SIEMENS

Getting Started

SINAMICS

S120

With Startdrive

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SIEMENS

SINAMICS

S120
Getting Started with Startdrive

Getting Started

Valid for:
Firmware Version 5.2, Startdrive V15.1

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6SL3097-5AG30-0BP1

Legal information

Warning notice system

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

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

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

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

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

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

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified 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:

⚠ WARNING
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 complied with. The information in the relevant documentation must be observed.

Trademarks

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

Disclaimer of Liability

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

Siemens AG
Digital Industries
Postfach 48 48
90026 NÜRNBERG
GERMANY

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Introduction

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1.1 The SINAMICS converter family

With the SINAMICS converter family, you can solve any individual drive task in the low-voltage, medium-voltage and DC voltage range. From converters to motors and controllers, all Siemens drive components are perfectly matched to each other and can be easily integrated into your existing automation system. With SINAMICS you are prepared for digitization. You benefit from highly efficient engineering with a variety of tools for the entire product development and production process. And you also save space in the control cabinet – thanks to the integrated safety technology.

You can find additional information about SINAMICS at the following address (http://www.siemens.com/sinamics).

1.2 General information about SINAMICS documentation

SINAMICS documentation

The SINAMICS documentation is organized in the following categories:

- General documentation/catalogs
- User documentation
- Manufacturer/service documentation

Standard scope

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

- Other functions not described in this documentation might be able 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 service.
- The documentation can also contain descriptions of functions that are not available in a particular product version of the drive system. Please refer to the ordering documentation only for the functionality of the supplied drive system.
- 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, and cannot take into consideration every conceivable type of installation, operation and service/maintenance.

Target group

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

Benefits

This manual provides all of the information, procedures and operator actions required for the particular usage phase.

Siemens MySupport/Documentation

You can find information on how to create your own individual documentation based on Siemens content and adapt it for your own machine documentation at the following address (https://support.industry.siemens.com/My/ww/en/documentation).

Additional information

You can find information on the topics below at the following address (https://support.industry.siemens.com/cs/de/en/view/108993276):

- Ordering documentation/overview of documentation
- Additional links to download documents
- Using documentation online (find and search in manuals/information)

Questions relating to the technical documentation

Please send any questions about the technical documentation (e.g. suggestions for improvement, corrections) to the following email address (mailto:docu.motioncontrol@siemens.com).

FAQs

You can find Frequently Asked Questions under Product Support (https://support.industry.siemens.com/cs/de/en/ps/faq).

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

Usage phase	Document/tool
Orientation	SINAMICS S Sales Documentation
Planning/configuration	• SIZER Engineering Tool • Configuration Manuals, Motors
Deciding/ordering	SINAMICS S120 catalogs • SINAMICS S120 and SIMOTICS (Catalog D 21.4) • SINAMICS Converters for Single-Axis Drives and SIMOTICS Motors (Catalog D 31) • SINAMICS Converters for Single-Axis Drives – Built-In Units (D 31.1) • SINAMICS Converters for Single-Axis Drives – Distributed Converters (D 31.2) • SINAMICS S210 Servo Drive System (D 32) • SINUMERIK 840 Equipment for Machine Tools (Catalog NC 62)
Installation/assembly	• SINAMICS S120 Equipment Manual for Control Units and Supplementary System Components • SINAMICS S120 Equipment Manual for Booksize Power Units • SINAMICS S120 Equipment Manual for Booksize Power Units C/D Type • SINAMICS S120 Equipment Manual for Chassis Power Units • SINAMICS S120 Equipment Manual for Chassis Power Units, Liquid-cooled • SINAMICS S120 Equipment Manual water-cooled chassis power units for common cooling circuits • SINAMICS S120 Equipment Manual for Chassis Power Units, Air-cooled • SINAMICS S120 Equipment Manual for AC Drives • SINAMICS S120 Equipment Manual Combi • SINAMICS S120M Equipment Manual Distributed Drive Technology • SINAMICS HLA System Manual Hydraulic Drives
Commissioning	• Startdrive Commissioning Tool • SINAMICS S120 Getting Started • SINAMICS S120 Commissioning Manual • SINAMICS S120 Function Manual Drive Functions • SINAMICS S120 Safety Integrated Function Manual • SINAMICS S120 Function Manual Communication • SINAMICS S120/S150 List Manual • SINAMICS HLA System Manual Hydraulic Drives
Usage/operation	• SINAMICS S120 Commissioning Manual • SINAMICS S120/S150 List Manual • SINAMICS HLA System Manual Hydraulic Drives
Maintenance/servicing	• SINAMICS S120 Commissioning Manual • SINAMICS S120/S150 List Manual
References	• SINAMICS S120/S150 List Manual

1.4 Where can the various topics be found?

Software		Manual
Alarms	Described in order of ascending numbers	SINAMICS S120/S150 List Manual
Parameters	Described in order of ascending numbers	SINAMICS S120/S150 List Manual
Function block diagrams	Sorted according to topic	SINAMICS S120/S150 List Manual
	Described in order of ascending numbers	
Drive functions		SINAMICS S120 Function Manual Drive Functions
Communication topics		SINAMICS S120 Function Manual Communication[2]
Safety Integrated	Basic and Extended Functions	SINAMICS S120 Safety Integrated Function Manual
	Basic Functions	SINAMICS S120 Function Manual Drive Functions
Commissioning	Of a simple SINAMICS S120 drive with STARTER	Getting Started[1]
Commissioning	With STARTER	SINAMICS S120 Commissioning Manual[1]
Commissioning	Of a simple SINAMICS S120 drive with Startdrive	Getting Started[2]
Commissioning	With Startdrive	SINAMICS S120 Commissioning Manual[2]
Web server		SINAMICS S120 Function Manual Drive Functions

Hardware			Manual
Control Units and expansion components	• Control Units • Option Boards • Terminal Modules	• HUB Modules • VSM10 • Encoder system connection	SINAMICS S120 Equipment Manual for Control Units and Supplementary System Components
Booksize power units	• Line connection • Line Modules • Motor Modules	• DC link components • Braking resistors • Control cabinet design	SINAMICS S120 Equipment Manual for Booksize Power Units
Power units, booksize C/D type format			SINAMICS S120 Equipment Manual for Booksize Power Units C/D Type
Chassis power units			SINAMICS S120 Equipment Manual for Chassis Power Units, air, liquid or water cooled
AC drive components			SINAMICS S120 Equipment Manual for AC Drives
S120 Combi components			SINAMICS S120 Equipment Manual Combi
Diagnostics via LEDs	STARTER		SINAMICS S120 Commissioning Manual[1]
	Startdrive		SINAMICS S120 Commissioning Manual[2]
Meaning of the LEDs			Equipment Manuals
High Frequency Drive components			SINAMICS S120 System Manual High Frequency Drives

[1] Up to firmware version 5.1 SP1

[2] From firmware version 5.2

1.5 Training and support

Training

At the following address (http://www.siemens.com/sitrain), you can find information about SITRAIN (Siemens training on products, systems and solutions for automation and drives).

Technical Support

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

1.6 Directives, standards, certificates

Relevant directives and standards

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

Certificates for download

The certificates can be downloaded from the Internet:

Certificates (https://support.industry.siemens.com/cs/ww/de/ps/13206/cert)

EC Declaration of Conformity

You can find the EC Declaration of Conformity for the relevant directives as well as the relevant certificates, prototype test certificates, manufacturers declarations and test certificates for functions relating to functional safety ("Safety Integrated") on the Internet at the following address (https://support.industry.siemens.com/cs/ww/en/ps/13231/cert).

The following directives and standards are relevant for SINAMICS S devices:

- **European Low Voltage Directive**
  SINAMICS S devices fulfil the requirements stipulated in the Low-Voltage Directive 2014/35/EU, insofar as they are covered by the application area of this directive.
- **European Machinery Directive**
  SINAMICS S devices fulfil the requirements stipulated in the Low-Voltage Directive 2006/42/EU, insofar as they are covered by the application area of this directive.
  However, the use of the SINAMICS S devices in a typical machine application has been fully assessed for compliance with the main regulations in this directive concerning health and safety.
- **Directive 2011/65/EU**
  SINAMICS S devices comply with the requirements of Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic devices (RoHS II).
- **European EMC Directive**
  SINAMICS S devices comply with the EMC Directive 2014/30/EU.
- **EMC requirements for South Korea**
  SINAMICS S devices with the KC marking on the type plate satisfy the EMC requirements for South Korea.
- **Eurasian conformity**
  SINAMICS S comply with the requirements of the Russia/Belarus/Kazakhstan customs union (EAC).

- **North American market**
  SINAMICS S devices provided with one of the test symbols displayed fulfill the requirements stipulated for the North American market as a component of drive applications.
  You can find the relevant certificates on the Internet pages of the certifier (http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.html).

- **Specification for semiconductor process equipment voltage drop immunity**
  SINAMICS S devices meet the requirements of standard SEMI F47-0706.

- **Australia and New Zealand (RCM formerly C-Tick)**
  SINAMICS S devices showing the test symbols fulfill the EMC requirements for Australia and New Zealand.

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

Not relevant standards

China Compulsory Certification

SINAMICS S devices do not fall in the area of validity of the China Compulsory Certification (CCC).

EMC limit values in South Korea

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

The EMC limit values to be observed for Korea correspond to the limit values of the EMC product standard for variable-speed electric drives EN 61800-3 of category C2 or the limit value class A, Group 1 to KN11. By implementing appropriate additional measures, the limit values according to category C2 or limit value class A, Group 1, are observed. Further, additional measures may be required, such as using an additional radio interference suppression filter (EMC filter).
The measures for EMC-compliant design of the system are described in detail in this manual respectively in the EMC Installation Guideline Configuration Manual.
The final statement regarding compliance with the standard is given by the respective label attached to the individual unit.

1.7 Additional information

Ensuring reliable operation

The manual describes a desired state which, if maintained, ensures the required level of operational reliability and compliance with EMC limit values.

Should there be any deviation from the requirements in the manual, appropriate actions (e.g. measurements) must be taken to check/prove that the required level of operational reliability and compliance with EMC limit values are ensured.

Spare parts

Spare parts are available on the Internet at the following address (https://www.automation.siemens.com/sow?sap-language=EN).

Product maintenance

The components are subject to continuous further development within the scope of product maintenance (improvements to robustness, discontinuations of components, etc).

These further developments are "spare parts-compatible" and do not change the article number.

In the scope of such spare parts-compatible further developments, connector/connection positions are sometimes changed slightly. This does not cause any problems with proper use of the components. Please take this fact into consideration in special installation situations (e.g. allow sufficient clearance for the cable length).

Use of third-party products

This document contains recommendations relating to third-party products. Siemens accepts the fundamental suitability of these third-party products.

You can use equivalent products from other manufacturers.

Siemens does not accept any warranty for the properties of third-party products.

Ground symbols

Table 1-1 Symbols

Icon	Meaning
	Connection for protective conductor
	Ground (e.g. M 24 V)
	Connection for function potential bonding

1.8 Using OpenSSL

Many SINAMICS products include OpenSSL. The following applies to these products:

- This product contains software (https://www.openssl.org/) that has been developed by the OpenSSL project for use in the OpenSSL toolkit.
- This product contains cryptographic software (mailto:eay@cryptsoft.com) created by Eric Young.
- This product contains software (mailto:eay@cryptsoft.com) developed by Eric Young.

1.9 Purpose of the document

This documentation is aimed at beginners who want to commission a drive system using Startdrive. The steps described in this document allow a simple SINAMICS S120 drive train (CU320-2 PN) to be put into operation. It does not claim to be complete, however. The complete commissioning functions are described in the Commissioning Manual with Startdrive.

1.10 General Data Protection Regulation

Compliance with the General Data Protection Regulation

Siemens respects the principles of data privacy, in particular the data minimization rules (privacy by design).

For the SINAMICS Startdrive product – including the installed SINAMICS DCC option package – this means the following:
The product only sends personal data to SIEMENS AG if the user explicitly requests this. This occurs in the following cases:

- If the SINAMICS Startdrive program and the SINAMICS DCC option package end unexpectedly, then the user is given the opportunity to send diagnostics information to SIEMENS AG for analysis. If the user avails themselves of this option, then their email address will be collected, transmitted and saved so that they can be contacted in the event of queries.
- The Totally Integrated Automation UPDATER enables the user to check whether updates are available for SINAMICS Startdrive and the SINAMICS DCC option package and to install them. The user can manually check for available updates or activate the corresponding setting in the TIA UPDATER for automatic updating. If the TIA Automation Update Server is used for verification or installation purposes, the IP address of the device used will be transmitted for technical reasons.

Beyond the previously mentioned information, the product only saves personal data in the project. The user is therefore responsible for ensuring compliance with the statutory data protection provisions. This applies in particular to the transfer of projects.

The following data must be taken into account.

- Windows login
  In the standard configuration, the product saves the login details of the Windows user together with technical function data (e.g. time stamp) in the project. The specified data is saved in order to trace changes in large configurations.
  For SINAMICS Startdrive and the SINAMICS DCC option package, reference to specific persons can be established via the project and all elements contained within it (e.g. devices and diagrams).
  The specified data can be viewed in the properties of the project and the elements in SINAMICS Startdrive and the SINAMICS DCC option package ("Author" property) and, with the exception of the most recent change to the project, subsequently modified.
- Usernames in the user administration
  The product only processes and saves additional personal data when the user explicitly enables one of the following functions.
  Usernames created by the user are saved by the user administration (security settings) to be able to verify them during subsequent authentication.
- Login for multi-user engineering
  For multi-user engineering, various technical function data (e.g. time stamp) are saved together with the login of the Windows user concerned in order to be able to trace project changes.

For the three previously mentioned points, the details relating to the specified functions must be observed in the relevant chapter in the information system of SINAMICS Startdrive and the SINAMICS DCC option package.

By generating the login or username, personal data can be pseudonymized for the functions. Deleting the project will cause all personal data saved within it to be deleted too. The particularities of multi-user engineering should be taken into consideration here (e.g. that the project not only needs to be deleted locally from the user's PC, but also from the server used).

Fundamental safety instructions

2

2.1 General safety instructions

⚠ WARNING

Electric shock and danger to life due to other energy sources

Touching live components can result in death or severe injury.

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

Generally, the following six steps apply when establishing safety:

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

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

⚠ WARNING

Risk of electric shock and fire from supply networks with an excessively high impedance

Excessively low short-circuit currents can lead to the protective devices not tripping or tripping too late, and thus causing electric shock or a fire.

- In the case of a conductor-conductor or conductor-ground short-circuit, ensure that the short-circuit current at the point where the inverter is connected to the line supply at least meets the minimum requirements for the response of the protective device used.
- You must use an additional residual-current device (RCD) if a conductor-ground short circuit does not reach the short-circuit current required for the protective device to respond. The required short-circuit current can be too low, especially for TT supply systems.

⚠ WARNING

Risk of electric shock and fire from supply networks with an excessively low impedance

Excessively high short-circuit currents can lead to the protective devices not being able to interrupt these short-circuit currents and being destroyed, and thus causing electric shock or a fire.

- Ensure that the prospective short-circuit current at the line terminal of the inverter does not exceed the breaking capacity (SCCR or Icc) of the protective device used.

⚠ WARNING

Electric shock if there is no ground connection

For missing or incorrectly implemented protective conductor connection for devices with protection class I, high voltages can be present at open, exposed parts, which when touched, can result in death or severe injury.

- Ground the device in compliance with the applicable regulations.

⚠ WARNING

Electric shock due to connection to an unsuitable power supply

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

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

⚠ WARNING

Electric shock due to equipment damage

Improper handling may cause damage to equipment. For damaged devices, hazardous voltages can be present at the enclosure or at exposed components; if touched, this can result in death or severe injury.

- Ensure compliance with the limit values specified in the technical data during transport, storage and operation.
- Do not use any damaged devices.

⚠ WARNING

Electric shock due to unconnected cable shield

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

- As a minimum, connect cable shields and the conductors of power cables that are not used (e.g. brake cores) at one end at the grounded housing potential.

⚠ WARNING

Arcing when a plug connection is opened during operation

Opening a plug connection when a system is operation can result in arcing that may cause serious injury or death.

- Only open plug connections when the equipment is in a voltage-free state, unless it has been explicitly stated that they can be opened in operation.

⚠ WARNING

Electric shock due to residual charges in power components

Because of the capacitors, a hazardous voltage is present for up to 5 minutes after the power supply has been switched off. Contact with live parts can result in death or serious injury.

- Wait for 5 minutes before you check that the unit really is in a no-voltage condition and start work.

NOTICE

Property damage due to loose power connections

Insufficient tightening torques or vibration can result in loose power connections. This can result in damage due to fire, device defects or malfunctions.

- Tighten all power connections to the prescribed torque.
- Check all power connections at regular intervals, particularly after equipment has been transported.

⚠ WARNING

Spread of fire from built-in devices

In the event of fire outbreak, the enclosures of built-in devices cannot prevent the escape of fire and smoke. This can result in serious personal injury or property damage.

- Install built-in units in a suitable metal cabinet in such a way that personnel are protected against fire and smoke, or take other appropriate measures to protect personnel.
- Ensure that smoke can only escape via controlled and monitored paths.

⚠ WARNING

Active implant malfunctions due to electromagnetic fields

Inverters generate electromagnetic fields (EMF) in operation. Electromagnetic fields may interfere with active implants, e.g. pacemakers. People with active implants in the immediate vicinity of an inverter are at risk.

- As the operator of an EMF-emitting installation, assess the individual risks of persons with active implants.
- Observe the data on EMF emission provided in the product documentation.

⚠ WARNING

Unexpected movement of machines caused by radio devices or mobile phones

When radio devices or mobile phones with a transmission power > 1 W are used in the immediate vicinity of components, they may cause the equipment to malfunction. Malfunctions may impair the functional safety of machines and can therefore put people in danger or lead to property damage.

- If you come closer than around 2 m to such components, switch off any radios or mobile phones.
- Use the "SIEMENS Industry Online Support app" only on equipment that has already been switched off.

NOTICE

Damage to motor insulation due to excessive voltages

When operated on systems with grounded line conductor or in the event of a ground fault in the IT system, the motor insulation can be damaged by the higher voltage to ground. If you use motors that have insulation that is not designed for operation with grounded line conductors, you must perform the following measures:

- IT system: Use a ground fault monitor and eliminate the fault as quickly as possible.
- TN or TT systems with grounded line conductor: Use an isolating transformer on the line side.

⚠ WARNING

Fire due to inadequate ventilation clearances

Inadequate ventilation clearances can cause overheating of components with subsequent fire and smoke. This can cause severe injury or even death. This can also result in increased downtime and reduced service lives for devices/systems.

- Ensure compliance with the specified minimum clearance as ventilation clearance for the respective component.

NOTICE

Overheating due to inadmissible mounting position

The device may overheat and therefore be damaged if mounted in an inadmissible position.

- Only operate the device in admissible mounting positions.

⚠ WARNING

Unrecognized dangers due to missing or illegible warning labels

Dangers might not be recognized if warning labels are missing or illegible. Unrecognized dangers may cause accidents resulting in serious injury or death.

- Check that the warning labels are complete based on the documentation.
- Attach any missing warning labels to the components, where necessary in the national language.
- Replace illegible warning labels.

NOTICE

Device damage caused by incorrect voltage/insulation tests

Incorrect voltage/insulation tests can damage the device.

- Before carrying out a voltage/insulation check of the system/machine, disconnect the devices as all converters and motors have been subject to a high voltage test by the manufacturer, and therefore it is not necessary to perform an additional test within the system/machine.

⚠ WARNING

Unexpected movement of machines caused by inactive safety functions

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

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

Note

Important safety notices for Safety Integrated functions

If you want to use Safety Integrated functions, you must observe the safety notices in the Safety Integrated manuals.

⚠ WARNING

Malfunctions of the machine as a result of incorrect or changed parameter settings

As a result of incorrect or changed parameterization, machines can malfunction, which in turn can lead to injuries or death.

- Protect the parameterization against unauthorized access.
- Handle possible malfunctions by taking suitable measures, e.g. emergency stop or emergency off.

2.2 Equipment damage due to electric fields or electrostatic discharge

Electrostatic sensitive devices (ESD) are individual components, integrated circuits, modules or devices that may be damaged by either electric fields or electrostatic discharge.

NOTICE

Equipment damage due to electric fields or electrostatic discharge

Electric fields or electrostatic discharge can cause malfunctions through damaged individual components, integrated circuits, modules or devices.

- Only pack, store, transport and send electronic components, modules or devices in their original packaging or in other suitable materials, e.g conductive foam rubber of aluminum foil.
- Only touch components, modules and devices when you are grounded by one of the following methods:
  - Wearing an ESD wrist strap
  - Wearing ESD shoes or ESD grounding straps in ESD areas with conductive flooring
- Only place electronic components, modules or devices on conductive surfaces (table with ESD surface, conductive ESD foam, ESD packaging, ESD transport container).

2.3 Warranty and liability for application examples

Application examples are not binding and do not claim to be complete regarding configuration, equipment or any eventuality which may arise. Application examples do not represent specific customer solutions, but are only intended to provide support for typical tasks.

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

2.4 Industrial security

Note

Industrial security

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

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

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

For additional information on industrial security measures that can be implemented, please visit:

Industrial security (https://www.siemens.com/industrialsecurity)

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

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed at:

Industrial security (https://www.siemens.com/industrialsecurity)

Further information is provided on the Internet:

Industrial Security Configuration Manual (https://support.industry.siemens.com/cs/ww/en/view/108862708)

⚠ WARNING

Unsafe operating states resulting from software manipulation

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

- Keep the software up to date.
- Incorporate the automation and drive components into a holistic, state-of-the-art industrial security concept for the installation or machine.
- Make sure that you include all installed products into the holistic industrial security concept.
- Protect files stored on exchangeable storage media from malicious software by with suitable protection measures, e.g. virus scanners.
- On completion of commissioning, check all security-related settings.
- Protect the drive against unauthorized changes by activating the "Know-how protection" converter function.

2.5 Residual risks of power drive systems

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

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

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

Overview

3

This manual provides instructions on how to commission a simple SINAMICS S120.

To create a sample project the following points are explained:

1. Which hardware components do you need for the sample project?
2. How do you create a simple project in the Startdrive commissioning tool?
3. How do you configure a drive?
4. How do you put the drive into operation?

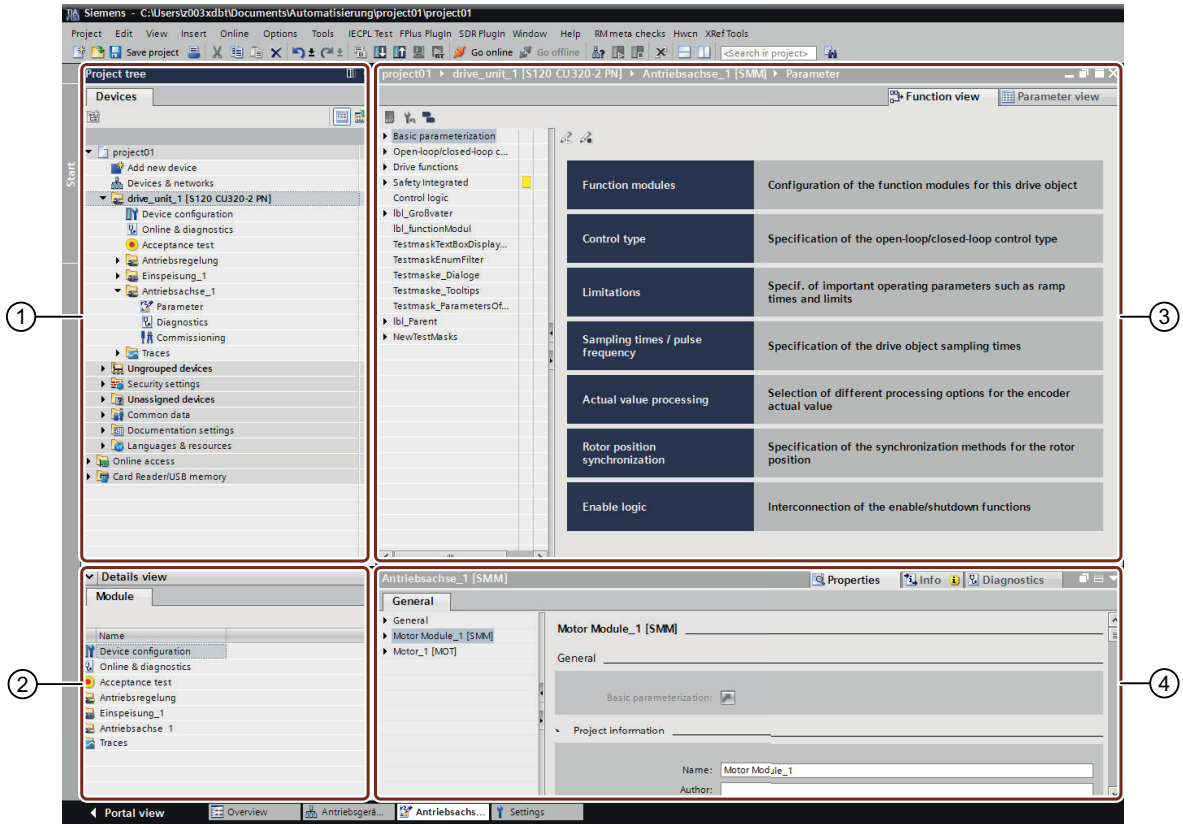
Startdrive commissioning tool

4

4.1 Structure of the user interface

4.1.1 Project view

The following figure shows an example of the most important sections of the project view.



① The components and project data are displayed in the "Project tree" window.

② The details of an item selected in the project tree are displayed in the "Details view" window.

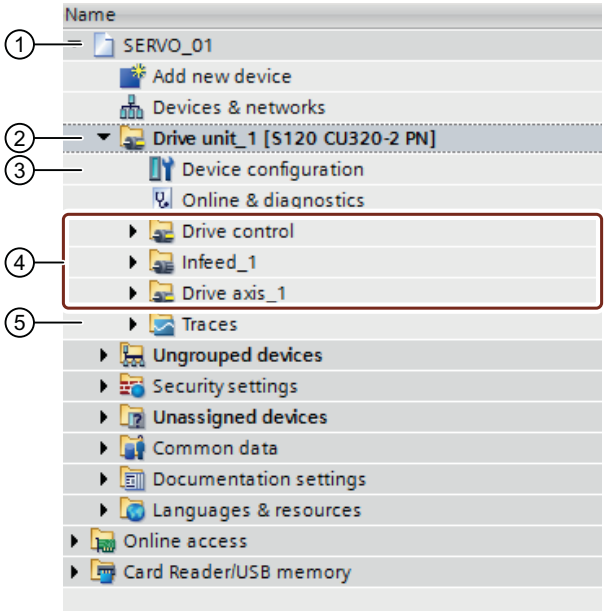
③ You can put together and parameterize your drive in the "Workspace" window.

④ The properties and parameters of an object selected in the workspace are displayed in the "Inspector window".

Figure 4-1 Example: Layout of the Startdrive user interface

4.1.2 Project navigation

Drives, drive components and project data are displayed and can be edited in the project tree. After inserting, drives and drive components are displayed as follows:



① Project name
② Name of the created drive
③ Device configuration of the new added drive
④ Created drive objects (automatic speed control, infeed unit, drive axis) of a drive
⑤ Trace recording of drive

Figure 4-2 Parts of a project

4.2 User interface - parameterization

4.2.1 Modules in the hardware catalog

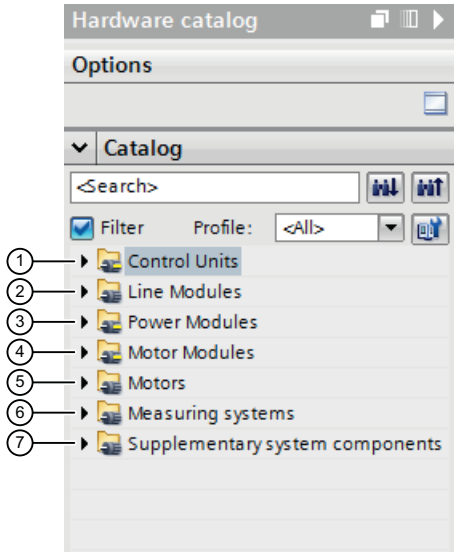
Overview

As soon as the device configuration is active, a hardware catalog can be displayed/hidden at the right-hand edge of the program window. The device configuration automatically becomes active as soon as a drive device was inserted. The required SINAMICS modules can be transferred from the hardware catalog into a project and specified.

For instance, you can insert an infeed unit from the hardware catalog (see "Inserting and specifying an infeed unit (Page 80)").

Components in the hardware catalog

The SINAMICS components are assigned to the following main groups in the hardware catalog:



① Control Units of type SINAMICS CU320-2
② Line Modules
③ Power Modules (chassis format)
④ Motor Modules
⑤ Motors (the motors are sorted according to motor type and article number, and are displayed with a core article number.)
⑥ Measuring systems (encoder types)
⑦ Supplementary system components

Figure 4-3 SINAMICS hardware components

4.2.2 Device view

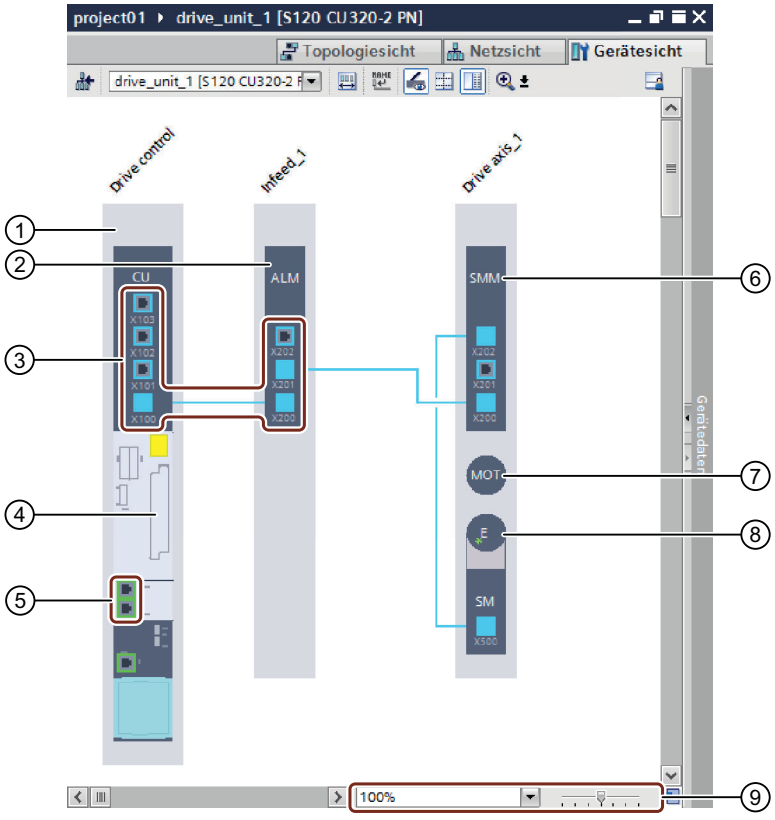
Overview

Configure the drive line-up in the device view. You insert components and edit the DRIVE-CLiQ connections. You can call the device view by double-clicking the "Device configuration" entry in the project tree.

The device view provides a graphical display of all of the configured modules and their interfaces. Withdrawable units for optional modules are also displayed.

Display of configured drives

The following figure shows an example of the most important parts of a configuration that are displayed in the device view.



① Control Unit
② Infeed
③ DRIVE-CLiQ interfaces and connections
④ Rack unit for optional modules
⑤ Bus interface (e.g. PROFINET)
⑥ Motor Module or Power Module
⑦ Motor
⑧ Encoder
⑨ Zoom factor setting

Figure 4-4 Example: Device view

4.2.3 Parameterization editor

Overview

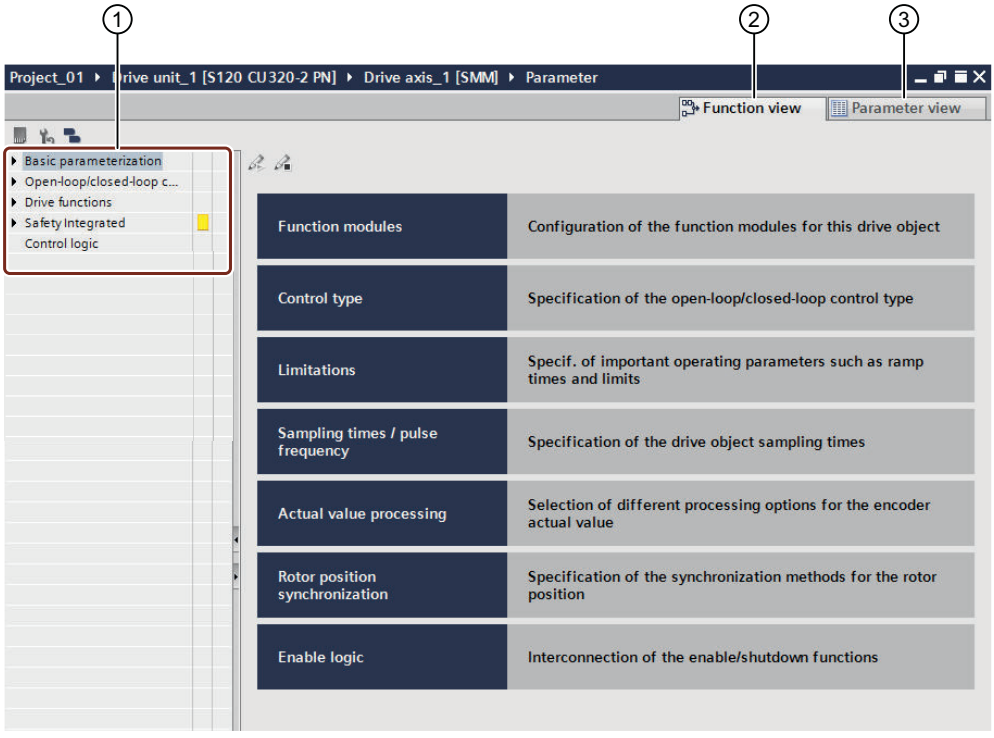
The parameterization editor is comprised of 2 tabs in which you can parameterize the drive:

- In the **function view**, you parameterize the drive using a graphic user interface. The individual screen forms are based on the function diagrams – and include the parameters required. Different input screens for facilitating the parameterization are displayed depending on the configured drive.
- All parameters of the configured drive are listed in the **parameter view** so that the drive can be completely parameterized there.

With the aid of the secondary navigation, you can navigate between the individual functions that you would like to parameterize in the function or parameter view. The secondary navigation shows all of the functions, sorted by topic, and limits the parameter view to a desired group of parameters.

Structure of the parameterization editor

The following figure shows an example of the structure of the parameterizing editor.



① Secondary navigation
② Function view
③ Parameter view

Figure 4-5 Example: Parameterizing editor

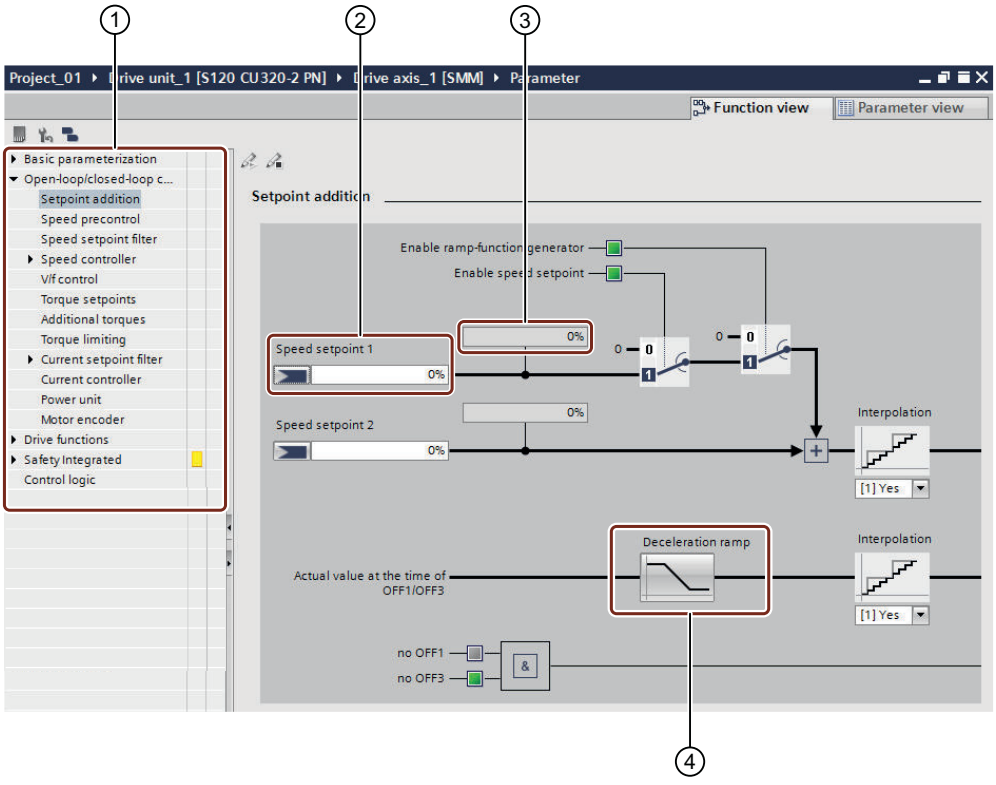
4.2.4 Function view

Overview

You parameterize the drive using a graphical user interface in the "Function view". The individual screen forms are based on the function diagrams – and include the parameters required.

Layout of the function view

The following figure shows an example of a screen form structure in the function view.



① Secondary navigation
② Fields for entering parameters or interconnections of BICO signals.
③ Display parameters
④ Button to display parameterizing dialog boxes or screen forms.

Figure 4-6 Example: Function view

Explanation of symbols

Symbol	Meaning
	Saving data in a non-volatile fashion
	Restoring factory settings
	Display invalid BICO wirings

Symbol	Meaning
	Activate Safety processing
	Save Safety processing

Default with drive-specific parameters

If you call interconnection screen forms in the function view, then a series of parameters are already preassigned values. For less experienced users, we recommend that they first work with the preassigned values. Experts, who have values for certain parameters that they have gained from experience, can generally make quick and specific changes to the parameterization. In the parameter view, extensive settings can be made, which are effective across various screen forms (see Chapter "Parameter view (Page 42)").

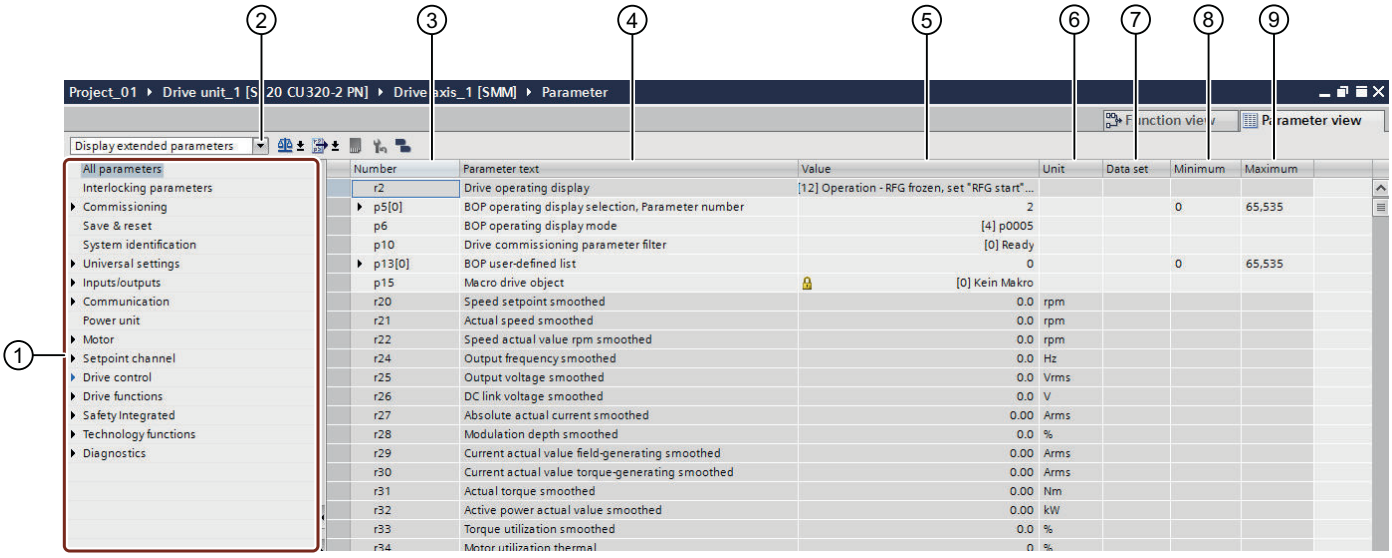
4.2.5 Parameter view

Overview

The "Parameter view" shows the parameters for a configured drive in a table.

Structure of the parameter view

The following figure shows an example of the structure of the parameter view.



① Secondary navigation (Depending on the selected function, the parameter view shows the corresponding parameter groups. This behavior applies to the following product groups: S120, S150, G150 and G130. The secondary navigation is not available for MV drives.)

② Drop-down list (the following options are available: Display standard parameters, Display extended parameters and Display service parameters.)

③ Parameter numbers

④ Parameter names

⑤ Parameter values

⑥ Units

⑦ Data records (column which displays which data record (e.g. MDS, DDS) a parameter belongs to.)

⑧ Minimum values

⑨ Maximum values

Figure 4-7 Example: Parameter list

Explanation of symbols

The following table gives an overview of the symbols that are displayed in the menu bar of the parameter list.

Symbol	Meaning
	Button for comparing the parameters of the drive object to another parameter set. • In offline mode, the parameters are compared to the factory settings by default. • In online mode, the parameters are compared to the offline settings by default. • The comparison can also be disabled again.
	Button for copying the parameters to a CSV file. The following options are available: • Exporting all of the displayed parameters to a CSV file. • Exporting the parameters of all of the drive objects to a CSV file.
	Button for retentive/power-independent storage of the parameterization (copy RAM to ROM).

Symbol	Meaning
	Button for restoring the factory settings.
	Button for displaying open BICO interconnections of all of the drive objects in the offline project.

Display of the parameters

The fields of the individual parameters are displayed in the list as follows:

Authorization	Offline mode color	Online mode color
Read only	Gray	Pale orange
Read/write	White	Orange

Blocked parameters

Note

Blocked parameters

Parameters with a lock icon cannot be edited or modified in offline mode. To enter these parameters in offline mode, you use the appropriate screen forms and dialogs in the hardware configuration, which you find in the device view.

Parameters can be locked in the parameter view to prevent changes. In this case, they are marked with the lock icon . Parameters are always locked in the following cases:

- When the parameter has been set by means of a previous basic parameterization (such as in the device configuration) and a parameter change would take effect later with an altered structure.
- For parameters that should generally not be manually changed by the user, e.g. because they are parameterized by a controller or other application.
- For parameters that are generally only to be configured in Startdrive via input screens. The display in the parameter view only provides an overview.

4.2.6 Inspector window

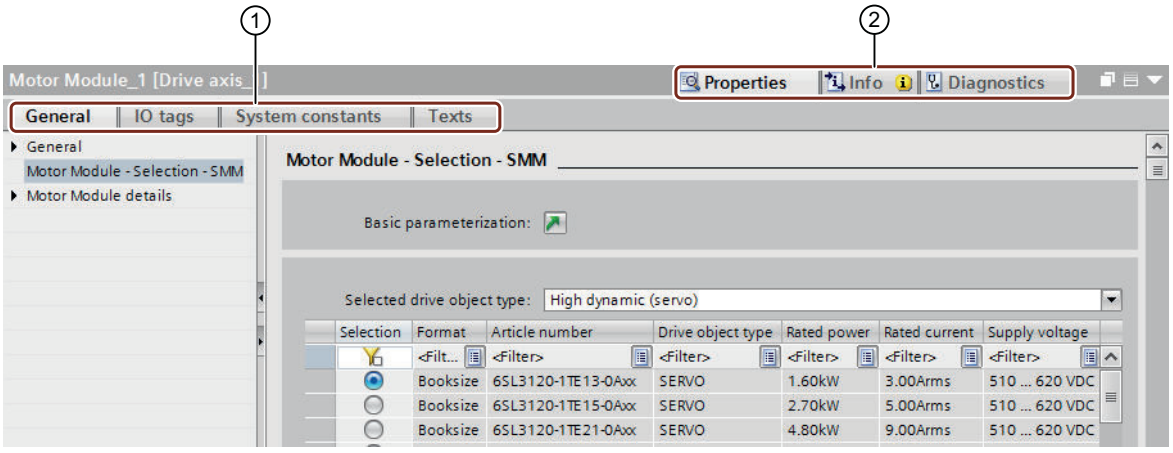
Overview

Properties and parameters of the selected object are displayed in the Inspector window. You can edit these properties and parameters. As a result, S120 drive objects that are newly inserted into the device view can be specified, for example.

Structure of the inspector window

The information and parameters in the Inspector window are subdivided into various information classes, which are displayed as main tab ② in the Inspector window.

The following figure shows an example of the structure of the inspector window:



① Secondary tabs (General, IO tags, System constants, Texts)

② Main tabs (Properties, Info, Diagnostics)

Figure 4-8 Example: Inspector window

Showing / hiding the inspector window

To show or hide the inspector window, proceed as follows:

1. Use the regular window icons in the header of the window.
   OR
2. In the device view, select an unspecified component and open the "Properties" shortcut menu.

Maximizing / minimizing the inspector window

The inspector window is only partially displayed when called. Display of the Inspector window can be maximized or minimized for specification of the components. Double-click on the header of the Inspector window to minimize or maximize the displayed Inspector window.

Division of the "Properties" tab

Each main tab contains information that is displayed via secondary tabs. The most important information for SINAMICS S120 drives can be found in the "Properties" main tab. The following secondary tabs are displayed in this main tab:

- **General**
  Display of the properties and settings of a drive unit, drive object or hardware component. Here you can enter the settings on the user interface. The secondary navigation is located in the left-hand part of the Inspector window. Information and parameters are arranged there in the groups. To expand a group, click on the arrow symbol ▶ next to the group name. If you select a group or a subgroup, then the appropriate information and parameters are displayed in the right-hand part of the Inspector window, where they can be edited.
  For S120 drives, mainly the drive objects used are specified (e.g. an infeed unit) using this subarea.
- **I/O variables**
  Displaying I/O variables of the PLC. The I/O variables are also listed in the PLC variable table.
  You can carry out the following actions in this tab:
  - Assign names for the tags.
  - Assign the tags to the user-defined tag table via a drop-down list.
  - Provide the tags with comments.
- **System constants**
  Display of the constants required by the system using the hardware identifiers of the modules. The system constants are also listed in the PLC variable table.
- **Texts**
  Display of the reference language and the specification of the text source for project texts.

4.2.7 Device configuration detection

Overview

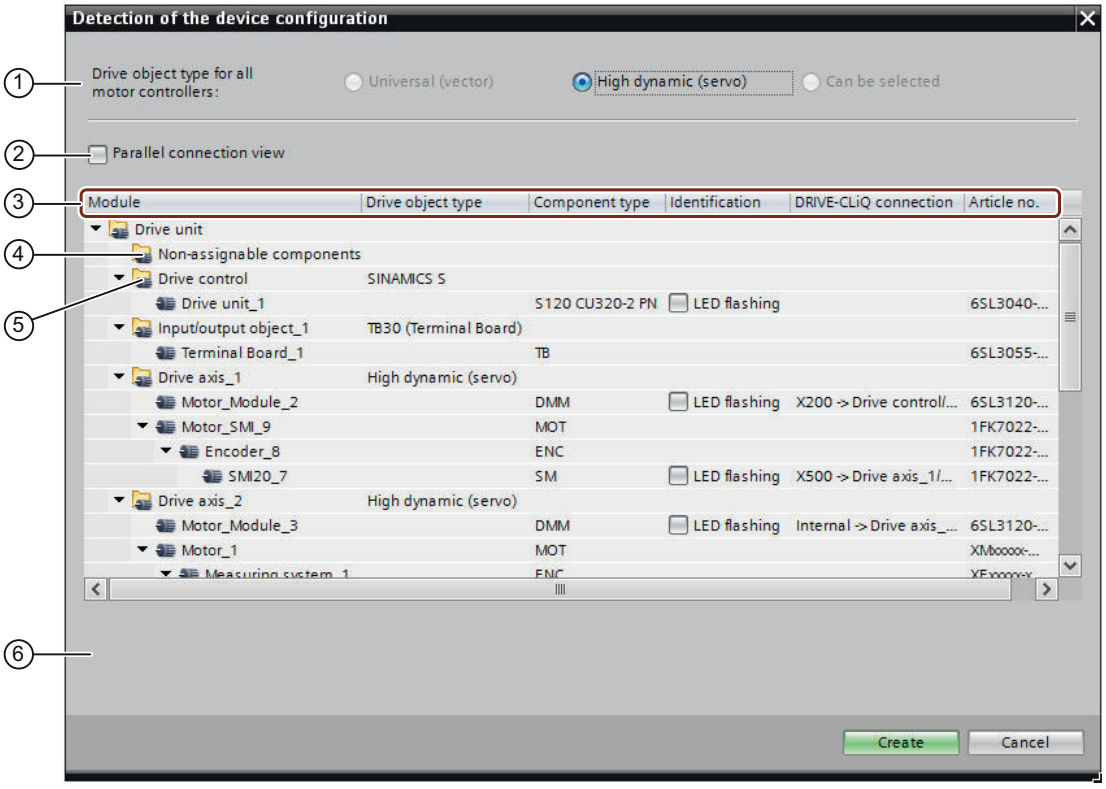
The results of a detection run are listed in the dialog "Detection of the device configuration". The components are assigned as follows:

- Components are assigned to drive objects.
- Drive objects are assigned to drive units.

All components, which could not be assigned to a module, are placed in the "Non-assignable components" folder (see "Determining the drive configuration (Page 119)").

Structure of the dialog

The following figure shows an example of the structure of the dialog.



① Drive object type of the motor controls

② Activation of the parallel connection view. In the parallel connection view, only the parallel connection-capable components are displayed.

③ The following information is displayed in the columns:

- Drive object type
- Component type
- Identification via LED. Is controlled on the Control Unit via parameters p9210 and p9211.
- DRIVE CLiQ connection of the components
- Article number of the component

④ List of the non-assignable components

⑤ List of the main components and assigned components

⑥ Creation information (optional)

Figure 4-9 Example: Device configuration detection

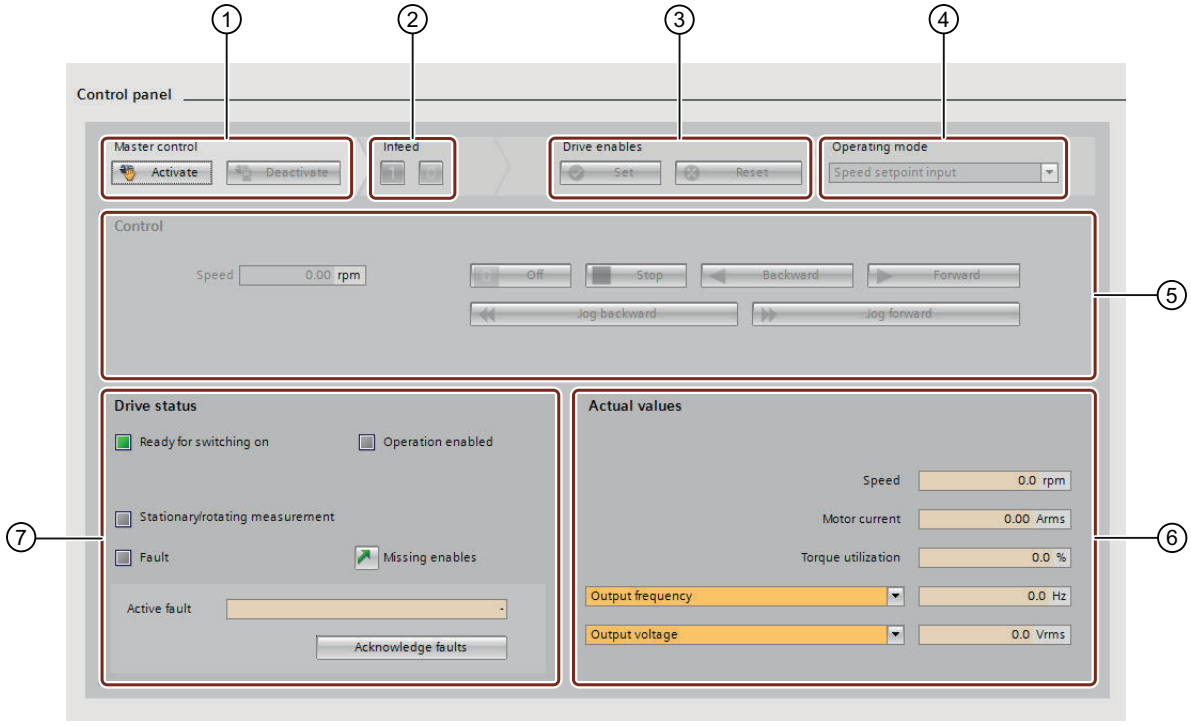
4.3 User interface - Control panel

Overview

The control panel is used for the control and monitoring of individual drives. You traverse drives with the control panel by specifying values. Depending on the operating mode, these are, for example, speed setpoints.

Layout of the control panel

The following figure shows as example the various components of the control panel:



① Activate/deactivate master control
② Switch on/off infeed
③ Set/reset drive enable signals
④ Select operating mode
⑤ Control drive
⑥ Display of the actual values
⑦ Indication of the drive status

Figure 4-10 Example: Control panel

Further information

You can find further information in Chapter "Using the control panel (Page 173)".

4.4 Information system

4.4.1 General remarks on the information system

The information system of the Startdrive in TIA Portal helps you solve your problems and offers the required help topics at each step of the configuration.

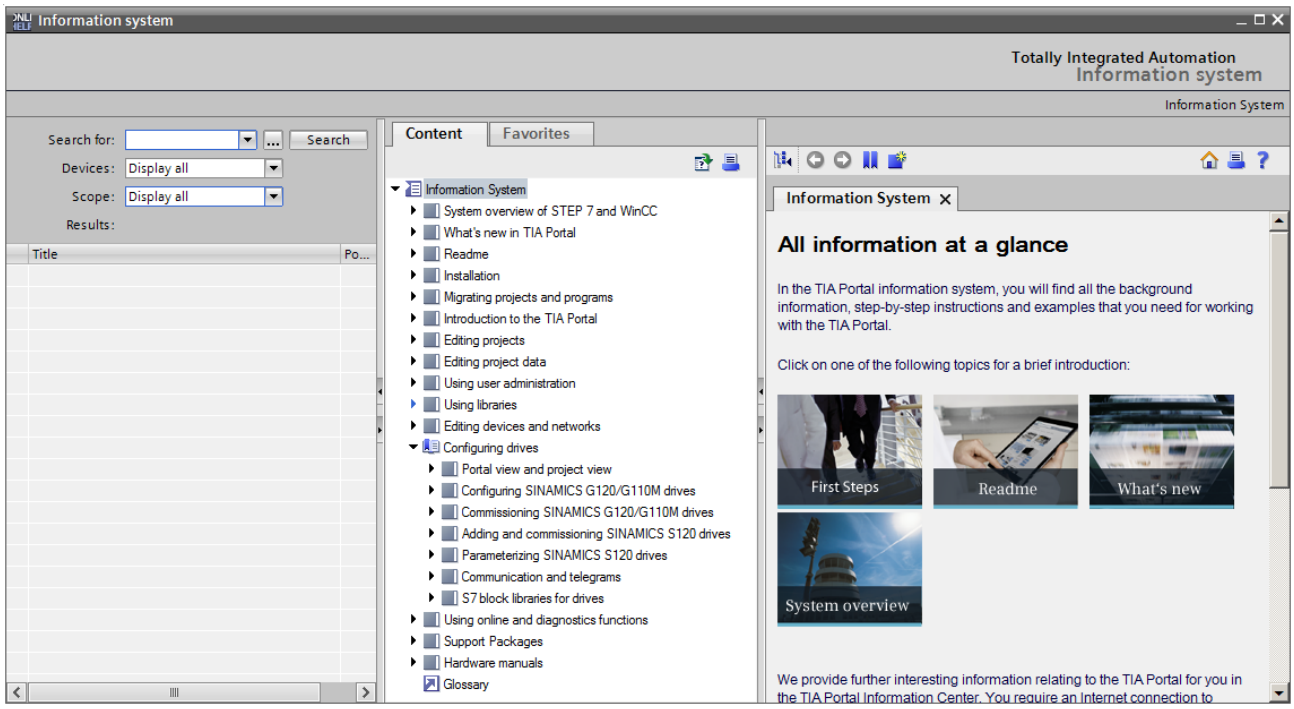
While working with the program, you receive the following support:

- Information system with all background information, step-by-step instructions and examples required to work with Startdrive.
- Tooltips for information on elements of the user interface, for example text boxes, buttons and icons. Some of the tooltips are supplemented by cascades containing more precise information.
- Help on the current context, for example on menu commands when you press the <F1> key.
- Help regarding messages or diagnostics.

The most important information regarding the Startdrive information system is provided below. Additional information can be obtained directly in the Startdrive online help by entering the search term "Help on information system".

Information system

The information system opens in a separate window. The following figure shows the information system for Startdrive in the TIA Portal:



The information system is divided into the following areas:

- Search area
  In the search area, you can perform a full text search across all help topics.
- Navigation area
  You can find the table of contents and favorites in the navigation area.
- Content area
  The help pages appear in the content area. You can open multiple tabs to view various help pages at the same time.

The arrows on the window dividers allow you to display and hide the individual sections. You can open both the search area and the navigation area to increase the contents area as needed.

Icons in the navigation area

The following icons are available in the navigation area of the information system:

Symbol	Function
	Search for updates Starts the search for hardware manuals, which are available as an update.
	Print Prints out pages or sections of the information system.

Icons in the contents area

The following icons are available in the contents area of the information system:

Symbol	Function
	Synchronize Displays the position of the open help topic in the table of contents.
	Forward / backward Navigates through the history of the help topics previously opened in this tab.
	Favorites Adds the current help topic to the favorites.
	New tab Opens a new, empty tab.
	Home page Displays the start page of the information system.
	Printing Prints the current help topic.
	Help Displays help on the information system.

Identification of the topics according to the information type

The information system provides you with a wide range of information. The help topics are identified by different symbols depending on the type of information they contain. Symbols tell you at a glance what kind of information you have just opened.

Symbol	Information type	Explanation
	Operating instructions	Describes the steps to follow in order to carry out a particular task.
	Example	Contains a practical application example that explains how to solve an automation task.
	Factual information	Includes background information regarding functions of the Startdrive and provides basic knowledge.
	Reference	Provides detailed reference information about instructions and objects for reference.

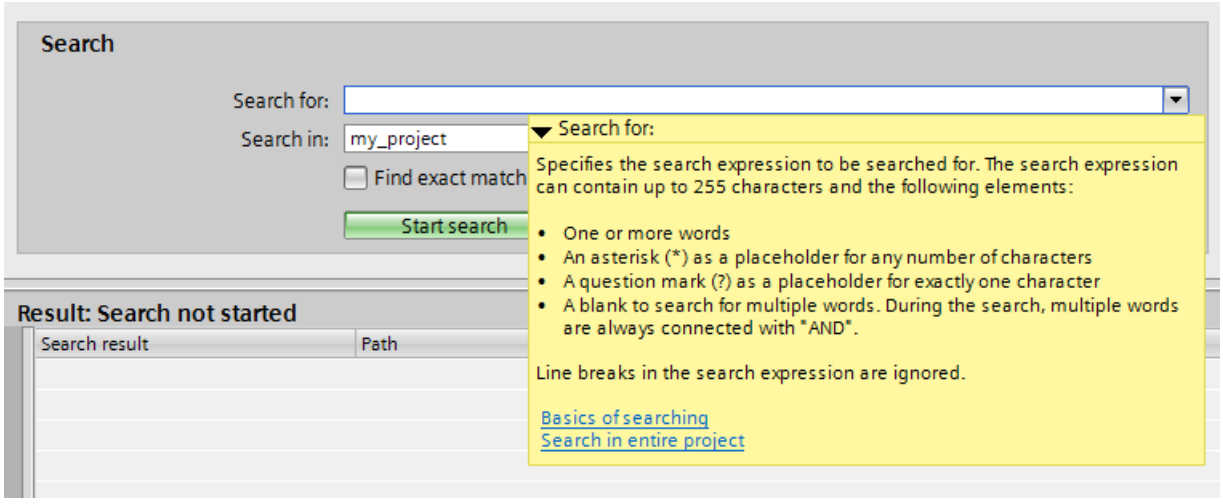
Tooltip

User interface elements offer brief information in the form of a tooltip.

Tooltips, which have an arrow icon on the left, contain additional information in tooltip cascades. If you position the mouse pointer briefly over the tooltip or click the arrow icon, this information is displayed. The automatic display of tooltip cascades can be disabled.

If additional information is available, a link to the corresponding help topic appears in the cascade. If you click on the link, the corresponding topic opens in the information system.

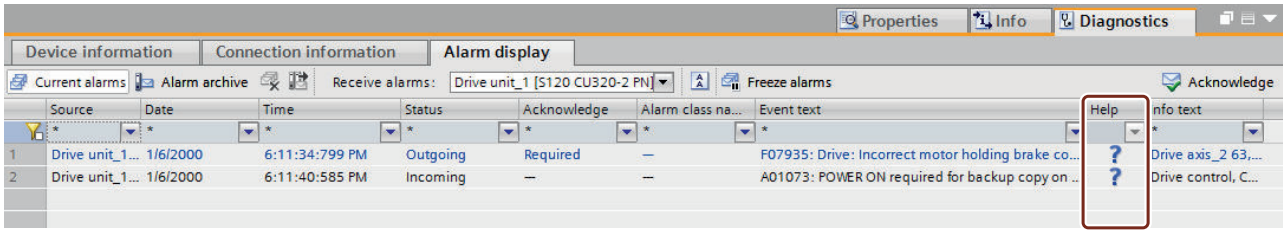
The following figure shows a tooltip with opened cascade:



Help for messages and diagnostics

Numerous actions in the Startdrive are supported with messages in the inspector window. The messages give information about whether or not an action was successful. In addition, you see which changes have been made in the project. Further help is available for some messages. If further help is available for an message, you access the help by clicking the question mark symbol.

The following figure shows the "Info" tab in the Inspector window with several messages and a question mark symbol:



In the same manner, additional support for listed messages can be called in the "Diagnostics" tab.

4.4.2 Opening the information system

Opening the information system with the menu

To access the information system on the home page, follow these steps:

1. Select "Display help" command from the "Help" menu.
   The start page of the information system opens.

Opening the information system with <F1>

To access the information system and help for the current context, proceed as follows:

1. Select an object for which you want to view the help, for example, a menu command or a program element.
2. Press <F1>.
   The information system opens. If information on the current context is available, the appropriate topic appears. If no information on the current context is available, the home page of the information system is displayed.

Opening the information system via tooltip cascades

To open the information system from a tooltip cascade, proceed as follows:

1. Move the mouse pointer over an object with a tooltip cascade.
   The tooltip cascade opens. If additional information is available, the tooltip cascade contains links to the corresponding help topics.
2. Click on a link.
   The information system opens and the additional help topic appears.

Opening help for error messages

Numerous actions in the Startdrive are supported with messages in the inspector window. If help on such a message is available, a blue question mark appears behind the message.

To view the help for a message, follow these steps:

1. Display the Inspector window.
2. Click on the blue question mark behind a message.
   The information system opens and the help error message appears. It contains an exact description of cause of the error and how to remedy it.

Fundamentals

5

5.1 Requirements for commissioning

Overview

The following requirements must be fulfilled for commissioning a SINAMICS S drive system:

- A programming device (PG/PC)
- TIA Portal with integrated engineering tool Startdrive
- A communications interface, e.g. PROFINET, Ethernet
- Completely wired-up drive line-up (see SINAMICS S120 manuals)

Configuration example

A configuration example with booksize components and PROFINET communication is shown in the following figure:

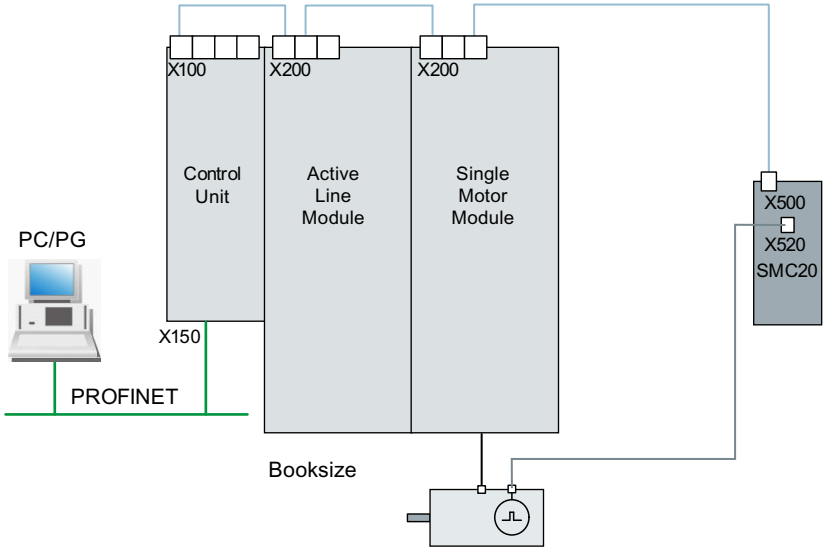


Figure 5-1 Example: layout of components

5.2 Safety instructions for commissioning

⚠ WARNING

Non-observance of the fundamental safety instructions and residual risks

The non-observance of the fundamental safety instructions and residual risks stated in Section 1 can result in accidents with severe injuries or death.

- Adhere to the fundamental safety instructions.
- When assessing the risk, take into account residual risks.

⚠ WARNING

Unexpected movement of the motor during motor data identification

Motor data identification causes movements of the drive, which can result in death, serious injury, or damage to property.

- Ensure that nobody is in the danger zone and that the mechanical parts can move freely.
- Respond to possible malfunctions by applying suitable measures (e.g. EMERGENCY STOP or EMERGENCY OFF).

⚠ WARNING

Non-observance of safety instructions and residual risks

If the safety instructions and residual risks are not observed in the associated hardware documentation, accidents involving severe injuries or death can occur.

- Observe the safety instructions provided in the hardware documentation.
- When assessing the risk, take into account residual risks.

Note

Please observe the installation guidelines and safety instructions in the SINAMICS S120 Manuals.

5.3 BICO interconnections

5.3.1 Binectors and connectors

Overview

Each drive contains a large number of connectable input and output variables and internal control variables.

The BICO technology (Binector Connector Technology) allows the drive to be adapted to a wide variety of conditions.

BICO parameters are identified accordingly in the parameter list or in the function diagrams.

The parameterization of the BICO parameters in Startdrive is possible in the following display areas:

- Parameter view
- Function view of a screen form

Definition: Binectors (BI, BO)

A binector is a unitless digital (binary) signal that can assume a value of 0 or 1. Binectors are divided into binector inputs (BI / signal sink) and binector outputs (BO / signal source).

Abbreviation	Symbol	Name	Description
BI		Binector Input (signal sink)	Can be connected with a binector output as source.
BO		Binector Output (signal source)	Can be used as a source for a binector input.

Definition: Connectors (CI, CO)

A connector is a digital signal, e.g. in the 32-bit format. It can be used to emulate words (16 bits), double words (32 bits), or analog signals. Connectors are subdivided into connector inputs (signal sink) and connector outputs (signal source).

Abbreviation	Symbol	Name	Description
CI		Connector Input (signal sink)	Can be connected with a connector output as source.
CO		Connector Output (signal source)	Can be used as a source for a connector input.

Invalid BICO wiring arrangements

If you click the icon  , the message "Invalid BICO wiring" is displayed, which informs you that there is invalid BICO wiring in the drive screen forms. You can call this symbol from the symbol bar of the function view and the parameter view.

Further information

Further information on BICO technology and BICO connections can be found in Section "Basics of the drive system" in the SINAMICS S120 Drive Functions Function Manual.

5.3.2 Interconnect BICO inputs

Overview

You perform the interconnection of binector or connector inputs in the interconnection dialog.

Procedure

To interconnect a BICO input, proceed as follows:

1. Click the binector or connector symbol of the signal that you want to connect.
   A connection dialog for the selection of the possible parameters opens. The drive object for which you want to make an interconnection is displayed automatically in the "Drive object" drop-down list on the right.

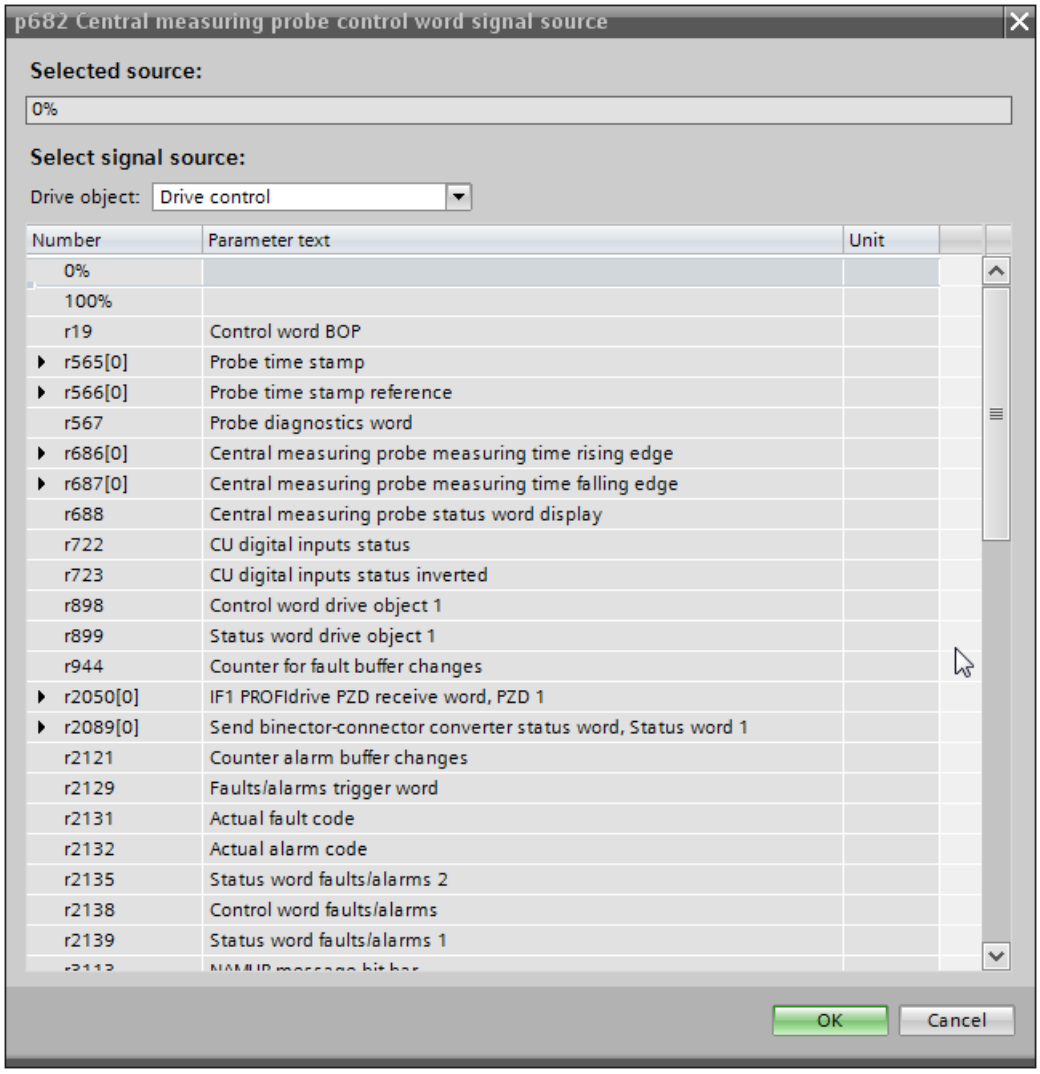
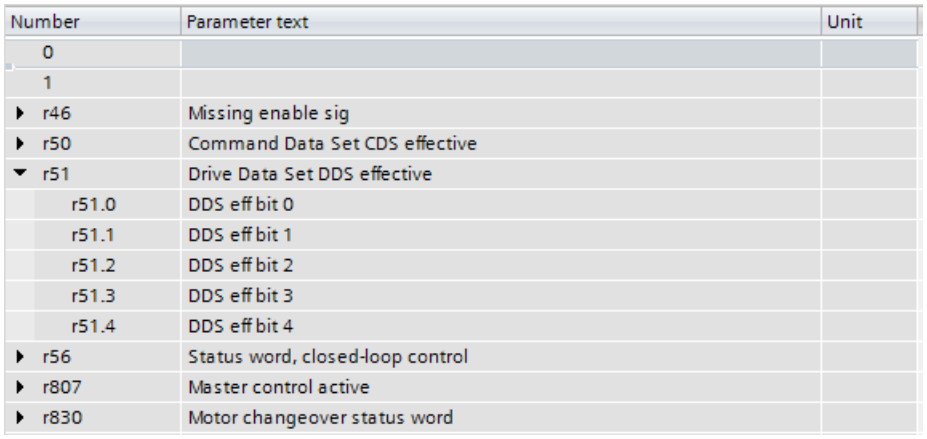


Figure 5-2 BICO interconnection dialog

   The last set signal source is displayed in the "Selected source" field. If a connection was not available previously, the value 0 is displayed.

2. Select the parameter that you want to connect.
   If connectable bits of the parameter are available, they are displayed in a drop-down list.



Number	Parameter text	Unit
0		
1		
▸ r46	Missing enable sig	
▸ r50	Command Data Set CDS effective	
▾ r51	Drive Data Set DDS effective	
r51.0	DDS eff bit 0	
r51.1	DDS eff bit 1	
r51.2	DDS eff bit 2	
r51.3	DDS eff bit 3	
r51.4	DDS eff bit 4	
▸ r56	Status word, closed-loop control	
▸ r807	Master control active	
▸ r830	Motor changeover status word	

Figure 5-3 BICO dialog: Parameter bits opened

3. Select the parameter bit that you want to connect.
4. Confirm with OK.
   The connection dialog closes.

Result

The binector or connector input is connected to the selected parameter (bit).

5.3.3 Interconnecting BICO outputs

Overview

You perform the interconnection of binector or connector outputs in the interconnection dialog.

Procedure

To interconnect a BICO output, proceed as follows:

1. Click the binector or connector symbol of the signal that you want to connect.
   A connection dialog for the selection of the possible parameters opens. The drive object for which you want to make an interconnection is displayed automatically in the "Drive object" drop-down list on the right.

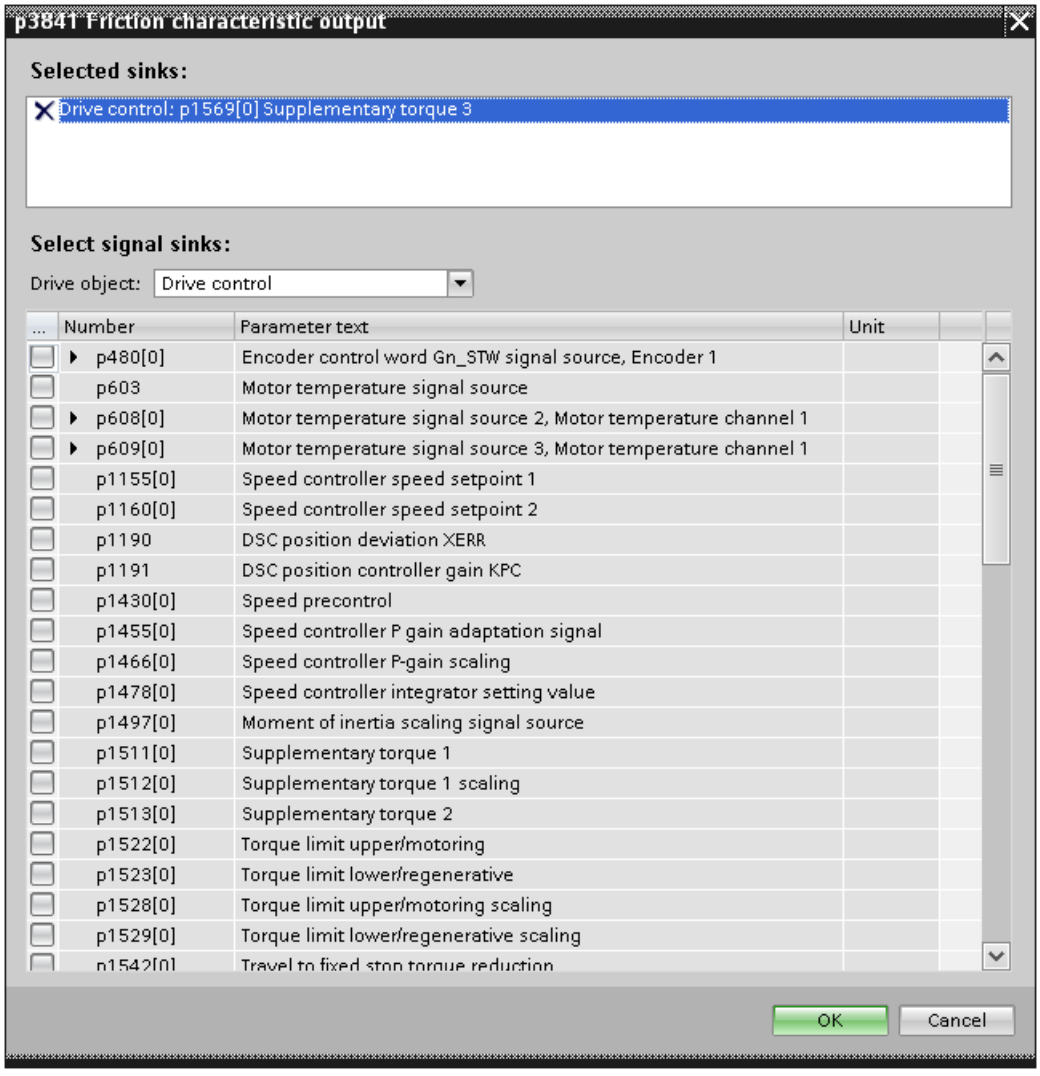


Figure 5-4 BICO dialog output

   The last set signal sink is displayed in the "Selected sinks" field. If a connection was not available previously, the text "No sink selected" is displayed.

2. Activate the check boxes for the parameters that you want to connect.
   If connectable bits of the parameter are available, they are displayed in a drop-down list.

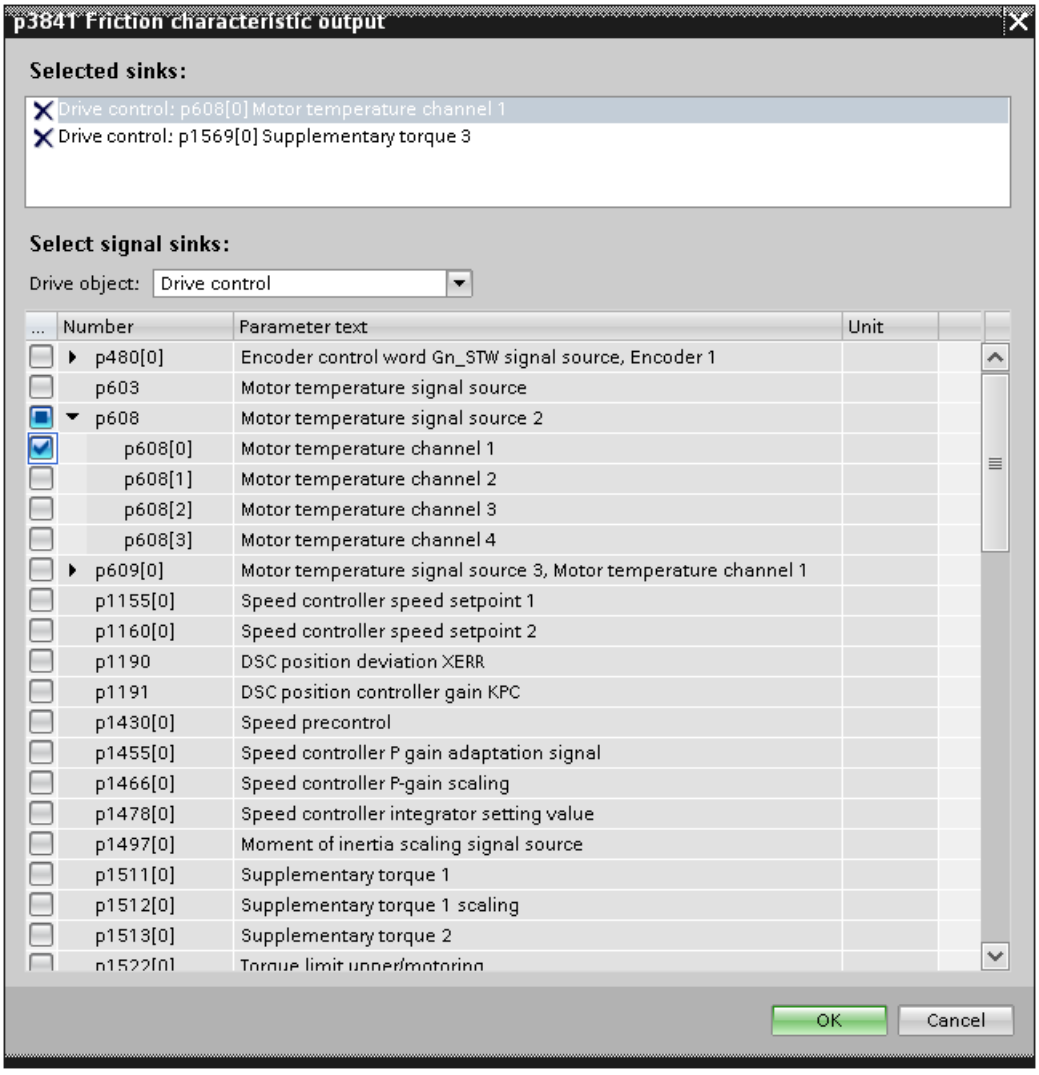


Figure 5-5 BICO dialog output: Parameter bits opened

3. Activate the check boxes for the parameter bits that you want to connect.
4. Confirm with OK.
   The connection dialog closes.

Result

The binector or connector output is connected to the selected parameter (bit).

Multiple connections at outputs

Several interconnections can be set simultaneously for a parameter, which for reasons of space however, cannot be displayed in the interconnections field. Clicking the icon next to the interconnection field opens a list, which shows all of the active parameter interconnections.

5.4 Comparing parameter settings

Overview

The actual parameters of a drive object can be compared with another parameter set using the comparison function in the parameter view.

Offline mode

The current parameters of the drive object are compared to the factory settings in offline mode by default.

Online mode

The current parameters of the drive object are compared with the offline settings in online mode.

Procedure

Proceed as follows when comparing the parameters of a drive object with another parameter set.

1. Open the parameter view for the device whose parameters you want to compare.
2. Click on the black arrow symbol of the button.
   A selection list containing the comparison options opens:
   - Deactivate comparison
   - Offline - Factory setting (default setting in offline mode)
   - Online - Offline (default setting in online mode)
   - Online - Factory setting
3. Select a comparison option.
   The selected comparison option is executed as follows:
   - The "Comparison" column is displayed.
   - The comparison result of the selected comparison option is displayed by icons in the "Comparison" column.

Number	Parameter text	Value	Unit	Compari...	Factory settings
r2	Drive operating display	[12] Operation - RFG frozen, ...			[12] Operation - RFG frozen,
p5[0]	BOP operating display selection, Parameter number	2			
p6	BOP operating display mode	[4] p0005			[4] p
p10	Drive commissioning parameter filter	[0] Ready			[1] Quick commissic
p13[0]	BOP user-defined list	0			
p15	Macro drive object	[0] Kein Makro			[0] Kein M
r20	Speed setpoint smoothed	0.0	rpm		

Figure 5-6 Example: "Comparison" column displayed

Optional:

If you click on the weighing scales icon of the button, then depending on the active parameterizing mode, the selected parameter is compared:

- Offline mode: By default, the parameters are compared with the factory settings.
- Online mode: By default, the parameters are compared with the offline settings.

Explanation of symbols

The following table gives you an overview of the symbols that are displayed in the "Comparison" column.

Icon	Meaning
	The comparison values are equal and error-free.
	Offline - Factory setting: The comparison values are different and error-free.
	Online - Offline: The comparison values are different and error-free.
	Online - Factory setting: The comparison values are different and error-free.
	The value of at least one subordinate parameter index is different from the factory setting.
	The value of at least one subordinate parameter index is different from the offline value.
	At least one of the two comparison values has a technological or syntax error.
	The comparison is not possible. At least one of the two comparison values is not available (e.g. snapshot).

5.5 Saving settings in the project

Overview

In Startdrive, settings are predominantly made via screen forms. The complete project must be saved in order that the settings made are permanently active.

Procedure

Proceed as follows to permanently save the settings in the project:

1. Click this toolbar icon  .
   OR
   Select the "Project > Save" or "Project > Save as" menu.
   As a result, you have permanently saved the settings in your Startdrive project.

5.6 Restoring factory settings

Overview

In online operation, you can restore the factory settings for the drive control.

Procedure

To restore the factory settings for the drive control, proceed as follows:

1. Establish an online connection (Page 111) to your drive unit.
2. Click the  icon in the function view of the active Startdrive project.
   The factory settings are restored.

5.7 Loading project data from a drive unit

Overview

You can load the saved project data from your drive unit into your current project in Startdrive.

Requirements

- A project is open.
- The hardware configuration and software to be loaded must be compatible with the Startdrive. You can only establish an online connection between the PG/PC and drive device if the PG/PC and the drive device are using the same firmware version. You can find further information about checking the firmware version in the SINAMICS S120 Commissioning Manual with Startdrive.

Procedure

To load the project data from a drive unit into your Startdrive project, proceed as follows:

1. Call the shortcut menu "Load from device (software)" or click on the icon (Load from device) in the toolbar.
   The "Upload preview" dialog box opens. Startdrive checks whether all prerequisites for loading have been met. In the event of any obstructions, these are displayed as messages in the dialog.

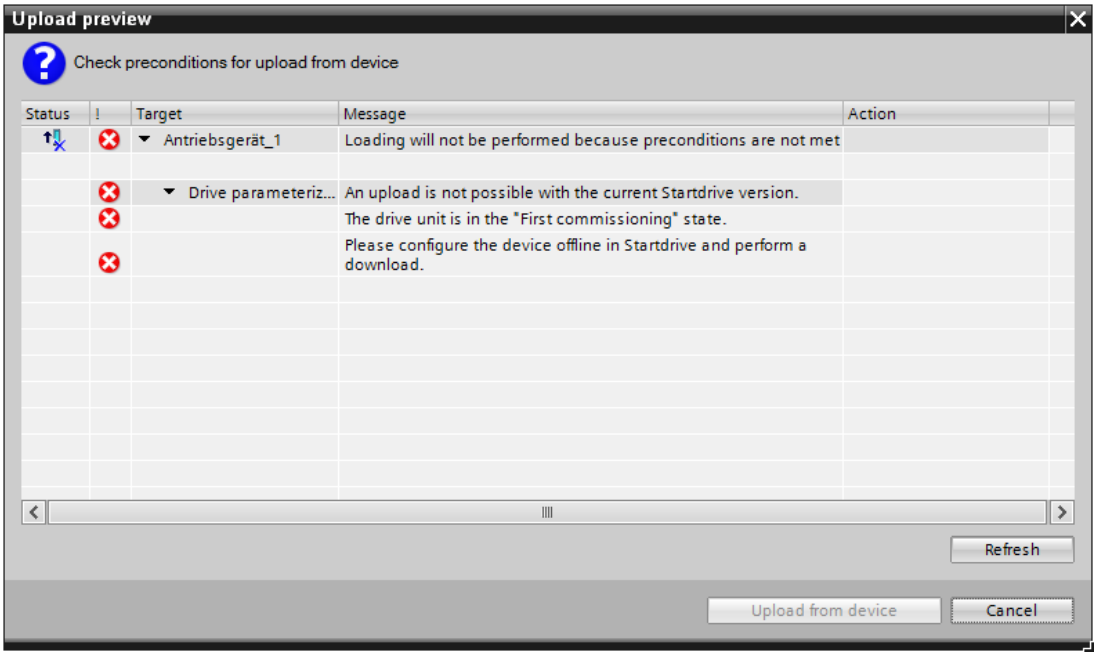


Figure 5-7 Example: Upload from device

2. Check the alarms in the "Upload preview" dialog, and select the necessary actions in the "Action" column.
   As soon as uploading becomes possible, the "Upload from device" button is enabled.
3. Click the "Upload from device" button.
   The loading operation is performed.

The project data has been loaded from the drive unit into your Startdrive project on the PC.

Commissioning

6

Overview

You perform the commissioning of your SINAMICS S120 drive in the TIA Portal with the integrated Startdrive engineering tool.

Requirement

- TIA Portal is installed on your PG/PC.
- You have all of the required licenses to be able to use the TIA Portal without limitations.

Commissioning workflow

You can commission a SINAMICS S120 drive in the following ways:

- **Creating a project offline in Startdrive.**
  The components of the drive are combined offline in Startdrive.
- **Loading the device configuration into the project.**
  The components of the drive are loaded into the project offline and supplemented as needed.
- **Creating a project by reading out a device configuration.**
  The components of the drive are read out online and supplemented offline as needed.

Creating a project OFFLINE in Startdrive

The following steps are required when commissioning a drive:

1. Create a project with Startdrive (Page 74).
2. Perform the basic parameterization of the drive units (Page 125).
3. Establish an online connection to the drive. (Page 111)
4. Download the project to the target device (Page 171).
5. Commission the drive via the control panel. (Page 173)
6. Result: The motor turns.

Loading the configuration of the drive OFFLINE into the project

For commissioning a drive by uploading the drive configuration to the project, the following steps are required:

1. Create a project with Startdrive (Page 74).
2. Establish an online connection to the drive. (Page 111)

3. Load the configuration of the drive into the project (Page 116).
4. Edit the determined device configuration in Startdrive. (Page 117)
5. Perform the basic parameterization of the drive units. (Page 125)
6. Download the project to the target device (Page 171).
7. Commission the drive via the control panel. (Page 173)
8. Result: The motor turns.

Creating a project by reading out a device configuration

The following steps are necessary for commissioning a drive by reading out a device configuration:

1. Create a project with Startdrive (Page 74).
2. Optional: Establish an online connection to the drive. (Page 111)
3. Determining the drive configuration (Page 119).
4. Edit the determined device configuration in Startdrive. (Page 123)
5. Perform the basic parameterization of the drive units. (Page 125)
6. Download the project to the target device (Page 171).
7. Commission the drive via the control panel. (Page 173)
8. Result: The motor turns.

6.1 Calling the TIA portal

To start the TIA Portal, click on the TIA Portal icon of your user interface or call it up via the Start menu of your PG/PC.

6.2 Check lists to commission SINAMICS S

You will find the checklists that must be observed before the commissioning of SINAMICS S120 drives in the following.

Checklist for commissioning booksize power units

Carefully observe the content of the following checklist, and read the safety instructions in the manuals before starting any work.

Check	OK
Are the environmental conditions in the permissible 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?	
Have the rules for the DRIVE-CLiQ topology 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 permitted 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 shield supports been correctly connected through a large surface area?	

Checklist for commissioning chassis power units

Carefully observe the content of the following checklist, and read the safety instructions in the manuals before starting any work.

Check	OK
Are the environmental conditions in the permissible 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?	
Are all necessary components of the configured drive line-up available, installed and connected?	

Check	OK
Do the temperature monitoring circuits fulfill the specifications of protective separation?	
Have the rules for the DRIVE-CLiQ topology 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 permitted 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)] must 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 Equipment 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 at the Infeed Module or the Power Module been removed?	
Is the period from the date of manufacture to the initial commissioning or the downtime of the power components less than two years[2)]?	
Is the drive operated from a higher-level controller/control room?	

1) We recommend using combined fuses 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 formed (see the "Maintenance and Servicing" chapter in the Equipment Manual). The rating plate can be used to ascertain the date of manufacture.

6.3 Creating a project offline in Startdrive

6.3.1 Creating a new project

6.3.1.1 Creating a new project (in the Portal view)

Precondition

You have opened the Startdrive in the TIA Portal (Page 71)application.

Creating a new project

You can create new projects once the Startdrive application has been opened in the TIA Portal.

1. Click on "Create new project" in the secondary navigation in the Portal view of Startdrive.
   The entry fields for the basic project data are displayed to the right in the detailed view.

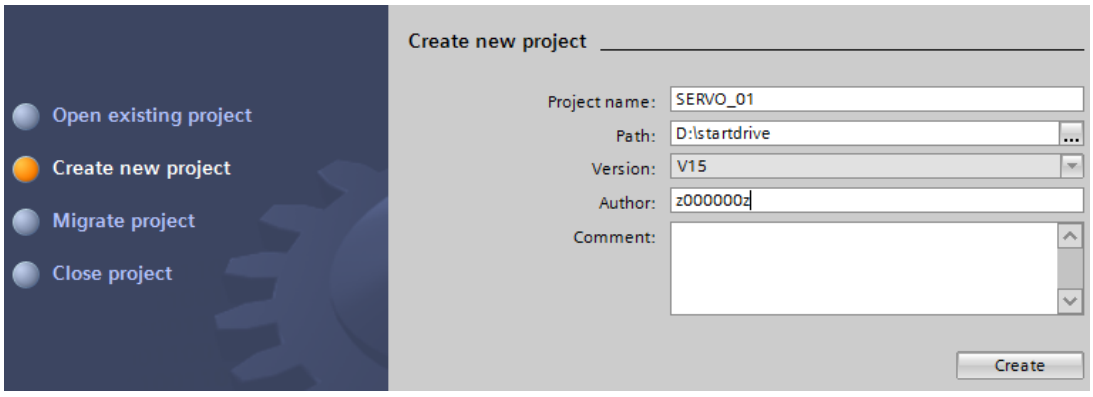


Figure 6-1 Entering project data

2. Enter the project data here:

Project name	Startdrive automatically counts each new project.
Path	The simpler the archive path for the project, the faster the project can be loaded.
Author	The login code for the person entering the data is preassigned.
Comment	You can save brief project information here.

3. Click on "Create" to save basic project data.
   The new project is created and simultaneously opened. Possible next steps are displayed in the detailed view.

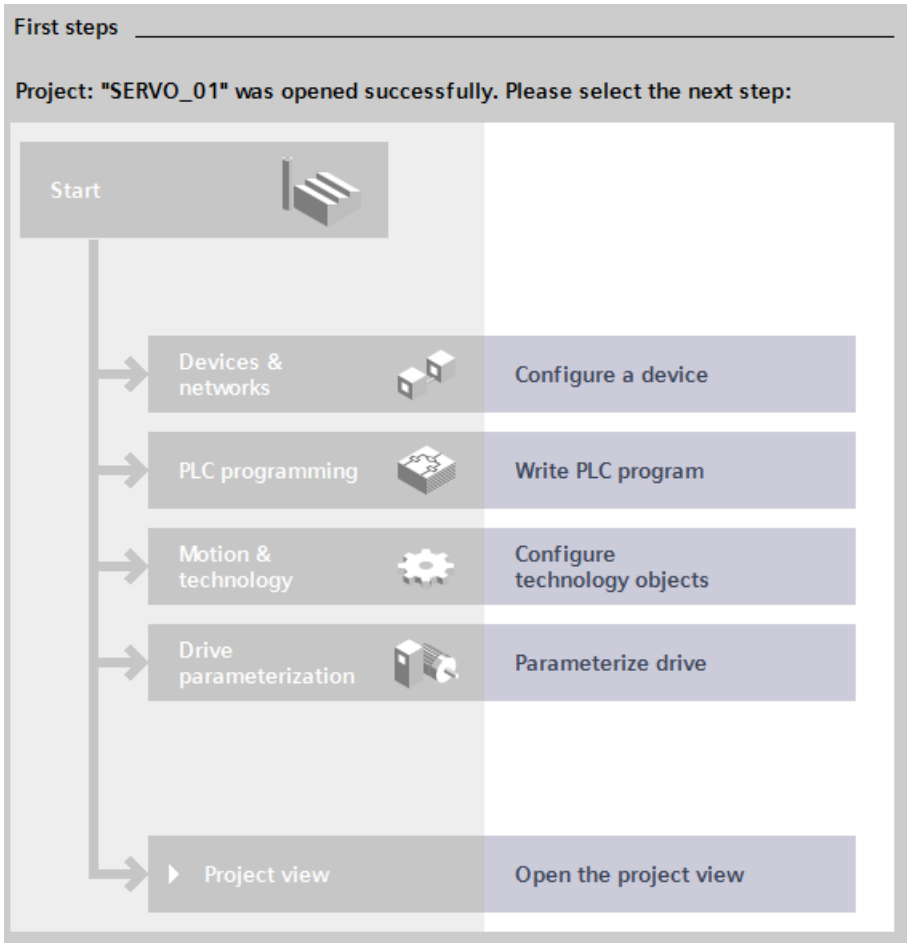


Figure 6-2 Getting Started

6.3.1.2 Creating a new project (in the Project view)

Precondition

You have opened the application Startdrive in the TIA Portal (Page 71) in the Project view.

Creating a new project

You can create new projects once the Startdrive application has been opened in the TIA Portal.

1. In the Startdrive Project view, select "Project > New".
   The "Create a new project" dialog box opens.

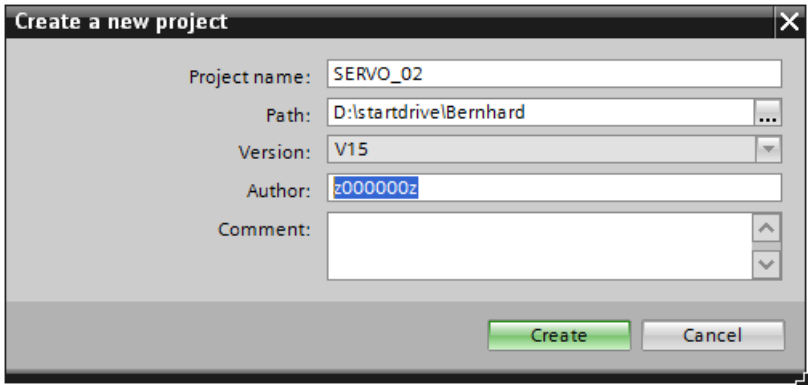


Figure 6-3 Creating a new project

2. Enter the project data here:

Project name	Startdrive automatically counts each new project.
Path	The simpler the archive path for the project, the faster the project can be loaded.
Author	The login code for the person entering the data is preassigned.
Comment	You can save brief project information here.

3. Click on "Create" to save basic project data.
   A new project is created in the Project tree and simultaneously opened.

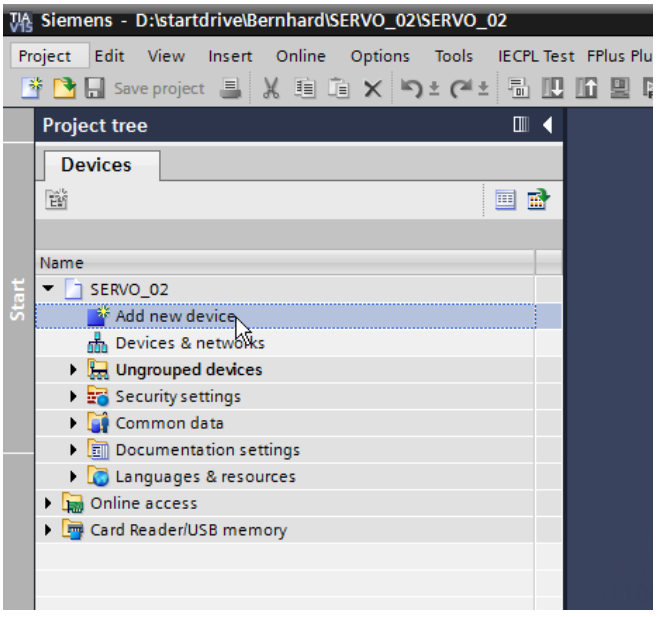


Figure 6-4 Project created (in the Project view)

You an now insert a new drive.

6.3.2 Inserting the drive unit offline

Overview

The following describes how to insert a SINAMICS S120 Control Unit into a new project via the project view.

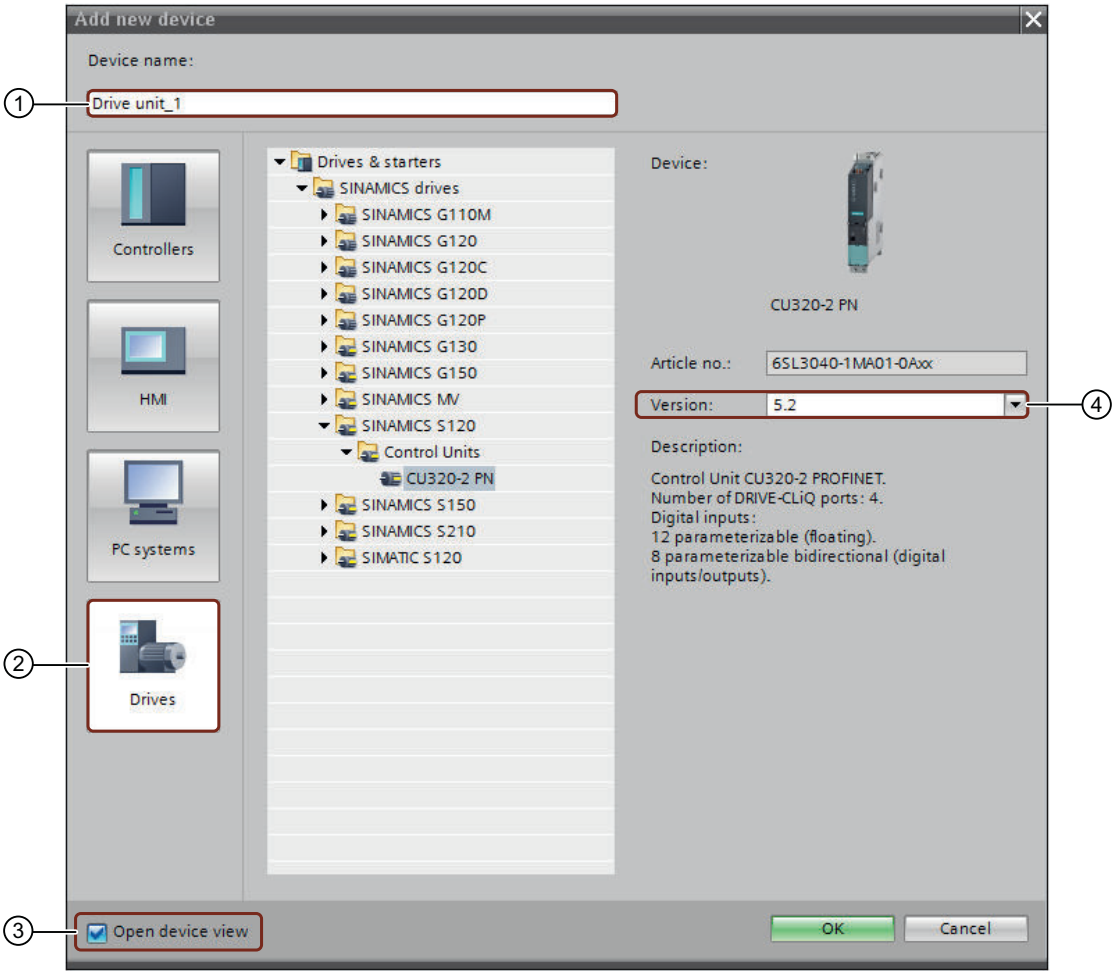
Requirement

- A project has been created (Page 76), or an existing project is open.

Procedure

To insert new drive units in the project view, proceed as follows:

1. Double-click "Add new device" in the project navigation.
   The appropriate dialog opens.



① "Device name" input field (default: Drive unit_x)
② "Drives" button
③ Activate/deactivate "Open device view" option
④ Firmware "Version" drop-down list

Figure 6-5 Dialog: Add new device

2. Click "Drives" to display the drives available.

3. Click on the desired SINAMCIS S120 drive unit in the "Control Units" list.

Note

Comparing and possibly changing version numbers

When creating a drive device, the current firmware version is always suggested. Under certain circumstances, the recommended firmware version does not match the version number on the memory card of your drive unit. If the version numbers do not match, it will not be possible to go online later. Therefore, please observe the following notes:

- Observe the version number in the "Version" drop-down list and ensure that the displayed version number matches the version number on the memory card of your drive unit.
- If necessary, change the version number via the "Version" drop-down list.

4. If required, assign a different device name in the input field.
5. Click "OK".
   OR
6. Double-click on the desired drive unit.
   If the "Open device view" option is activated, the drive unit is automatically created in Startdrive and displayed in the device view.

Result

The drive unit is inserted and can be configured further.

6.3.3 Inserting an infeed unit

6.3.3.1 Inserting and specifying an infeed unit

Preconditions

- A project has been created.
- The Control Unit is inserted in the device configuration.

Note

Sequence

Generally, the infeed is inserted in the configuration immediately after the drive in the device view. In this case, the infeed is also automatically wired to the drive (X100).

You can also insert an infeed at a later point in time (for example, after the Motor Module). The infeed is then no longer automatically wired because the standard interface X100 intended for the infeed is already occupied (e.g. with the Motor Module).

In this case, the device configuration must be changed manually. You can wire the infeed manually to a free interface. You can also change the wiring of the drive object that is currently linked to X100 of the drive, to a different interface. X100 would then be free again and when the infeed is inserted, it is automatically linked to X100.

Procedure

You can add an infeed via the hardware catalog.

1. Open the "Line Modules" entry in the hardware catalog.
   Active Line Modules, Basic Line Modules and Smart Line Modules can be selected.
2. Select the unspecified infeed in the hardware catalog.

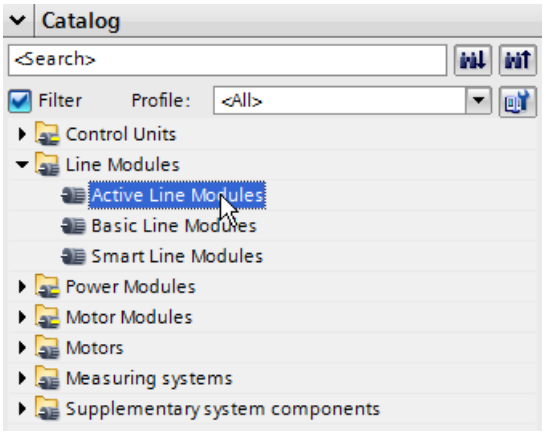


Figure 6-6 Selecting an infeed

3. Drag the unspecified infeed to the device view.

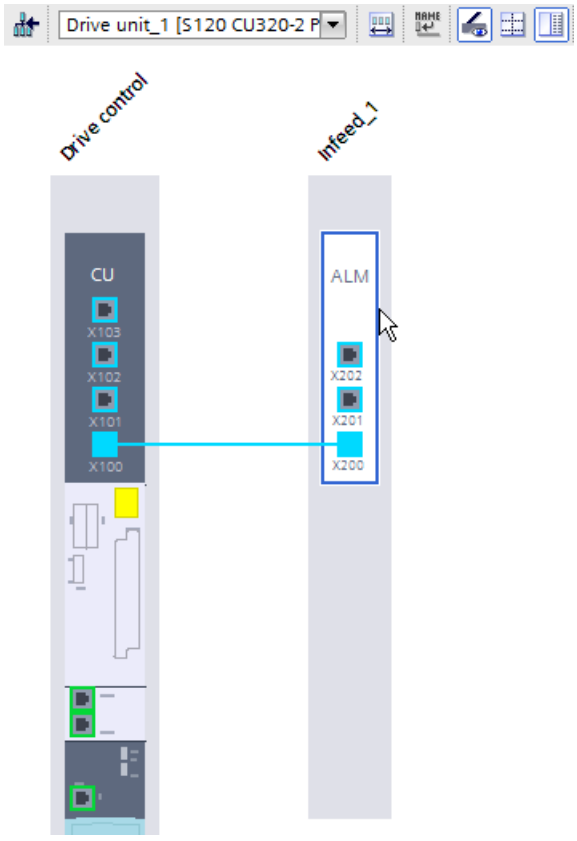


Figure 6-7 Infeed inserted

Generally, the DRIVE-CLiQ connection is automatically established. The unspecified infeed must now be specified in more detail.

4. In the device view, click the infeed. Make sure that you click in the white area of the infeed.

5. In the secondary navigation of the inspector window, select "Line Module - Selection – ALM"
6. Select your infeed in the list based on the article number.

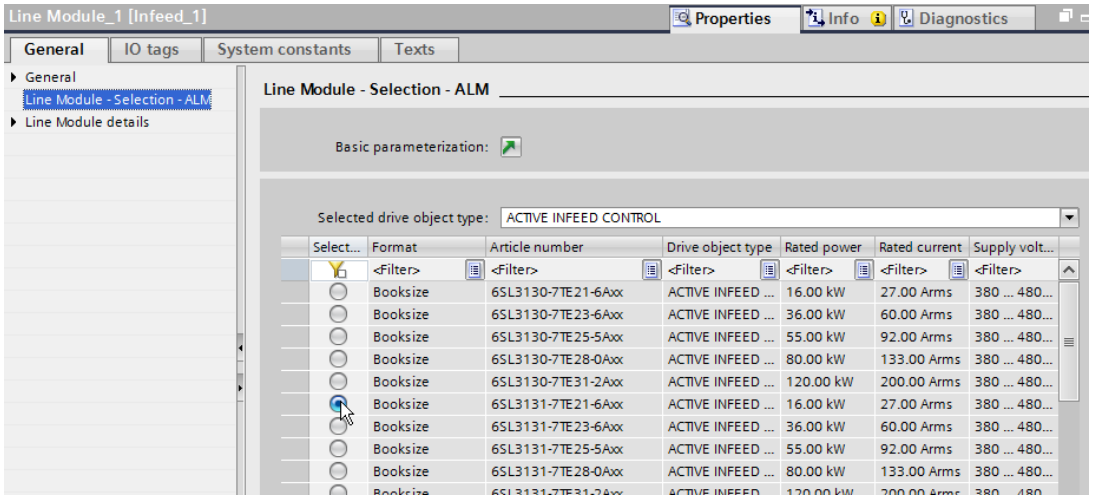


Figure 6-8 Line Module selection

The unspecified infeed is assigned the data of the selected infeed.
The white area turns dark gray.
The DRIVE-CLiQ-connection between the interfaces X100 and X200 is drawn as default setting.

Result

The infeed unit is inserted and specified.

Connecting infeed units in parallel

To connect infeed units (Line Modules) in parallel with already added modules, proceed as follows:

1. Open the "Line Modules" entry in the hardware catalog.
2. If you have not yet inserted any infeed unit, drag the desired, non-specified infeed unit into the device view and specify this infeed unit.
3. Drag a non-specified infeed unit into the device view in the light gray area of the existing infeed unit.

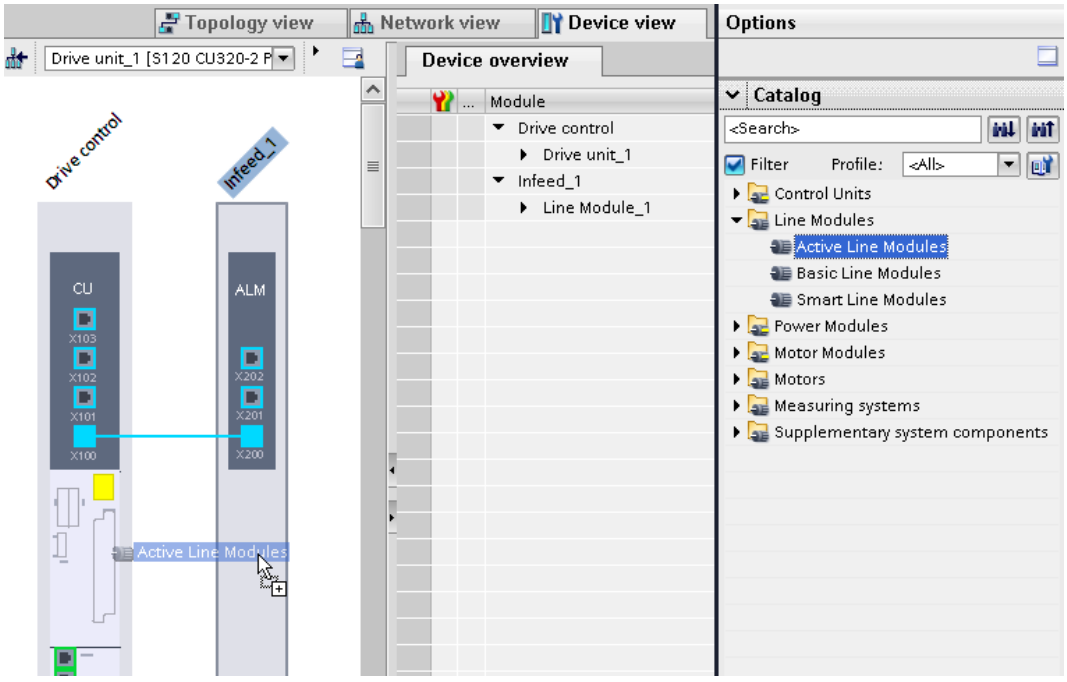


Figure 6-9 Connect the infeed in parallel

Then also specify the infeed unit connected in parallel.
You can connect further infeed units in parallel in the same manner.

Result

The infeed unit connected in parallel is inserted and specified. The white area turns gray. The infeed units are linked with one another via interfaces X201 and X200.

Note

If required, parallel connection can be activated or deactivated for individual infeed units via the inspector window (Line Module_xx/drop-down list "Component activation").

For deactivation, the respective infeed unit must be disconnected from the network (using a contactor, for example). Motor supply cables must be opened.

6.3.3.2 Making detailed settings

Overview

The following detailed settings can be made during commissioning:

- Drive unit line supply voltage for all types of infeed units
- Parameterization of a line filter when using an Active Line Module (ALM)

Important notes

Observe the following information before you make the detailed settings for the infeed unit that is used.

Note

Use of an Active Line Module

Following automatic commissioning, the appropriate filter for the matching Active Interface Module (AIM) is pre-selected as the line filter. If the drive line-up is set up differently, then the line filter type must be adjusted.

Note

Switching on a new/modified network

When first switched on with a new/modified network, an automatic controller setting must be implemented using the line and DC link identification routine (p3410). While the identification routine is running, it is not permissible for other loads to be switched in/switched out.

Procedure

To make detailed settings for an infeed unit, proceed as follows:

1. Select the infeed in the device view and open the Inspector window.
2. Select the "Line Module details > Line Module settings" menu in the Inspector window. In the screen form, the following setting options are displayed:

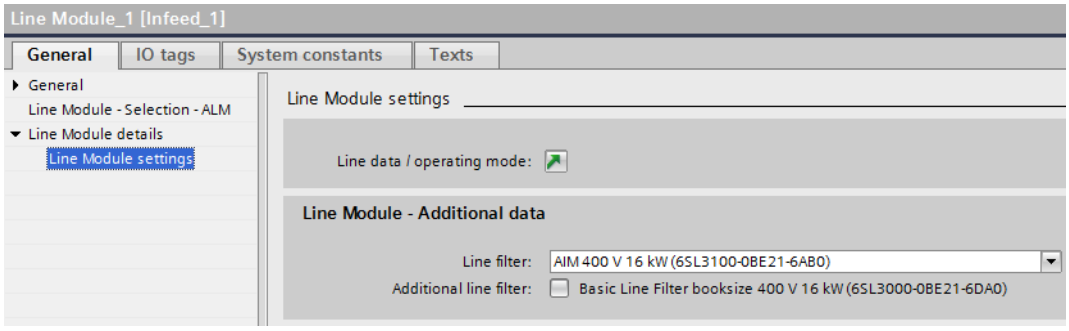


Figure 6-10 Example: Detailed settings for infeed for ALM

3. In order to parameterize the device supply voltage, click the icon next to the "Line data / operating mode" entry.
   The "Line data / Operating mode" screen form is opened:

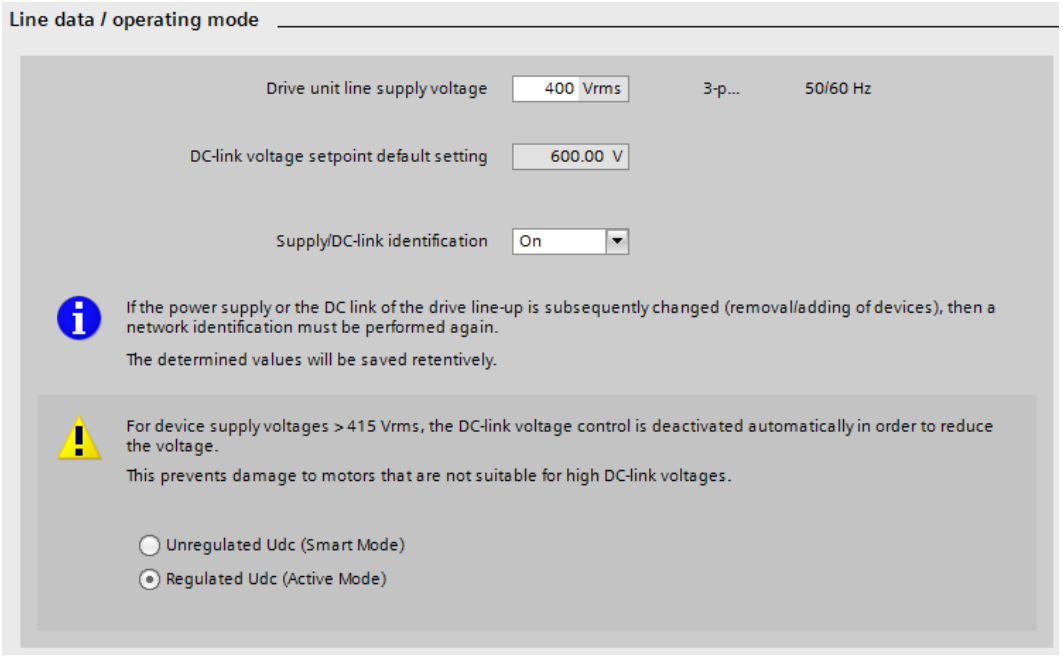


Figure 6-11 Example: line data / operating mode for ALM

   Set the desired device supply voltage here (see "Line data/operating mode (Page 135)").
   Make the other entries depending on the infeed unit type:
   However, if you are using an ALM, then proceed as follows:

   – If you use a Basic Line Module (BLM) or Smart Line Module (SLM), the detailed setting is completed.
   – If you use an Active Line Module (ALM), proceed further as follows.

4. if you are using a different line filter than the pre-selected line filter, select the desired line filter in the drop-down list with the same name (p0220[0]).
5. If you use an Active Interface Module with an integrated line filter for the booksize design, you can additionally activate a specified Basic Line Filter. Activate the "Basic Line Filter Booksize ..." (p0220[1]) option for this.

You have made the detailed settings for the infeed of your device configuration.

6.3.4 Inserting a Motor Module or Power Module

Overview

When creating a Motor Module or Power Module, the "High dynamic (servo)" drive object type becomes active by default. If you want to use the "Universal (Vector)" drive object type in your hardware device configuration, however, you can change the module type in Startdrive. Many of the following settings depend on the set drive object type. The setting of the correct type is therefore prerequisite for all other settings during the commissioning and further parameterization of the Motor Module or Power Module.

Note

Adapting the device configuration when the drive object type is changed

- Make sure that you first set the drive object type in the device configuration, and only then add and specify the motor, measuring systems or supplementary system components.
- If you change the drive object type subsequently, there is a danger that the configuration of some components is lost and has to be repeated.

Requirement

- A project has been created.
- A Control Unit has been inserted into the device configuration.
- An infeed is inserted.
  You can also add an infeed unit at a later point in time. In this case, you must manually wire the infeed unit with the other components (see "Inserting and specifying an infeed unit (Page 80)").

  Note

  As a rule, when Power Modules are used, you can dispense with an infeed unit.

Distinction between Motor Modules and Power Modules

Applications

The module types differ mainly in terms of their application areas.

- **Motor Module**
  - Single-axis and multiple-axis applications
- **Power Module**
  - Single-axis applications (usually without the use of an infeed unit)

Creating and configuring

The procedure for creating and configuring a device in the device configuration of Startdrive is almost the same for Motor Modules and Power Modules. The device configuration of the drive requires at least one of the cited modules.

6.3.4.1 Inserting and specifying a Motor Module

Overview

You can insert a Motor Module into the device configuration as a Single Motor Module or as a Double Motor Module.

Procedure

Proceed as follows to insert and specify a Motor Module in your device configuration:

1. Open "Motor Modules" in the hardware catalog.
2. Select the required, unspecified Motor Module in the device overview.

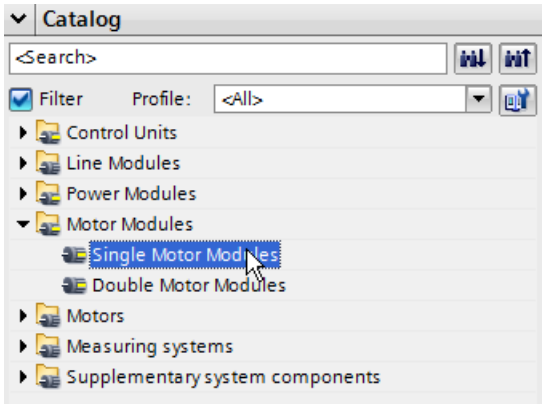
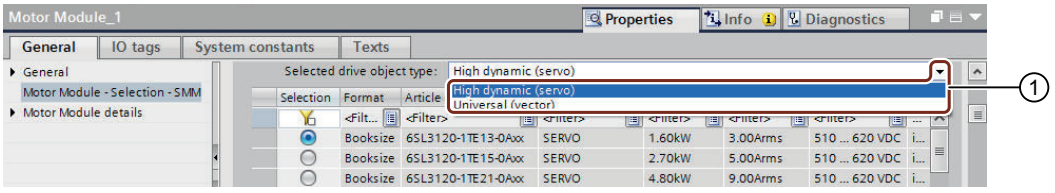


Figure 6-12 Example: Single Motor Module selected

3. Drag the unspecified Motor Module into the device view.
   The DRIVE-CLiQ connection is automatically created.
4. Click the Motor Module in the device view. Ensure that you click in the white area of the Motor Module.
5. Open the inspector window if it has not been opened yet.
6. In the Inspector window, select entry "Motor Module - Selection - xxx".



① Options in the "Selected drive object type" drop-down list

Figure 6-13 Example: specifying a Single Motor Module

All Motor Modules for the "High dynamic (servo)" drive object type (default setting) are displayed in the list. If you want to use a drive object of the type "Universal (vector)", you must switch over the list display.

7. If you are using drive objects, type "Universal (vector)", then select the "Universal (vector)" option in the "Selected drive object type" drop-down list.
   A confirmation prompt appears as to whether you really want to change the drive object type.

8. Click "Yes" to confirm the prompt.
   The list of Motor Modules is now refreshed. Only Motor Modules type "Universal (vector)" can now be selected. In the same way, the list can be switched back to modules, type "High dynamic (servo)".
9. Select your Motor Module from the list of available Motor Modules based on the article number.
   The data of the selected Motor Module are assigned to the unspecified Motor Module. The white area turns dark gray.

Result

The Motor Module is inserted and specified.

6.3.4.2 Inserting and specifying a Power Module

Overview

You can only insert a Power Module into the device configuration as an AC Power Module.

Procedure

Proceed as follows to insert and specify a Power Module in your device configuration:

1. Open the "Power Modules" item in the hardware catalog.
2. Select the required, unspecified Power Module in the device overview.

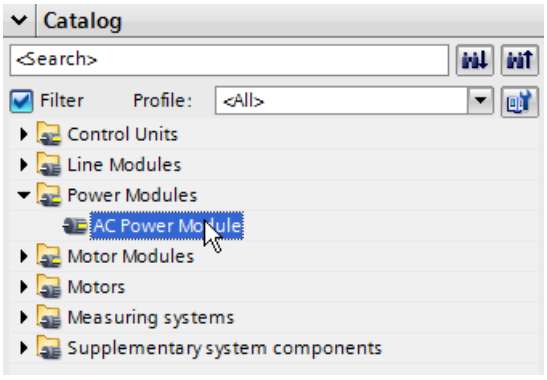
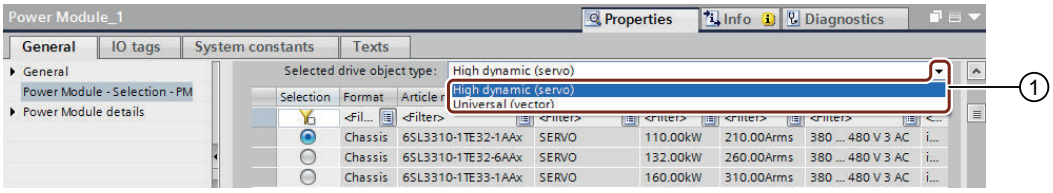


Figure 6-14 Power Module selected

3. Drag the unspecified Power Module into the device view.
   The DRIVE-CLiQ connection is automatically established.
4. In the device view, click the Power Module. Make sure that you click on the white area of the Power Module.
5. Open the inspector window if it has not been opened yet.

6. In the Inspector window, select entry "Power Module - Selection - xxx".



① Options in the "Selected drive object type" drop-down list

Figure 6-15 Example: Power Module specified

All Power Modules for the "High dynamic (servo)" drive object type (default setting) are displayed in the list. If you want to use a drive object of the type "Vector", you must switch over the list display.

7. If you are using drive objects, type "Universal (vector)", then select the "Universal (vector)" option in the "Selected drive object type" drop-down list.
A confirmation prompt appears as to whether you really want to change the drive object type.
8. Click "Yes" to confirm the prompt.
The list of Power Modules is now refreshed. Now, only Power Modules, type "Universal (vector)" can be selected. In the same way, the list can be switched back to modules, type "High dynamic (servo)".
9. Select your Power Module from the list of available Power Modules based on the article number.
The data of the selected Power Module are assigned to the unspecified Power Module. The white area turns dark gray.

Result

The Power Module has been inserted and specified.

6.3.4.3 Making detailed settings

Overview

The following detail settings can be carried out in the Inspector window for Motor Modules and Power Modules:

- **Settings**
  - Allows the modification of the preallocated supply voltage.
  - Indicates the standard for power settings of the converter and motor.
- **Supplementary data**
  - Allows filter settings for modules of the "Vector" type drive object.

The procedure described in the following shows the detailed settings using a Power Module as example and is the same for both types of modules.

Procedure

To make the detailed settings for a Power Module, proceed as follows:

1. Select the desired Power Module in the device view and open the Inspector window.
2. Select the menu "Power Module Details > Power Module Settings" in the Inspector window. The preallocated supply voltage is displayed in the screen forms:

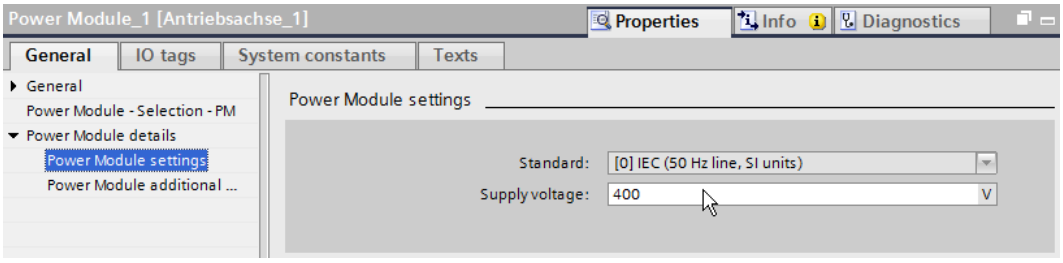


Figure 6-16 Example: Power Module Settings

3. Enter a new supply voltage as required.
4. If you use the "Vector" drive object type, you can set additional data.
   Select the menu "Power Module Details > Power Module Additional Data" in the Inspector window.
5. Select a desired filter in the "Output filter" drop-down list.

NOTICE
Damage to a sine-wave filter through incorrect parameter assignment If a sine-wave filter is installed in your hardware configuration, the sine-wave filter can be destroyed if it has not been set in the additional data of the Motor Module or Power Module. • Set the installed sine-wave filter in the "Output filter" drop-down list and add the required filter parameter data.

Additional display or entry fields are now unhidden depending on the respective filter selected.

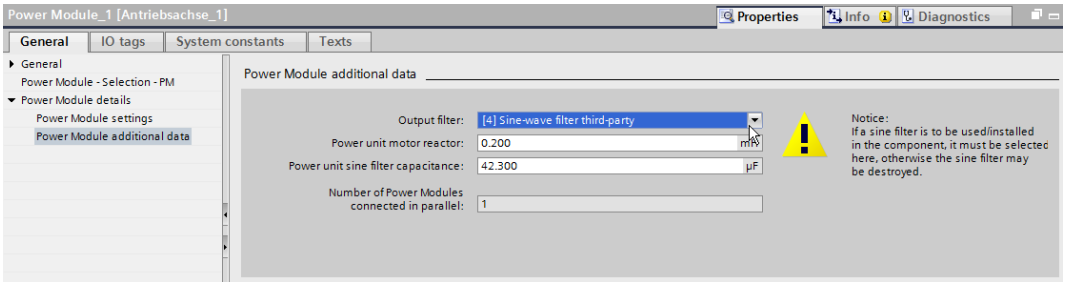


Figure 6-17 Example: Power Module additional data

6. Now parameterize the associated detailed settings for the selected filter.

Result

You have performed the detail settings for a selected Power Module or Motor Module.

6.3.4.4 Connecting Motor Modules or Power Modules in parallel

Overview

Several Power Modules or Motor Modules can be interconnected in parallel in vector control in Startdrive. During commissioning, power units connected in parallel are treated like a power unit on the line or motor side. The parameter view of the actual values changes only slightly when there is a parallel connection; suitable sum values are formed from the individual values of the power units.

The procedure described in the following shows the parallel connection using a Motor Module as example and is the same for both types of modules.

Procedure

To connect several Motor Modules in parallel, proceed as follows:

1. Open "Motor Modules" in the hardware catalog.
2. If you have not yet inserted a Motor Module in the device configuration, drag the required, non-specified Motor Module into the device view and specify it (see "Inserting and specifying a Motor Module (Page 88)").
3. Drag an unspecified Motor Module into the device view, into the light gray area of the existing Motor Module.

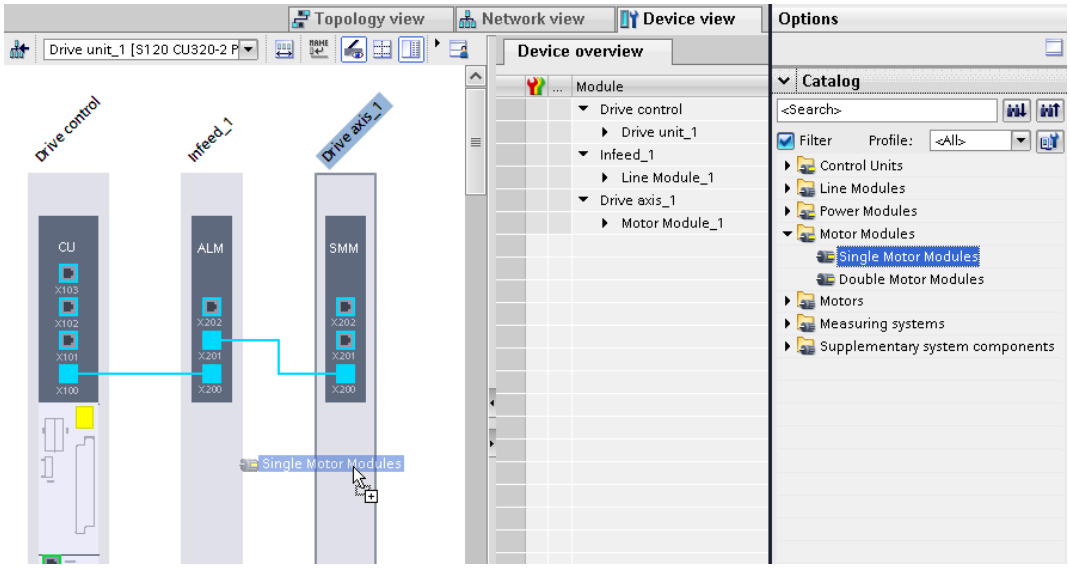


Figure 6-18 Example: Connecting Motor Modules in parallel

Then also specify the Motor Module connected in parallel (see "Inserting and specifying a Motor Module (Page 88)").
Additional Motor Modules can be connected in parallel in the same manner.

Result

The Motor Module connected in parallel is inserted and specified. The white area turns gray. The Motor Modules are linked with one another via interfaces X401 and X400.

Note

Activating / deactivating individual Motor Modules

If required, you can activate or deactivate a parallel connection for individual Motor Modules via the Inspector window (Motor Module_xxx / drop-down list "Component activation"). For deactivation, the respective Motor Module must be disconnected from the network (using a contactor, for example). Motor supply lines must be opened.

6.3.4.5 Changing the drive object type

Overview

The drive object type can be changed in the Motor Modules drop-down list or in the Power Modules drop-down list and in the project information of the drive axis.

Requirement

- A Motor Module or a Power Module is created and, if required, specified in Startdrive in the device configuration.

Changing the drive object type in the drop-down list of the Motor Modules or Power Modules

To change a drive object type in the drop-down list of the Motor Modules or Power Modules, proceed as follows:

1. If the device configuration is not active in your Startdrive project, call it via the project tree.
2. Select the desired drive axis in the device configuration.
3. Open the Inspector window if it has still not been opened or displayed.

4. In the Inspector window, select entry "Motor Module - Selection - xxx" or "Power Module - Selection - xxx".
   A list of relevant modules opens:

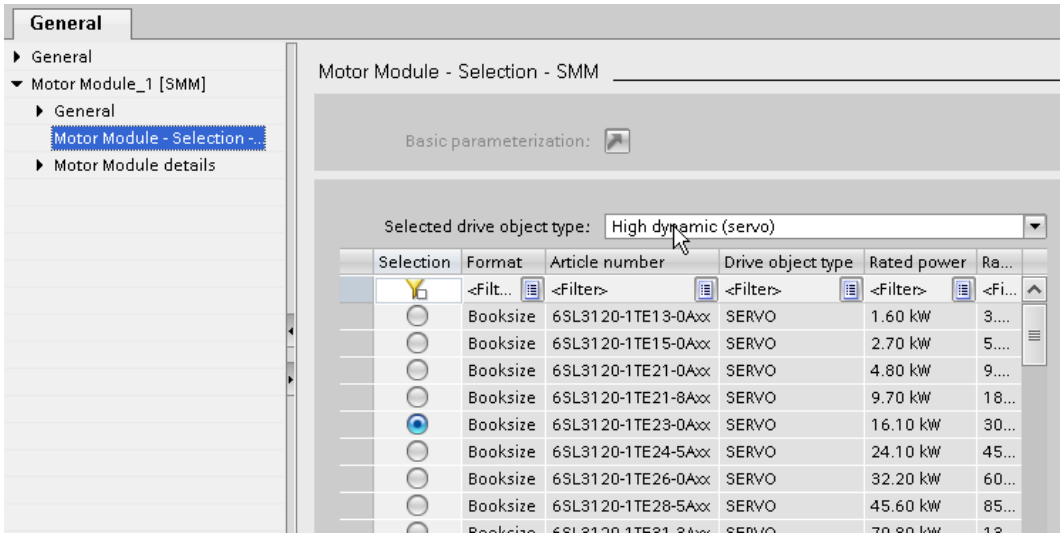


Figure 6-19 Changing the drive object type in the module list

5. Select the required type (High dynamic "SERVO" or Universal "VECTOR") in the "Selected drive object type" drop-down list.
   A confirmation prompt appears as to whether you really want to change the drive object type.
6. Click "Yes" to confirm the prompt.
   The Motor/Power Module drop-down list is now refreshed. Only Motor/Power Modules of the selected type are now available for selection.
7. Save the changes in the project (see "Saving settings in the project (Page 65)").

Changing the drive object type in the project information

To change a drive object type in the project information of the drive axis, proceed as follows:

1. If the device configuration is not active in your Startdrive project, call it via the project tree.
2. Select the desired drive axis in the device configuration.
3. Open the inspector window if it has not been opened yet.

4. In the Inspector window, select the "General" menu.

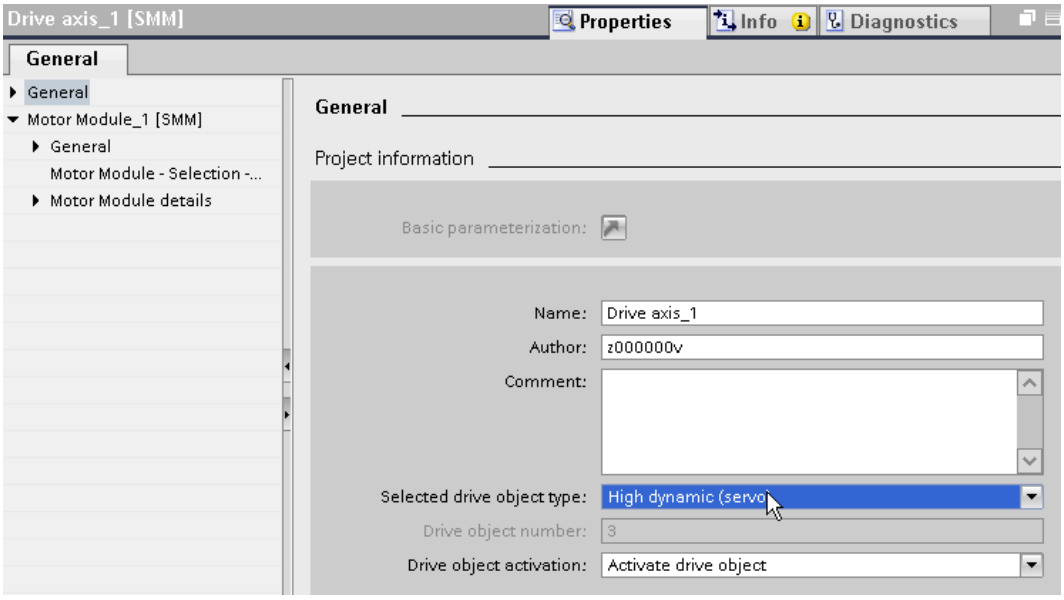


Figure 6-20 Example: Changing the drive object type

5. Select the required type in the "Selected drive object type" drop-down list.
   A confirmation prompt appears as to whether you really want to change the drive object type.
6. Click "Yes" to confirm the prompt.
   The desired drive object type is set.
7. Save the changes in the project (see "Saving settings in the project (Page 65)").

6.3.5 Inserting a motor

6.3.5.1 Overview

Startdrive manages the motor data of numerous motors in a motor list. Motors can therefore be quickly specified via the Inspector window. Motors that are not included in the motor list are specified by manually entering the motor data (e.g. rating plate values) in the Inspector window (see "Inserting and specifying motors that are missing from the motor list (Page 97)").

Preconditions

- A project has been created.
- The Control Unit is inserted in the device configuration.
- A Motor Module or a Power Module is inserted.

- An infeed is inserted.

  Note

  If you add the infeed unit at a later point in time, then you must manually wire the "infeed unit" component with the other components.

- An encoder is inserted (optional).

6.3.5.2 Inserting and specifying motors from the motor list

Procedure

Proceed as follows to insert and specify motors in your device configuration:

1. Open "Motors" in the hardware catalog.
   The following motor types are available for selection:
   - DRIVE-CLiQ motors

     Note

     For DRIVE-CLiQ motors, when loading the project data (see "Load the project to the drive unit (Page 171)") to the drive unit, the motor and encoder data are automatically read from the hardware being used. It is not possible (or necessary) to specify the motor data at this point. However, for consistency reasons, after loading to a drive device and reading from the hardware, ensure that the project data is again transferred to the Startdrive project (see "Loading project data from a drive unit (Page 67)").

   - Induction motors
   - Synchronous motors
   - Reluctance motors
   - Motor data input (motor data must be entered manually, see Chapter "Inserting and specifying motors that are missing from the motor list (Page 97)").
2. Select the unspecified motor in the device overview.
3. Drag the unspecified motor to the lower area of the Motor Module.
4. Click the unspecified motor in the device view.
5. Open the Inspector window if it has still not been opened or displayed.
6. In the Inspector window, select entry "Motor- Selection - ...".
7. Based on the article number, select a motor with the appropriate motor encoder from the list.
   The data of the selected motor are assigned to the unspecified motor. The white area turns dark gray.
   If you have selected a motor with encoder, the encoder and the encoder evaluation are also added automatically.

Result

The motor is inserted and specified. If you have selected a motor without encoder, add an encoder and an encoder evaluation in the next step.

6.3.5.3 Inserting and specifying motors that are missing from the motor list

Overview

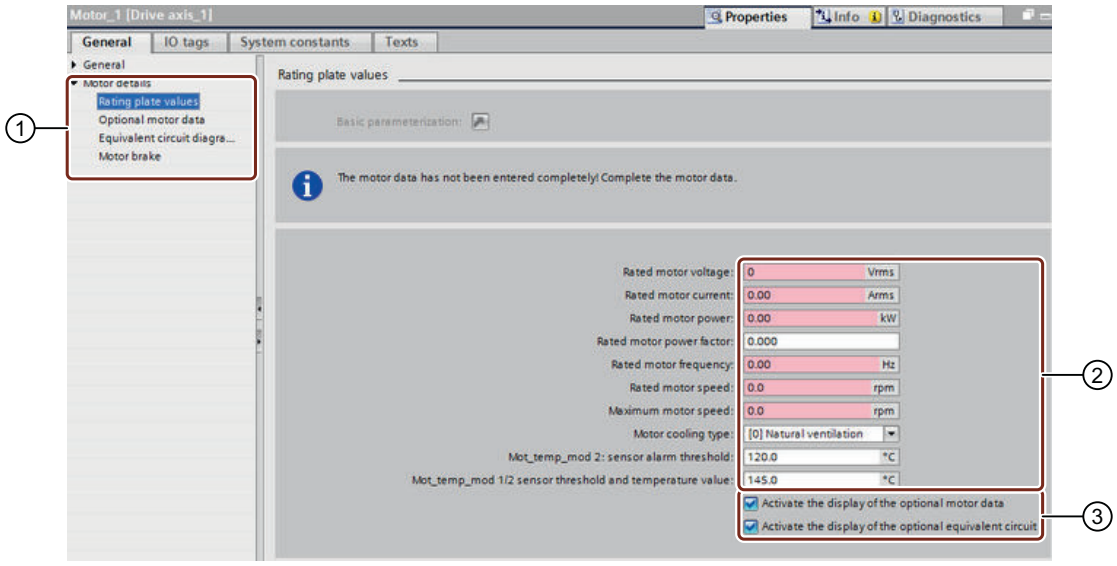
If you want to insert, specify and manage motors in your device configuration, which are not contained in the motor list, you can enter the most important motor data, such as the rating plate values of the motor, manually in the Inspector window.

Procedure

To insert and specify motors that are not listed in the motor list into your device configuration, proceed as follows:

1. Open the "Motors" item in the hardware catalog and then the subitem "Motor data input". The motors are presorted according to motor type. A range of induction motors, synchronous motors and reluctance motors are available for a general selection.
2. Select the desired, unspecified motor in the device overview.
3. Drag the desired, unspecified motor to the lower area of the Motor Module.
4. Click the unspecified motor in the device view.
5. Open the inspector window if it has not been opened yet.
6. In the Inspector window, select the "Motor details" menu.
   The expandable menu item "Motor details" ① consists of the following subsections:
   - Rating plate values
   - Motor brake (see Chapter"Adding a standard motor")
   - Optional motor data (can also be activated)
   - Equivalent circuit diagram data (can also be activated)

7. If you want to record motor data under "Optional motor data" and "Equivalent circuit diagram data", activate the following options in the "Rating plate values" screen form:
   - "Activate display of the optional motor data"
   - "Activate display of the optional equivalent circuit diagram data"



① Motor details (including additional options)
② Mandatory fields (pink background)
③ Additional options (deactivated by default)

Figure 6-21 Example: Motor details

The additionally activated subareas are displayed in the inspector window under "Motor details" ①.

8. Acquire the required motor data of the inserted motor.

Note

The input fields marked in pink ② are mandatory fields. If appropriate values are not entered in these fields, then the device configuration cannot be completed.

Note

We recommend entering the values in the inspector window under "Motor details". Individual parameters may be locked in the parameter view and cannot be set.

Result

The motor is specified with the manually acquired motor data. The white area turns dark gray.

If you have selected a motor with encoder, the encoder and the encoder evaluation are also added automatically.

6.3.5.4 Configuring motor details

Overview

You can configure the following motor details for motors during commissioning:

- Basic parameter assignment
- Rating plate values
- Motor brake

Procedure

To configure the motor details, proceed as follows:

1. Select the motor in the device view and open the Inspector window.
2. In the inspector window, select the "Motor details > Rating plate values" menu.
   In the screen form, the following setting options are displayed:

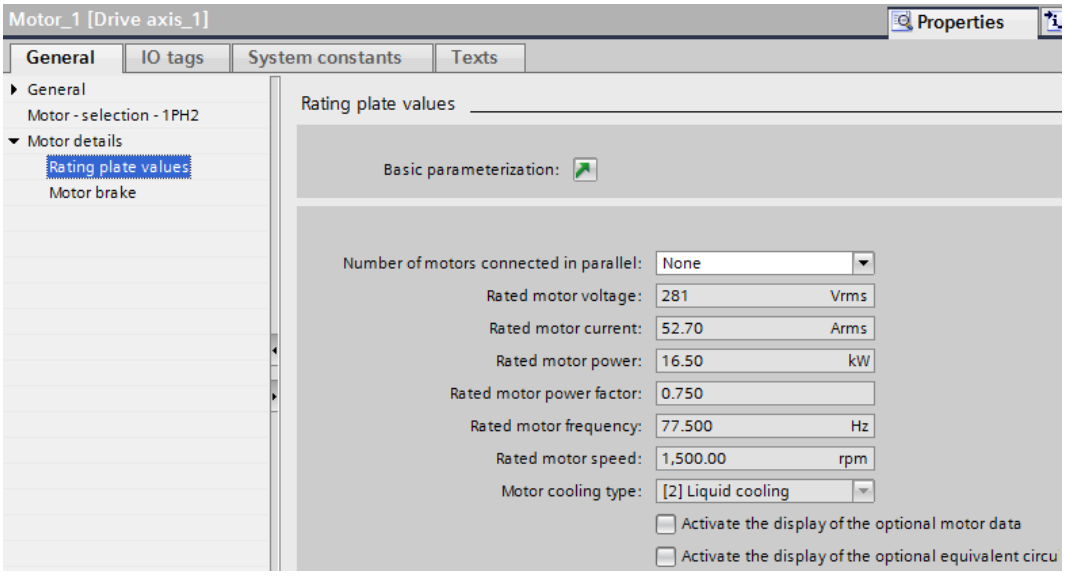


Figure 6-22 Motor details: configuring rating plate values

3. To perform the basic parameter assignment for the motor, click the icon next to the "Basic parameterization" entry.
   The function view of the drive axis is opened:
   Make the required settings here (see "Performing basic parameterization (Page 125)").
4. In the Inspector window, select the menu "Motor details > Rating plate values" again.
5. Make the settings in the white fields.
   The gray fields are refreshed automatically in accordance with your settings.

6. In the Inspector window, select the "Motor details > Motor brake" menu.
   The current configuration of the motor holding brake is displayed in the screen form.

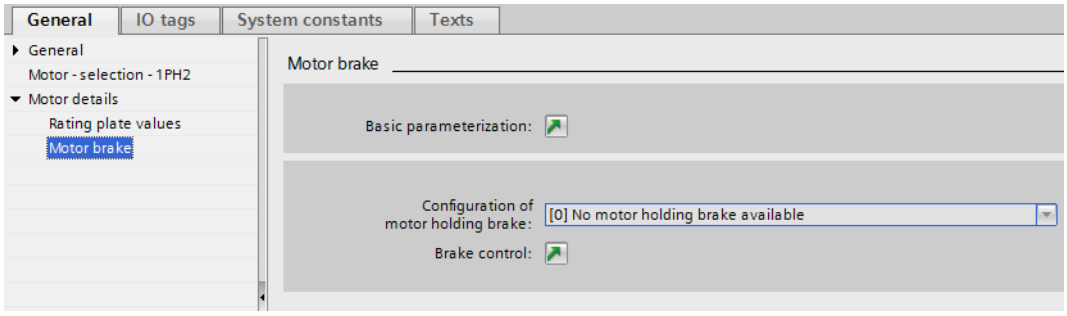


Figure 6-23 Motor details: configuring a motor brake

7. To change the configuration of the motor holding brake, click the  icon next to the "Brake control" entry.
   The "Brake control" screen form opens.

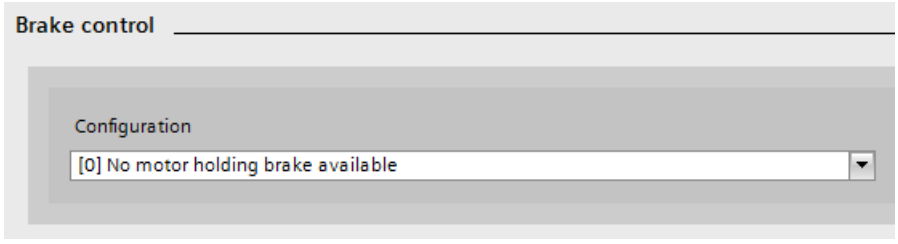


Figure 6-24 Motor details: configuring brake control

8. Select the desired brake control from the "Configuration" drop-down list and make the required detailed settings. You can find further information about the detailed settings of the brake control in Chapter "Configuring brake control" of the SINAMICS S120 Commissioning Manual with Startdrive.
   The selected brake control is displayed in the motor details.

Result

You have made the detailed settings for the selected motor in your device configuration.

6.3.6 Inserting measuring systems

6.3.6.1 Overview

Encoder types

In measuring systems, there is a general distinction between two types of encoders:

- Motor encoder
  Motor encoders are normally mounted on the motor shaft so that motor motion (angle of rotation, rotor position, etc.) can be directly measured. They provide an actual speed value that is incorporated in the control (speed and current control) so that for fast controllers the actual speed value must also be provided sufficiently quickly. This is the reason that high quality encoders must be used for motor encoders.
  - Siemens motors that have already been configured are created in the device view with the matching encoder and the encoder evaluation.
  - DRIVE-CLiQ motors are inserted together with an encoder. The drive and encoder parameters are transferred when you then load the configuration to the drive (download). The correct motor and encoder configuration are available offline in the project after an upload.
- Machine encoder
  Machine encoders are installed in the machine. Using machine encoders, for example, you synchronize the speed of a belt to another belt, or you determine the position of a workpiece. Basic, mounted encoders can be used in this case as these values are normally not required in a fast speed controller or current controller cycle.

Available encoders in Startdrive

The following encoder types are supported in Startdrive:

- DRIVE-CLiQ encoder
  These encoders are parameterized when downloading - and after an upload, are correctly displayed.
- SIN/COS encoders
  Incremental encoders that supply a sinusoidal/cosinusoidal type signal are also available with SSI protocol.
- HTL/TTL encoders
  Incremental encoders, which supply a square wave pattern, are also available with SSI protocol.
- Resolvers
  Rotary position encoders.
- EnDat 2.1
  Absolute encoders, which are controlled via the ENDAT 2.1 protocol.

- SSI encoder
  Absolute encoders, which are controlled via the SSI protocol.
- Distance-coded zero marks
  Zero marks are set if reference point approach is not possible or is not accepted.

Note

Encoders from the hardware catalog

SIEMENS in-house encoders which are listed in the hardware catalog no longer have to be parameterized as they are already preassigned the appropriate settings.

In contrast, third-party encoders must be parameterized as described below.

Further information

You can find exhaustive information about the encoders in Chapter "Important measuring systems/encoders" of the SINAMICS S120 Commissioning Manual with STARTER.

6.3.6.2 Inserting an encoder

Preconditions

- A project has been created.
- The Control Unit is inserted in the device configuration.
- An infeed is inserted.
  In case of doubt, you can also add the infeed at a later point in time. However, in this case, you must manually wire the "infeed" component with the other components.
- A Motor Module is inserted.
- A motor is inserted (optional).

Utilizing this procedure, you insert the encoder after the motor (see Chapter "Inserting and specifying motors from the motor list (Page 96)").

Procedure

Proceed as follows to insert and specify an encoder in your device configuration:

1. Open "Measuring systems" in the hardware catalog.
   One of the following measuring systems can be selected:
2. Select the unspecified encoder in the device overview.

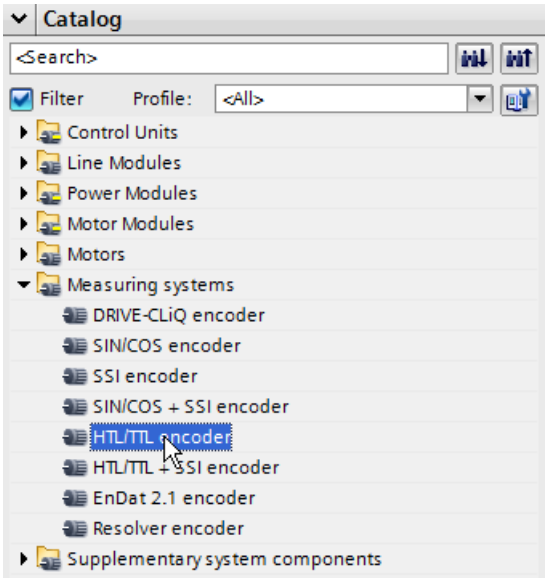


Figure 6-25 Encoder selected

3. Drag the unspecified encoder to the lower area of the Motor Module.
   An encoder and a Sensor Module are created.
4. Click the unspecified encoder in the device view.
5. Open the Inspector window if it has still not been opened or displayed.
6. In the Inspector window, select entry "Measuring system- Selection - ...".
7. Select the required encoder in the "Measuring system - Selection - ..." list.
   The data of the selected encoder are assigned to the unspecified encoder. The white area turns dark gray.
   Further, a Sensor Module - encoder evaluation is also inserted.

Result

The encoder is inserted and specified.

Adding additional encoders

If you require additional encoders for your device configuration, then you can configure these in the same way. These encoders are then normally used as machine encoders.

6.3.6.3 Specifying the encoder evaluation

Overview

Various Sensor Modules are available for the encoder evaluation. Different types are offered for selection depending on the encoder.

Requirement

- You have already specified an encoder.
- The non-specified encoder evaluation is displayed.

Procedure

To specify the encoder evaluation, proceed as follows:

1. Click on the non-specified encoder evaluation.
   The Sensor Modules that are available are listed in the Inspector window.

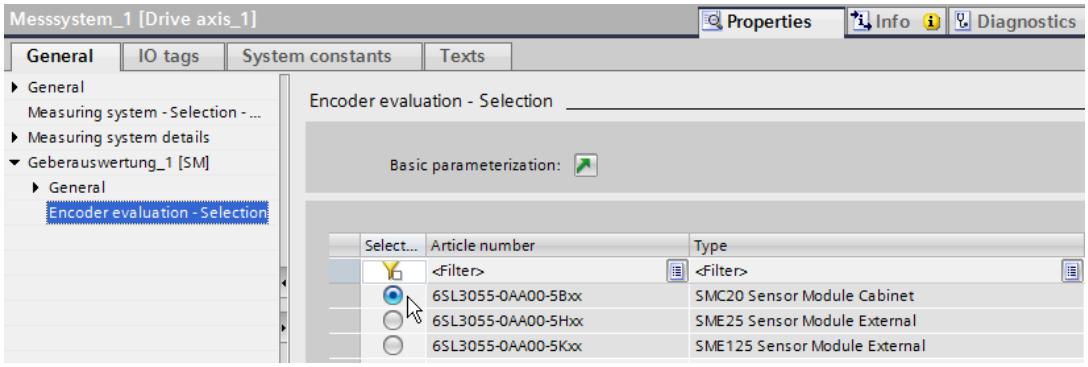


Figure 6-26 Encoder evaluation specified

2. Select your Sensor Module.

Result

The Sensor Module has been specified.

6.3.6.4 Making detailed settings

Overview

You can configure the following encoder details for measuring systems during commissioning:

- Actual value processing
- Encoder details (e.g. encoder type, incremental tracks, gear ratio).

Procedure

To configure the encoder details, proceed as follows:

1. Select the encoder in the device view and open the Inspector window.
2. In the Inspector window, select the "Measuring system details" menu.
3. To configure the actual value processing, click the icon next to the "Actual value processing" entry.
   The "Actual value processing" screen form opens:

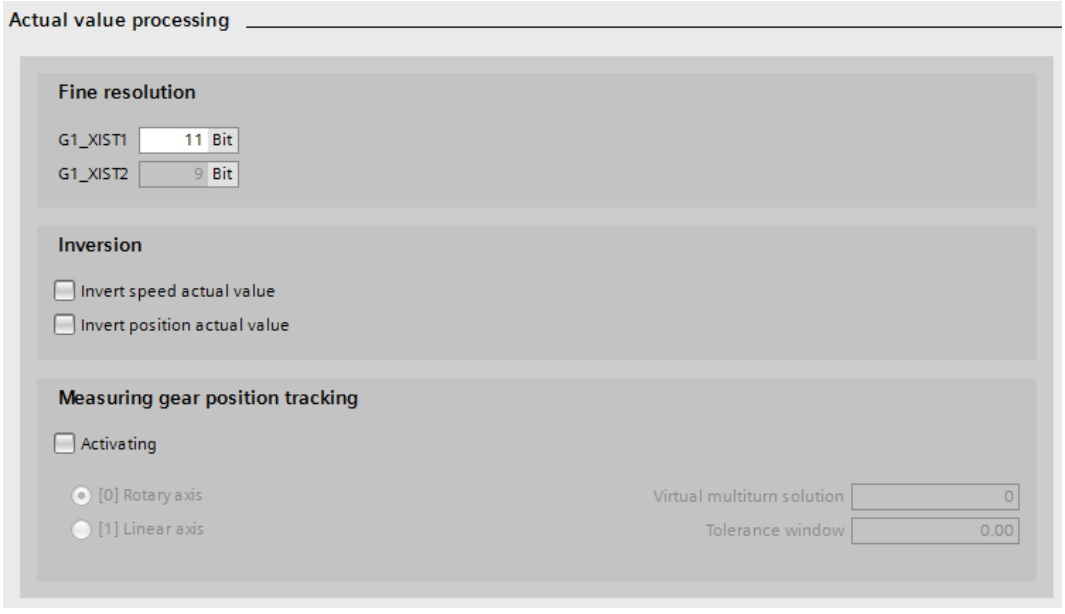


Figure 6-27 Example: Actual value processing

Make the required settings here (see chapter "Actual value processing (Page 145)").

4. In the Inspector window, select the menu "Measuring system details" again.
   In the screen form, the following setting options are displayed:

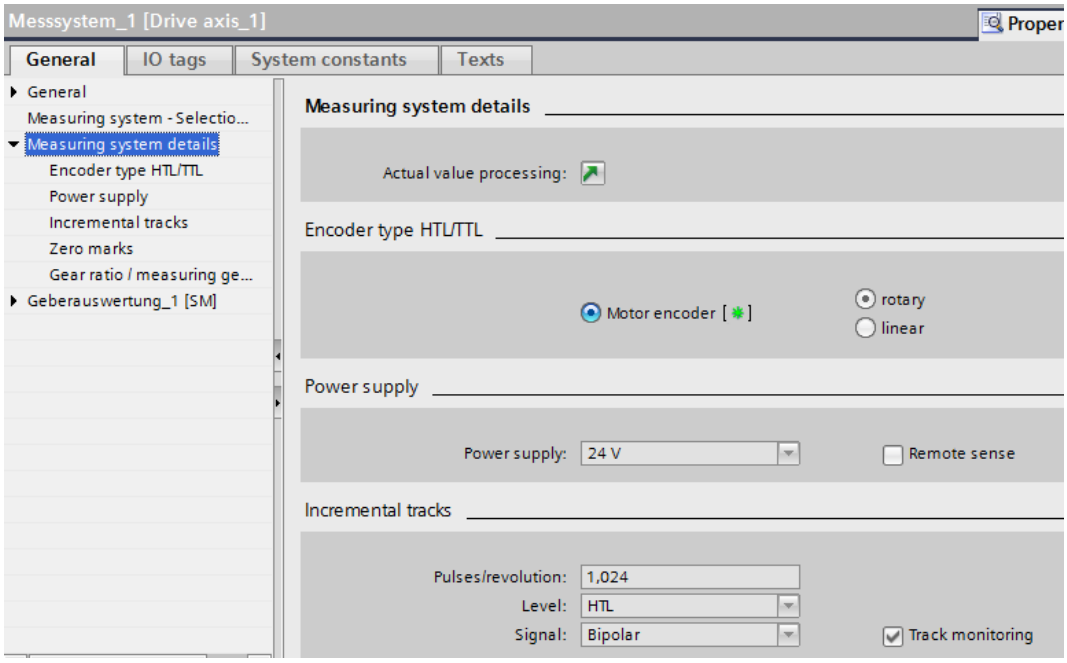


Figure 6-28 Overview: Encoder details

5. Make the detailed settings for the encoder in the white fields.
   The gray fields are automatically corrected in accordance with your settings.

Result

You have made the detailed settings for the selected encoder in your device configuration.

6.3.7 Inserting additional system components

The following components can be inserted additionally in the device configuration of your drive:

- Communication Board CBE20
- Terminal Module
- Terminal Board TB30
- Voltage Sensing Module VSM10

Since the procedures for inserting the components into the device configuration are different, they are described individually in the following.

6.3.7.1 Insert Communication Board CBE20

Overview

The CBE20 Communication Board is a flexible component, which can be operated in Startdrive with the "SINAMICS link" communication profile.

Requirement

- A project has been created.
- A Control Unit is contained in the device configuration.
- No Terminal Board TB30 is contained in the device configuration.

Note

A TB30 Terminal Board and a CBE20 Communication Board cannot be created simultaneously in the device configuration.

Procedure

To insert a CBE20 into the device configuration, proceed as follows:

1. Open "Supplementary system components > Communication Boards" in the hardware catalog.
2. Select the "CBE20 Communication Board" in the drop-down list.
3. Drag the "Communication Board CBE20" into the device view into the light gray border area of the Control Unit.

Result

The CBE20 is inserted in the drive, and does not have to be specified in any more detail.

6.3.7.2 Insert Terminal Module

Overview

With Terminal Modules, you can expand the interfaces of the Control Unit. They are connected to the Control Unit via DRIVE-CLiQ.

Requirement

- A project has been created.
- A Control Unit is contained in the device configuration.

Procedure

To insert a Terminal Module into the device configuration, proceed as follows:

1. Open "Additional system components > Terminal Modules" in the hardware catalog. The following Terminal Modules are available for selection: TM15, TM31, TM41, TM120 and TM150.
2. Select the desired Terminal Module in the drop-down list.
3. Drag the Terminal Module to the device view.

Result

The Terminal Module is inserted in the drive and does not have to be specified in any more detail. The DRIVE-CLiQ connections are automatically created.

6.3.7.3 Insert Terminal Board TB30

Overview

Terminal Board TB30 is a terminal module with which it is possible to expand the interfaces of the Control Unit. The Terminal Board is inserted into the option slot of the Control Unit.

Requirement

- A project has been created.
- A Control Unit is contained in the device configuration.
- No Communication Board CBE20 is contained in the device configuration.
  TB30 and CBE20 cannot be created simultaneously in the device configuration.

Note

A TB30 Terminal Board and a CBE20 Communication Board cannot be created simultaneously in the device configuration.

Procedure

To insert a TB30 into the device configuration, proceed as follows:

1. Open "Additional system components > Terminal Boards" in the hardware catalog. The "TB30 Terminal Board" entry is displayed.
2. Select the TB30 Terminal Board in the device overview.
3. Drag the Terminal Board to the device view.

Result

The TB30 is inserted in the drive and does not have to be specified in any more detail.

6.3.7.4 Insert Voltage Sensing Module VSM10

Overview

Voltage Sensing Modules (VSM) can be used for the following different drive objects:

- **Infeed**
  - Is used for voltage measurement (e.g. for the "mains transformer" function).
  - The VSM10 allows an exact recording of the line voltage curve and supports the fault-free operation of the Line Modules in unfavorable network conditions.
- **Motor Modules** of the type Vector
  - Required for the functions "synchronize" and "flying restart".

Requirement

- A project has been created.
- A Control Unit has been inserted into the device configuration.
- An infeed is inserted into the device configuration.
  OR
- A Motor Module of the vector type is available.

Information for inserting Voltage Sensing Modules

Observe the following information before you insert a Voltage Sensing Module into the device configuration.

Note

When Active Line Modules or Smart Line Modules of the Chassis design are inserted, Voltage Sensing Modules are also automatically inserted.

Procedure

To insert a VSM10 into the device configuration, proceed as follows:

1. Open "Supplementary system components > Voltage Sensing Modules" in the hardware catalog.
2. Select the "Voltage Sensing Module VSM10" in the drop-down list.
3. Drag the "Voltage Sensing Module VSM10" into the device view on the infeed unit, or alternatively on a vector-type Motor Module.

Result

The VSM10 is inserted in the selected drive object and does not need to be further specified. The DRIVE-CLiQ connections are automatically created.

Operation of several VSMs per Line Module

Depending on the type and design, a maximum of 3 VSMs (e.g. Active Line Modules in Chassis design) can be added to a Line Module.

Note

Activating the "Line transformer" function module

If you operate several VSMs on one Line Module, you must activate the "Line transformer" function module in the basic parameterization of the Line Module.

Note

Deleting additional Voltage Sensing Modules

If you delete additional VSMs, you must deactivate the "Line transformer" function module in the basic parameterization in order to avoid negatively impacting the computing performance of the Control Unit.

Further information

You can find further information on the system rules for operating multiple VSMs per Line Module in the SINAMICS S120 Function Manual Drive Functions.

6.4 Establishing an online connection to the drive unit

6.4.1 Overview

Interfaces for the online connection

2 interfaces are available for CU320-2 PN Control Units, via which you can go online with the drive:

- Ethernet commissioning interface X127
- PROFINET interface X150

The example given in this Getting Started section relates to interface X127.

First you connect your PC to the appropriate Control Unit interface.

IP addresses of the CU (hardware)

For X127, an IP address and a subnet mask have already been assigned on the Control Unit in the factory:

- IP address: 169.254.11.22
- Subnet mask: 255.255.0.0

IP addresses in the project

A CU320-2 PN is created with the following IP addresses in a project in TIA Portal:

The addresses correspond to the addresses that have already been assigned in the drive.

- IP address: 169.254.11.22
- Subnet mask: 255.255.0.0

The PROFINET addresses are in the range of the PROFINET subnet of a SIMATIC S7 controller so that you can network the drive with a controller without having to adapt the subnet mask and the IP address.

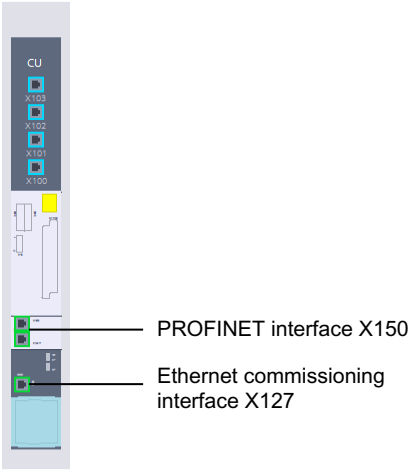


Figure 6-29 CU320-2 PN interfaces

Selecting the preferred PG/PC interface

If you prefer to use a specific network interface of your PG/PC to establish an online connection, you can preset this interface.

1. Select the "Options > Settings" menu.
   The settings of the TIA Portal are displayed.
2. Select the "Online and diagnostics" entry in the area navigation.
3. In the "Preset connection path for online access" area, specify the type of the PG/PC interface as well as the interface itself.
4. Activate the "Use preset connection path for online access" option.

6.4.2 Using an online connection via the Ethernet interface

Overview

The Ethernet interface X127 with a default IP address is available for commissioning your drive.

Requirement

New Startdrive project

- You have created a project in Startdrive and inserted a CU320-2 PN.
- You have connected your PG/PC with the drive via the X127 Ethernet interface.

Note

As the Ethernet interface X127 has already been assigned an IP address, you can go online directly.

Existing Startdrive project

- If you are using an existing project and devices have already been created, in the project, check the IP address of the interface in the Inspector window at "Properties > General > Ethernet addresses" and the IP address assigned to the device. The addresses and subnet masks must be identical.

Quick search via "Online access"

In order to obtain a fast overview, you can start a search in "Online access" at the required interface. If the wiring to your drive is error-free and you have wired the correct drive (LED flashing for checking), the drive is displayed with the appropriate IP address.

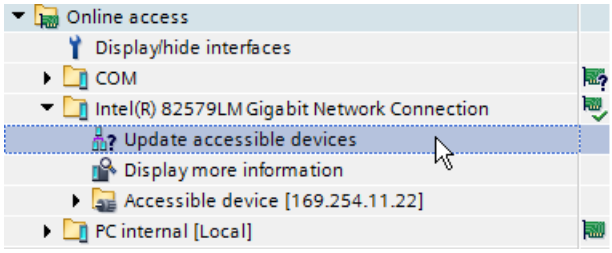


Figure 6-30 Online access

Establishing an online connection

To establish an online connection between your PG/PC and the drive, proceed as follows:

1. Select the drive unit with which you want to go online in the project navigation (or in the device view).
2. Click the Go online button.
   The "Go online" dialog opens.

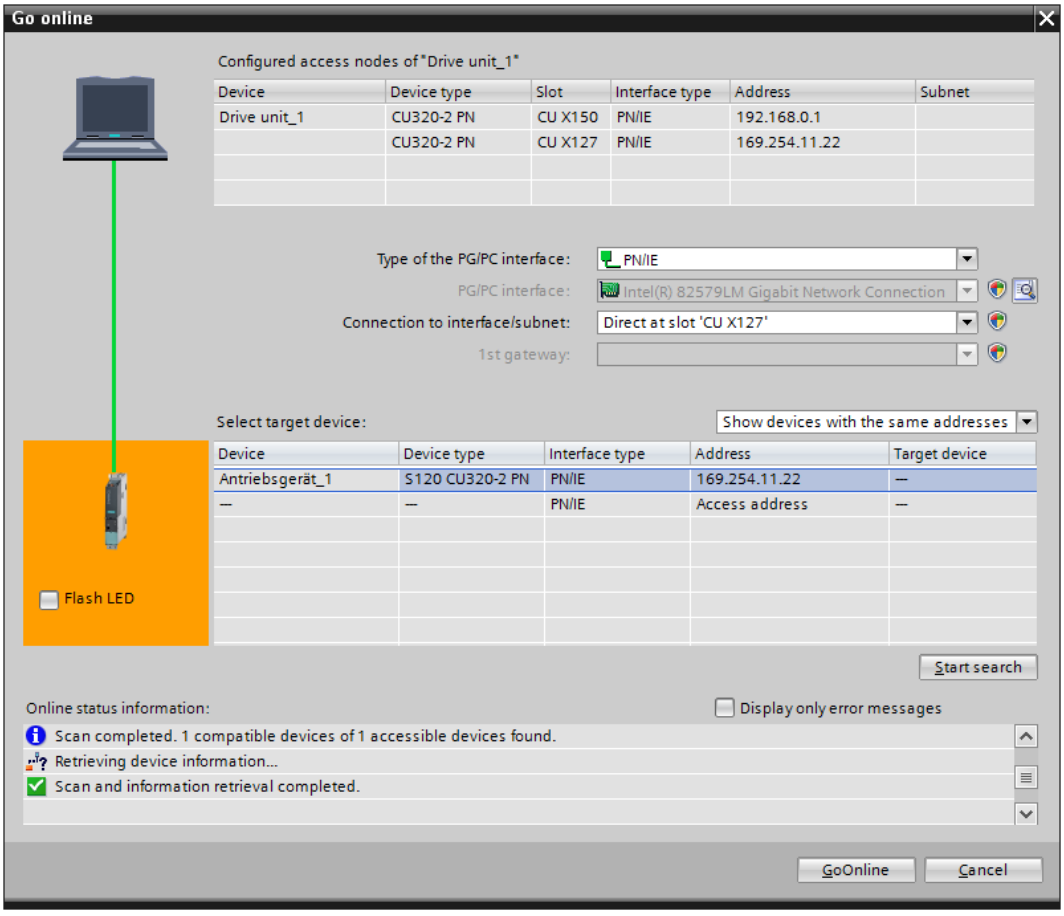


Figure 6-31 Example: Go online

3. If a correctly configured interface has still not been set, then select "Type of the PG/PC interface" in the drop-down list.
4. If no interface has yet been preset, select the "PG/PC interface" for your PC in the drop-down list.
5. Select the required "Connection to interface/subnet" from the drop-down list.
   For Ethernet/IE, this is X127 of the CU320-2 PN.
6. Select one of the following search options in the "Select target device" drop-down list:
   - Show devices with the same addresses
   - Show all compatible nodes
   - Displaying accessible nodes

7. In order to search for the drive unit with the set parameters, click "Start search". The devices that are found are displayed in the table of results.
8. Select your drive unit from the table.
9. To establish an online connection to the drive unit, click "Connect".

Result

An online connection exists between your PG/PC and the drive. The settings are used automatically the next time you go online and the "Go online" dialog is no longer displayed.

6.5 Alternative: Loading the configuration of the drive into the project

6.5.1 Uploading a device as a new station

Overview

You can also put your drive into operation via the "Upload device as new station" function.

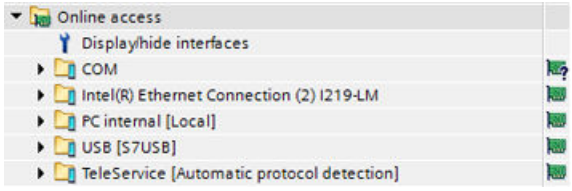
Requirement

- There is a physical LAN connection between the drive and the PG/PC.
- You have created a project or have opened an existing project.

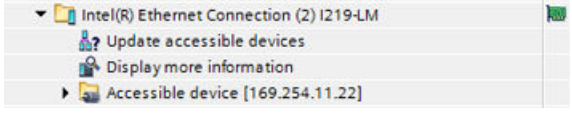
Procedure

To upload a device as a new station, proceed as follows:

1. In the project tree, click on the arrow icon ▶ next to the "Online access" function.
   The following commands/options are then displayed:

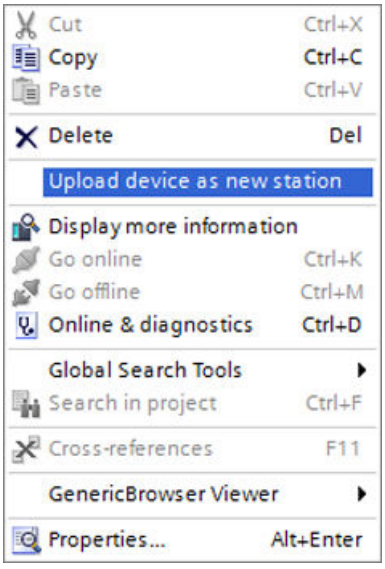


2. Click on the arrow icon ▶ next to the option "Intel(R) Ethernet Connection (2) I219-LM".
   The following commands/options are then displayed:



3. If the entry "Accessible device [169.254.11.22]" is not displayed, double-click the function "Update accessible devices".
   "Accessible device [169.254.11.22]" is then displayed in the list.

4. Select the entry "Accessible device [169.254.11.22]" and right-click in the selected line.
   The list of the possible options/commands appears.
5. Select the command "Upload device as new station".



Result

The configuration is loaded from the drive into the project.

6.5.2 Post-processing the drive configuration

Overview

In an ideal scenario, all of the drive components are transferred into the drive configuration and specified via the automatic configuration. In this case, the error-free configuration is confirmed in the message display and the configuration does not have to be post-processed.

Error when reading out the drive configuration

If, however, not all drive components could be read out by the automatic configuration, although they do exist physically, the components are created unspecified in the device view. The missing specification must therefore be added in the device configuration.

Specifying unspecified components

To specify non-specified components, proceed as follows:

1. Click in the inner white area of the unspecified component envelope.
   The area is shown as selected.
2. Open the inspector window if it has not been opened yet.

3. In the secondary navigation of the Inspector window, select "... - Selection".
   A selection of the available components is displayed on the right in "... - Selection".
4. Select the component.

Result

- The component is displayed in the device view as specified (the area now has a dark color).
  The data are displayed accordingly in the device overview.
- The data of the selected component unit were assigned to the unspecified component unit.

6.6 Alternatively: Creating a project with a device configuration derived from the hardware

6.6.1 Determining the drive configuration

Overview

The individual steps for automatically determining the drive configuration via the function "Detection of the device configuration" are described in the following.

Requirement

- A project has been created.
- A Control Unit has been inserted into the device configuration.
- An online connection has been established to the drive.

Performing device configuration identification

To determine the drive configuration via the function "Detection of the device configuration", proceed as follows:

1. Select the desired drive in the project tree or in the device configuration.
2. Call the "Device configuration detection" shortcut menu.
   The "Go online" dialog is displayed if an online connection to the target device has not been established yet.

   Note

   An online connection is required for the automatic configuration.

3. If there is no online connection yet, establish an online connection (see "Establishing an online connection to the drive unit (Page 111)").

Result

- The topology of the drive is read out. Existing DRIVE-CLiQ interconnections are imported directly from the actual topology of the drive.
- The "Detection of the device configuration" dialog opens.

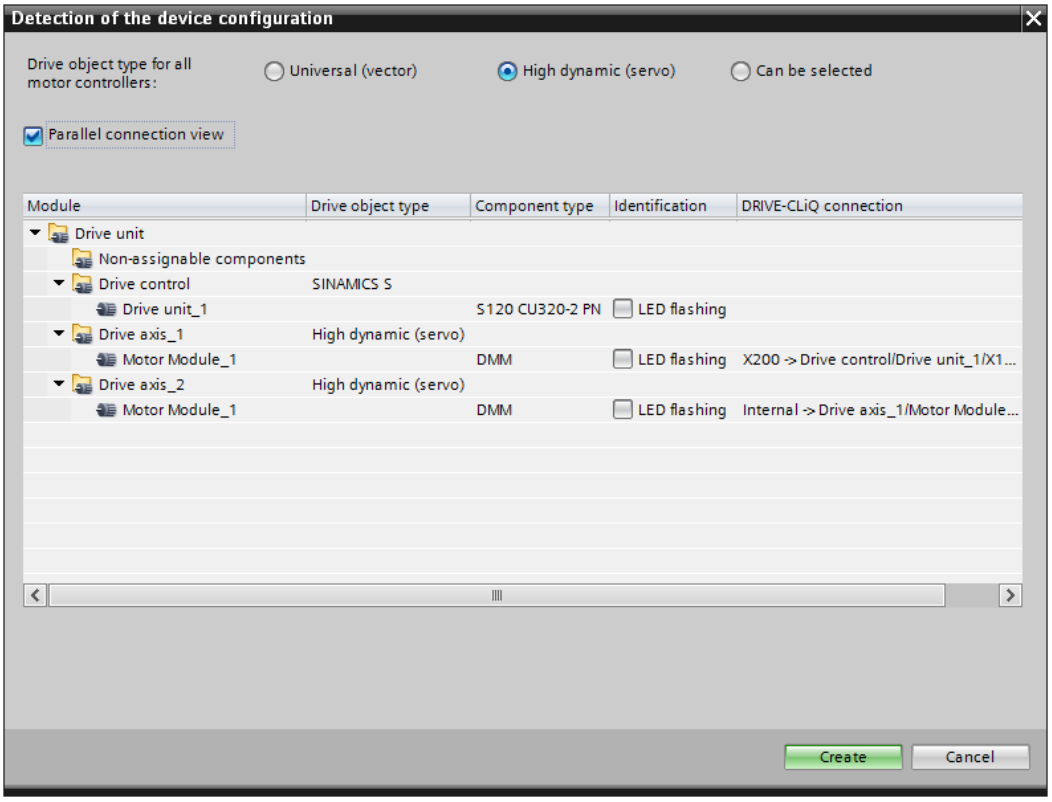


Figure 6-32 Example: Device configuration detection - all components assigned

Overview of the read-out components

All of the read-out components are displayed in an overview (see "Device configuration detection (Page 46)"). The list shows all components which can be assigned to a main component (e.g. infeed unit).

Non-assignable components

Components that are not automatically assigned to a main component during device configuration detection are listed at "Non-assignable components". These components can be manually assigned via drag-and-drop or via the shortcut menu of a main component.

Note

All of the components listed in the "Non-assignable components" folder prevent the creation of the read-out actual topology into the drive configuration.

Remedy

If individual non-assigned components cannot be assigned to a main component, delete the corresponding list entries in the "Non-assignable components" folder. As a result, the remaining components can be imported into the drive configuration.

Selecting the drive object type of the motor control (optional)

After the drive configuration has been read out, the drive object type in the header of the dialog box is automatically set to "High dynamic (servo)".

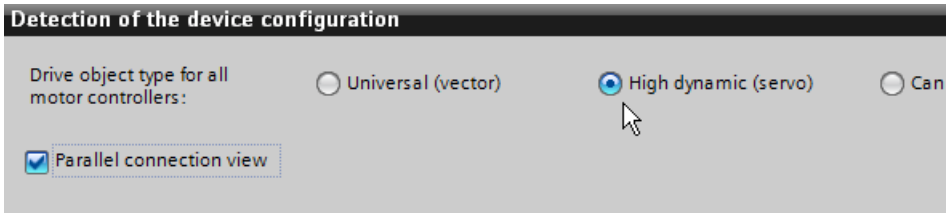


Figure 6-33 Default drive object type

If you want to set another motor control, proceed as follows:

1. Activate the option of the required drive object type in the dialog header.
   - Universal (vector)
   - Highly dynamic (servo)
   - Selectable
     The drive object type can be individually assigned for each detected drive axis.
2. If you selected the "Can be selected" option, select the required drive object type for each drive axis in the column of the same name via a drop-down list.

Result

You have selected the drive object type of the motor control.

Configuring the topology

If all components found in the actual topology have been assigned, no further adaptations must be made in the "Detection of the device configuration" dialog. The "Create" button is then enabled. If the "Create" button is grayed out and not active, further adaptations in the topology are required. The following options are available to you for this:

Changing the assignment of components

To change the assignment of the components, proceed as follows:

1. Select a component in the list that you want to assign to a different main component.
2. Move this component to the desired main component using drag & drop.

Assigning a non-assigned component to a main component

To assign non-assigned components to a main component, proceed as follows:

1. Select a component that is not yet assigned in the "Non-assignable components" folder.
2. Call the "Assign to / Main component xy" shortcut menu.
   "Main component xy" stands for all of the main components used in the list.
   The component is assigned to the desired main component in the list.

Deleting a component

To delete individual components, proceed as follows:

1. Select the component that you would like to delete.
2. Call the "Delete" shortcut menu.
   The component is deleted.

Renaming the component

To rename individual components, proceed as follows:

1. Select the components which are to be renamed.
2. Call the "Rename" shortcut menu.
3. Enter a new name for the component.

Connecting components in parallel

The parallel connection view supports you in the parallel connection of components.

To activate the "Parallel connection view" option, proceed as follows:

1. Activate the "Parallel connection view" option.
   The "Connect in parallel at" shortcut menu is displayed.
2. To interconnect individual components in parallel, you have the following options:
   - Drag & Drop
     To interconnect individual components with one another in parallel, drag and drop components that are capable of parallel connection together.
   - Shortcut menu
     Right-click the components to be connected in parallel. All of the drive objects to which the selected component can be connected in parallel are displayed in the shortcut menu under the "Connect in parallel at" menu entry. The "All" item switches the selected power unit parallel to all connectable components.

Cancelling a parallel connection

To eliminate an existing parallel connection, proceed as follows:

1. Move individual components to the higher-level drive using the drag-and-drop feature.
   OR
2. Select a component that is connected in parallel and then the shortcut menu "Disconnect parallel connection".

6.6.2 Importing a determined drive configuration into the Startdrive project

Overview

After you have checked and, if applicable, corrected the automatically determined topology, you can import this topology into a Startdrive project.

Note

Overwriting existing components

If you have already created components in your Startdrive project before the automatic determination of the drive configuration, then these components are overwritten when the data from the automatic determination is created.

Requirement

- There are no non-assignable components in the drive configuration.

Procedure

To import the determined topology into your Startdrive project, proceed as follows:

1. Make sure that there are no non-assignable components in the "Device configuration detection" dialog.
   The "Create" button only becomes active when all of the non-assignable components are assigned to a main component or are deleted (see Chapter "Determining the drive configuration (Page 119)").
2. Click the "Create" button.

Result

The topology is created in the configuration of the selected drive and is displayed in the device view.

6.6.3 Post-processing the drive configuration

Overview

In an ideal scenario, all of the drive components are transferred into the drive configuration and specified via the automatic configuration. In this case, the error-free configuration is confirmed in the message display and the configuration does not have to be post-processed.

Error when reading out the drive configuration

If, however, not all drive components could be read out by the automatic configuration, although they do exist physically, the components are created unspecified in the device view. The missing specification must therefore be added in the device configuration.

Specifying unspecified components

To specify non-specified components, proceed as follows:

1. Click in the inner white area of the unspecified component envelope.
   The area is shown as selected.
2. Open the inspector window if it has not been opened yet.
3. In the secondary navigation of the Inspector window, select "... - Selection".
   A selection of the available components is displayed on the right in "... - Selection".
4. Select the component.

Result

- The component is displayed in the device view as specified (the area now has a dark color).
  The data are displayed accordingly in the device overview.
- The data of the selected component unit were assigned to the unspecified component unit.

Performing basic parameterization 7

7.1 Control Unit

7.1.1 Web server

7.1.1.1 Activating and configuring the web server

The web server provides information on a SINAMICS device via its web pages. The server is accessed using an Internet browser (see Chapter "Supported browsers (Page 127)"). You can find further information on access to the web server and the functions of the web server in Chapter "Web server" of the SINAMICS S120 Function Manual Drive Functions.

You configure the web server in the Startdrive commissioning tool in the "Web server" screen form. Generally you can perform the configuration both in the ONLINE as well as in the OFFLINE mode of the Startdrive. We recommend that you configure the web server OFFLINE.

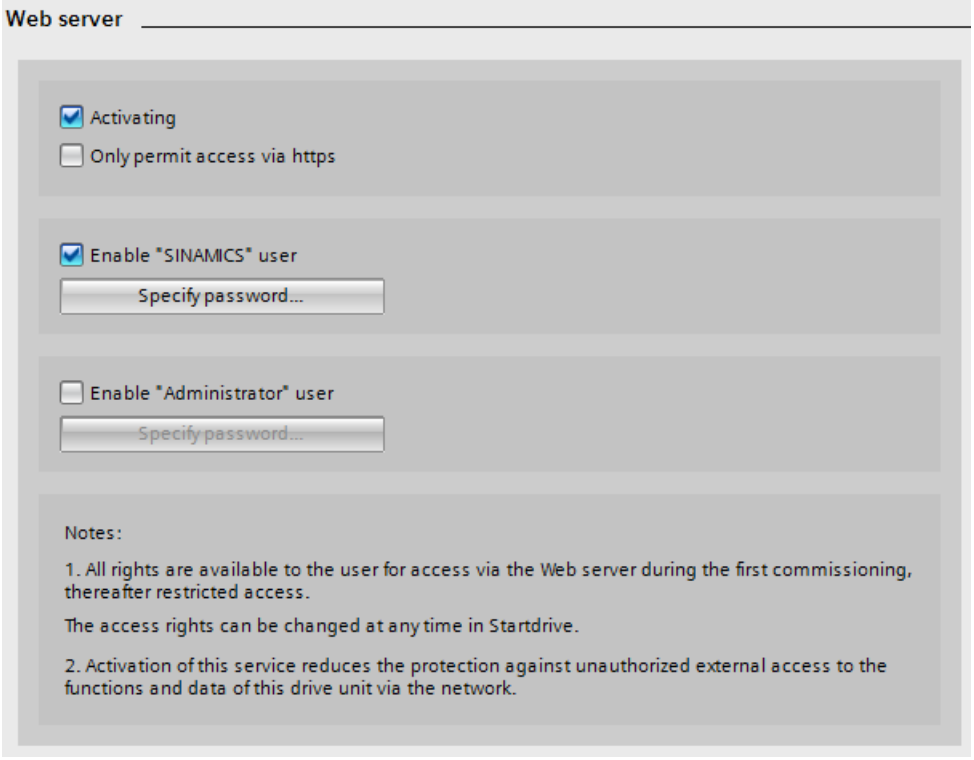


Figure 7-1 Web server configuration with default settings

The following table provides an overview of the configurations that you can perform OFFLINE and/or ONLINE.

Configuration	OFFLINE	ONLINE
Activate / deactivate the web server	x	x
Permit access via https only	x	x
Activate "SINAMICS" user	x	x
Activate "Administrator" user	x	x
Create password (all users)	x	x
Change password (all users)	-	x
Delete password ("SINAMICS" user)	-	x

Note

Transferring passwords created OFFLINE to the drive

Passwords defined OFFLINE must be transferred to the drive before accessing the web server. To transfer the passwords defined OFFLINE to the drive unit, proceed as follows:

1. Connect to your drive unit ONLINE.
   See Chapter "Establishing an online connection to the drive (Page 111)".
2. Load the set project data into your drive unit.
   See Chapter "Loading project data into the drive (Page 171)".

Deactivating the web server

When your converter is supplied, the web server is activated as default setting. When required, you can deactivate the web server as follows:

1. In the configuration dialog, deactivate the "Activate" option.
2. Then save the project to accept the settings.

Restricting web server access to just secure connections

Using the default configuration of the web server, you can access the SINAMICS S120 converter via an HTTP connection or via an encrypted HTTPS connection. Using the configuration, access can be restricted so that only a secure HTTPS connection is possible. To prevent hacking attacks and data manipulation, we recommend that you restrict access to just the secure HTTPS connection.

NOTICE

Using non-encrypted connections (HTTP)

When using the HTTP protocol, the login data is also sent unencrypted. Using the HTTP protocol facilitates, among other things, hacking attacks and stolen passwords – and can result in data manipulation by unauthorized persons.

- Limit access to secure HTTPS connections so that all data is transferred encrypted.

The configuration option provided to limit connections to just HTTPS can only be changed when the web server is active:

- In the Startdrive configuration dialog
- In the web server prior to commissioning for the first time
- Using parameter p8986

Note

Access to the web server via PROFINET interface X150

In the parameter view, you can configure HTTP or HTTPS access to the web server via a PROFINET interface using parameters p8986.1, p8984 and p8985. To do this, you must activate access to the web server with p8986.0 = 1 or via the screen form "Web Server".

Procedure:

1. In the configuration dialog, activate option "Only permit access via https".

7.1.1.2 Supported browsers

You can display the content of the web server either on a PC/laptop screen, a tablet PC or a smart phone. The web server integrated in SINAMICS S120 converters supports the following browsers:

Commissioning device	Operating system	Supported browsers
PC	Windows (from Version 7)	• Microsoft Internet Explorer (Version 11) • Microsoft Edge (Version 14) • Mozilla Firefox (Version 62) • Google Chrome (Version 69)
	Note: We recommend the use of Windows 10, version 1803, dated April 2018 or later.	**Note:** We recommend the use of Google Chrome in the supported version 69.
Tablet / smartphone	Apple iOS (from Version 12.0)	• Google Chrome (Version 69) • Safari (Version 12.0)
	Android (from Version 4.4.4)	• Google Chrome (Version 69)

If the web server does not respond, or if buttons are inactive or are not labeled, although the converter is not fully utilized with internal calculations, load the web server page again as follows:

- With the PC via <F5>
- With the smart phone or tablet via 

7.1.1.3 Setting or changing web server user accounts

Overview

For SINAMICS S120, the rights of both user accounts "SINAMICS" and "Administrator" are permanently predefined and cannot be changed by users. The user "Administrator" has full access rights by default. However, the standard "SINAMICS" user only has restricted access rights.

For web server user accounts, you can make the following settings in Startdrive:

- Enable or disable a "SINAMICS" or "Administrator" user.
- Create a password for a "SINAMICS" or "Administrator" user.
- Change the password of a "SINAMICS" or "Administrator" user.
- Delete the password of a "SINAMICS" user.

Defaults

The web server provides the following default settings for the users "SINAMICS" and "Administrator":

- **"SINAMICS" user**
  - No password set.
    For these users we recommend that a password is assigned. With a password, you prevent an attacker from assigning a password and thereby blocking other commissioning engineers. Also observe the specifications for the creation of secure passwords below.
- **"Administrator" user**
  - No password set.
    A password **must** be assigned for this user. If no password has been assigned, the following alarm appears when attempting to log on "A09000: Web server security: Administrator password not set". Also observe the specifications for the creation of secure passwords below.

Specifications for secure passwords

Observe the following information and notes for the creation of passwords:

Note

The password must include the following elements to provide protection against unauthorized access, e.g. unauthorized persons.

- At least 8 characters
- Uppercase and lowercase letters
- Numbers and special characters (e.g. ?!%+)

The password must not be used elsewhere.

7.1.2 Configuring inputs/outputs of the Control Unit

7.1.2.1 Configuring the inputs/outputs of the Control Unit

Overview

You can change the interconnection of digital inputs 0 to 7, 16, 17, 20 and 21 on the CU320-2 Control Unit in the "Isolated digital inputs" screen form.

- Digital inputs are used for the acquisition of digital signals. For example, drive enable signals can be controlled externally. The interconnection of digital inputs is made via BICO interconnections.
- For every digital input signal there is the corresponding inverted signal which can also be used for interconnection.

Simulation mode

The selection box for the terminal evaluation / simulation switchover is **only visible online**.

Interconnect the digital inputs 0 to 7, 16, 17 and 20, 21

Interconnect the signal sources of digital inputs 0 to 7, 16, 17, 20 and 21 (r0722 and r0723). Several interconnections are possible.

7.1.2.2 Bidirectional digital inputs/outputs

Overview

The bidirectional inputs/outputs of terminals X122 and X132 on the CU (DO1) can be used by a drive object as well as by a higher-level controller (resource sharing). The assignment to a terminal is defined by means of BICO interconnections which are either connected to a controller via the DO1 telegram p0922 = 39x or to a drive object.

You can change the interconnection of the bidirectional digital inputs/outputs on the input/output component.

- You can assign bidirectional digital inputs/outputs in the function. This means that you have the option of parameterizing an input or an output.
- Digital inputs are used for the acquisition of digital signals. For example, drive enable signals can be controlled externally.
- For every digital input signal there is the corresponding inverted signal which can also be used for interconnection.
- Digital outputs are used for the feedback of signals such as enable signals.

Changing the view of the screen form

The view of this screen form can be reduced to the essentials via a checkbox. Changing the function of one of the bidirectional digital inputs/outputs is not possible in the optimized view. The view of the screen form can also be switched to a simulation mode. This switchover only functions in online mode.

1. If you want to optimize the view, activate the "Optimize view" option.
2. If you want to switch to a simulation from the terminal evaluation, select "Simulation" in the drop-down list of a digital input.

Parameterizing the digital inputs/outputs 8 to 15

Each of the bidirectional digital inputs/outputs can be parameterized as an input or output using the selector.

Selector position	Description
Digital input 	Default setting when calling the screen form the first time. Digital inputs 8 to 15 can be interconnected with this switch position. Several interconnections are possible. The selector can be switched by clicking from digital input to digital output.
Digital output 	Digital outputs 8 to 15 can be interconnected with this switch position. Several interconnections are possible. The selector can be switched by clicking from digital output to digital input.

To parameterize the digital inputs/outputs 8 to 15, proceed as follows:

1. Select the digital input/output on the required terminal.
2. Interconnect the signal source of the digital input (8 to 15).
   OR
3. Proceed as follows to change the digital input into a digital output:
   - Click the selector.
   - Then connect the signal sink of the digital output (8 to 15).
   - If you want to invert the digital output, click on this icon .
     When inverted, the icon looks like this  .
4. Repeat steps 2 or 3 for all digital inputs/outputs of the required terminal.

7.1.2.3 Measuring sockets

Overview

The measuring sockets output the analog signals. Any freely interconnectable signal can be output at any measuring socket. A measuring socket can be used, for example, to output the actual speed value (r0063) to a measuring instrument connected to the measuring socket.

Note

Only for commissioning and service

The measuring sockets may only be used for commissioning and service purposes. The measurements may be performed only by appropriately trained skilled personnel.

You can make the following settings:

- Activate the limitation to a characteristic.
- Interconnect signal sources.
- Parameterize a characteristic.
- Define an offset.

Interconnect signal sources

To interconnect signal sources with the available measuring sockets, proceed as follows:

1. Select one of the following settings in the "Limitation" drop-down list of a measuring socket:
   - Limitation On
     If signals are output outside the permissible measuring range, the signal is limited to 4.98 V or to 0 V.
   - 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 V to 0 V.
2. Select the signal sources (p0771[0...2]) whose signal is to be output via the measuring socket for the respective measuring sockets T0, T1 and T2.

r0060	CO: Speed setpoint before speed setpoint filter
r0063	CO: Actual speed value
r0069[0...2]	CO: Actual phase currents value
r0075	CO: Field-generating current setpoint
r0076	CO: Actual field-generating current value
r0077	CO: Torque-generating current setpoint
r0078	CO: Actual torque-generating current value

3. The scaling specifies the processing of the measured signal. This requires the definition of a straight line with two points.
   Click the "Scaling" button in the adjustment range of a measuring socket.
   The "Scaling CU320 measuring socket Tx" dialog opens. You can define the values of a characteristic curve in this dialog.

4. In the dialog, select individual values within their defined limits, which are displayed in the relevant tooltips.
   - Characteristic value x2 (p0779)
   - Characteristic value y2 (p0780)
   - Characteristic value y1 (p0778)
   - Characteristic value x1 (p0777)

   Example: x1/y1 = 0%/2.49 V x2/y2 = 100%/4.98 V
   - 0.0% is mapped to 2.49 V.
   - 100.0% is mapped to 4.98 V.
   - -100.0% is mapped to 0.00 V.
5. Confirm your entries with "OK".
6. Enter the required offset value in the "Offset" field for the relevant measuring socket. The offset is applied additively to the signal to be output. The signal to be output can thus be displayed within the measuring range.

Function diagrams (see SINAMICS S120/S150 List Manual)

- 8134 Diagnostics - measuring sockets (T0, T1, T2)

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

Adjustable parameters

- p0771[0...2] CI: Measuring sockets signal source
- p0777[0...2] Measuring sockets characteristic curve value x1
- p0778[0...2] Measuring sockets characteristic curve value y1
- p0779[0...2] Measuring sockets characteristic curve value x2
- p0780[0...2] Measuring sockets characteristic curve value y2
- p0783[0...2] Measuring sockets offset
- p0784[0...2] Measuring sockets limitation on/off

Display parameters

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

7.2 Infeed unit

7.2.1 Available infeed units

Overview

Infeed units (Line Modules) include the central line infeed for the DC link. Various infeed units are available to address various application scenarios.

Basic parameterization of the infeed unit

You define the following data in the basic parameterization of the infeed unit:

- Function modules
- Line supply data / Operating mode
- Enable logic
- Line contactor control

7.2.2 Function modules

Overview

When required, during the basic parameterization you can switch-in various function modules for the selected infeed unit.

Note

You can activate or deactivate function modules only offline.

Note

The display of the function modules that can be activated is dynamic and depends on the selected infeed and the configuration of this infeed.

The following table provides an overview of the function modules that can be used. In addition to the individual function modules, the table includes an explanations of how each function module can be used.

Function module	Explanation
Frequently used function modules	
Master/slave (r0108.19)	Redundant operation of several ALMs connected to one DC link.
External Braking Module (r0108.26)	Control of an external Braking Module in order to be able to absorb braking energy in the event of a power failure.
Additional function modules	

Function module	Explanation
Free function blocks (r0108.18)	Activates the F blocks.
Supplementary closed-loop control (r0108.3)	For applications with asymmetrical line voltages: A negative sequence system current controller is used to balance the line currents and reduce the DC link ripple. For applications with resonance effects in the current or the filter voltage (e.g. in line systems with low short-circuit power ratings). Freely parameterizable band-pass filters for resonance damping.
Dynamic grid support (r0108.7)	For power generation applications in power grids: Functions for grid support with fault ride-through and line monitoring (incl. active anti-islanding) according to the applicable grid codes.
Grid droop control (r0108.12)	Installation, synchronization and operation of island grids: Control of line frequency and line voltage in single operation or together with other generators.
Recorder (r0108.5)	Function to record hardware-related fault events
Line transformer (r0108.4)	For power generation applications: Magnetization of a transformer to limit the inrush current when the line system is connected. Compensation of direct current components and voltage drops at the transformer in conjunction with dynamic grid support or grid droop control.
Supplementary cosinus phi module (r0108.10)	Precise cos(Phi) determination based on fundamental current and voltage components with BICO-interconnectable input variables (in contrast to power factor r0038).

Activating a function module

Proceed as follows to activate a function module:

1. Click on the desired function module (e.g. Master/Slave).
   Repeat this step for all additional function modules that you wish to activate.
2. Save the project to back up the settings.

7.2.3 Line supply data / Operating mode

Overview

You set the most important parameters for the operation of an infeed in the function view of the "Line data / operating mode" screen form. The corresponding parameters are displayed depending on the infeed type.

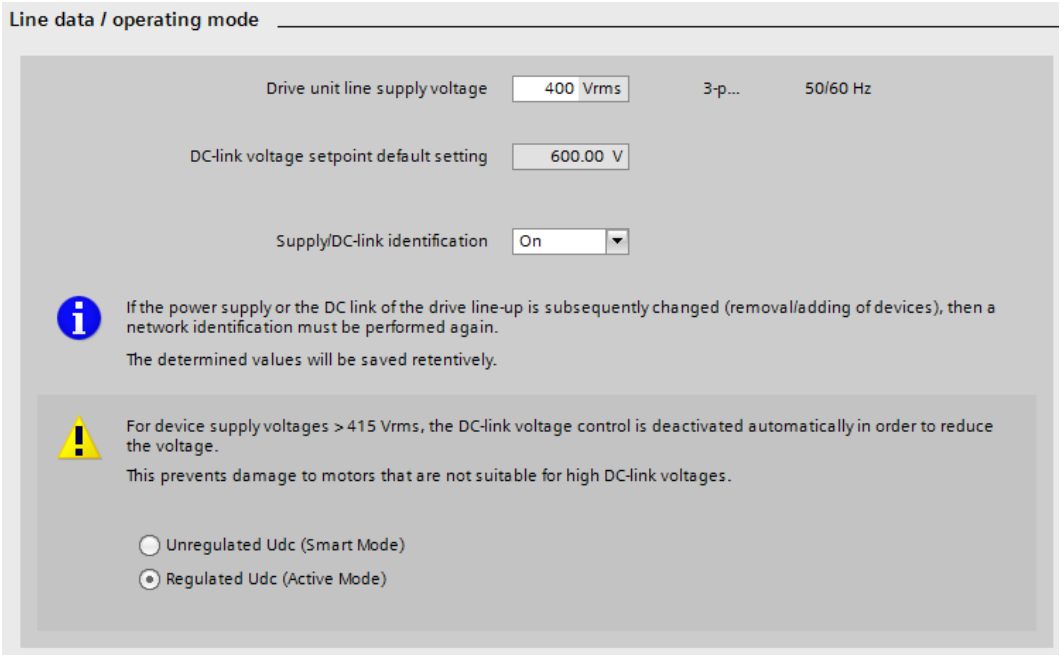


Figure 7-2 Example: line supply data/operating mode for an Active Line Module

The representation of this screen form is dependent upon the respective Line Module being used:

Setting	ALM	SLM	BLM	Explanation
Device supply voltage	x	x	x	-
DC-link voltage setpoint default setting	x	x	-	The value in this field (p3510) is determined automatically from the defined operating voltage.
Supply/DC-link identification	x	x	-	If the line supply / DC-link identification has already been performed once, then the value is preset to "OFF".
Operating mode for ALM	x	-	-	Presetting of the operating mode is dependent upon the operating voltage of the ALM: > 415 V_{eff} = Udc Unregulated (Smart Mode) active ≤ 415 V_{eff} = Udc Regulated (Active Mode) active

Setting the line data and operating mode

The parameters in this screen form are assigned default values when creating the device.

1. Enter a value for the device supply voltage in the "Device supply voltage" field (p0210).
2. To activate the line/DC link identification, in the drop-down list "Supply/DC link identification", select option "On".

Selecting the operating mode for ALM

The operating mode depends on the motor voltage.

Example: The DC-link voltage must be lower in the USA. For this reason, you can switch the mode of an Active Line Module in order to be able to use it as a Smart Line Module (Smart Mode). You can set the operating mode in this screen form for operating voltages greater than 415 V_{rms} (ALM).

1. Set one of the two operating modes:
   - "Udc Unregulated (Smart Mode)"
     In Smart Mode, the regenerative capability is maintained, but this results in a lower DC-link voltage compared to Active Mode. The DC-link voltage depends on the current supply voltage.
   - "Udc Regulated (Active Mode)"
     In Active Mode, the DC-link voltage is regulated to a settable setpoint (p3510) to produce a sinusoidal supply current (cos φ = 1). The size of the reactive current is also regulated and can be set specifically.

7.2.4 Enable logic

Overview

You can connect several signal sources for the enable signals in the function view of the "Enable logic" screen form.

Interconnecting signal sources for the enable signals

To interconnect the signal sources for the enable signals, proceed as follows:

1. Interconnect the signal source via "p0840" for "OFF1 (low active)".
2. Connect the 1st signal source via "p0844" for "Instantaneous OFF (OFF2) signal source 1".
3. Connect the 2nd signal source via "p0845" for "Instantaneous OFF (OFF2) signal source 2".
4. Interconnect the signal source via "p0852" for "Enable operation".

7.2.5 Line contactor control

Overview

This function allows an external line contactor to be controlled. The closing and opening of the line contactor can be monitored by evaluating the feedback contact of the line contactor.

The line contactor can be controlled with the following drive objects via r0863.1:

- For the infeed drive object
- For the SERVO and VECTOR drive objects

Parameterizing the switch-on delay and the monitoring time

This dialog shows the enable interconnection of the line contactor.

1. Enter in the "Power unit / switch-on delay" (p0862) field, the switch-on delay.
2. Enter the monitoring time of the network contactor in the "Line contactor / monitoring time" field (p0861).
   The monitoring time starts with each switching operation of the line contractor (r0863.1). If no feedback from the line contactor is detected within this time, a message is issued.
3. Connect the binector input for "Line contactor feedback" (p0860).
   Use for activated monitoring (BI: p0860 not equal r0863.1), the BO: r0863.1 signal of the dedicated drive object for controlling the line contactor.
4. Connect the binector output for "Control contactor (r0963.1)".

7.3 Drive axes

7.3.1 SERVO drives

7.3.1.1 Basic parameterization of the drive axes

During the basic configuration, not all of the available options are displayed in the drop-down list "Basic parameterization". Options are either not displayed at all (e.g. mechanical options), or are shown grayed out. In this case, options that are grayed out are not available for parameterization. The following table lists the available options for the basic parameterization of a SERVO drive axis or axes – and the dependency regarding display and selectability of options during the basic parameterization.

Note

Dynamic display and selectability of options

The display and/or selectability of certain options is dynamic, and depends on the settings, which are carried out within an option other than the required option.

The following table provides an overview of the maximum number of options of the basic parameterization and lists the conditions under which individual options can be displayed and selected.

Table 7-1 Basic parameterization: selectable options

Option	"Basic parameterization" list	
	Is displayed	Selectable
Function modules	x	x
Control type	x	x
Limits	x	x
Sampling times/pulse frequency	x	x
Actual value processing[1)]	x	-
Rotor position synchronization[1)]	x	-
Mechanical system[2)]	-	-
Enable logic	x	x

[1)] Can be selected if a SERVO motor with encoder was configured.

[2)] Is displayed and is selectable if either the "Basic positioner" or "Closed loop position control" function module was activated (see Chapter "Function modules (Page 139)").

Precondition

- The SERVO drive axis is OFFLINE.

7.3.1.2 Function modules

Overview

When required, during the basic parameterization you can switch-in various function modules for the selected drive axis.

Requirement

- The drive axis is offline.

Note

You can activate or deactivate function modules only offline.

Function description

Note

The display of the function modules that can be activated is **dynamic** and depends on the selected drive axis and the configuration of this drive axis.

The following table provides an overview of the function modules that can be used. In addition to the individual function modules, the table includes an explanations of how each function module can be used.

Function module	Explanation
Frequently used function modules	
Extended setpoint channel (r0108.8)	Activates the "Setpoint channel" area with 7 configuration screen forms.
Technology controller (r0108.16)	Activates the "Technology controller" area with 4 configuration screen forms.
Basic positioner (r0108.4)	In the "Technology functions" area, activates the "Basic positioner" and "Position control" functions. Supplements the "Basic parameterization" area to include the "Mechanical system" function.
Extended messages/monitoring functions (r0108.17)	In the "Drive functions" area, supplements the "Messages and monitoring" function to include the "Load torque monitoring" function.
Extended brake control (r0108.14)	In the "Drive functions" area, adds the "Brake control" function.
Additional function modules	
Free function blocks (r.0108.18)	Activates the F blocks.
Moment of inertia estimator / OBT	Activates the moment of inertia estimator.
Extended torque control (r0108.1)	In the "Technology functions" area, activates the "Extended torque control" function
Advanced Positioning Control (APC) (r0108.7)	In the "Technology functions" area, activates the "Active oscillation damping (APC)".
Extended current setpoint filter (r0108.21)	In the "Open-loop/closed-loop control" area, extends the "Current setpoint filter" to include an additional 6 filters.
Recorder	Allows fault events to be recorded.

Function module	Explanation
Position control (r0108.3)	In the "Technology functions" area, activates the "Position controller" function. Also supplements the "Basic parameterization" area to include the "Mechanical system" function.
DSC with spline (r0108.6)	In the "Open-loop/closed-loop control" area, extends the interconnection of the "Speed precontrol" function. Adds the "Dynamic Servo Control" secondary screen form.
Extended stop and retract (r0108.9)	In the "Setpoint channel" area, activates the "Extended stop and retract" function.
Cogging torque compensation (r0108.22)	In the parameter view, activates all parameters of the "Cogging torque compensation" parameter group. Cogging torque compensation can only be parameterized via the parameter view. **Note:** The activation of this function module leads to a significant increase in the required computing time per drive axis. The operation of 6 servo axes on one Control Unit can no longer be guaranteed in all constellations and should be reduced to 5 axes.

Activating function modules

Proceed as follows to activate a function module:

1. Click on the desired function module (e.g. technology controller).
   Repeat this step for all additional function modules that you wish to activate.

   Note

   When the "basic positioner" function module is activated, then the "position control" function module is automatically activated as well.

2. Save the project to back up the settings.

7.3.1.3 Control mode

Overview

Speed control (with and without encoder) and torque control are available for SERVO drives.

Speed control

The speed control of a variable-speed drive has the task of following the speed according to a specified setpoint (reference variable) as precisely as possible and without overshoot.

Torque control

The torque control has the task of ensuring that the torque actual value tracks the torque setpoint as precisely as possible, i.e. without any delay and with low associated ripple. For this control type, the torque is the command variable.

Requirement

- You have completely specified and configured the motor used in the device configuration of the drive axis.

Note

This basic parameterization cannot be performed without having completed this full configuration.

Selecting the control type

To select a control type, proceed as follows:

1. Select one of the following control types (p1300) in the drop-down list:
   - Speed control with encoder
   - Speed control without encoder
   - Torque control with encoder

If you selected a control type with encoder, the encoder is now shown in the diagram.

7.3.1.4 Limits

Overview

You define the basic attributes of the drive control using the "Limits" function.

Parameters	Designation	Description
p1121	Ramp-down time	Ramp-down time which the drive requires to decelerate from maximum speed (p1082) to standstill.
p1135	OFF3 ramp-down time	The OFF3 ramp-down time sets the ramp-down time from maximum speed down to standstill for the OFF3 command.

Requirement

- You have completely specified and configured the motor used in the device configuration of the drive axis.

Note

This basic parameterization cannot be performed without having completed this full configuration.

7.3.1.5 Drive settings

Overview

No entries are required on this page for motors with DRIVE-CLiQ interface or motors of the motor database.

Requirement

- You have completely specified and configured the motor used in the device configuration of the drive axis.

Note

This basic parameterization cannot be performed without having completed this full configuration.

Setting the calculation of the drive functions

To set the calculation of the drive functions, proceed as follows:

1. Select one of the following applications in the "Technology application" (p0500) drop-down list:
   - [100] Standard drive (servo)
   - [101] Feed drive (limit current limitation)
   - [102] Spindle drive (rated current limitation)
   - [103] Feed drive (maximum power limitation)
2. In the "Motor data identification stationary" (p1910) drop-down list, select how the motor data identification is to be performed for a stationary motor:
   - [-3] Accept identified parameters
   - [-2] Encoder inversion actual value (F07993)
   - [-1] Start motor data identification without acceptance
   - [0] Inactive/block
   - [1] Start motor data identification with acceptance

Setting the calculation of the controller data

To set the calculation of the controller data, proceed as follows:

1. Select one of the following options for the calculation of the controller data in the "Calculation controller data" (p3940) drop-down list:
   - [0] No calculation
     The motor data is not calculated. This is the default setting.
   - [1] Complete calculation
     The equivalent circuit diagram data is also calculated using the motor data.
   - [2] Calculation without equivalent circuit diagram data
     The equivalent circuit diagram data entered during the parameter assignment of the motor is not changed. The equivalent circuit diagram data is not calculated.
2. After the calculation type has been set (exception: "No calculation"), you can confirm the calculation if this has not been done already (red status symbol).
   To do this, click the "Confirm calculation" button.
   The "Technology application" option is then disabled for the drive functions and the set application can no longer be changed. The disable can be cancelled via the "Enable" button.
   If you have canceled the disable, then you must subsequently reconfirm the calculation type.

7.3.1.6 Sampling times/pulse frequency

Overview

From a pulse frequency of 800 Hz and higher, we recommend that you enter the sampling times and the pulse frequency for the drive.

Note

You can only activate or deactivate the "Sampling times/pulse frequency" function when you are offline.

Setting the defaults

The sampling times are preset via parameter p0112. To make the presettings, proceed as follows:

1. Select one of the following defaults via the drop-down list (p0112):
   - [0] Expert
   - [1] xLow
   - [2] Low
   - [3] Standard
   - [4] High
   - [5] xHigh

   The designation of the defaults refer to the desired output frequency and control dynamic response. If a particularly high output frequency or control dynamic response is required, "xHigh" would be the correct default. The selected default affects the following control loops:
   - p0115[0]: Sampling times for internal control loops, current controller
   - p0115[1]: Sampling times for internal control loops, speed controller
   - p0115[2]: Sampling times for internal control loops, flux controller
   - p0115[3]: Sampling times for internal control loops, setpoint channel
   - p0115[4]: Sampling times for internal control loops, position controller
   - p0115[5]: Sampling times for internal control loops, positioning
   - p0115[6]: Sampling times for internal control loops, technology controller

   The display of the parameter values set for p0115 changes depending on the default setting made.

   Note

   If the sampling times of the current controller and speed controller are changed (see also p0115), it is recommended that the controller settings are recalculated via p0340 = 4 after the commissioning (p0010 = 0).

Entering the sampling times manually

If you have set "Expert" in p0112, you can manually configure each of the following sampling times for the following control loops (p0115):

- p0115[0]: Sampling times for internal control loops, current controller
- p0115[1]: Sampling times for internal control loops, speed controller
- p0115[2]: Sampling times for internal control loops, flux controller
- p0115[3]: Sampling times for internal control loops, setpoint channel
- p0115[4]: Sampling times for internal control loops, position controller
- p0115[5]: Sampling times for internal control loops, positioning
- p0115[6]: Sampling times for internal control loops, technology controller

Note

You cannot set the values arbitrarily. The rules for setting the sampling times can be found in Chapter "System rules, sampling times and DRIVE-CLiQ wiring" of the SINAMICS S120 Function Manual Drive Functions.

Enter the sampling times for the internal control loops.

Setting the pulse frequency

Set the pulse frequency via p1800.

7.3.1.7 Actual value processing

Overview

The actual value processing is used to determine the cyclic and absolute actual values of the encoder, and to transfer the encoder position from the drive to an open-loop control/position control.

Preparing actual values

To transfer the encoder position from the drive to an open-loop control / position control, the "Cyclical actual value" = Gn_XIST1 and "Absolute actual value" = Gn_XIST2 (n = 1 or 2, number of the encoder) data is used in a telegram. The values can be set only for absolute encoders.

- The incremental position change of the encoder is transferred to the controller in the "Cyclical actual value" Gn_XIST_1. The drive evaluates only the counting pulses of the encoder, which it then uses to form the "Cyclical actual value".
- The cyclical values of the encoder requested by the controller prior to the transfer are not transferred in the "Absolute actual value" = Gn_XIST2.

Gn_XIST_1 and Gn_XIST_2 contain the following information:

- Encoder pulse count (Gn_XIST_1)
- Fine resolution (Gn_XIST_1)
- Multiturn information (Gn_XIST_2)

Fine resolution p0419 (XIST_1)

Encoders with their sampling mechanism provide significantly more precise information than that determined with the pulse counts. They can be evaluated by the drive unit and transferred as fine resolution to the controller. Change the fine resolution, for example, when increased precision is required for machining a workpiece.

Fine resolution for incremental encoders

For incremental encoders, the analog signals of the C and D tracks are evaluated. A position value is determined uniquely via the two analog voltage values in all four quadrants of a revolution. The analog voltage values allow a high fine resolution, e.g. 11 bits = 2048. Together with a resolution of 11-bit (= 2048) encoder pulses per revolution this gives a 22-bit resolution.

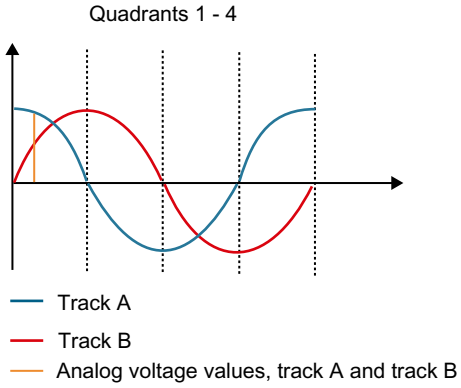


Figure 7-3 Incremental encoders

Fine resolution for TTL/HTL encoders

TTL/HTL pulse encoders operate with digital signals whose fine resolution is less-precise than that for incremental encoders. The digital signals permit only a fine resolution of 2 bits = 4, because only the signal edges can be counted here.

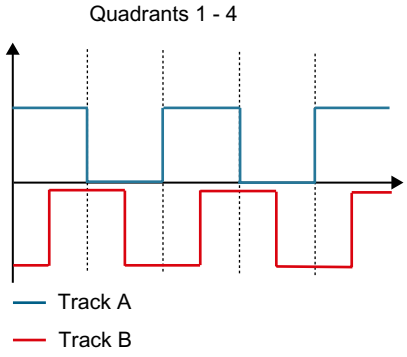


Figure 7-4 TTL/HTL encoders

Multiturn resolution XIST_2 (p0421)

For multiturn encoders, the number of resolvable revolutions is displayed and set via the resolution. With the number of revolutions, you also specify the measuring range (for example, the travel path for a spindle). Typical values are, for example, 9 bits = 512 revolutions or 12 bits = 4096 revolutions.

The value of p0421 acts on p0483 (actual position value) and is required once only when the encoder position (absolute position) is read at start-up.

Relationship between multiturn resolution and fine resolution

The encoder actual values transferred from the drive to the controller are limited to 32 bits. If, for example, a standard multiturn encoder with a multiturn resolution of 12 bits (4096) and an encoder resolution of 11 bits (2048) is used, the encoder actual value is reduced to only 32-12-11=9 bits (512) for transferring the fine resolution.

If a higher fine resolution needs to be transferred in the encoder actual value, the multiturn resolution of the encoder actual value must be reduced, which although it increases the precision of the encoder, it also decreases the absolute measuring range of the encoder.

1. Enter here the fine resolution of the encoder used in bits. The pre-setting is 11 bits and is sufficient for all Siemens motor encoders.
2. The multiturn resolution is set to 9 bits for all Siemens motor encoders and does not need to be adjusted.

Should you nevertheless need a higher fine resolution, it is important to note that, in the case of incremental encoders, the position values of the multiturn resolution still lie within one of the quadrants (see graphic above). The following graphic shows the interaction between multiturn information and fine resolution. Increasing the fine resolution moves the value of the multiturn information to the left.

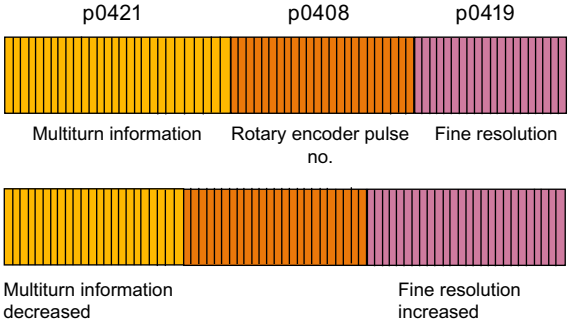


Figure 7-5 Encoder actual values X_IST1

It is important that the multiturn information is still sufficient to record all revolutions which are important for determining the position at start-up. If all values lie outside the quadrants, uncontrolled movements of the axis can occur.

Parameterizing actual value processing

To parameterize the actual value processing, proceed as follows.

Requirement

- The motor used in the device configuration of the drive axis is completely specified and configured.

Note

This basic parameterization cannot be performed without having completed this full configuration.

Extrapolating position values

This parameter is displayed only for pure SSI encoders, namely, for encoders without HTL/TTL or SIN/COS tracks. Because, compared with the speed controller cycle of the SINAMICS, the serial transfer is relatively slow, the data can already be obsolete on arrival at the Sensor Module. If the data transfer is not fast enough, you may need to switch to encoders with a faster data transmission rate.

1. Activate "Extrapolate position values " in order to extrapolate the SSI data for the next speed controller cycle.
   - Advantage: The dead time between two speed controller cycles reduces and the closed-loop controller becomes more dynamic.
   - Disadvantage: For fluctuating speeds, the extrapolated value accuracy can vary.
2. Evaluate the advantages and disadvantages carefully.
3. Also check the deployed baud rate. A higher baud rate may allow a sufficiently fast data transmission.

Inverting values

As the mounting direction of the encoder (at the right- or left-hand side) cannot be defined, but depends on the specific motor being used (linear motor, torque motor, etc.), where appropriate, invert the position and the speed in order to reverse the direction.

1. Select the "Actual speed value inverted" option (p0410.0)
2. Select the "Actual position value inverted" option (p0410.1)

Parameterizing the measuring gearbox position tracking

Position tracking enables the load position to be reproduced when using gearboxes. It can also be used to extend the position range.

1. Activate the position tracking for measuring gearboxes.
2. Select whether the position tracking should be made for a rotary axis or linear axis (p0411). A rotary axis is considered to be a modulo axis (modulo correction can be activated by a higher-level controller or EPOS). For a linear axis, the position tracking is used principally to extend the position range (see "Virtual multiturn resolution").

Virtual multiturn resolution

With a rotary absolute encoder (p0404.1 = 1) with activated position tracking (p0411.0 = 1), the virtual multiturn resolution (p0412) can be used to enter a virtual multiturn resolution. This makes it possible to generate a virtual multiturn encoder (r0483) from a singleturn encoder. The virtual encoder range must be able to be represented via r0483.

When no measuring gearboxes (n = 1) are present, the value in p0421 replaces the actual number of stored revolutions of a rotary absolute encoder. Increasing this value extends the position range (see linear axis). When measuring gearboxes are present, this value sets the resolvable motor revolutions represented in r0483.

Tolerance window

After switch on, the difference between the stored position and the current position is determined and initiated depending on the following:

- Difference within the tolerance window: The position is reproduced based on the current encoder actual value.
- Difference outside the tolerance window: Message F07449 is issued.
- The tolerance window is preassigned to the encoder range quadrant, although it can be changed.

7.3.1.8 Rotor position synchronization

Overview

For synchronous motors, the pole position identification (PolID) determines the electrical pole position that is required for the field-oriented control. Normally, the electrical pole position is provided with absolute information by a mechanically adjusted encoder.

Note

The content of the "Rotor position synchronization" screen form depends on the encoder used.

A PolID is not required for the following encoder properties:

- Absolute encoder (e.g. EnDat, DRIVE-CLiQ encoder)
- Encoder with C/D track and number of pole pairs ≤ 8
- Hall sensor
- Resolver with integer ratio from the number of motor pole pairs to the number of encoder pole pairs
- Incremental encoder with an integer ratio from the number of motor pole pairs to the number of encoder pulses

Note

Using the Function Manual

Please also refer to the description of the pole position identification provided in the "SINAMICS S120 Function Manual Drive Functions". The supplementary conditions for using the individual techniques are also described in the appropriate chapter.

Determining the suitable technique for the pole position identification

⚠ WARNING

Danger to life caused by the movement of the motor when measuring unbraked motors

When carrying out the measurement for motors that are not braked, the current that flows can cause the motor to move, which in turn can lead to death or severe injuries.

- Ensure that nobody is present in the hazardous zone and that the mechanical system can move freely.

	Saturation-based	Motion-based	Elasticity-based
Brake available	Possible	Not possible	Required
Motor can move freely	Possible	Required	Not possible
Motor has no iron	Not possible	Possible	Possible

Parameterizing the pole position identification

The pole position identification (PolID) differs depending on the motor type:

- For SIEMENS motors
- For motors that are not listed in the motor selection.

Requirement

- You have completely specified and configured the motor used in the device configuration of the drive axis.

Note

This basic parameterization cannot be performed without having completed this full configuration.

Procedure for SIEMENS motors

When using standard Siemens use the automatic default setting for the PolID.

Procedure for motors that are not listed in the motor selection

For these motors, you must parameterize the pole position identification yourself.

1. Select a suitable technique for the motor used in the "Technique" (p1980) drop-down list.
   - [0] Saturation-based 1st + 2nd harmonics
     The saturation-based pole position identification is the preferred technique if it is not possible that the motor moves.
     The saturation-based PolID technique only functions for motors with an iron core. As a result of the iron saturation, depending on the rotor position, the motor inductance changes in various space-vector directions.

     ⚠ WARNING

     Danger to life due to uncontrolled motor movement

     During the saturation-based pole position identification, if a motor is not braked, it can move in an uncontrolled fashion, which can result in death or serious injury.
     - Ensure that nobody is present in the hazardous zone and that the mechanical system can move freely.
     - Ensure that this technique is only performed by appropriately trained and experienced technical experts.

     Note

     Contact the SIEMENS service organization if you are **not** familiar and trained in using this technique.

   - [1] Saturation-based 1st harmonic
   - [4] Saturation-based 2-stage
   - [10] Motion-based
     The motion-based PolID technique is the preferred technique if the motor can move. The motor traverses left and right along a defined path. If both paths are identical, the pole position identification (PolID) was successful.
   - [20] Elasticity-based
   - [99] No technique selected
2. Select the "Pole position identification" option to activate the technique.

Result

Why was synchronization **not** successful?

- The motor provides insufficient or no torque.
- The motor becomes hot too fast.

Fine synchronization

The pole position identification (PolID) technique provides coarse synchronization. If zero marks are present, after traversing the zero mark(s), the pole position is calibrated automatically with the zero mark position (fine synchronization). The zero mark position must be calibrated mechanically or electrically (p0431). If the encoder system permits this calibration, a fine synchronization is recommended (p0404.15 = 1) because it avoids measurement spreads and permits an additional test of the determined pole position.

Suitable zero marks are:

- A zero mark in the complete traversing range
- Equidistant zero marks
- Distance-coded zero marks

7.3.1.9 Mechanical system

Overview

In the "Mechanical system" screen form, check the settings of the position control and adjust them if necessary. Depending on the encoder type selected for position control and the motor encoder, various configurations are displayed for the mechanical system.

The "Position tracking" option allows the load position to be reproduced when using gearboxes. This option can also be used to extend the position range. The position tracking of the load gear however, is only relevant for a motor encoder (encoder 1).

Parameterizing encoder selection for position control

An encoder is assigned to the position control during commissioning. This encoder setting is shown in a drop-down list at the top right in the "Mechanical system" screen form. You can change the encoder assignment in this screen form before parameterizing the position control. The following options are available:

1. Select the required encoder in the "Encoder system" (p2502) drop-down list.
   - No encoder
   - Encoder 1
   - Encoder 2
   - Encoder 3
2. Enter the motor revolutions for the gear ratio between the motor shaft and load shaft in the "Number of motor revolutions" (p2504) field.
3. Enter the load revolutions for the gear ratio between the motor shaft and load shaft in the "Number of load revolutions" (p2505) field.
4. Enter the neutral length unit LU per load revolution in the "LU per load revolution" (p2506) field.

5. Interconnect the "Modulo correction activation" (p2577) signal source for the activation of the modulo correction.
6. Correct the default value for axes with modulo correction in the "Modulo correction modulo range" (p2576) field.

Parameterizing the load gearbox position tracking

If you have parameterized encoder 1 for the position control, you can set the position tracking as follows:

1. Activate the "Activate load gearbox position tracking" (p2729.0) option.
2. Activate the desired axis type (p2720.1).
   By default, the "Rotary axis" axis type is active.
3. If required, correct the number of resolvable revolutions for a rotary absolute encoder in the "Virtual revolutions" (p2721) field.
4. If required, correct the value for the tolerance window for the position tracking in the "Position tracking tolerance window" (p2722) field. The value is specified in whole encoder pulses.

Examples of LU configurations

The unit LU is a free dimension, independent of SI units, for the position control of an EPOS axis.

The LU per load revolution upper limit is limited by the encoder resolution (rXXXX). A value above this limit can be selected, but then not all set positions can be approached because they may be between two encoder lines. This could result in an unsmooth axis.

The LU per load revolution should be selected as high as possible. In this way, a better dynamic response can be achieved. If the values for p2506 are too low, this can result in jumps when speed precontrol is activated.

For good repeat accuracy, the LU per load resolution should be selected in the ratio of 1:10 to the encoder resolution, if the encoder supports this resolution at the required dynamic response.

Example 1: Linear axis – spindle (encoder on the motor side)

Leadscrew pitch = 10 mm

Gear ratio i = 1 (p2505 / p2504)

Target variable to be controlled: mm

Encoder resolution = 15,000 LU

10 mm distance are travelled per load revolution. According to the encoder resolution, maximum 15,000 LU/10 mm = 1,500 LU/mm can be defined. We will select 1,000 LU per mm (1 LU = 1 µm). 10 mm per revolution results in 10,000 per revolution:

- p2506 = 10,000 LU per load revolution

Example 2: Rotary axis (encoder on the motor side)

Gear ratio i = 44.5

- p2504 = 445 motor revolutions
- p2505 = 10 load revolutions

Target variable to be controlled: ° (degrees)

Encoder resolution = 364,544 LU

360° are travelled per load revolution. According to the encoder resolution, maximum 364,544 LU/360° = 1012 LU/° can be defined. We will select 100 LU per ° (1 LU = 0.01°). 360° per revolution results in 36,000 LU per load revolution.

- p2506 = 36,000 LU per load revolution

Example 3: Modulo axis – chain drive

The chain has 250 chain links and a chain link is 0.0338667344 m long. The output wheel has 40 teeth, i.e. 40 chain links are moved per revolution. The target positions are at a distance of 25 chain links to one another.

Gear ratio i = 114.28 (rounded off)

Ratio of the number of teeth of the gearbox = 106,967/936

- p2504 = 106,967 motor revolutions
- p2505 = 936 load revolutions

Encoder resolution = 468,095 LU

The encoder resolution is too low here to convert the chain links to a linear SI unit without rounding-off errors having an effect on the modulo correction. A chain link must therefore be taken as target variable.

Target variable to be controlled: 1 chain link

40 chain links travelled per load revolution. According to the encoder resolution, maximum 468,095 LU / 40 chain links = 11,702 LU / chain link can be selected. We will therefore select 1,000 LU per chain link (1 LU = 33.8667344 µm). 40 chain links per revolution results in:

- p2506 = 40,000 LU per load revolution
- p2576 = 250,000 LU modulo range

Examples of LU configurations

The unit LU per load revolution is a free dimension, independent of SI units, for the position control of an EPOS axis.

The LU per load revolution upper limit is limited by the encoder resolution (rXXXX). A value above this limit can be selected, but then not all set positions can be approached because they may be between two encoder lines. This could result in an unsmooth axis.

The LU per load revolution should be selected as high as possible. In this way, a better dynamic response can be achieved. If the values for p2506 are too low, this can result in jumps when speed precontrol is activated.

For good repeat accuracy, the LU per load revolution should be selected in the ratio of 1:10 to the encoder resolution, if the encoder supports this resolution at the required dynamic response.

Example 1: Linear axis – spindle (encoder on the motor side)

Leadscrew pitch = 10 mm

Gear ratio i = 1 (p2505/p2504)

Target variable to be controlled: mm

Encoder resolution = 15,000 LU

10 mm distance are travelled per load revolution. According to the encoder resolution, maximum 15,000 LU/10 mm = 1,500 LU/mm can be defined. We will select 1,000 LU per mm (1 LU = 1 µm). 10 mm per revolution results in 10,000 per revolution:

- p2506 = 10,000 LU per load revolution

Example 2: Rotary axis (encoder on the motor side)

Gear ratio i = 44.5

- p2504 = 445 motor revolutions
- p2505 = 10 load revolutions

Target variable to be controlled: °

Encoder resolution = 364,544 LU

360° are travelled per load revolution. According to the encoder resolution, maximum 364,544 LU/360° = 1012 LU/° can be defined. We will select 100 LU per ° (1 LU = 0.01°). 360° per revolution results in 36,000 LU per load revolution.

- p2506 = 36,000 LU per load revolution

Example 3: Modulo axis – chain drive

The chain has 250 chain links and a chain link is 0.0338667344 m long. The output wheel has 40 teeth, i.e. 40 chain links are moved per revolution. The target positions are at a distance of 25 chain links to one another.

Gear ratio i = 114.28 (rounded off)

Ratio of the number of teeth of the gearbox = 106,967/936

- p2504 = 106,967 motor revolutions
- p2505 = 936 load revolutions

Encoder resolution = 468,095 LU

The encoder resolution is too low here to convert the chain links to a linear SI unit without rounding-off errors having an effect on the modulo correction. A chain link must therefore be taken as target variable.

Target variable to be controlled: 1 chain link

40 chain links travelled per load revolution. According to the encoder resolution, maximum 468,095 LU/40 chain links = 11,700 LU/chain link can be selected. We will therefore select 1,000 LU per chain link (1 LU = 33.8667344 µm). 40 chain links per revolution results in:

- p2506 = 40,000 LU per load revolution
- p2576 = 250,000 LU modulo range

7.3.1.10 Enable logic

Overview

If, when commissioning, you interconnected telegrams, then these interconnections are displayed in the "Enable logic" screen form. Further specification is not required.

If, when commissioning, you did not specify any telegram types, then you must interconnect the required signal sources in the "Enable logic" screen form.

Interconnecting signal sources

To interconnect a signal sources, proceed as follows:

1. Connect the signal source for the "Infeed operation" (p0864) command.
2. Interconnect the signal source for command "OFF1 (low active)" (p0840).
   This command corresponds to control word 1 bit 1 (STW1.1) in the PROFIdrive profile.
3. Connect the 1st signal source for the "OFF2 (low active) signal source 1" command (p0844).
   This command corresponds to control word 1 bit 1 (STW1.1) in the PROFIdrive profile.
4. Connect the 2nd signal source for the "OFF2 (low active) signal source 2" command (p0845).
5. Connect the 1st signal source for the "OFF3 (low active) signal source 1" command (p0848).
   This command corresponds to control word 1 bit 2 (STW1.2) in the PROFIdrive profile.
6. Connect the 2nd signal source for the "OFF3 (low active) signal source 2" command (p0849).
   This command corresponds to control word 1 bit 2 (STW1.2) in the PROFIdrive profile.
7. Interconnect the signal source for the "Enable operation" command (p0852).
   This command corresponds to control word 1 bit 3 (STW1.3) in the PROFIdrive profile.

7.3.2 VECTOR drives

7.3.2.1 Basic parameterization of the drive axes

During the basic configuration, not all of the available options are displayed in the drop-down list "Basic parameterization". The following table lists the available options for the basic parameterization of a VECTOR drive axis or axes – and the dependency regarding display and selectability of options during the basic parameterization.

Note

Dynamic display of options

The display of certain options is dynamic, and depends on the settings, which are carried out within another option other than the required option. In the "Basic parameterization" list, the "Mechanical system" option is only displayed if beforehand, the "Basic positioner" function module was activated (see Chapter "Function modules (Page 157)").

Precondition

- The VECTOR drive axis is OFFLINE.

7.3.2.2 Function modules

Overview

When required, during the basic parameterization you can switch-in various function modules for the selected drive axis.

Note

You can activate or deactivate function modules only offline.

Note

The display of the function modules that can be activated is dynamic and depends on the selected drive axis and the configuration of this drive axis.

The following table provides an overview of the function modules that can be used. In addition to the individual function modules, the table includes an explanations of how each function module can be used.

Function module	Explanation	S120 VEC-TOR	S150	G150	G130
Frequently used function modules					
Extended messages/monitoring functions (r0108.17)	In the "Drive functions" area, supplements the "Messages and monitoring" function to include the "Load torque monitoring" function.	X	X	X	X

Function module	Explanation	S120 VEC-TOR	S150	G150	G130
Technology controller (r0108.16)	Activates the "Technology controller" area with 4 configuration screen forms.	X	X	X	X
Speed/torque control (r0108.2)	In the "Drive functions" area, supplements the "Friction characteristic" function to include 2 configuration screen forms. In the "Open-loop/closed-loop control" area, supplements the configuration screen forms to include the following functions. • Speed setpoint filter • Speed controller • Torque setpoints • Current setpoint filter • Flux setpoint • Current controller • Motor encoder **Note:** The "Motor encoder" configuration screen form is only displayed if the motor was configured with an encoder. As default setting, the function module is activated.	X	X	X	X
Extended brake control (r0108.14)	In the "Drive functions" area, adds the "Brake control" function.	X	X	X	X
Basic positioner (r0108.4)	In the "Technology functions" area, activates the "Basic positioner" and "Position control" functions. Supplements the "Basic parameterization" area to include the "Mechanical system" function.	X	X	-	-
Additional function modules					
Free function blocks (r0108.18)	Activates the F blocks.	X	-	-	-
Recorder (r0108.5)	Allows fault events to be recorded.	X	X	X	X
Moment of inertia estimator (r0108.10)	In the "Open-loop/closed-loop control" area, adds the "Speed setpoint filter" function. The moment of inertia estimator can now be activated in the "Precontrol" subdialog. The dialog is extended by additional parameters for the moment of inertia estimator.	X	X	X	X
Position control (r0108.3)	In the "Technology functions" area, activates the "Position controller" function. Also supplements the "Basic parameterization" area to include the "Mechanical system" function.	X	X	-	-

Requirement

- The drive axis is offline.

Note

The basic parameterization for the selected drive axis can only be carried out offline.

Activating a function module

Proceed as follows to activate a function module:

1. Click on the desired function module (e.g. technology controller).
   Repeat this step for all additional function modules that you wish to activate.

   Note

   When the "basic positioner" function module is activated, then the "position control" function module is automatically activated as well.

2. Save the project to back up the settings.

7.3.2.3 Control mode

Overview

The following control modes are available for vector drives:

- U/f control with linear characteristic
- U/f control with linear characteristic and FCC
- U/f control with parabolic characteristic
- U/f control with parameterizable characteristic
- U/f control with linear characteristic and ECO
- U/f control for drive requiring a precise frequency (e.g. textiles)
- U/f control for drive requiring a precise frequency and FCC
- U/f control with parabolic characteristic and ECO
- Operation with braking resistor
- I/f control with fixed current
- U/f control with independent voltage setpoint
- Speed control (without encoder)
- Speed control (with encoder)
- Torque control (without encoder)
- Torque control (with encoder)

Requirement

- The motor used in the device configuration of the drive axis is completely specified and configured.

Note

This basic parameterization cannot be performed without having completed this full configuration.

Selecting the control type

Select one of the control types listed above (p1300).

The screen form is structured according to the selected control type.

Note

If a "U/f control xxx" version is selected as the control type, other setting screen forms in the secondary navigation of the drive axis, such as current controller or current setpoint filter, are automatically hidden.

7.3.2.4 Limits

Overview

You define the basic attributes of the drive control using the "Limits" function.

Number	Designation	Description
p0640	Current limit	Determines the limit value of the motor overload current.
p1080	Minimum speed	Sets the lowest possible speed / velocity. This value is not fallen below in operation.
p1082	Maximum speed	Sets the highest possible speed / velocity. The value is calculated during the commissioning phase in accordance with the motor and drive unit and can only be equal to or less than the value in p0322 (maximum motor speed).
p1120	Ramp-up time	Ramp-up/ramp-down time always refers to the time interval from motor standstill to the set maximum speed (without using roundings).
p1121	Ramp-down time	
p1135	OFF3 ramp-down time	The OFF3 ramp-down time is effective from the maximum speed down to the motor stand-still.

Requirement

- The motor used in the device configuration of the drive axis is completely specified and configured.

Note

This basic parameterization cannot be performed without having completed this full configuration.

7.3.2.5 Optimization runs

Using the "Optimization run" function, you can calculate motor and controller data for motors in the motor list as well as for non-listed motors.

Requirements

- You have completely specified and configured the motor used in the device configuration of the drive axis.

Note

Specifying third-party (non-listed) motors

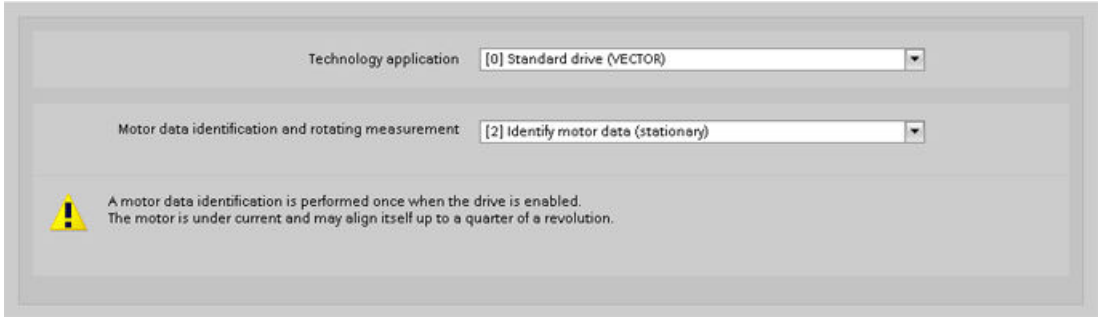
When third-party motors are specified, the motor data must be manually entered (see Chapter "Inserting and specifying motors that are missing from the motor list (Page 97)").

Note

This basic parameterization cannot be performed without having completed this full configuration.

Setting the technological application and selection of the motor data identification

1. Select one of the following applications in the "Technology application" (p0500) drop-down list:
   - [0] Standard drive (VECTOR)
   - [1] Pumps and fans
   - [2] Encoderless control down to f = 0 (passive loads)
   - [3] Dynamic response in the field-weakening range
   - [4] Approach with high breakaway torque
   - [5] High load inertia
2. In the drop-down list "Motor data identification and rotating measurement" (p1900), select how the motor data identification is to be carried out for a stopped motor:
   - [0] Disabled
   - [1] Motor data ident. (standstill) and speed controller opt.
   - [2] Motor data identification (standstill)



Motors from the motor list

For motors with DRIVE-CLiQ interface or motors from the motor list (see Chapter "Inserting and specifying motors from the motor list (Page 96)"), no additional entries are required when automatically calculating the motor/controller parameters.

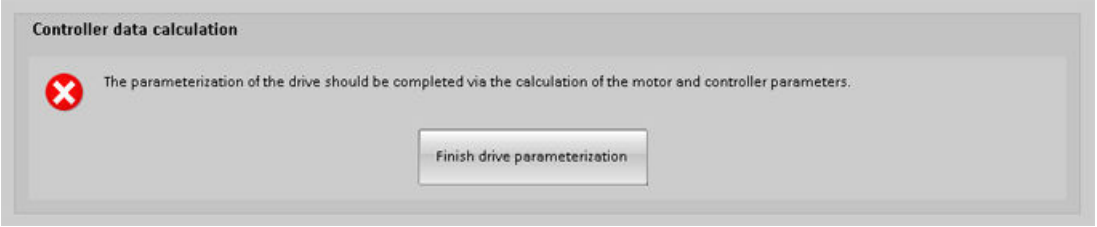
Third-party motors

Motor and controller parameters must first be calculated for third-party motors and motors that are not in the motor list.

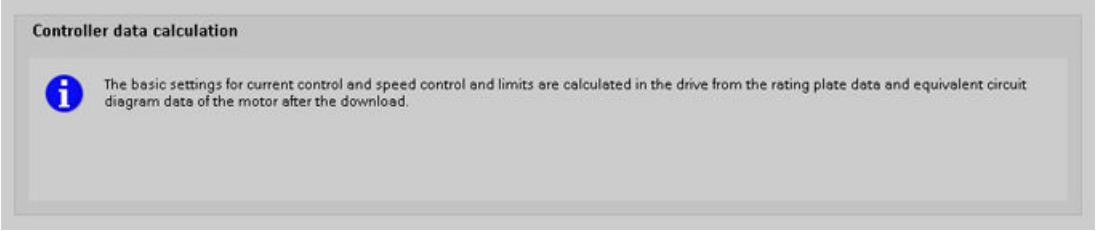
Procedure

Proceed as follows to finalize calculating motor and controller parameters:

1. In the "Controller data calculation" field, click on "Finish drive parameterization".



The automatic calculation of motor and controller parameters is completed and the following message displayed.



7.3.2.6 Actual value processing

Overview

The actual value processing is used to determine the cyclic and absolute actual values of the encoder, and to transfer the encoder position from the drive to an open-loop control/position control.

Preparing actual values

To transfer the encoder position from the drive to an open-loop control / position control, the "Cyclical actual value" = Gn_XIST1 and "Absolute actual value" = Gn_XIST2 (n = 1 or 2, number of the encoder) data is used in a telegram. The values can be set only for absolute encoders.

- The incremental position change of the encoder is transferred to the controller in the "Cyclical actual value" Gn_XIST_1. The drive evaluates only the counting pulses of the encoder, which it then uses to form the "Cyclical actual value".
- The cyclical values of the encoder requested by the controller prior to the transfer are not transferred in the "Absolute actual value" = Gn_XIST2.

Gn_XIST_1 and Gn_XIST_2 contain the following information:

- Encoder pulse count (Gn_XIST_1)
- Fine resolution (Gn_XIST_1)
- Multiturn information (Gn_XIST_2)

Fine resolution p0419 (XIST_1)

Encoders with their sampling mechanism provide significantly more precise information than that determined with the pulse counts. They can be evaluated by the drive unit and transferred as fine resolution to the controller. Change the fine resolution, for example, when increased precision is required for machining a workpiece.

Fine resolution for incremental encoders

For incremental encoders, the analog signals of the C and D tracks are evaluated. A position value is determined uniquely via the two analog voltage values in all four quadrants of a revolution. The analog voltage values allow a high fine resolution, e.g. 11 bits = 2048. Together with a resolution of 11-bit (= 2048) encoder pulses per revolution this gives a 22-bit resolution.

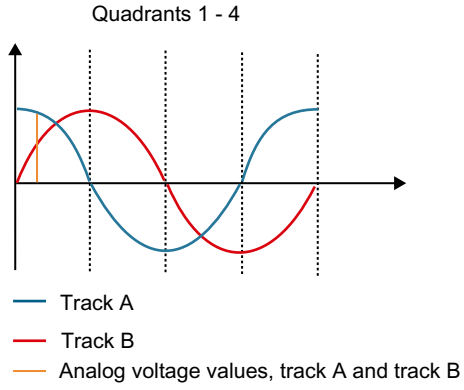


Figure 7-6 Incremental encoders

Fine resolution for TTL/HTL encoders

TTL/HTL pulse encoders operate with digital signals whose fine resolution is less-precise than that for incremental encoders. The digital signals permit only a fine resolution of 2 bits = 4, because only the signal edges can be counted here.

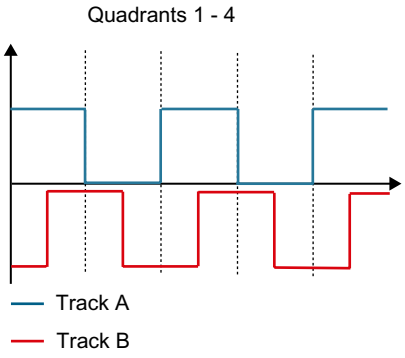


Figure 7-7 TTL/HTL encoders

Multiturn resolution XIST_2 (p0421)

For multiturn encoders, the number of resolvable revolutions is displayed and set via the resolution. With the number of revolutions, you also specify the measuring range (for example, the travel path for a spindle). Typical values are, for example, 9 bits = 512 revolutions or 12 bits = 4096 revolutions.

The value of p0421 acts on p0483 (actual position value) and is required once only when the encoder position (absolute position) is read at start-up.

Relationship between multiturn resolution and fine resolution

The encoder actual values transferred from the drive to the controller are limited to 32 bits. If, for example, a standard multiturn encoder with a multiturn resolution of 12 bits (4096) and an encoder resolution of 11 bits (2048) is used, the encoder actual value is reduced to only 32-12-11=9 bits (512) for transferring the fine resolution.

If a higher fine resolution needs to be transferred in the encoder actual value, the multiturn resolution of the encoder actual value must be reduced, which although it increases the precision of the encoder, it also decreases the absolute measuring range of the encoder.

1. Enter here the fine resolution of the encoder used in bits. The pre-setting is 11 bits and is sufficient for all Siemens motor encoders.
2. The multiturn resolution is set to 9 bits for all Siemens motor encoders and does not need to be adjusted.

Should you nevertheless need a higher fine resolution, it is important to note that, in the case of incremental encoders, the position values of the multiturn resolution still lie within one of the quadrants (see graphic above). The following graphic shows the interaction between multiturn information and fine resolution. Increasing the fine resolution moves the value of the multiturn information to the left.

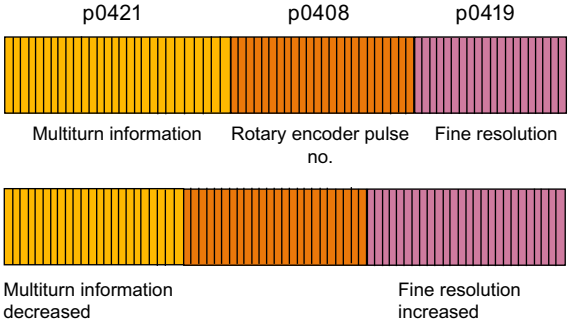


Figure 7-8 Encoder actual values X_IST1

It is important that the multiturn information is still sufficient to record all revolutions which are important for determining the position at start-up. If all values lie outside the quadrants, uncontrolled movements of the axis can occur.

Parameterizing actual value processing

To parameterize the actual value processing, proceed as follows.

Requirement

- The motor used in the device configuration of the drive axis is completely specified and configured.

Note

This basic parameterization cannot be performed without having completed this full configuration.

Extrapolating position values

This parameter is displayed only for pure SSI encoders, namely, for encoders without HTL/TTL or SIN/COS tracks. Because, compared with the speed controller cycle of the SINAMICS, the serial transfer is relatively slow, the data can already be obsolete on arrival at the Sensor Module. If the data transfer is not fast enough, you may need to switch to encoders with a faster data transmission rate.

1. Activate "Extrapolate position values " in order to extrapolate the SSI data for the next speed controller cycle.
   - Advantage: The dead time between two speed controller cycles reduces and the closed-loop controller becomes more dynamic.
   - Disadvantage: For fluctuating speeds, the extrapolated value accuracy can vary.
2. Evaluate the advantages and disadvantages carefully.
3. Also check the deployed baud rate. A higher baud rate may allow a sufficiently fast data transmission.

Inverting values

As the mounting direction of the encoder (at the right- or left-hand side) cannot be defined, but depends on the specific motor being used (linear motor, torque motor, etc.), where appropriate, invert the position and the speed in order to reverse the direction.

1. Select the "Actual speed value inverted" option (p0410.0)
2. Select the "Actual position value inverted" option (p0410.1)

Parameterizing the measuring gearbox position tracking

Position tracking enables the load position to be reproduced when using gearboxes. It can also be used to extend the position range.

1. Activate the position tracking for measuring gearboxes.
2. Select whether the position tracking should be made for a rotary axis or linear axis (p0411). A rotary axis is considered to be a modulo axis (modulo correction can be activated by a higher-level controller or EPOS). For a linear axis, the position tracking is used principally to extend the position range (see "Virtual multiturn resolution").

Virtual multiturn resolution

With a rotary absolute encoder (p0404.1 = 1) with activated position tracking (p0411.0 = 1), the virtual multiturn resolution (p0412) can be used to enter a virtual multiturn resolution. This makes it possible to generate a virtual multiturn encoder (r0483) from a singleturn encoder. The virtual encoder range must be able to be represented via r0483.

When no measuring gearboxes (n = 1) are present, the value in p0421 replaces the actual number of stored revolutions of a rotary absolute encoder. Increasing this value extends the position range (see linear axis). When measuring gearboxes are present, this value sets the resolvable motor revolutions represented in r0483.

Tolerance window

After switch on, the difference between the stored position and the current position is determined and initiated depending on the following:

- Difference within the tolerance window: The position is reproduced based on the current encoder actual value.
- Difference outside the tolerance window: Message F07449 is issued.
- The tolerance window is preassigned to the encoder range quadrant, although it can be changed.

7.3.2.7 Mechanical system

Overview

In the "Mechanical system" screen form, check the settings of the position control and adjust them if necessary. Depending on the encoder type selected for position control and the motor encoder, various configurations are displayed for the mechanical system.

The "Position tracking" option allows the load position to be reproduced when using gearboxes. This option can also be used to extend the position range. The position tracking of the load gear however, is only relevant for a motor encoder (encoder 1).

Parameterizing encoder selection for position control

An encoder is assigned to the position control during commissioning. This encoder setting is shown in a drop-down list at the top right in the "Mechanical system" screen form. You can change the encoder assignment in this screen form before parameterizing the position control. The following options are available:

1. Select the required encoder in the "Encoder system" (p2502) drop-down list.
   - No encoder
   - Encoder 1
   - Encoder 2
   - Encoder 3
2. Enter the motor revolutions for the gear ratio between the motor shaft and load shaft in the "Number of motor revolutions" (p2504) field.
3. Enter the load revolutions for the gear ratio between the motor shaft and load shaft in the "Number of load revolutions" (p2505) field.
4. Enter the neutral length unit LU per load revolution in the "LU per load revolution" (p2506) field.
5. Interconnect the "Modulo correction activation" (p2577) signal source for the activation of the modulo correction.
6. Correct the default value for axes with modulo correction in the "Modulo correction modulo range" (p2576) field.

Parameterizing the load gearbox position tracking

If you have parameterized encoder 1 for the position control, you can set the position tracking as follows:

1. Activate the "Activate load gearbox position tracking" (p2729.0) option.
2. Activate the desired axis type (p2720.1).
   By default, the "Rotary axis" axis type is active.
3. If required, correct the number of resolvable revolutions for a rotary absolute encoder in the "Virtual revolutions" (p2721) field.
4. If required, correct the value for the tolerance window for the position tracking in the "Position tracking tolerance window" (p2722) field. The value is specified in whole encoder pulses.

Examples of LU configurations

The unit LU is a free dimension, independent of SI units, for the position control of an EPOS axis.

The LU per load revolution upper limit is limited by the encoder resolution (rXXXX). A value above this limit can be selected, but then not all set positions can be approached because they may be between two encoder lines. This could result in an unsmooth axis.

The LU per load revolution should be selected as high as possible. In this way, a better dynamic response can be achieved. If the values for p2506 are too low, this can result in jumps when speed precontrol is activated.

For good repeat accuracy, the LU per load resolution should be selected in the ratio of 1:10 to the encoder resolution, if the encoder supports this resolution at the required dynamic response.

Example 1: Linear axis – spindle (encoder on the motor side)

Leadscrew pitch = 10 mm

Gear ratio i = 1 (p2505 / p2504)

Target variable to be controlled: mm

Encoder resolution = 15,000 LU

10 mm distance are travelled per load revolution. According to the encoder resolution, maximum 15,000 LU/10 mm = 1,500 LU/mm can be defined. We will select 1,000 LU per mm (1 LU = 1 µm). 10 mm per revolution results in 10,000 per revolution:

- p2506 = 10,000 LU per load revolution

Example 2: Rotary axis (encoder on the motor side)

Gear ratio i = 44.5

- p2504 = 445 motor revolutions
- p2505 = 10 load revolutions

Target variable to be controlled: ° (degrees)

Encoder resolution = 364,544 LU

360° are travelled per load revolution. According to the encoder resolution, maximum 364,544 LU/360° = 1012 LU/° can be defined. We will select 100 LU per ° (1 LU = 0.01°). 360° per revolution results in 36,000 LU per load revolution.

- p2506 = 36,000 LU per load revolution

Example 3: Modulo axis – chain drive

The chain has 250 chain links and a chain link is 0.0338667344 m long. The output wheel has 40 teeth, i.e. 40 chain links are moved per revolution. The target positions are at a distance of 25 chain links to one another.

Gear ratio i = 114.28 (rounded off)

Ratio of the number of teeth of the gearbox = 106,967/936

- p2504 = 106,967 motor revolutions
- p2505 = 936 load revolutions

Encoder resolution = 468,095 LU

The encoder resolution is too low here to convert the chain links to a linear SI unit without rounding-off errors having an effect on the modulo correction. A chain link must therefore be taken as target variable.

Target variable to be controlled: 1 chain link

40 chain links travelled per load revolution. According to the encoder resolution, maximum 468,095 LU / 40 chain links = 11,702 LU / chain link can be selected. We will therefore select 1,000 LU per chain link (1 LU = 33.8667344 µm). 40 chain links per revolution results in:

- p2506 = 40,000 LU per load revolution
- p2576 = 250,000 LU modulo range

7.3.2.8 Enable logic

Overview

If, when commissioning, you interconnected telegrams, then these interconnections are displayed in the "Enable logic" screen form. Further specification is not required.

If, when commissioning, you did not specify any telegram types, then you must interconnect the required signal sources in the "Enable logic" screen form.

Interconnecting signal sources

To interconnect a signal sources, proceed as follows:

1. Connect the signal source for the "Infeed operation" (p0864) command.
2. Connect the signal source for the "OFF1 (low active)" command (p0840).
   This command corresponds to control word 1 bit 1 (STW1.1) in the PROFIdrive profile.
3. Connect the 1st signal source for the "OFF2 (low active) signal source 1" command (p0844).
   This command corresponds to control word 1 bit 1 (STW1.1) in the PROFIdrive profile.
4. Connect the 2nd signal source for the "OFF2 (low active) signal source 2" command (p0845).
5. Connect the 1st signal source for the "OFF3 (low active) signal source 1" command (p0848).
   This command corresponds to control word 1 bit 2 (STW1.2) in the PROFIdrive profile.
6. Connect the 2nd signal source for the "OFF3 (low active) signal source 2" command (p0849).
   This command corresponds to control word 1 bit 2 (STW1.2) in the PROFIdrive profile.
7. Interconnect the signal source for the "Enable operation" command (p0852).
   This command corresponds to control word 1 bit 3 (STW1.3) in the PROFIdrive profile.

Loading the project to the target device 8

8.1 Loading project data into the drive

Overview

In order to set up your project, you need to load the project data you generated offline on the connected drive units. Project data are generated, for example:

- When configuring the hardware
- When configuring networks and connections

Requirements

- Startdrive is in online mode.
- The project data is consistent.
- Each drive unit to be loaded can be accessed online.

Procedure

To download the project data into your drive unit, proceed as follows:

1. Select one or more drive units in the project tree.
2. Call the shortcut menu "Load into device".
   OR
3. Click on the icon "Load to device" in the toolbar.
   - **Online connection exists**
     If an online connection exists between a project and a drive device, the "Load preview" dialog opens. Messages are displayed and necessary actions are suggested in this dialog.
   - **Online connection does not exist**
     If there is no established online connection, the "Extended loading" dialog opens and you must first select the interfaces with which the online connection to the device should be established. You have the option of showing all compatible devices by selecting the corresponding option and clicking the "Start search" command (see also "Establishing an online connection to the drive unit (Page 111)").

4. Check the messages in the "Load preview" dialog. Activate the required actions in the "Action" column to perform a secure download.

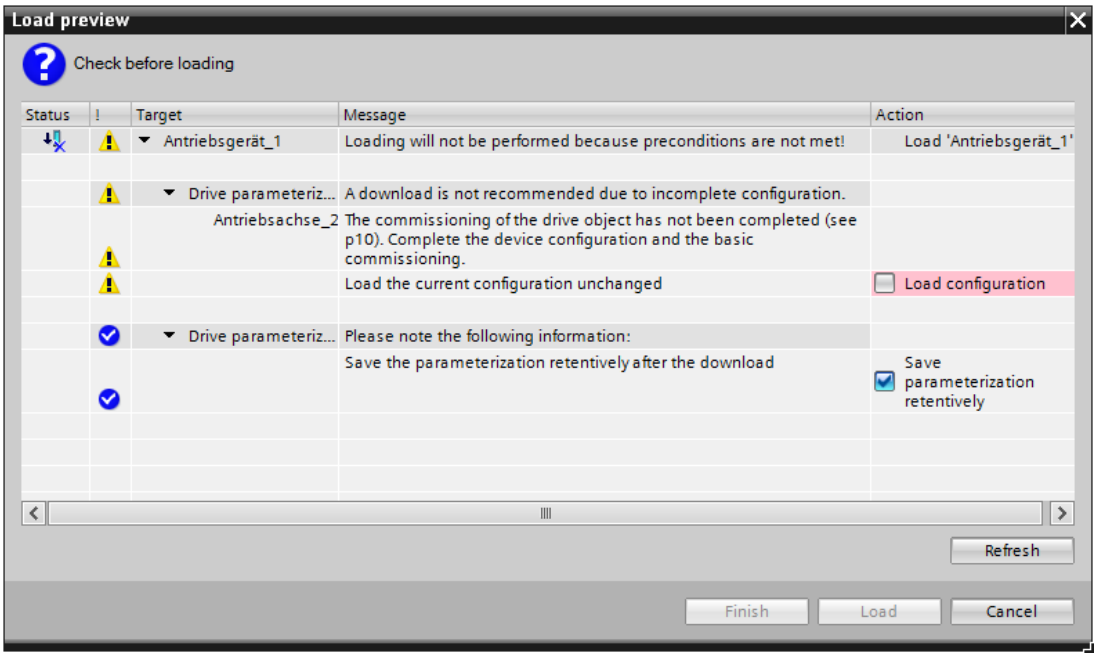


Figure 8-1 Example: Load preview

As soon as downloading becomes possible, the "Load" button is enabled.

5. Click "Load".
   The loading operation is performed.

   – **Synchronization requirement**
     If there is a need for synchronization, the system automatically displays the "Synchronization" dialog. Messages are displayed and necessary actions are suggested in this dialog. You have the option of performing these actions or forcing the download without synchronization by clicking "Force download to device". If you have performed the suggested actions, you will be asked whether you want to continue with the download. The "Load results" dialog then opens. In this dialog, you can check whether the load task was successful and select any further actions.

6. Click "Finish".

Result

The selected project data has been downloaded to the drive units.

Note

Upload from device

Conversely, the project data of a selected drive unit can also be uploaded into your Startdrive project. See "Loading project data from a drive unit (Page 67)" in this regard.

Commissioning a drive

9

9.1 Using the control panel

Overview

You use the control panel to transverse the drive, thus testing the settings that have already been made (see "Drive control panel").

⚠ WARNING

Non-observance of the safety instructions for the drive control panel

The safety shutdowns from the higher-level controller have no effect with this function. The "Stop with space bar" function is not guaranteed in all operating states. Incorrect operation by untrained personnel – without taking into account the appropriate safety instructions – can therefore result in death or severe injury.

- Make sure that this function is only used for commissioning, diagnostic and service purposes.
- Make sure that this function is only used by trained and authorized skilled personnel.
- Make sure that a hardware device is always available for the EMERGENCY OFF circuit.

Note

Drive reacts immediately

Although all enable signals are removed before returning the master control, the setpoints and commands still come from the original parameterized sources after the master control is returned.

Requirement

- There is an online connection to the drive unit.

Procedure

When an online connection to the drive unit has been established, the bar in the header area is shown in color. The control elements are grayed-out – with the exception of the "Activate" button. The remaining control elements become active after you have activated the control panel and set the enable signals.

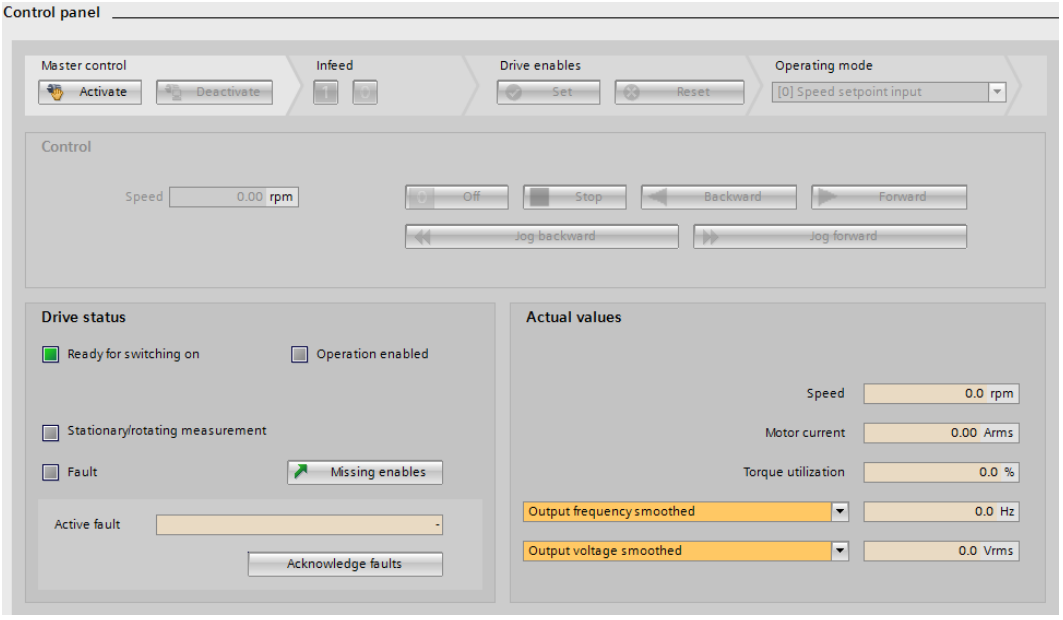


Figure 9-1 Example: Control panel deactivated

When you activate the control panel, you assume master control of the drive. When you deactivate the control panel, you return the master control. The control panel can always only be activated for one drive.

Activating the control panel

To activate the control panel, proceed as follows:

1. Click the "Activate" button at "Master control".
   The "Activate master control" message window opens.
2. Carefully read the warning note and check the value of the monitoring time.
   The monitoring time specifies the time during which the connection from the PG/PC to the drive is cyclically monitored. The minimum value is 1000 ms.
3. Click "Continue" to confirm the monitoring time.
   The message window closes.

The control panel is active.

Activating the infeed

If an infeed is available in your drive, then the infeed must also be activated. If it is not activated, no further drive release can be set.

Click the "1" icon at "Infeed" to switch on the infeed.

Deactivating the control panel

Proceed as follows to return the master control:

1. Click the "Off" button to switch off the drive.
2. Click the "Deactivate" button at "Master control".
   The "Deactivate master control" message window opens.
3. Click "Yes" to disable the master control.

The master control is deactivated.

Setting drive enable signals

To set the required enable signals for the control panel, proceed as follows:

1. Click "Set" at "Drive enable signals".
   Further areas of the control panel are activated.
2. Click "Acknowledge faults" to acknowledge currently pending faults.

Resetting drive enable signals

To reset unneeded drive enable signals, click on the "Reset" button under "Drive enable signals".

Result

- You are able to traverse the drive with the control panel.
- Enable signals and faults are displayed at "Drive status".
- In addition to "Active fault", the currently pending fault is displayed.

9.2 Run the drive

Overview

After you have set the drive enable signals, in the "Control Panel" screen form specify the operating mode and switch on the motor.

Traversing the drive with specified speed

To specify the speed setpoint, proceed as follows:

1. In the "Operating Mode" drop-down list, select menu item "Speed setpoint specification".
2. Enter a speed setpoint in the "Speed" field with which the motor is to turn.
   Once you have specified the speed setpoint, the drive is switched on as soon as you click one of the buttons "Start backward", "Start forward", "Jog forward" or "Jog backward" for the first time.
   The motor does not accelerate until you click the "Backward" or "Forward" buttons.
   - To rotate the motor backwards, click the "Backward" button.
   - To rotate the motor forward, click the "Forward" button.
   - Click the "Jog forward" button to inch the motor forward.
   - Click the "Jog backward" button to inch the motor backward.

   Note
   Rotation through clicking

   The motor continues to rotate while you keep the mouse clicked on the button. Traversing stops when you release the mouse button.

Stopping the drive

Click "Stop" to stop the drive.

Switch off the drive

Click the "Off" button to switch off the drive.

Viewing actual values of the drive

The current values of various parameters are displayed at "Actual values".

Appendix

A

A.1 List of abbreviations

Note

The following list of abbreviations includes all abbreviations and their meanings used in the entire SINAMICS family of drives.

A

Abbreviation	Derivation of abbreviation	Meaning
A…	Alarm	Warning
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 coding standard for the exchange of information
AS-i	AS-Interface (Actuator Sensor Interface)	AS-Interface (open bus system in automation technology)
ASM	Asynchronmotor	Induction motor
AVS	Active Vibration Suppression	Active load vibration damping
AWG	American Wire Gauge	American Wire Gauge (Standard for cross-sections of cables)

B

Abbreviation	Derivation of abbreviation	Meaning
BB	Betriebsbedingung	Operation condition
BERO	-	Contactless proximity switch
BI	Binector Input	Binector input
BIA	Berufsgenossenschaftliches Institut für Arbeitssicherheit	BG Institute for Occupational Safety and Health
BICO	Binector Connector Technology	Binector connector technology

Abbreviation	Derivation of abbreviation	Meaning
BLM	Basic Line Module	Basic Line Module
BO	Binector Output	Binector output
BOP	Basic Operator Panel	Basic operator panel

C

Abbreviation	Derivation of abbreviation	Meaning
C	Capacitance	Capacitance
C…	-	Safety message
CAN	Controller Area Network	Serial bus system
CBC	Communication Board CAN	Communication Board CAN
CBE	Communication Board Ethernet	PROFINET communication module (Ethernet)
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	Computerized Numerical Control	Computer-supported numerical control
CO	Connector Output	Connector output
CO/BO	Connector Output/Binector Output	Connector/binector output
COB-ID	CAN Object-Identification	CAN Object Identification
CoL	Certificate of License	Certificate of License
COM	Common contact of a change-over relay	Center contact of a change-over contact
COMM	Commissioning	Commissioning
CP	Communication Processor	Communications 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	Control Unit DC

D

Abbreviation	Derivation of abbreviation	Meaning
DAC	Digital Analog Converter	Digital analog converter
DC	Direct Current	Direct current
DCB	Drive Control Block	Drive Control Block
DCBRK	DC Brake	DC braking
DCC	Drive Control Chart	Drive Control Chart
DCN	Direct Current Negative	Direct current negative
DCP	Direct Current Positive	Direct current positive

Abbreviation	Derivation of abbreviation	Meaning
DDC	Dynamic Drive Control	Dynamic Drive Control
DDS	Drive Data Set	Drive Data Set
DHCP	Dynamic Host Configuration Protocol	Dynamic Host Configuration Protocol (Communication protocol)
DI	Digital Input	Digital input
DI/DO	Digital Input/Digital Output	Digital input/output, bidirectional
DIN	Deutsches Institut für Normung	Deutsches Institut für Normung (German Institute for Standardization)
DMC	DRIVE-CLiQ Hub Module Cabinet	DRIVE-CLiQ Hub Module Cabinet
DME	DRIVE-CLiQ Hub Module External	DRIVE-CLiQ Hub Module External
DMM	Double Motor Module	Double Motor Module
DO	Digital Output	Digital output
DO	Drive Object	Drive object
DP	Decentralized Peripherals	Distributed I/O
DPRAM	Dual Ported Random Access Memory	Dual-Port Random Access Memory
DQ	DRIVE-CLiQ	DRIVE-CLiQ
DRAM	Dynamic Random Access Memory	Dynamic Random Access Memory
DRIVE-CLiQ	Drive Component Link with IQ	Drive Component Link with IQ
DSC	Dynamic Servo Control	Dynamic Servo Control
DSM	Doppelsubmodul	Double submodule
DTC	Digital Time Clock	Timer

E

Abbreviation	Derivation of abbreviation	Meaning
EASC	External Armature Short-Circuit	External armature short-circuit
EDS	Encoder Data Set	Encoder data set
EEPROM	Electrically Erasable Programmable Read-Only Memory	Electrically Erasable Programmable Read-Only Memory
EGB	Elektrostatisch gefährdete Baugruppen	Electrostatic sensitive devices
EIP	EtherNet/IP	EtherNet Industrial Protocol (real-time Ethernet)
ELCB	Earth Leakage Circuit Breaker	Residual current operated circuit breaker
ELP	Earth Leakage Protection	Ground-fault monitoring
EMC	Electromagnetic Compatibility	Electromagnetic compatibility
EMF	Electromotive Force	Electromotive force
EMK	Elektromotorische Kraft	Electromotive force
EMV	Elektromagnetische Verträglichkeit	Electromagnetic compatibility
EN	Europäische Norm	European standard
EnDat	Encoder-Data-Interface	Encoder interface
EP	Enable Pulses	Pulse enable
EPOS	Einfachpositionierer	Basic positioner
ES	Engineering System	Engineering system
ESB	Ersatzschaltbild	Equivalent circuit diagram

Abbreviation	Derivation of abbreviation	Meaning
ESD	Electrostatic Sensitive Devices	Electrostatic sensitive devices
ESM	Essential Service Mode	Essential service mode
ESR	Extended Stop and Retract	Extended stop and retract

F

Abbreviation	Derivation of abbreviation	Meaning
F…	Fault	Fault
FAQ	Frequently Asked Questions	Frequently Asked Questions
FBLOCKS	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
FEPROM	Flash-EPROM	Non-volatile write and read memory
FG	Function Generator	Function generator
FI	-	Fault current
FOC	Fiber-Optic Cable	Fiber-optic cable
FP	Funktionsplan	Function diagram
FPGA	Field Programmable Gate Array	Field Programmable Gate Array
F-PLC	Fail-safe PLC	Fail-safe PLC
FW	Firmware	Firmware

G

Abbreviation	Derivation of abbreviation	Meaning
GB	Gigabyte	Gigabyte
GC	Global Control	Global control telegram (broadcast telegram)
GND	Ground	Reference potential for all signal and operating voltages, usually defined as 0 V (also referred to as M)
GSD	Gerätestammdatei	Generic Station Description: Describes the features of a PROFIBUS slave
GSV	Gate Supply Voltage	Gate supply voltage
GUID	Globally Unique Identifier	Globally Unique Identifier

H

Abbreviation	Derivation of abbreviation	Meaning
HF	High frequency	High frequency
HFD	Hochfrequenzdrossel	Radio frequency reactor
HLA	Hydraulic Linear Actuator	Hydraulic linear actuator

Abbreviation	Derivation of abbreviation	Meaning
HLG	Hochlaufgeber	Ramp-function generator
HM	Hydraulic Module	Hydraulic Module
HMI	Human Machine Interface	Human Machine Interface
HTL	High-Threshold Logic	Logic with high interference threshold
HTTP	Hypertext Transfer Protocol	Hypertext Transfer Protocol (communication protocol)
HTTP	Hypertext Transfer Protocol Secure	Hypertext Transfer Protocol Secure (communication protocol)
HW	Hardware	Hardware

I

Abbreviation	Derivation of abbreviation	Meaning
i. V.	In Vorbereitung	Under development: This property is currently not 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	Inbetriebnahme	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	Impulslöschung	Pulse suppression
IP	Internet Protocol	Internet Protocol
IPO	Interpolator	Interpolator
ISO	Internationale Organisation für Normung	International Standards Organization
IT	Isolé Terre	Non-grounded three-phase line supply
IVP	Internal Voltage Protection	Internal voltage protection

J

Abbreviation	Derivation of abbreviation	Meaning
JOG	Jogging	Jogging

K

Abbreviation	Derivation of abbreviation	Meaning
KDV	Kreuzweiser Datenvergleich	Data cross-check
KHP	Know-how protection	Know-how protection
KIP	Kinetische Pufferung	Kinetic buffering
Kp	-	Proportional gain
KTY84-130	-	Temperature sensor

L

Abbreviation	Derivation of abbreviation	Meaning
L		
L	-	Symbol for inductance
LED	Light Emitting Diode	Light emitting diode
LIN	Linearmotor	Linear motor
LR	Lageregler	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
LWL	Lichtwellenleiter	Fiber-optic cable

M

Abbreviation	Derivation of abbreviation	Meaning
M	-	Symbol for torque
M	Masse	Reference potential for all signal and operating voltages, usually defined as 0 V (also referred to as GND)
MB	Megabyte	Megabyte
MCC	Motion Control Chart	Motion Control Chart
MDI	Manual Data Input	Manual data input
MDS	Motor Data Set	Motor data set
MLFB	Maschinenlesbare Fabrikatebezeichnung	Machine-readable product code
MM	Motor Module	Motor Module
MMC	Man-Machine Communication	Man-machine communication
MMC	Micro Memory Card	Micro memory card
MRCD	Modular Residual Current protection Device	Modular Residual Current protection Device
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

Abbreviation	Derivation of abbreviation	Meaning
MSR	Motorstromrichter	Motor-side converter
MT	Messtaster	Probe

N

Abbreviation	Derivation of abbreviation	Meaning
N. C.	Not Connected	Not connected
N…	No Report	No report or internal message
NAMUR	Normenarbeitsgemeinschaft für Mess- und Regeltechnik in der chemischen Industrie	Standardization association for measurement and control in chemical industries
NC	Normally Closed (contact)	NC contact
NC	Numerical Control	Numerical control
NEMA	National Electrical Manufacturers Association	Standardization association in USA (United States of America)
NM	Nullmarke	Zero mark
NO	Normally Open (contact)	NO contact
NSR	Netzstromrichter	Line-side converter
NTP	Network Time Protocol	Standard for synchronization of the time of day
NVRAM	Non-Volatile Random Access Memory	Non-volatile read/write memory

O

Abbreviation	Derivation of abbreviation	Meaning
OA	Open Architecture	Software component which provides additional functions for the SINAMICS drive system
OAIF	Open Architecture Interface	Version of the SINAMICS firmware as of which the OA application can be used
OASP	Open Architecture Support Package	Expands the commissioning tool by the corresponding OA application
OC	Operating Condition	Operation condition
OCC	One Cable Connection	One-cable technology
OEM	Original Equipment Manufacturer	Original equipment manufacturer
OLP	Optical Link Plug	Bus connector for fiber-optic cable
OMI	Option Module Interface	Option Module Interface

P

Abbreviation	Derivation of abbreviation	Meaning
p…	-	Adjustable parameters
P1	Processor 1	CPU 1
P2	Processor 2	CPU 2
PB	PROFIBUS	PROFIBUS
PcCtrl	PC Control	Master control

Abbreviation	Derivation of abbreviation	Meaning
PD	PROFIdrive	PROFIdrive
PDC	Precision Drive Control	Precision Drive Control
PDS	Power unit Data Set	Power unit data set
PDS	Power Drive System	Drive system
PE	Protective Earth	Protective ground
PELV	Protective Extra Low Voltage	Safety extra-low voltage
PFH	Probability of dangerous failure per hour	Probability of dangerous failure per hour
PG	Programmiergerät	Programming device
PI	Proportional Integral	Proportional integral
PID	Proportional Integral Differential	Proportional integral differential
PLC	Programmable Logical Controller	Programmable logic controller
PLL	Phase-Locked Loop	Phase-locked loop
PM	Power Module	Power Module
PMI	Power Module Interface	Power Module Interface
PMSM	Permanent-magnet synchronous motor	Permanent-magnet synchronous motor
PN	PROFINET	PROFINET
PNO	PROFIBUS Nutzerorganisation	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
PT1000	-	Temperature sensor
PTC	Positive Temperature Coefficient	Positive temperature coefficient
PTP	Point To Point	Point-to-point
PWM	Pulse Width Modulation	Pulse width modulation
PZD	Prozessdaten	Process data

Q

Abbreviation	Derivation of abbreviation	Meaning
No entries		

R

Abbreviation	Derivation of abbreviation	Meaning
r…	-	Display parameters (read-only)
RAM	Random Access Memory	Memory for reading and writing
RCCB	Residual Current Circuit Breaker	Residual current operated circuit breaker
RCD	Residual Current Device	Residual current device
RCM	Residual Current Monitor	Residual current monitor
REL	Reluctance motor textile	Reluctance motor textile

Abbreviation	Derivation of abbreviation	Meaning
RESM	Reluctance synchronous motor	Synchronous reluctance motor
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
RKA	Rückkühlanlage	Cooling unit
RLM	Renewable Line Module	Renewable Line Module
RO	Read Only	Read only
ROM	Read-Only Memory	Read-only memory
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 as 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 as EIA485)
RTC	Real Time Clock	Real-time clock
RZA	Raumzeigerapproximation	Space-vector approximation

S

Abbreviation	Derivation of abbreviation	Meaning
S1	-	Continuous operation
S3	-	Intermittent duty
SAM	Safe Acceleration Monitor	Safe acceleration monitoring
SBC	Safe Brake Control	Safe brake control
SBH	Sicherer Betriebshalt	Safe operating stop
SBR	Safe Brake Ramp	Safe brake ramp monitoring
SBT	Safe Brake Test	Safe brake test
SCA	Safe Cam	Safe cam
SCC	Safety Control Channel	Safety Control Channel
SCSE	Single Channel Safety Encoder	Single-channel safety encoder
SD Card	SecureDigital Card	Secure digital memory card
SDC	Standard Drive Control	Standard Drive Control
SDI	Safe Direction	Safe motion direction
SE	Sicherer Software-Endschalter	Safe software limit switch
SESM	Separately-excited synchronous motor	Separately excited synchronous motor
SG	Sicher reduzierte Geschwindigkeit	Safely limited speed
SGA	Sicherheitsgerichteter Ausgang	Safety-related output
SGE	Sicherheitsgerichteter Eingang	Safety-related input
SH	Sicherer Halt	Safe stop
SI	Safety Integrated	Safety Integrated
SIC	Safety Info Channel	Safety Info Channel

Abbreviation	Derivation of abbreviation	Meaning
SIL	Safety Integrity Level	Safety Integrity Level
SITOP	-	Siemens power supply system
SLA	Safely-Limited Acceleration	Safely limited acceleration
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	Sensorless vector control
SM	Sensor Module	Sensor Module
SMC	Sensor Module Cabinet	Sensor Module Cabinet
SME	Sensor Module External	Sensor Module External
SMI	SINAMICS Sensor Module Integrated	SINAMICS Sensor Module Integrated
SMM	Single Motor Module	Single Motor Module
SN	Sicherer Software-Nocken	Safe software cam
SOS	Safe Operating Stop	Safe operating stop
SP	Service Pack	Service pack
SP	Safe Position	Safe position
SPC	Setpoint Channel	Setpoint channel
SPI	Serial Peripheral Interface	Serial peripheral interface
SPS	Speicherprogrammierbare Steuerung	Programmable logic controller
SS1	Safe Stop 1	Safe Stop 1 (time-monitored, ramp-monitored)
SS1E	Safe Stop 1 External	Safe Stop 1 with external stop
SS2	Safe Stop 2	Safe Stop 2
SS2E	Safe Stop 2 External	Safe Stop 2 with external stop
SSI	Synchronous Serial Interface	Synchronous serial interface
SSL	Secure Sockets Layer	Encryption protocol for secure data transfer (new TLS)
SSM	Safe Speed Monitor	Safe feedback from speed monitor
SSP	SINAMICS Support Package	SINAMICS support package
STO	Safe Torque Off	Safe torque off
STW	Steuerwort	Control word

T

Abbreviation	Derivation of abbreviation	Meaning
TB	Terminal Board	Terminal Board
TEC	Technology Extension	Software component which is installed as an additional technology package and which expands the functionality of SINAMICS (previously OA application)
TIA	Totally Integrated Automation	Totally Integrated Automation
TLS	Transport Layer Security	Encryption protocol for secure data transfer (previously SSL)
TM	Terminal Module	Terminal Module

Abbreviation	Derivation of abbreviation	Meaning
TN	Terre Neutre	Grounded three-phase line supply
Tn	-	Integral time
TPDO	Transmit Process Data Object	Transmit Process Data Object
TSN	Time-Sensitive Networking	Time-Sensitive Networking
TT	Terre Terre	Grounded three-phase line supply
TTL	Transistor-Transistor-Logic	Transistor-transistor logic
Tv	-	Rate time

U

Abbreviation	Derivation of abbreviation	Meaning
UL	Underwriters Laboratories Inc.	Underwriters Laboratories Inc.
UPS	Uninterruptible Power Supply	Uninterruptible power supply
USV	Unterbrechungsfreie Stromversorgung	Uninterruptible power supply
UTC	Universal Time Coordinated	Universal time coordinated

V

Abbreviation	Derivation of abbreviation	Meaning
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	Verband Deutscher Elektrotechniker [Association of German Electrical Engineers]
VDI	Verein Deutscher Ingenieure	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

Abbreviation	Derivation of abbreviation	Meaning
WEA	Wiedereinschaltautomatik	Automatic restart
WZM	Werkzeugmaschine	Machine tool

X

Abbreviation	Derivation of abbreviation	Meaning
XML	Extensible Markup Language	Extensible markup language (standard language for Web publishing and document management)

Y

Abbreviation	Derivation of abbreviation	Meaning
No entries		

Z

Abbreviation	Derivation of abbreviation	Meaning
ZK	Zwischenkreis	DC link
ZM	Zero Mark	Zero mark
ZSW	Zustandswort	Status word

A.2 Documentation overview

General documentation/catalogs			
SINAMICS	G110	D 11	- Converter Chassis Units 0.12 kW up to 3 kW
	G120	D 31	- SINAMICS Converters for Single-Axis Drives and SIMOTICS Motors
	G130, G150	D 11	- Converter Chassis Units - Converter Cabinet Units
	S120, S150	D 21	- SINAMICS S120 Chassis Units and Cabinet Modules - SINAMICS S150 Converter Cabinet Units
	S120	D 21.4	- SINAMICS S120 and SIMOTICS
Manufacturer/service documentation			
SINAMICS	G110		- Getting Started - Operating Instructions - List Manuals
	G120		- Getting Started - Operating Instructions - Installation Manuals - Function Manual Safety Integrated - List Manuals
	G130		- Operating Instructions - List Manual
	G150		- Operating Instructions - List Manual
	GM150, SM120/SM150, GL150, SL150		- Operating Instructions - List Manuals
	S110		- Equipment Manual - Getting Started - Function Manual - List Manual
	S120		- Getting Started - Commissioning Manual - Function Manual Drive Functions - Function Manual Communication (from Firmware V5.2) - Function Manual Safety Integrated - Function Manual DCC - List Manual - Equipment Manual for Control Units and Additional System Components - Equipment Manual for Booksize Power Units - Equipment Manual for Booksize Power Units C/D Type - Equipment Manual for Air-Cooled Chassis Power Units - Equipment Manual for Liquid-Cooled Chassis Power Units - Equipment Manual for Water-Cooled Chassis Power Units for Common Cooling Circuits - Equipment Manual Combi - Equipment Manual for Cabinet Modules - Equipment Manual for AC Drives - SINAMICS S120M Equipment Manual Distributed Drive Technology - SINAMICS HLA System Manual Hydraulic Drive
	S150		- Operating Instructions - List Manual
	S210		- SINAMICS S210 Operating Instructions
Motors			- Configuration Manuals, Motors
General			- Configuration Manual, EMC Installation Guideline

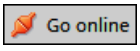
A.3 Shortcut menus and icons in Startdrive

A.3.1 Function calls project view

A.3.1.1 Project navigation

Shortcut menu

The shortcut menu of a drive in the project navigator contains the following entries:

Menu item	Icon (button) in the toolbar	Description
Open	-	Opens the drive device view.
Parameters	-	Opens the parameter view in the working area.
Cut		Cuts the selected content and copies it to the clipboard.
Copy		Copies the content to the clipboard.
Paste		Inserts the clipboard content into the project navigation.
Delete	-	Deletes the selected content from the project navigation.
Rename	-	Permits a designation to be changed.
Go to topology view	-	Opens the topology view for drives that are networked via PROFINET.
Go to network view	-	Opens the network view.
Download to device		Loads the data from the project into the drive (only when online).
Upload from device (software)		Loads the data from the device into the project (only when online).
Compile	-	Compiles existing programs.
Go online		Establishes an online connection to the drive.
Go offline		Disconnects the online connection - the drive goes offline.
Online & diagnostics	-	Opens the Online & diagnostics editor; if the drive is not online, Start-drive tries to establish an online connection.
Browsing a project		Opens a search mask You can browse for individual information about the active project using this mask.
Properties	-	Opens the Properties dialog of the drive. There, for example you set bus parameters.

A.3.2 BICO interconnections

The following icons are used for BICO interconnections:

Icon	Meaning
	Allows the BICO interconnection of a binector input. The interconnection dialog is opened by clicking on the icon.
	Allows the BICO interconnection of a binector output. The interconnection dialog is opened by clicking on the icon.
	Allows the BICO interconnection of a connector input. The interconnection dialog is opened by clicking on the icon.
	Allows the BICO interconnection of a connector output. The interconnection dialog is opened by clicking on the icon.
	Clicking on the icon next to the interconnection field allows a list of all of the active interconnections of the parameter to be opened/displayed.
	Shows that invalid BICO wiring exists in the drive screen forms.

A.3.3 Special elements in the screen forms

User interface elements are used in the Startdrive screen forms, which deviate from a standard Windows operation. A brief list with explanation is provided below:

Element (icon, button, etc.)	Explanation
	Changeover switch in position 1. Position 0 can be selected with a mouse click.
	Changeover switch in position 0. Position 1 can be selected with a mouse click.
	Changeover switch in position x. Position y can be selected with a mouse click.
	Changeover switch in position y. Position x can be selected with a mouse click.
	Switch for the inversion of signals for digital outputs. In this switch position, the signal is not inverted.
	Switch for the inversion of signals for digital outputs. In this switch position, the signal is inverted.

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Additional information

Siemens:
www.siemens.com

Industry Online Support (service and support):
www.siemens.com/online-support

IndustryMall:
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Siemens AG
Digital Industries
Motion Control
P O Box 3180
D-91050 Erlangen
Germany

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