electromagnetic compatibility |
| EMF | Electromagnetic Force | Electromagnetic force |
| EMF | Electromagnetic force | Electromagnetic force |
| EMC | Electromagnetic compatibility | Electromagnetic compatibility |
| EN | European standard | European standard |
| EnDat | Encoder Data Interface | Encoder interface |
| EP | Enable Pulses | Pulse enable |
| EPOS | Basic positioner | Basic positioner |
| ES | Engineering System | Engineering System |
| ESB | Equivalent circuit diagram | Equivalent circuit diagram |
| ESD | Electrostatic Sensitive Devices | Electrostatic sensitive devices |
| ESR | Extended Stop and Retract | Extended stop and retract |
| F | | |
| F | Fault | Fault |
| FAQs | Frequently Asked Questions | Frequently asked questions |
| FBL | Free Blocks | Free function blocks |
| FCC | Function Control Chart | Function Control Chart |
| FCC | Flux Current Control | Flux current control |
| FD | Function Diagram | Function diagram |
| F-DI | Failsafe Digital Input | Fail-safe digital input |
| F-DO | Failsafe Digital Output | Fail-safe digital output |
| FEM | Separately excited synchronous motor | Separately excited synchronous motor |
| FEPROM | Flash EPROM | Non volatile read and write memory |
| FG | Function Generator | Function generator |
| FI | - | Fault current |
| FOC | Fiber-Optic Cable | Fiber-optic cable |
| FP | Function diagram | Function diagram |
| FPGA | Field Programmable Gate Array | Field Programmable Gate Array |
| FW | Firmware | Firmware |
| G | | |
| GB | Gigabyte | Gigabyte |

| Abbreviation | Source of abbreviation | Meaning |
|--------------|---|---|
| GC | Global Control | Global Control Telegram (Broadcast Tele- gramm) |
| GND | Ground | Reference potential for all signal and operat- ing voltages, usually defined as 0 V (also referred to as G) |
| GSD | Generic Station Description | Generic station description: Describes the characteristics of a PROFIBUS slave |
| GSV | Gate Supply Voltage | Gate Supply Voltage |
| GUID | Globally Unique Identifier | Globally unique identifier |
| н | | |
| HF | High Frequency | High frequency |
| HFD | High-frequency reactor | High-frequency reactor |
| RFG | Ramp-Function Generator | Ramp-function generator |
| HMI | Human Machine Interface | Human machine interface |
| HTL | High-Threshold Logic | Logic with a high fault threshold |
| HW | Hardware | Hardware |
| I | | |
| u.d. | under development | Under development: This feature is not cur- rently available |
| I/O | Input/Output | Input/output |
| I2C | Inter-Integrated Circuit | Internal serial data bus |
| IASC | Internal Armature Short Circuit | Internal armature short circuit |
| IBN | Commissioning | Commissioning |
| ID | Identifier | Identification |
| IE | Industrial Ethernet | Industrial Ethernet |
| IEC | International Electrotechnical Commission | International Electrotechnical Commission |
| IF | Interface | Interface |
| IGBT | Insulated Gate Bipolar Transistor | Insulated gate bipolar transistor |
| IGCT | Integrated Gate-Controlled Thyristor | Semiconductor power switch with integrated control electrode |
| IL | Pulse cancelation | Pulse cancelation |
| IP | Internet Protocol | Internet Protocol |
| IPO | Interpolator | Interpolator |
| IT | Isolé Terré | Non-grounded three-phase power supply |
| IVP | Internal Voltage Protection | Internal voltage protection |
| J | | |
| JOG | Jogging | Jogging |
| к | | |
| CDC | Crosswise data comparison | Crosswise data comparison |
| KIP | Kinetic buffering | Kinetic buffering |
| Кр | - | Proportional gain |
| KTY | - | Special temperature sensor |

| Abbreviation | Source of abbreviation | Meaning |
|--------------|---|---|
| L | | |
| L | - | Formula symbol for inductance |
| LED | Light Emitting Diode | Light Emitting Diode |
| LIN | Linear motor | Linear motor |
| PC | Position Controller | Position Controller |
| LSB | Least Significant Bit | Least significant bit |
| LSC | Line-Side Converter | Line-side converter |
| LSS | Line Side Switch | Line side switch |
| LU | Length Unit | Length unit |
| FOC | Fiber-Optic Cable | Fiber-optic cable |
| Μ | | |
| Μ | - | Formula symbol for torque |
| Μ | Ground | Reference potential for all signal and operat- ing voltages, usually defined as 0 V (also referred to as GND) |
| MB | Megabyte | Megabyte |
| MCC | Motion Control Chart | Motion Control Chart |
| MDS | Motor Data Set | Motor data set |
| MLFB | Machine-Readable Product Code | Machine-Readable Product Code |
| MMC | Man-Machine Communication | Man-machine communication |
| MMC | Micro Memory Card | Micro memory card |
| MSB | Most Significant Bit | Most significant bit |
| MSC | Motor-Side Converter | Motor-side converter |
| MSCY_C1 | Master Slave Cycle Class 1 | Cyclic communication between master (Class 1) and slave |
| MSR | Motor-side converter | Motor-side converter |
| MT | Probe | Probe |
| Ν | | |
| N. C. | Not Connected | Not connected |
| N | No Report | No message or internal message |
| NAMUR | Standardization association for measure- ment and control in the chemical industry | Standardization association for measure- ment and control in the chemical industry |
| NC | Normally Closed (contact) | NC contact |
| NC | Numerical Control | Numerical control |
| NEMA | National Electrical Manufacturers Associa- tion | Standardization body in the US |
| NM | Zero mark | Zero mark |
| NO | Normally Open (contact) | NO contact |
| NSR | Line-side converter | Line-side converter |
| NVRAM | Non-Volatile Random Access Memory | Non-volatile read/write memory |

| Abbreviation | Source of abbreviation | Meaning |
|--------------|------------------------------------|--|
| 0 | | |
| OA | Open Architecture | Open Architecture |
| OC | Operating Condition | Operating condition |
| OEM | Original Equipment Manufacturer | Original Equipment Manufacturer |
| OLP | Optical Link Plug | Fiber-optic bus connector |
| OMI | Option Module Interface | Option module interface |
| Р | | |
| p | - | Adjustable parameters |
| PB | PROFIBUS | PROFIBUS |
| PcCtrl | PC Control | Control for master |
| PD | PROFIdrive | PROFIdrive |
| PDS | Power unit Data Set | Power unit data set |
| PE | Protective Earth | Protective earth |
| PELV | Protective Extra Low Voltage | Protective extra low voltage |
| PEM | Permanent-magnet synchronous motor | Permanent-magnet synchronous motor |
| PG | Programming device | Programming device |
| PI | Proportional Integral | Proportional integral |
| PID | Proportional Integral Differential | Proportional integral differential |
| PLC | Programmable Logic Controller | Programmable logic controller |
| PLL | Phase-Locked Loop | Phase-locked loop |
| PN | PROFINET | PROFINET |
| PNO | PROFIBUS user organization | PROFIBUS user organization |
| PPI | Point-to-Point Interface | Point-to-point interface |
| PRBS | Pseudo Random Binary Signal | White noise |
| PROFIBUS | Process Field Bus | Serial data bus |
| PS | Power Supply | Power supply |
| PSA | Power Stack Adapter | Power Stack Adapter |
| PTC | Positive Temperature Coefficient | Positive temperature coefficient |
| PTP | Point-To-Point | Point-to-Point |
| PWM | Pulse Width Modulation | Pulse width modulation |
| PZD | Process data | Process data |
| R | | |
| r | - | Display parameters (read-only) |
| RAM | Random Access Memory | Read/write memory |
| RCCB | Residual Current Circuit Breaker | Residual current operated circuit breaker |
| RCD | Residual Current Device | Residual current operated circuit breaker |
| RCM | Residual Current Monitor | Residual current monitor |
| RFG | Ramp-Function Generator | Ramp-function generator |
| RJ45 | Registered Jack 45 | Term for an 8-pin socket system for data transmission with shielded or non-shielded multi-wire copper cables |

| Abbreviation | Source of abbreviation | Meaning |
|--------------|-------------------------------|--|
| RKA | Cooling unit | Cooling unit |
| RO | Read Only | Read only |
| RPDO | Receive Process Data Object | Receive process data object |
| RS232 | Recommended Standard 232 | Interface standard for cable-connected serial data transmission between a sender and receiver (also known under EIA232) |
| RS485 | Recommended Standard 485 | Interface standard for a cable-connected differential, parallel, and/or serial bus system (data transmission between a number of senders and receivers, also known under EIA485) |
| RTC | Real Time Clock | Real time clock |
| RZA | Space vector approximation | Space vector approximation |
| S | | |
| S1 | - | Uninterrupted duty |
| S3 | - | Intermittent duty |
| SBC | Safe Brake Control | Safe brake control |
| SBH | Safe operating stop | Safe operating stop |
| SBR | - | Safe acceleration monitoring |
| SCA | Safe Cam | Safe cam |
| SD Card | SecureDigital Card | Secure digital memory card |
| SE | Safe software limit switch | Safe software limit switch |
| SG | Safely reduced speed | Safely reduced speed |
| SGA | Safety-related output | Safety-related output |
| SGE | Safety-related input | Safety-related input |
| SH | Safe standstill | Safe standstill |
| SI | Safety Integrated | Safety Integrated |
| SIL | Safety Integrity Level | Safety Integrity Level |
| SLM | Smart Line Module | Smart Line Module |
| SLP | Safely-Limited Position | Safely-limited position |
| SLS | Safely Limited Speed | Safely limited speed |
| SLVC | Sensorless Vector Control | Vector control without encoder |
| SM | Sensor Module | Sensor Module |
| SMC | Sensor Module Cabinet | Sensor Module Cabinet |
| SME | Sensor Module External | Sensor Module External |
| SN | Safe software cam | Safe software cam |
| SOS | Safe Operating Stop | Safe operating stop |
| SP | Service Pack | Service pack |
| SPC | Setpoint Channel | Setpoint channel |
| SPI | Serial Peripheral Interface | Serial interface for connecting peripherals |
| PLC | Programmable Logic Controller | Programmable logic control |

| Abbreviation | Source of abbreviation | Meaning |
|--------------|------------------------------------|--|
| SS1 | Safe Stop 1 | Safe stop 1 (monitored for time and ramping up) |
| SS2 | Safe Stop 2 | Safe stop 2 |
| SSI | Synchronous Serial Interface | Synchronous serial interface |
| SSM | Safe Speed Monitor | Safe feedback for speed monitoring (n < nx) |
| SSP | SINAMICS Support Package | SINAMICS support package |
| STO | Safe Torque Off | Safe torque off |
| STW | Control word | Control word |
| т | | |
| ТВ | Terminal Board | Terminal Board |
| TIA | Totally Integrated Automation | Totally Integrated Automation |
| ТМ | Terminal Module | Terminal module |
| TN | Terre Neutre | Grounded three-phase supply network |
| Tn | - | Integral time |
| TPDO | Transmit Process Data Object | Transmit process data object |
| ТТ | Terre Terre | Grounded three-phase supply network |
| TTL | Transistor-Transistor Logic | Transistor-transistor logic |
| Τv | - | Rate time |
| U | | |
| UL | Underwriters Laboratories Inc. | Underwriters Laboratories Inc. |
| UPS | Uninterruptible Power Supply | Uninterruptible power supply |
| UPS | Uninterruptible Power Supply | Uninterruptible power supply |
| UTC | Universal Time Coordinated | Universal time coordinated |
| V | | |
| VC | Vector Control | Vector control |
| Vdc | - | DC link voltage |
| VdcN | - | Partial DC link voltage negative |
| VdcP | - | Partial DC link voltage positive |
| VDE | Verband Deutscher Elektrotechniker | Association of German electrical engineers |
| VDI | Verein Deutscher Ingenieure | Association of German Engineers |
| VPM | Voltage Protection Module | Voltage Protection Module |
| Vpp | Volt peak-to-peak | Volt peak-to-peak |
| VSM | Voltage Sensing Module | Voltage Sensing Module |
| W | | |
| AR | Automatic restart | Automatic restart |
| MT | Machine Tool | Machine tool |
| x | | |
| XML | Extensible Markup Language | Standard language for Web publishing and document management |

| Abbreviation | Source of abbreviation | Meaning |
|--------------|------------------------|-------------|
| Z | | |
| DC link | DC link | DC link |
| ZM | Zero Mark | Zero mark |
| ZSW | Status word | Status word |

A.2 List of abbreviations



Suggested improvements

If you come across any misprints in this document, please let us know using this form. We would also be grateful for any suggestions and recommendations for improvement.

Appendix A.2 List of abbreviations

| То: | From |
|---|-------------------------------|
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Suggestions and/or corrections

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