SIEMENS

Commissioning Manual

SINAMICS

S120

With Startdrive

Edition 06/2020

www.siemens.com/drives

SIEMENS

SINAMICS

S120
Commissioning with Startdrive

Commissioning Manual

Valid as of:
Firmware Version 5.2 SP3, Startdrive V16 Update 3

06/2020
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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.

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Introduction 1

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 about SINAMICS under Product Support (https://support.industry.siemens.com/cs/de/en/ps/faq).

Siemens Support while on the move

With the "Siemens Industry Online Support" app, you can access more than 300,000 documents for Siemens Industry products – any time and from anywhere. The app supports you in the following areas, for example:

- Resolving problems when executing a project
- Troubleshooting when faults develop
- Expanding a system or planning a new system

Furthermore, you have access to the Technical Forum and other articles that our experts have drawn up:

- FAQs
- Application examples
- Manuals
- Certificates
- Product announcements and much more

The "Siemens Industry Online Support" app is available for Apple iOS and Android.

Data matrix code on the rating plate

The data matrix code on the rating plate contains the specific device data. This code can be read-in with any smartphone and technical information for the appropriate device can be displayed via the "Industry Online Support" mobile app.

Websites of third-party companies

This document includes hyperlinks to websites of third-party companies. Siemens is not responsible for and shall not be liable for these websites or their content, as Siemens has not checked the information contained in the websites and is not responsible for the content or information they provide. The use of such websites is at the user's own risk.

1.3 Usage phases and their documents/tools

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 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 with Startdrive • SINAMICS S120 Commissioning Manual with Startdrive • 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 with Startdrive • SINAMICS S120/S150 List Manual • SINAMICS HLA System Manual Hydraulic Drives
Maintenance/servicing	• SINAMICS S120 Commissioning Manual with Startdrive • 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 with Startdrive[2)]
Commissioning	With Startdrive	SINAMICS S120 Commissioning Manual with Startdrive[2)]
Web server		SINAMICS S120 Function Manual Drive Functions

Hardware			Manual
Control Units and expansion components	• Control Units • Option Boards • Terminal Modules	• DRIVE-CLiQ 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
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 with Startdrive[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

You can find information on SITRAIN at the following address (http://www.siemens.com/sitrain). SITRAIN offers training courses for products, systems and solutions in drive and automation technology from Siemens.

Technical Support

To ask a technical question or create a support request, click on "Support Request" at the following address and select "Create Request".

See also

Technical Support (https://support.industry.siemens.com/cs/ww/en/sc)

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

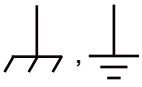
This document contains recommendations relating to third-party products. Siemens accepts the fundamental suitability of these third-party products.

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 Scope of the document

Scope of the document

The commissioning of a SINAMICS S120 drive system with Startdrive is described in this manual. The commissioning manual applies both to SINAMICS S120 drives and to the following drive systems that use a CU320-2 PN:

- SINAMICS S150
- SINAMICS G130
- SINAMICS G150

Further information on the topics: Commissioning, parameterization and SINAMICS functions can be found in the Startdrive information system.

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.
- User names in the user administration
  The product only processes and saves additional personal data when the user explicitly enables one of the following functions.
  User names 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 Startdrive information system and the SINAMICS DCC option package.

By generating the login or user name, 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 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 converter 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 converter 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

Damage to equipment due to unsuitable tightening tools.

Unsuitable tightening tools or fastening methods can damage the screws of the equipment.

- Be sure to only use screwdrivers which exactly match the heads of the screws.
- Tighten the screws with the torque specified in the technical documentation.
- Use a torque wrench or a mechanical precision nut runner with a dynamic torque sensor and speed limitation system.

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

Converters 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 converter 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

Using radio devices or mobile telephones in the immediate vicinity of the components can result in equipment malfunction. Malfunctions may impair the functional safety of machines and can therefore put people in danger or lead to property damage.

- Therefore, if you move closer than 20 cm to the components, be sure to switch off radio devices or mobile telephones.
- 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 Security information

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. Siemens' products and solutions 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. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit
https://www.siemens.com/industrialsecurity (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 are available and that 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 under
https://www.siemens.com/industrialsecurity (https://new.siemens.com/global/en/products/services/cert.html#Subscriptions).

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.

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.

Startdrive engineering tool

3

Overview

The Startdrive engineering tool is available for configuring and parameterizing drives in the TIA Portal.

You can perform the following tasks, for example, with Startdrive:

- You create projects for drive-specific solutions.
- You insert drives in the project as single drives or link the drives to higher-level controllers.
- You configure drives by entering the power units, motors and encoders used.
- You assign parameters to the drives by specifying command sources, setpoint sources and control mode.
- You extend the parameter assignment with drive-specific functions such as the free function blocks and a technology controller.
- You go online on the drive and test the parameter assignment via the drive control panel.
- You perform diagnostics when an error occurs.

User interface

The Startdrive engineering tool is integrated seamlessly in the TIA Portal. The following display areas and functions support you during the configuration and parameterization of your drives:

- **Hardware catalog**
  In the hardware catalog, you select the Control Unit, infeed unit, Motor Modules or Power Modules, motors, measuring systems (encoders), and supplementary system components.
- **Parameterizing editor**
  Use the Parameterizing editor to adapt the drive according to the drive task.
- **Device configuration**
  Insert specific components, such as Power Modules, in the device configuration.
- **Network view**
  In the Network view, network the drive with a higher-level controller and assign parameters for the communication.
- **Online mode**
  In online mode, test the drive with the drive control panel and load the parameter assignment to the drive.

Ordering software

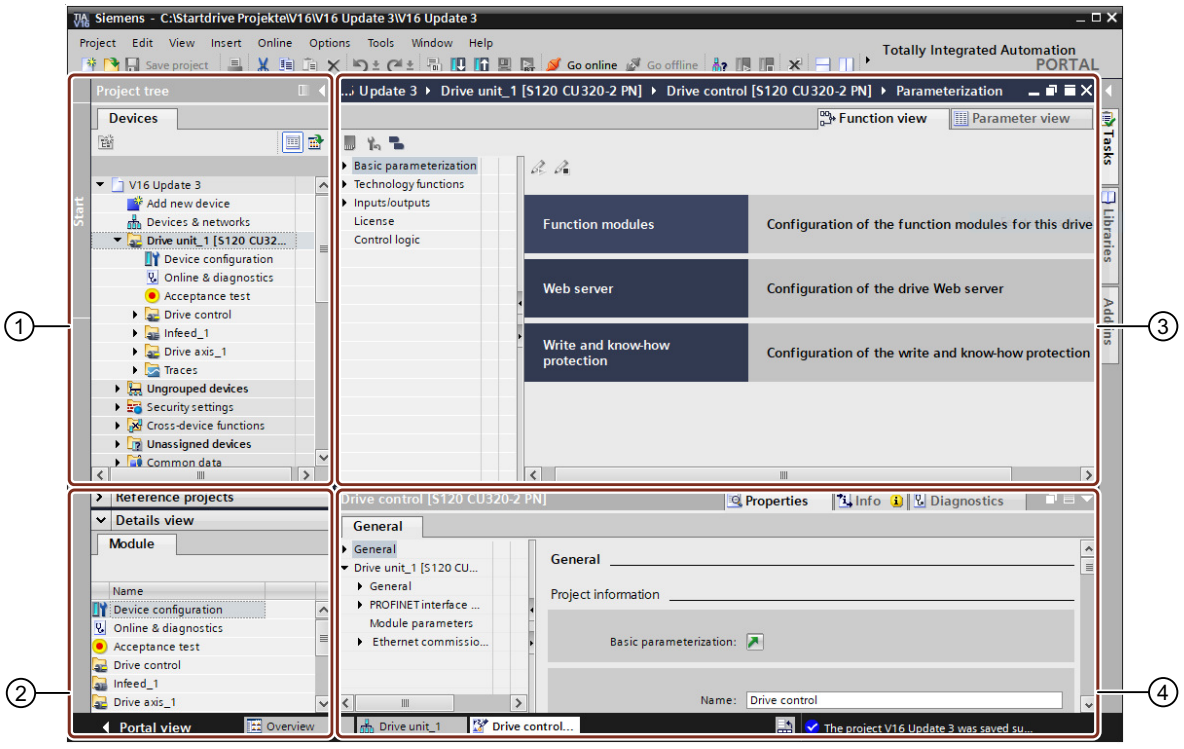
You can order and download SINAMICS Startdrive V16 and available updates from the address specified below. You can find information about requirements that must be fulfilled before installation as well as installation notes on the website.

- SINAMICS Startdrive V16 (https://support.industry.siemens.com/cs/ww/en/view/109771710)

3.1 Structure of the user interface

3.1.1 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.

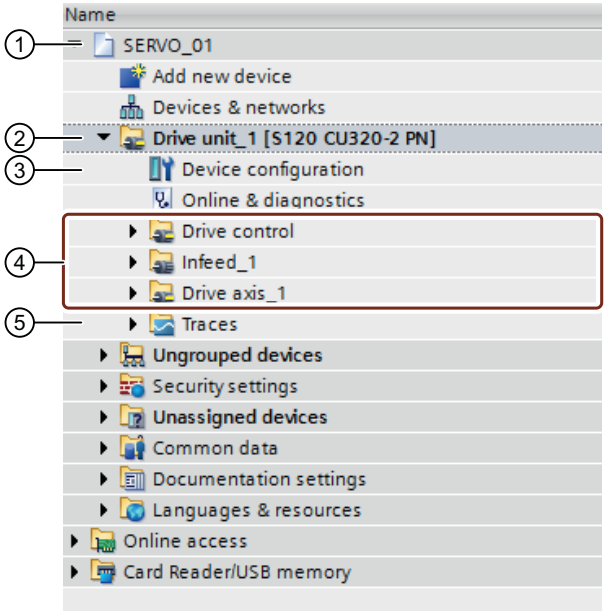
③ You can put together and parameterize your drive in the "Workspace" window.

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

Figure 3-1 Example: Layout of the Startdrive user interface

3.1.2 Project navigation

Drives, drive components and project data are displayed in the project tree and can be edited in the working area. 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 3-2 Parts of a project

3.2 User interface - parameterization

3.2.1 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 Chapter "Inserting an infeed unit (placeholder) (Page 110)").

Components in the hardware catalog

The following hardware components are available, depending on the selected Control Unit:

Components	Designation	Types of construction	CU310-2 PN	CU320-2 PN
Line Modules	Active Line Module	Chassis, Booksize	–	x
	Basic Line Module		–	x
	Smart Line Module		–	x
Power Modules	AC Power Module	Chassis	x	x
	PM240-2	Blocksize	–	x[1)]
Motor Modules	Single Motor Module	Chassis, Booksize	–	x
	Double Motor Module	Booksize	–	x
Motors[2)]	DRIVE-CLiQ motors		x	x
	Induction motors		x	x
	Synchronous motors		x	x
	Reluctance motors		x	x
	Third-party motors		x	x
Measuring systems (encoder types)	DRIVE-CLiQ encoder		x	x
	SIN/COS encoders		x	x
	SSI encoder		x	x
	SIN/COS and SSI encoders		x	x
	HTL/TTL encoder		x	x
	HTL/TTL and SSI encoders		x	x
	EnDat 2.1 encoder		x	x
	Resolver-encoder		x	x

Components	Designation	Types of construction	CU310-2 PN	CU320-2 PN
Supplementary system components	Communication Boards		–	x
	DRIVE-CLiQ Hub Modules		x	x
	Terminal Boards		–	x
	Terminal Modules		x	x
	Voltage Sensing Modules		x	x

1) The PM240-2 Power Module is inserted together with a Control Unit Adapter (CUA) in the device configuration. The following types are available: CUA31, CUA32.

2) The motors are sorted according to motor type and article number and are displayed with a generic article number.

Different number of components in other Control Units

The components listed in the previous table are used only in part by other Control Units that are based on a CU320-2 PN (e.g.: S150, G150 or G130).

You will find further information about configurable components in the Startdrive information system.

3.2.2 Device view

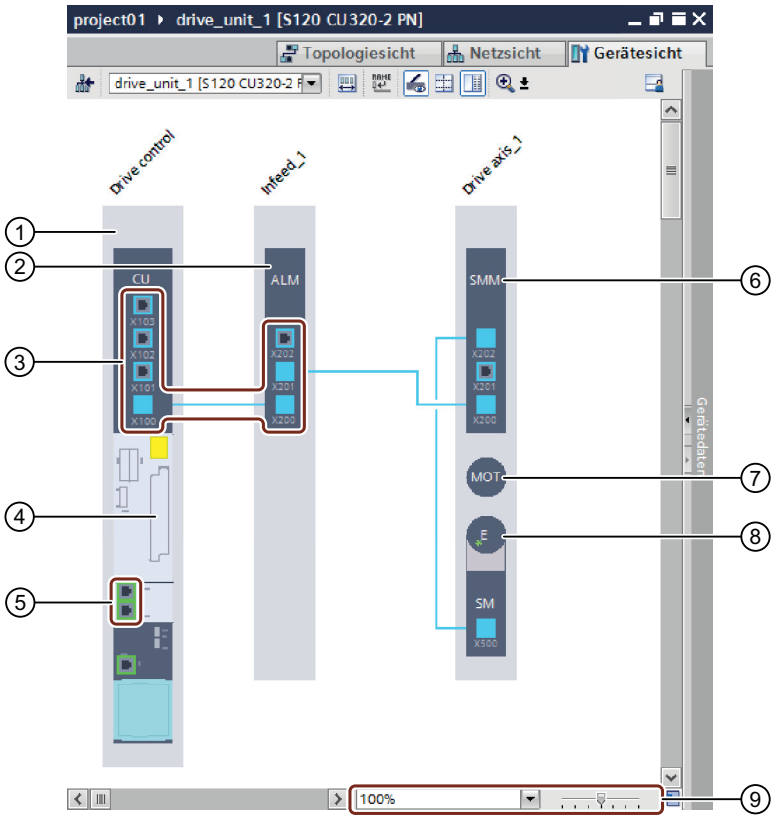
Overview

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 3-3 Example: Device view

3.2.3 Parameterization editor

Overview

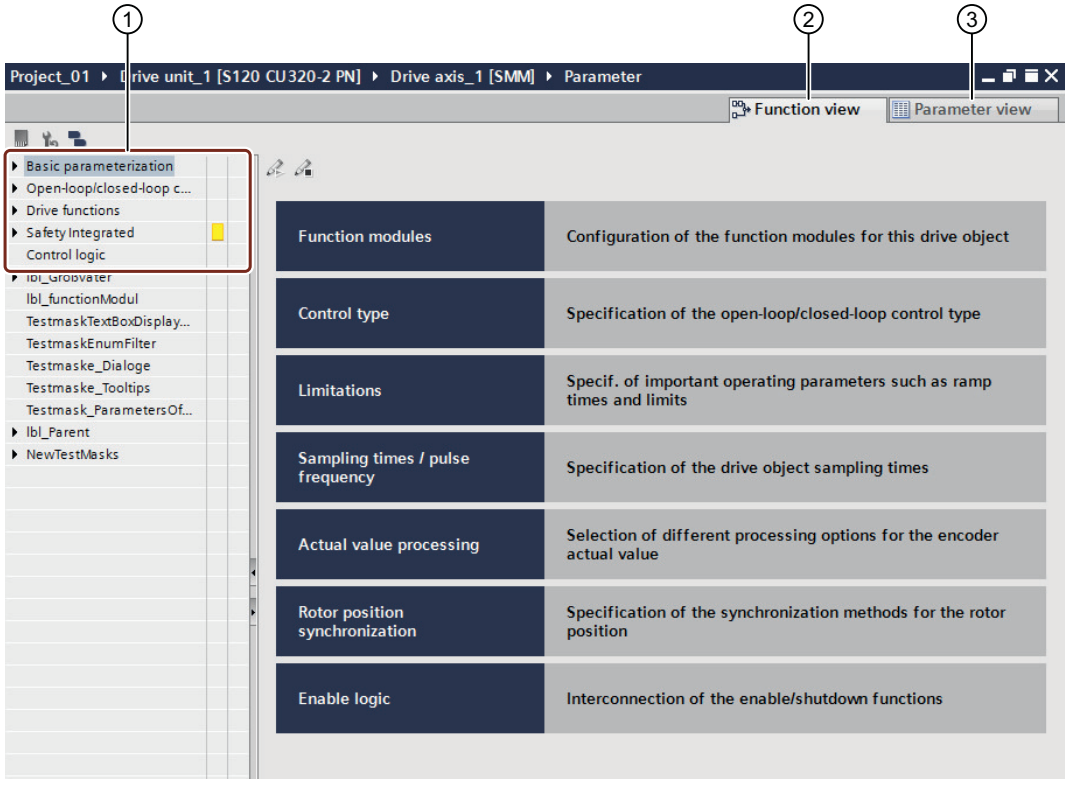
The parameterization editor is comprised of 2 tabs in which you can parameterize the drive:

- 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 3-4 Example: Parameterizing editor

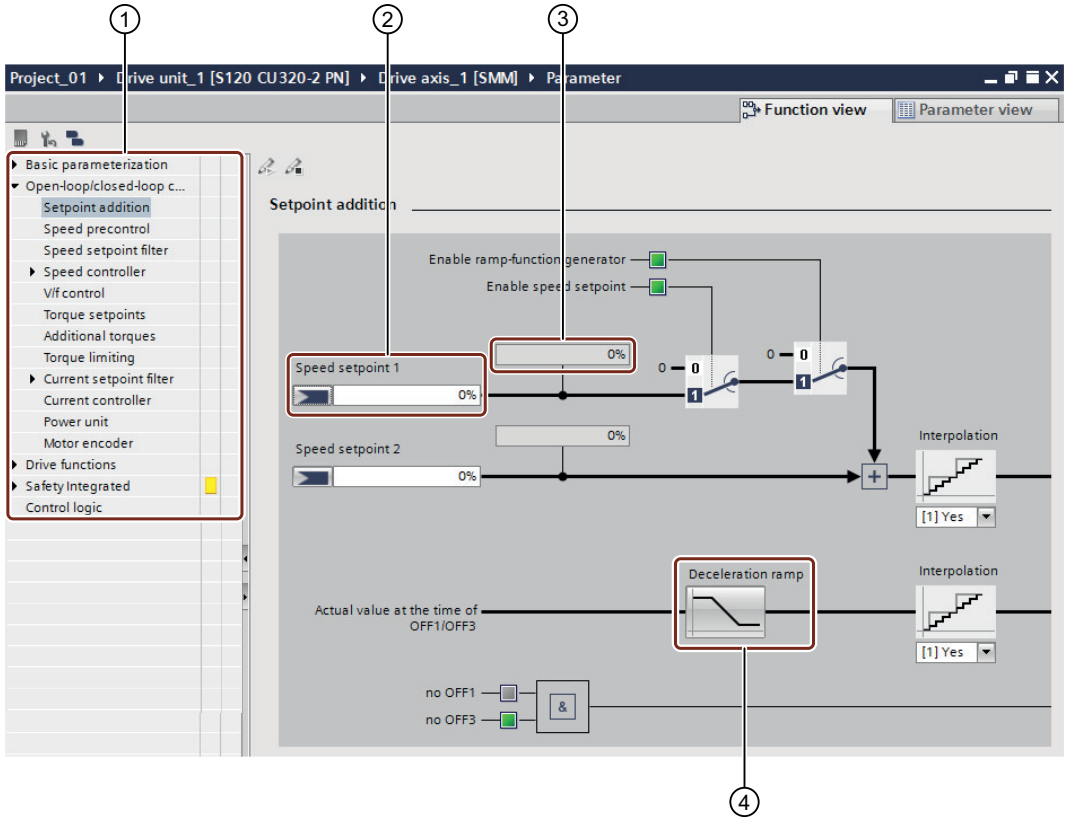
3.2.4 Function view

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 3-5 Example: Function view

Explanation of icons

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

Icon	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. Extensive settings can be made in the parameter view which are effective across various screen forms.

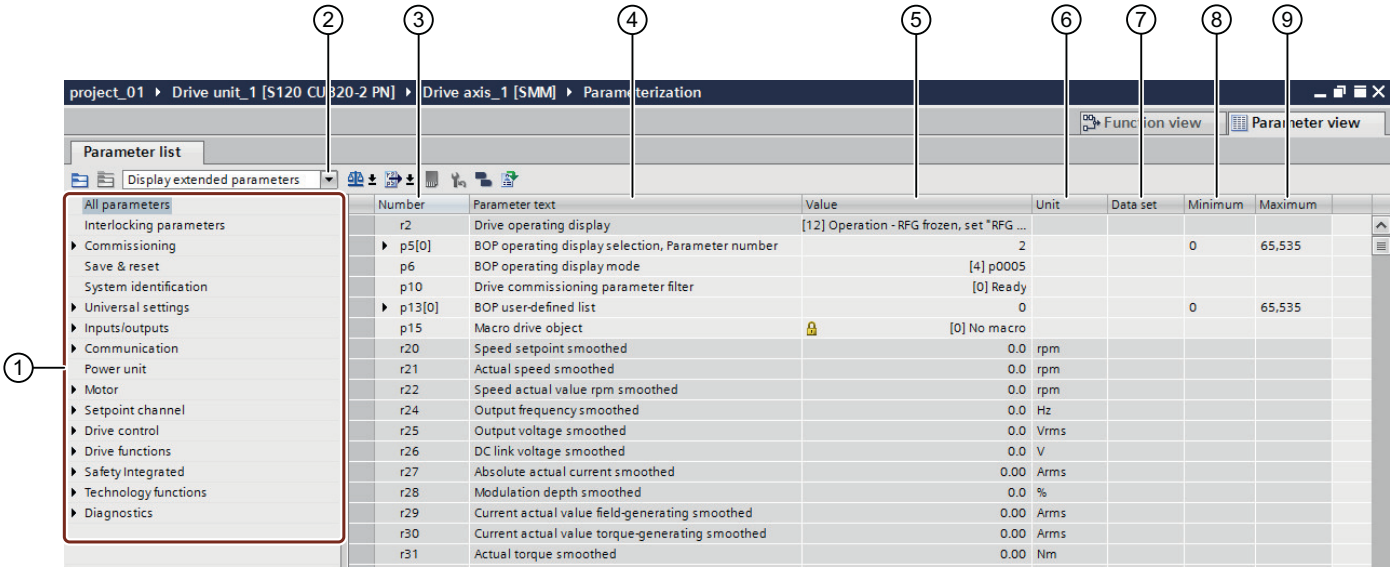
3.2.5 Parameter view

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 applies to the following product groups: S120, S150, G150 and G130.

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 sets:
Here it is displayed as to which data set (e.g. MDS, DDS) a parameter belongs.

⑧ Minimum values

⑨ Maximum values

Figure 3-6 Example: Parameter list

Explanation of icons

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

Icon	Meaning
	Expands or reduces all secondary navigation nodes.
	Expands or reduces all nodes below the selected node.

Icon	Meaning
	Compares the parameters of the drive object with 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.
	Starts a CSV export. 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.
	Retentively saves the parameters (copy RAM to ROM).
	Restores the factory settings.
	Shows open BICO interconnections on all drive objects in the offline project.
	Opens an exception list for know-how protection.

Display of the parameters

The fields of the individual parameters are displayed in the list using the following colors:

Authorization	Offline mode	Online mode
Readable	Gray	Light orange
Readable/changeable	White	Orange

Blocked parameters

Parameters that are marked using a lock icon are locked and cannot be changed.

Offline mode

In the offline mode, parameters can be locked for the following reasons:

- If parameters can only be changed in the online mode. The lock icon disappears as soon as you switch into the online mode.

Note

Blocked parameters

Parameters with lock icon cannot be 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.

Online mode

In the online mode, parameters can be locked for the following reasons:

- If a parameter was set in the course of the basic parameterization, and a change would subsequently result in a change to the structure.
- For parameters that should not be changed by the user, e.g. because they are parameterized by a controller or another application.
- For parameters that are only to be configured in Startdrive via input screens. In these cases, the display in the parameter view only provides an overview.

Using parameter lists

You can find additional information about using parameter lists in Chapter "Using parameter lists (Page 79)".

3.2.6 Inspector window

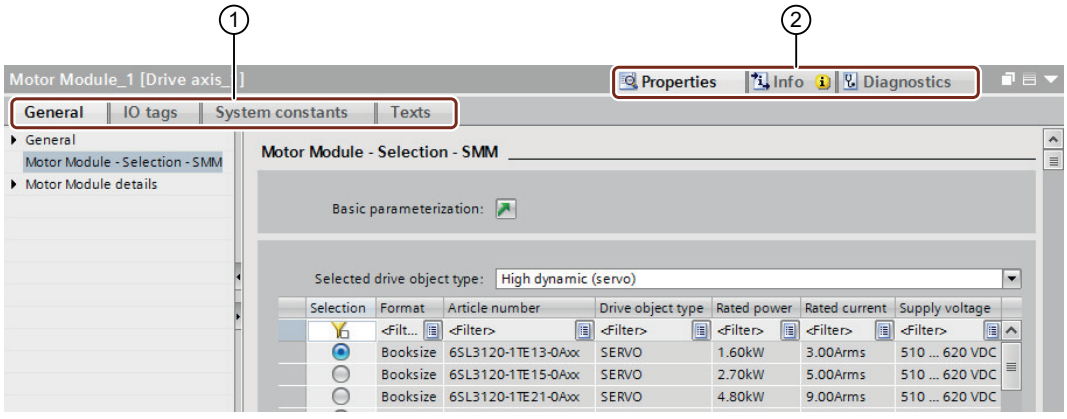
Overview

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 3-7 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 icon ▶ 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.

3.2.7 Device configuration detection

Overview

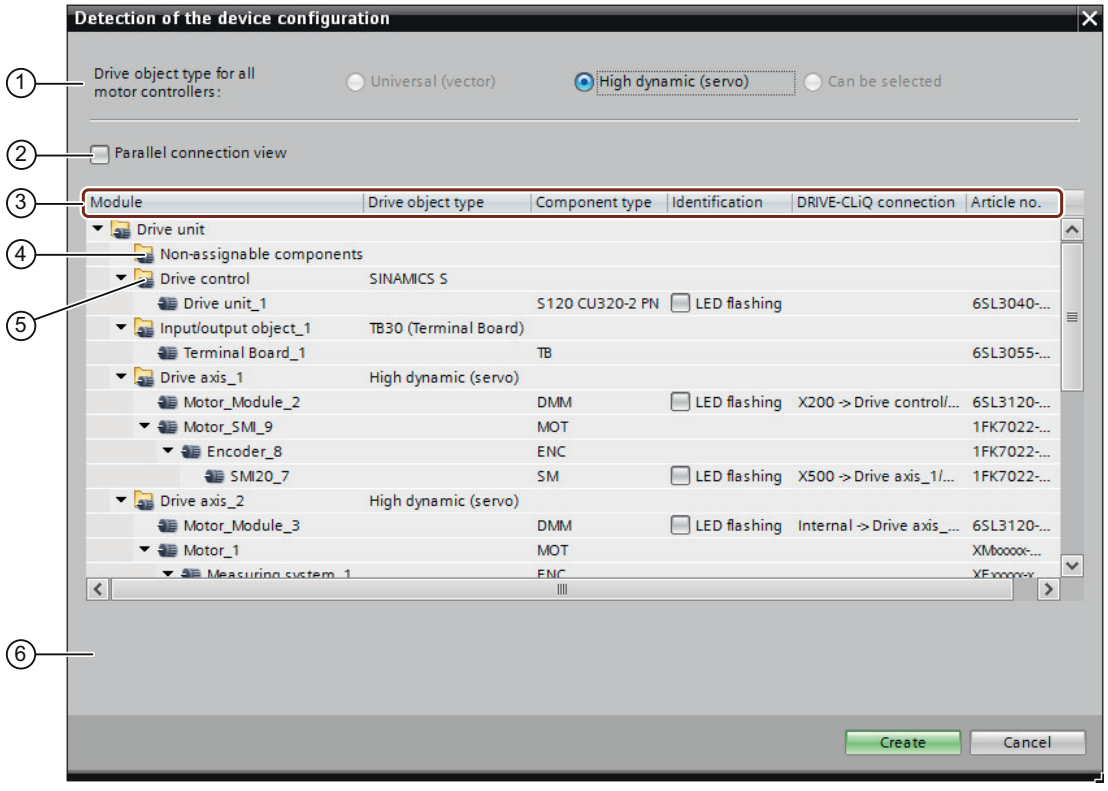
The results of a detection run are listed in the dialog "Detection of the device configuration". The components are assigned as follows:

- 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 Chapter "Determining the drive configuration (Page 174)").

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 3-8 Example: Device configuration detection

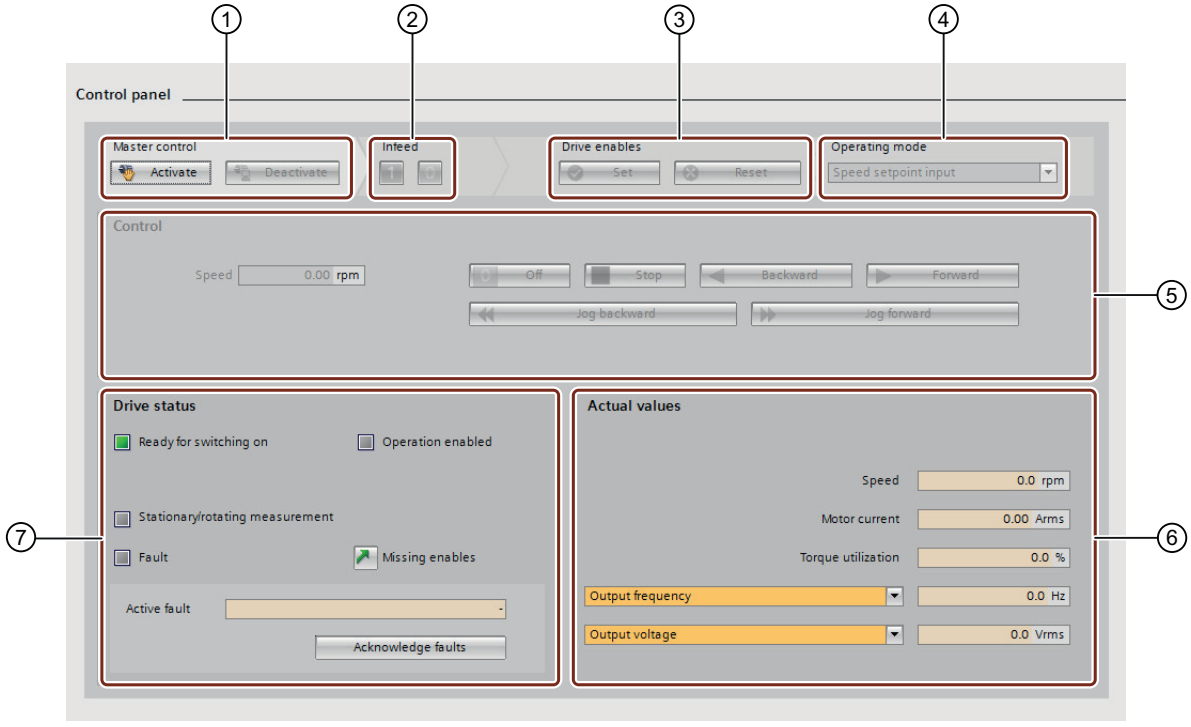
3.3 User interface - Control panel

Overview

The control panel is used for the control and monitoring of individual drives. You traverse drives from the control panel by specifying values (e.g. speed setpoint).

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/switch-off infeed
③ Set/reset drive enable signals
④ Select operating mode
⑤ Control drive (elements vary slightly depending on the set operating mode.)
⑥ Display of the actual values
⑦ Indication of the drive status

Figure 3-9 Example: CU320-2 PN

Restrictions

- The "Switch-on/switch-off infeed" ② option is only available when using a CU320-2 PN without a PM240-2 Power Module.

Further information

You can find further information in Chapter "Using the control panel (Page 244)".

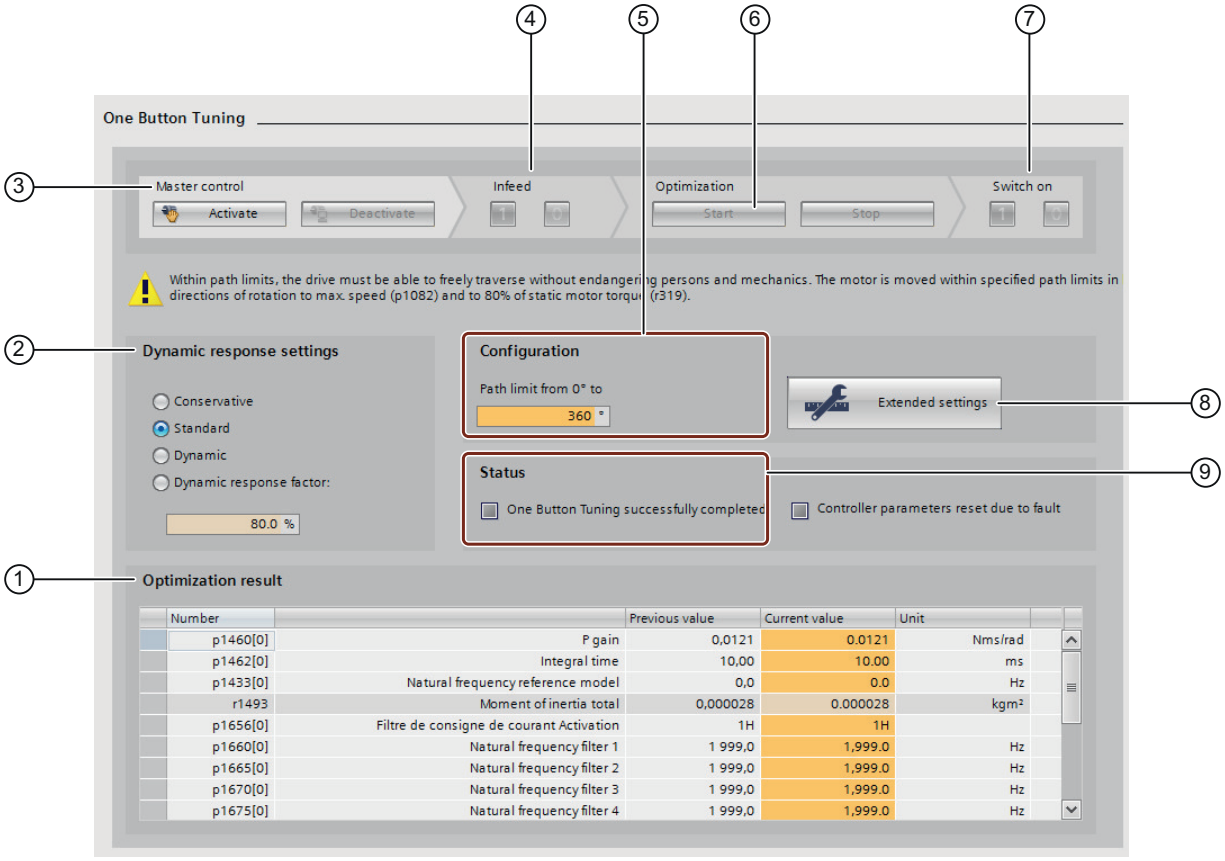
3.4 User interface - One Button Tuning (OBT)

Overview

One Button Tuning (OBT) is used to determine the optimum control parameters of a servo drive.

Structure of the screen form

The following diagram shows as example the various components of the "One Button Tuning" screen form:



① Result of the controller optimization:
Shows among other things a comparison of the values before and after tuning.
② Dynamic response settings
③ Activate/deactivate master control
④ Switch-on/switch-off infeed
⑤ Configuration / distance limit
⑥ Start optimization
⑦ Activate/deactivate controller optimization
⑧ Advanced settings for selected parameters
⑨ Status of controller optimization

Figure 3-10 Example: CU320-2 PN

Restrictions

- Option "Dynamic response factor" in the setting range "Dynamic response settings" ② is only available when using a CU320-2 PN.
- Option "Switch-on/switch-off infeed" ④ is only available when using a CU320-2 PN.

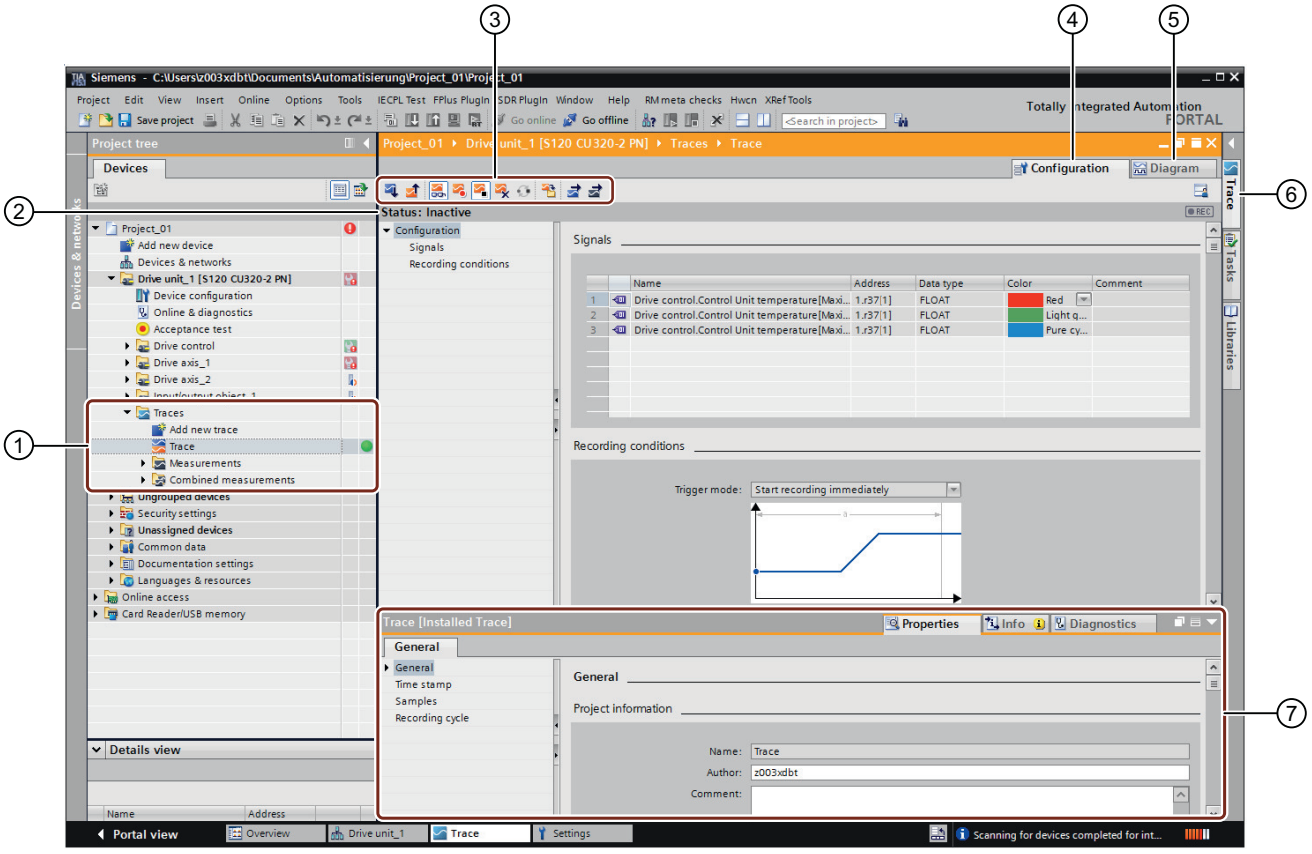
Further information

You can find further information in Chapter "One Button Tuning (OBT) (Page 253)".

3.5 User interface - trace function

Structure of the user interface

The user interface of the trace function is made up of several display areas. The following figure shows an example of the structure of the trace user interface.



① Project tree: Here, you can add a new trace or call an existing trace.

② Status display: The status of the actual trace recording is displayed here. The status is displayed in the **online mode** only.

③ Toolbar: You manage traces in the project and in the drive using the operator controls in the toolbar.

④ Configuration: Here, you perform the device-specific configuration of the trace (e.g. duration of recording, trigger condition, signal selection).

⑤ Diagram: The recorded values are displayed in a curve diagram here. The signal sources of the displayed measurement are also displayed.

⑥ Trace: The measurement cursor data and snapshots are displayed here.

⑦ Inspector window: General information on the trace configuration is displayed here.

Figure 3-11 Example: CU320-2 PN

3.5.1 Curve diagram

Overview

The curve diagram displays the selected signals of a recording. Binary signals are shown in the lower diagram as bit track. You can adapt the display of the signals in the signal table and with the toolbar of the curve diagram.

Setting options and displays in the curve diagram

The following figure shows an example of the representation in Startdrive:

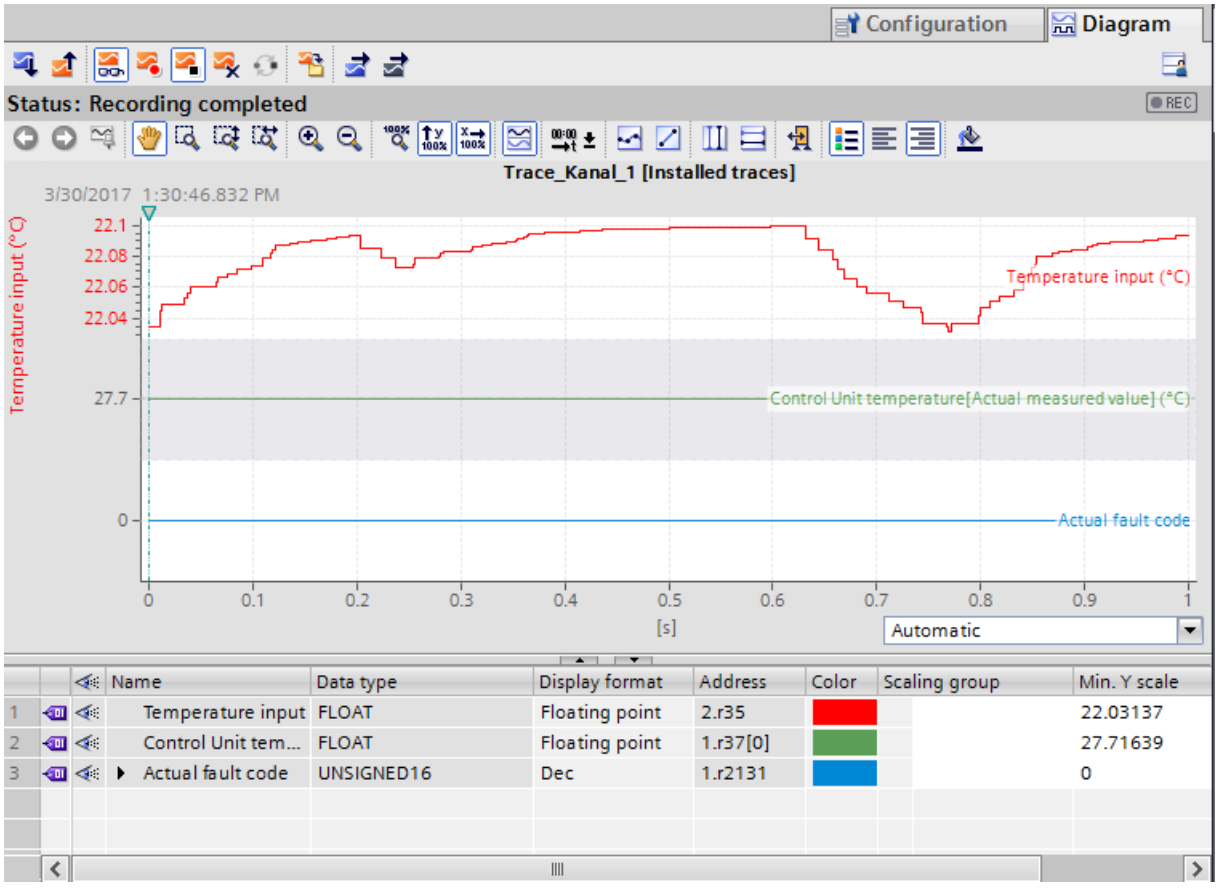


Figure 3-12 Overview: Curve diagram

3.5.2 Signal table

Overview

The signals of the selected measurement and setting options for individual properties are displayed in a list in the signal table. Recording data of traces and changed settings in the signal table are only displayed in online mode. If you switch to offline mode, the information is lost. If the installed trace is added to the measurements, the current settings of the signal table are saved in the measurement.

The signals can be sorted using drag-and-drop. The bits of a signal can be resorted within a signal.

Layout of the signal table

The following figure shows an example of the structure of the signal table.

			Si...	Name	Data type	Display format	Address	Formula		Color	Scaling gro...	Min. Y scale	Max. Y scale	Y(t1)	Y(t2)	Delt...	Unit	Comment
1			$0	"Trace-Data"....	Int	Dec +/-					Temp	0	1800	106	74	-32		
2			$1	"Trace-Data".C...	Real	Floating point					Temp	0	1800	-27....	27....	55....		
3			$2	"Trace-Data".Sir	Real	Floating point						-99.99971	99.99997	96....	96....	-0.0...		

Further information

You can find additional information on the signal table in the information system of the Startdrive in the TIA Portal.

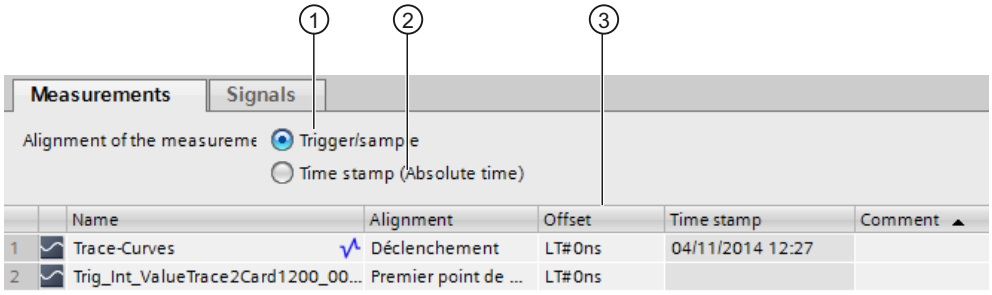
3.5.3 Measurements (overlay measurements)

Overview

The "Measurements" tab displays the individual measurements and, for example, provides the setting options for synchronization.

Layout of the "Measurements" tab

The following figure shows an example of the structure of the "Measurements" tab.



① "Trigger/measurement point":

This option facilitates the alignment of the measurements in accordance with the trigger or measurement point. The individual zero point for the measurement is predefined in the table under the "Alignment" column.

② "Time stamp (absolute time)":

This option facilitates the alignment of the measurements in accordance with the time stamp. The signals are aligned in accordance with the time from the absolute time stamp.

③ "Name":

The measurement names and change options are displayed here.

"Alignment":

The individual zero point of a measurement is defined here. All of the displayed signals of the measurement are relative to the defined zero point.

"Offset":

The measurement can be moved left or right on the time axis by the specified offset here.

"Time stamp":

The trigger instant is displayed here.

"Comment":

The comments and input option for a signal are displayed here.

Figure 3-13 Example: "Measurements" tab

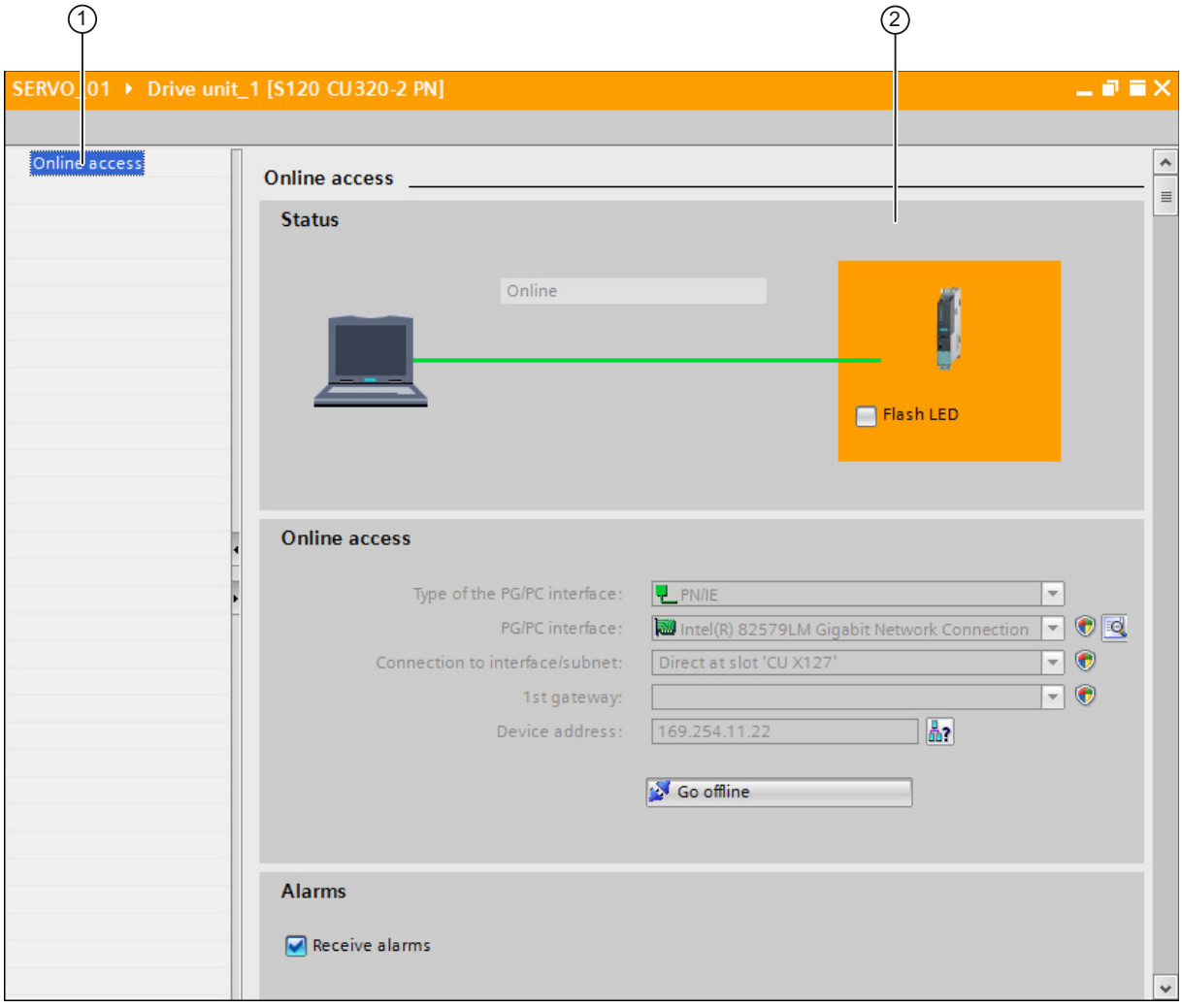
3.6 Online and diagnostics

Overview

You can check the status of the online accesses using function "Online & Diagnostics", and if necessary, you can establish or disconnect an online connection.

Layout of working area "Online access"

The following figure shows an example of the structure of the "Online access" working area:



① "Online access"

② Working area for online access and diagnostics

Figure 3-14 Example: Online access

Further information

You can find further information in Chapter "Online diagnostics (Page 328)".

3.7 Information system

Overview

The Startdrive information system opens in a separate window. The following diagram shows an example of the Startdrive information system in the TIA Portal:

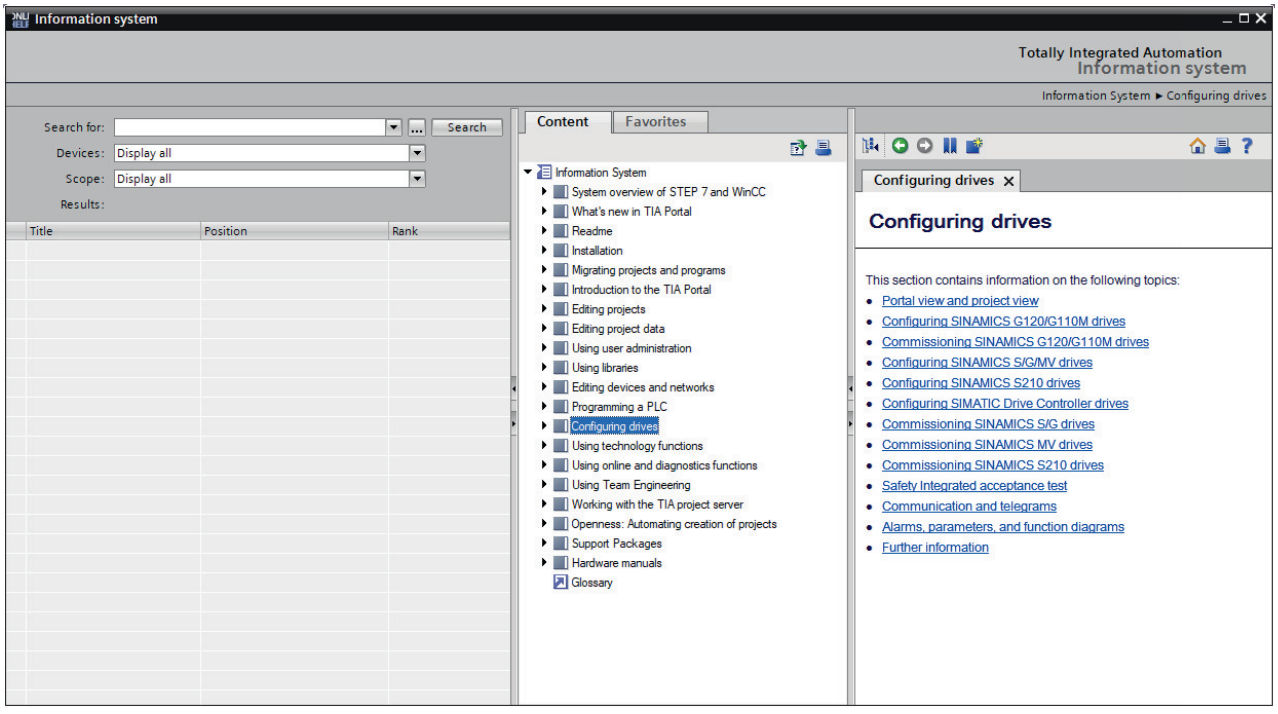


Figure 3-15 Example: Configuring drives

The information system is divided into the following sections:

- **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 several tabs to display different help pages at the same time.

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

Calling help topics

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

You receive the following support when working in Startdrive:

- **Information system**
  The Startdrive information system provides background information, step-by-step instructions and examples that are needed for working in Startdrive.
- **Tooltips**
  The tooltips in Startdrive provide information on interface elements. In some instances, tooltips are supplemented by cascades containing more precise information.
- **Help for the current context**
  You can open the help for the current context (e.g. for menu commands) via the <F1> function key.
- **Help regarding messages or diagnostics**
  The help for messages or diagnostics are displayed in the inspector window and can be called there.
- **Help for parameters and function diagrams**
  You can call help for parameters and function diagrams by clicking on the particular locations in a help text.

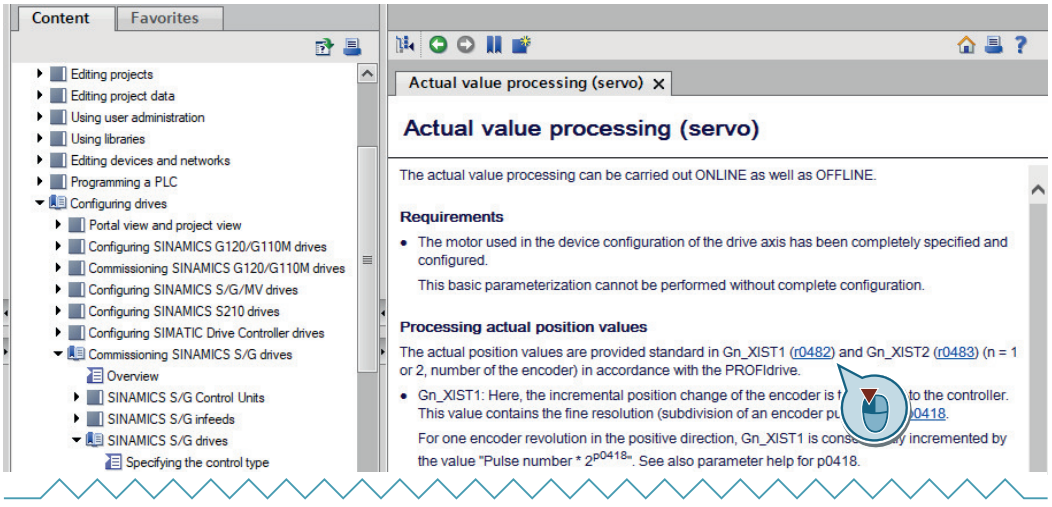


Figure 3-16 Example: Calling help for parameters

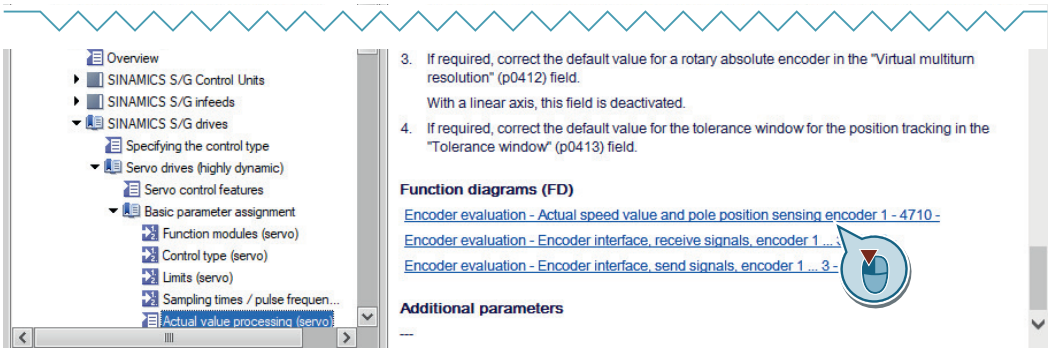


Figure 3-17 Example: Calling function diagrams

The most important information regarding the Startdrive information system is provided below.

Opening the information system with the menu

To open the Startdrive information system, select the command "Display help" in the "Help" menu.

The start page of the information system opens.

Further information

You can find further information in the Startdrive information system by searching for "Help on information system".

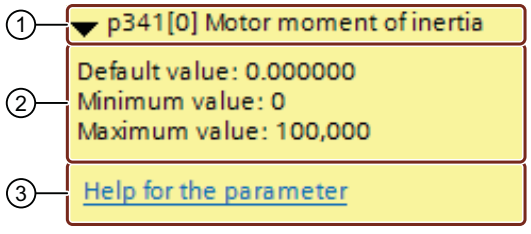
3.7.1 Tooltip

Overview

Interface items (e.g. input fields, buttons, icons) give you brief information in the form of tooltips. Tooltips, which have an arrow icon at the left, contain additional information.

If additional information is available, a link to the corresponding help topic appears in the lower area of the tooltip dialog. To display the additional information, proceed as follows:

A tooltip with complete content is shown as example in the following figure:



① Tooltip topic
② Additional information
③ Help on parameters/additional information

Figure 3-18 Example: Tooltip opened

Opening additional information

If there is additional information in the tooltip, you can open it as follows:

1. Click on the arrow icon ▼ in the displayed tooltip.
   OR
2. Keep the mouse pointer for a longer period of time over the tooltip.
   The additional information is displayed in the tooltip.

Note

The automatic display of tooltip cascades can be disabled.

Opening further information

If there is more detailed information in the tooltip, you can open it as follows:

1. Click on a link in the lower section of the opened tooltip dialog.
   The information system opens and the additional help topic appears.

3.7.2 Help for the current context

Overview

You can open help for the current context (e.g. menu command, program element) via the <F1> function key.

Opening the information system with <F1>

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

1. Select an object (e.g. menu command, program element) for which you would like to display the help.
2. Press <F1>.
   The information system opens. If there is information on the current context, the further help topic is displayed. If no information on the current context is available, the home page of the information system is displayed.

3.7.3 Help for messages and diagnostics

Overview

Numerous actions in 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.

The following figure shows an example of the "Info" tab with some messages.

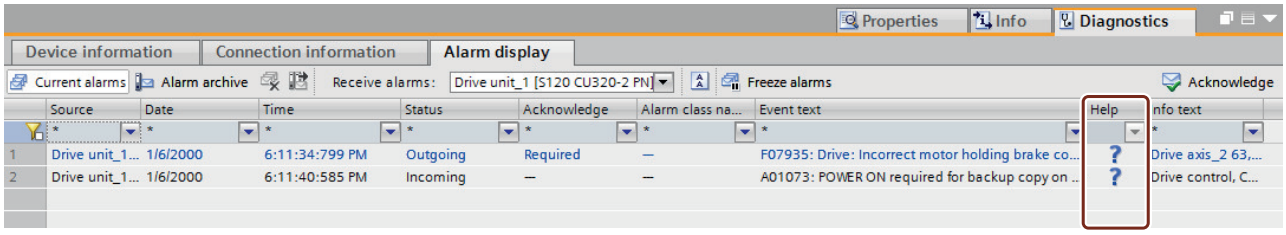


Figure 3-19 Example: messages in the inspector window

Opening the help for messages and diagnostics

Some messages offer further help. To display the help for a message, proceed as follows:

1. Ensure that the inspector window is open.
2. Click on the 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.

In the same way, you can call additional support for listed messages under the "Diagnostics" tab.

Further information

You can find further information on the inspector window in Chapter "Inspector window (Page 48)".

3.8 Project protection and user administration

Overview

You can also use the user administration in the TIA Portal for Startdrive projects. In this way, for example, a project can be protected against unintentional or unauthorized modification. A user sets up the project protection to activate user management. This user is created as a project administrator. Once the project protection has been activated, the project can only be opened and edited by authorized users.

Note

Withdrawing project protection

Project protection once setup **cannot** be withdrawn again.

Users

A project administrator must add users and user groups. The following user and user groups are permissible:

- Local project users
  Users who are defined and managed in a TIA Portal project. These user accounts are only valid for one TIA Portal project. It makes sense to use project user accounts if the entire automation solution is developed in one project.
- Global users and user groups
  These user accounts are defined and managed outside the TIA Portal in UMC (User Management Component). You can import global users and user groups into the different TIA Portal projects with which these users are to work. To add users and user groups from UMC, the corresponding rights are required in UMC.

You can assign specific roles to users or user groups, which in turn can be linked to different function rights.

Function rights

There are the following general function rights to which a role can be assigned:

Function right	Open project	Change project	Open user administration (Editor)
Open a project, read access only	x	-	-
Open project reading / writing	x	x	-
Managing users and roles	x[1)]	x[1)]	x

[1)] To be able to administer users and roles of the project, the user requires the function right "Open project reading/writing".

In addition to these general function rights, further engineering and runtime rights can be assigned. The descriptions of these specific function rights can be found in the corresponding areas of the help. Several function rights can be assigned to a role.

Roles

When you enable user administration, the system creates the following two roles:

- ES Administrator
  This role is assigned to the project user first created and has all three function rights by default. Each project requires at least one administrator, authorized to edit the project and the security settings. In addition, other users may be assigned the right to manage users and roles.
- ES Standard
  Users with this role have the "Open project read-only" and "Open project read/write" rights.

You cannot change or delete these system roles. You can create additional roles and assign these the required function rights.

Note

Additional local user administrations

Besides the user administration for projects, there are also additional user administrations in certain areas of the TIA Portal, e.g. for WinCC Panels.

Further information

You will find further information on user management (e.g. activating user management, managing project users, defining password guidelines, etc.) in the Startdrive information system.

Fundamentals

4

4.1 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 Startdrive engineering tool
- 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:

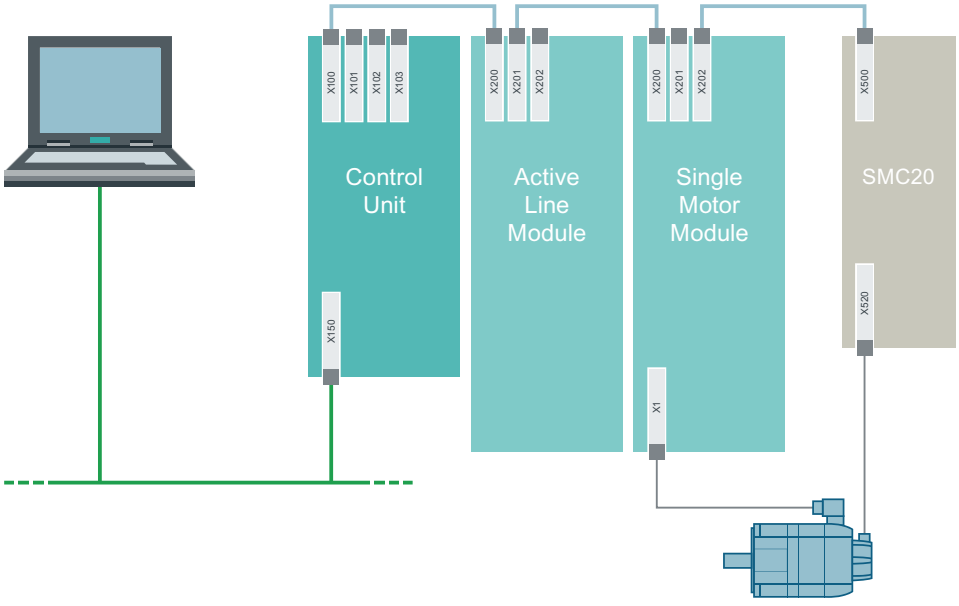


Figure 4-1 Example: layout of components

4.2 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.

4.3 BICO interconnections

4.3.1 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.

BICO parameters can be parameterized in the Startdrive engineering tool in the following display areas:

- Parameter view
- Function view

Definition: Binectors

A binector is a unitless digital (binary) signal that can assume a value of 0 or 1.

Binectors are subdivided into binector inputs (BI) and binector outputs (BO).

Abbreviation	Icon	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

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 (CI) and connector outputs (CO).

Abbreviation	Icon	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.

Multiple BICO interconnections

Icon  has the following meanings:

- Icon in the toolbar:
  Determines all open BICO interconnections in the drive objects of the project.
- Icon next to the interconnection:
  Opens an interconnection dialog in which you can create a bit-by-bit interconnection (multiple interconnections).

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.

4.3.2 Interconnect BICO inputs

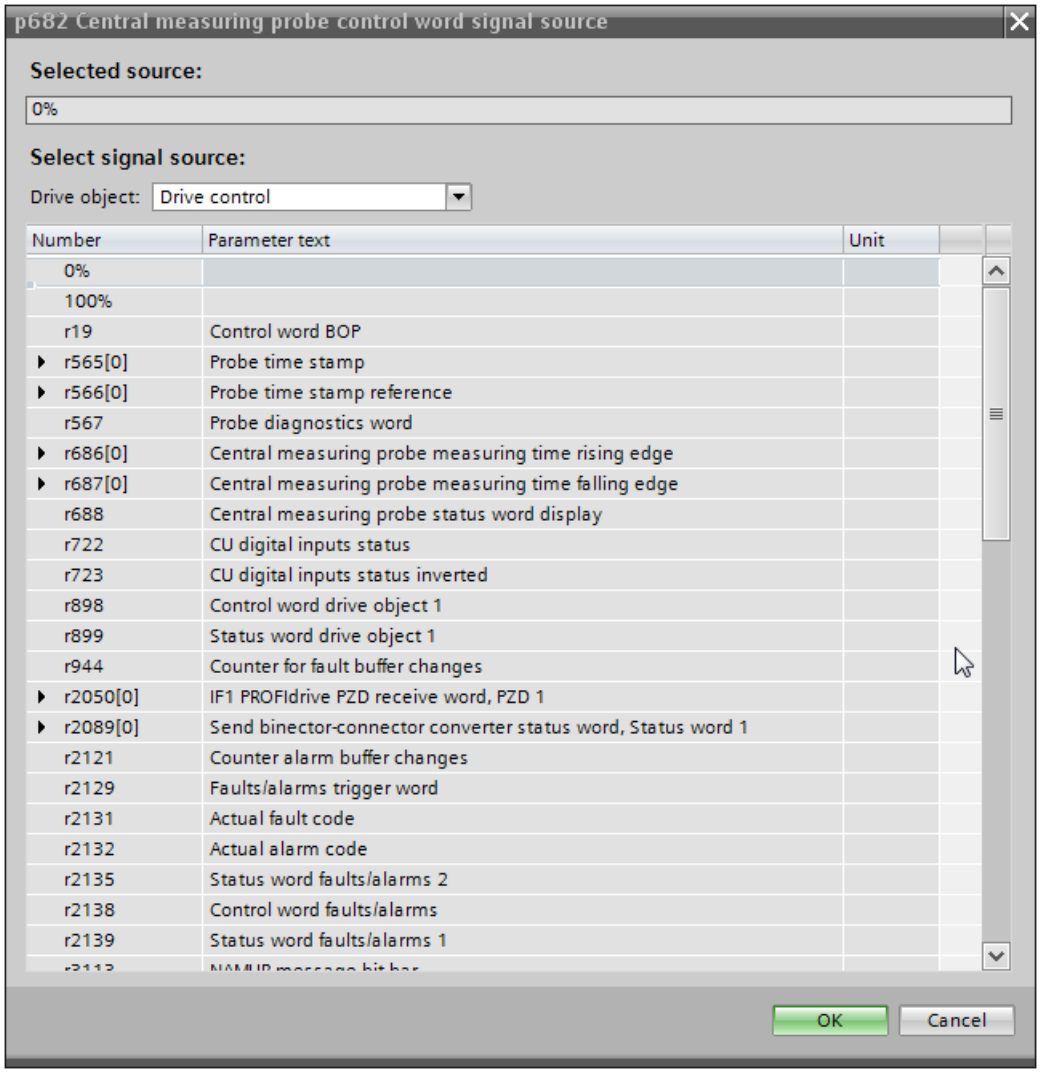
Overview

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

Procedure

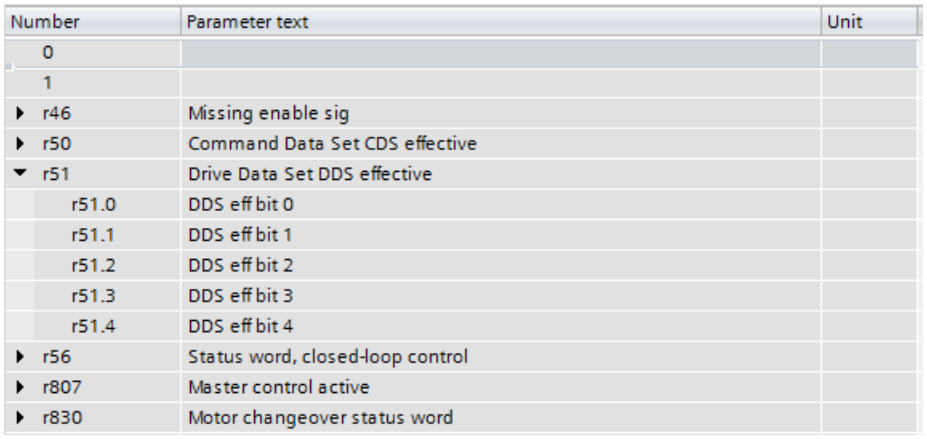
To interconnect a BICO input, proceed as follows:

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.



   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	

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).

4.3.3 Interconnecting BICO outputs

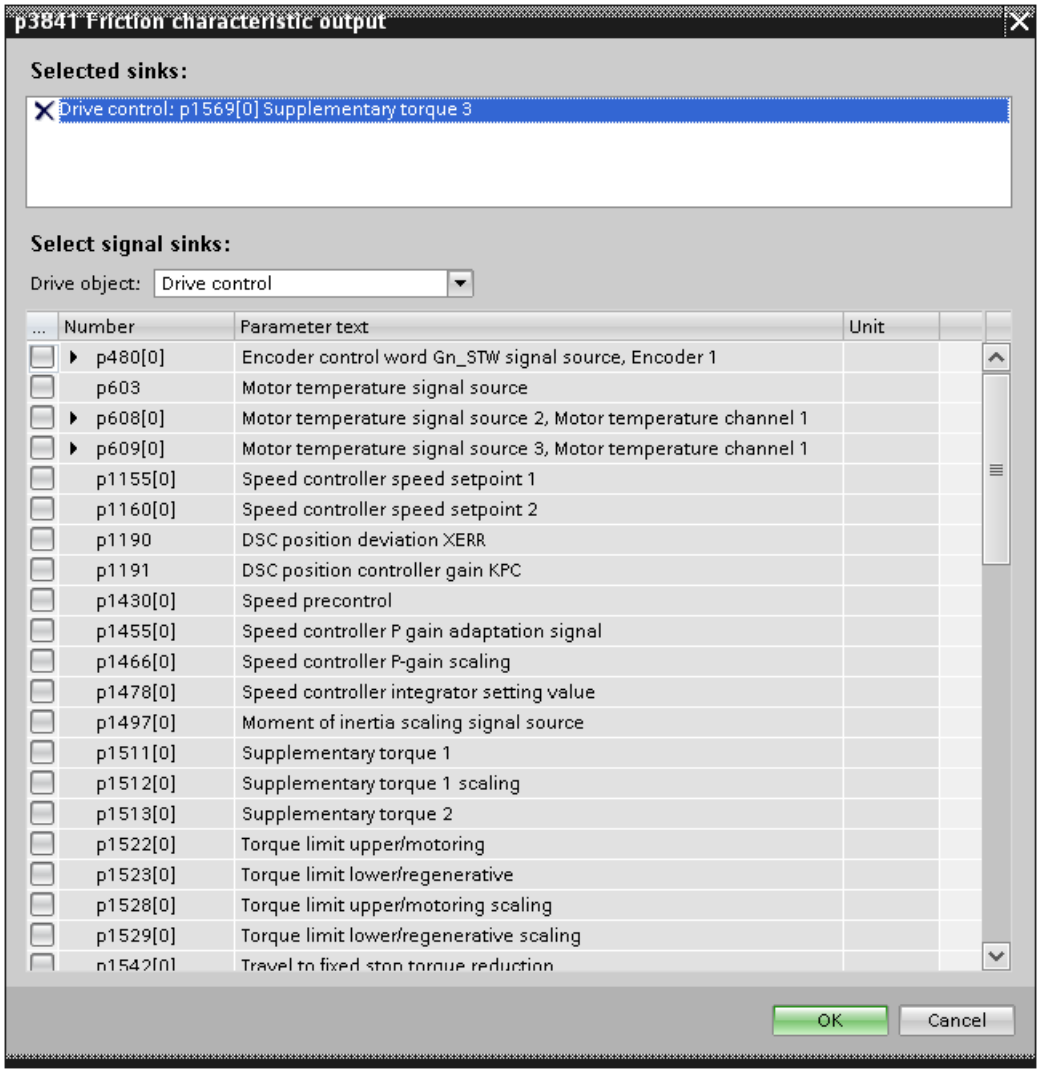
Overview

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

Procedure

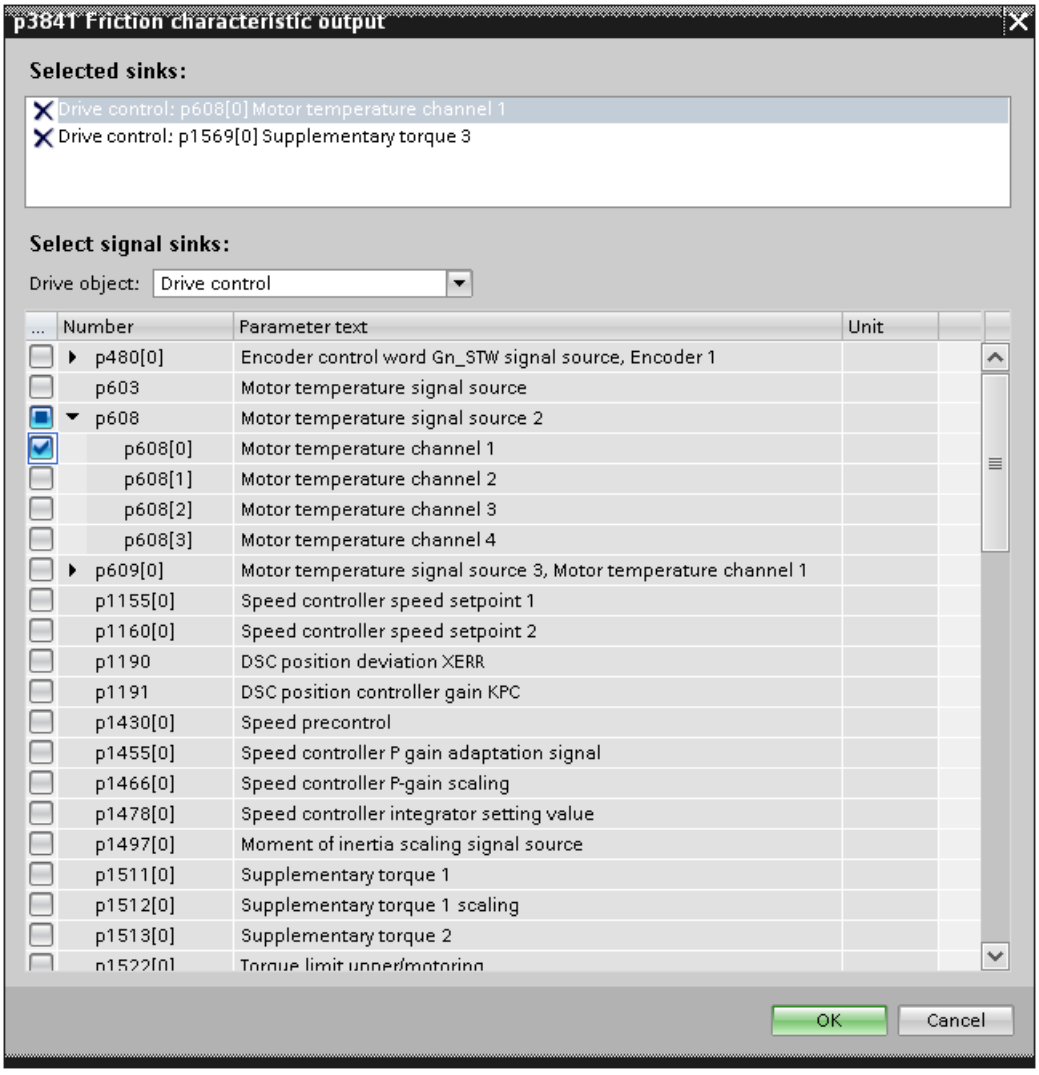
To interconnect a BICO output, proceed as follows:

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.



   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.



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.

4.4 Activating / deactivating individual drive components

Function description

Configure the drive, which comprises a CU and additional components, in the device view (DRIVE-CLiQ Editor). All drive components are activated by default.

When replacing parts, carrying out testing or service, it may be necessary to briefly deactivate and then reactivate individual components. The following options are available in the device view:

- Deactivate component:
  Deactivates a selected component.
- Activate component:
  Activates a deactivated component.
- Deactivate component and not available:
  Deactivates individual components in a large drive line-up that are actually missing. This facilitates the maximum expansion level of a drive project.
  Deactivated components in the drive project can also be missing in the hardware without any errors being generated because of it. Possible applications are, for example, testing parts of a large plant or commissioning components when parts are replaced.

Components that can be deactivated:

The components that can be deactivated are listed in the following table:

Component	All/no options can be used[1)]
Control Unit (CU)	–
Line Module[2)]	X
Power Module[3)]	X
Motor Module	X
Motor	–
Measuring systems / encoders	–
Encoder evaluation	X
Control Unit Adapter (CUA)[2)]	X
DRIVE CLiQ Hub Module (DMC20 / DME20)	–
Communication Board (CBE 20)[2)]	–
Terminal Board (TB30)[2)]	–
Terminal Modules	–
Voltage Sensing Modules	X

1) The following applies to individual components and not to drive objects.

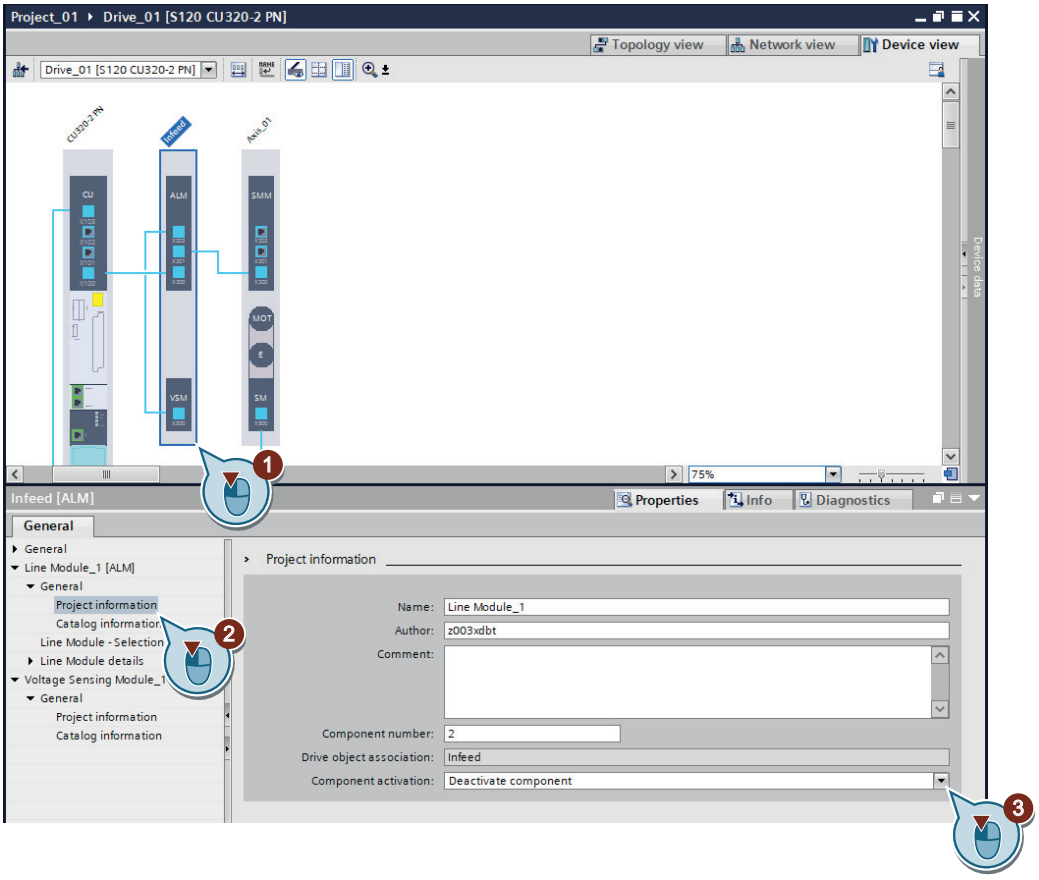
2) Only available for CU320-2 PN.

3) For CU310-2 PN, the Control Unit Adapter (CUA) is not available for PM240-2.

Deactivating / activating component

Proceed as follows to deactivate a component in the device view:

1. In the device view, select the drive object, (e.g. infeed) with the component that you wish to deactivate ①.



2. In the inspector window, open menu "General" of the required component and click on entry "Project information" ②.
3. In the drop-down list "Component activation", select the required option ③.
   The following options are available:
   - Deactivate component
   - Activate component
   - Deactivate component and not available
4. Save the project.

4.5 Using parameter lists

4.5.1 Editing the parameter list

Overview

The following functions are available in the parameter view:

- Monitoring and editing parameter values
- Changing/restricting parameter view
- Exporting the parameters as CSV

Additional information on the user interface structure is provided in Chapter "Parameter view (Page 44)".

Monitoring and editing parameter values

Input fields of parameters, which can be changed, are shown in orange in the online mode.

Proceed as follows to change parameters in the online mode:

1. Establish an online connection (Page 152).
2. If necessary, change individual parameter values/settings.
3. Confirm the change with <Enter>.
   The settings immediately become effective in the drive.

Changing the parameter view

You can toggle between the following views:

- "Display standard parameters" (default setting):
  This view displays the most important and typical parameters of the drive.
- "Display extended parameters":
  This view contains parameters that are required by experts for extended settings.
- "Display service parameters":
  This view contains parameters that are required by service employees.

Filter selection

Independent of the selected setting, as default, all parameters of a selected drive object are displayed.

In the secondary navigation, to filter the displayed list, click on the required category (e.g. commissioning). Only the parameter set for the selected category is then displayed.

Exporting the parameters to CSV file

Files in the CSV format (*.csv) can only be opened in spreadsheet programs or editors.

Proceed as follows to export the parameter list as CSV file:

1. Click on the arrow icon in the button .
   A menu selection opens. The following export options are available:
   - Exporting displayed parameters in a CSV file
   - Exporting parameters of all drive objects in a CSV file
2. Select the required export option.
   The Export window opens.
3. Select a storage location in your directory tree, assign a name for the CSV file and click "Save".
   The parameter list is saved as a CSV file.

4.5.2 Searching for parameters

Use the standard search function of the TIA Portal to specifically search for parameters.

More detailed information about searching and the search settings is provided in the Startdrive information system. You can call help directly from the tooltip.

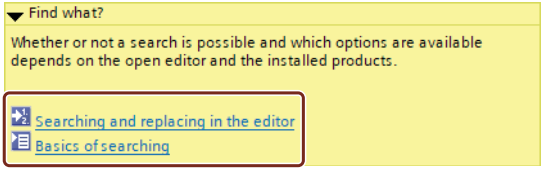


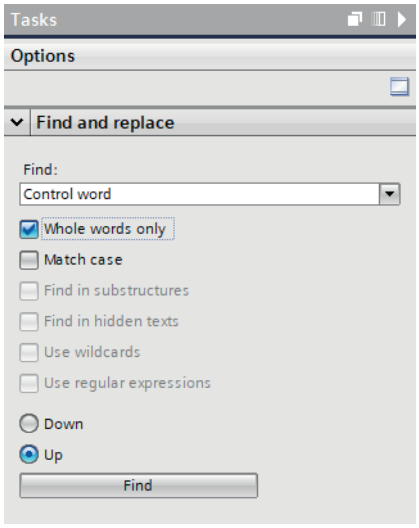
Figure 4-2 Example: Calling help from the tooltip

Procedure

The standard TIA Portal search is displayed in the "Tasks" viewlet.

Proceed as follows to search for individual parameters or terms:

1. Ensure that the parameter view is selected.
   The parameter is selected if the upper editor bar is dark blue.
2. Enter <Ctrl+F>.



3. Enter a parameter number or a search term in the search field (e.g. control word).
4. Press <Enter> or click on "Search".
   If the parameter or term being searched for is found, then this is highlighted in the parameter list.
5. Press <F3> to jump to the next search result.

4.5.3 Comparing parameters

Overview

Using the comparison function in the parameter view, you can compare the actual value in the parameter set of a drive object (e.g. infeed) with values from the factory settings or from the offline/online mode.

Offline mode

In the offline mode, the actual values are compared to the factory settings by default.

Online mode

In the online mode, the actual values are compared to the offline settings by default. In addition, you can compare the actual values with the factory settings.

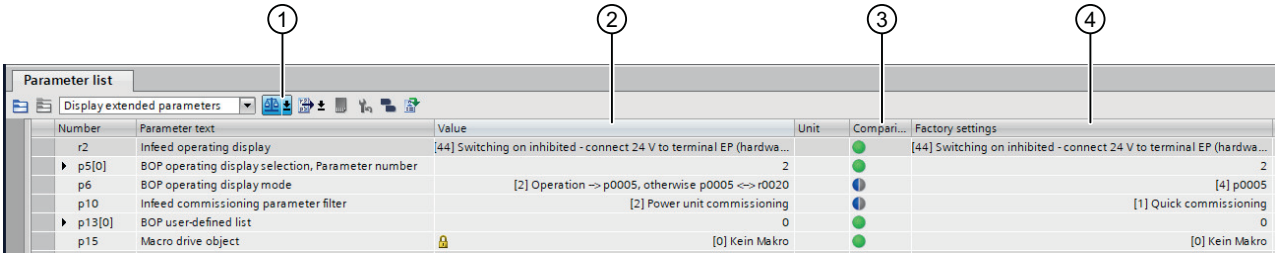
Procedure

Proceed as follows to make a comparison:

1. Open the parameter view of the drive object whose parameter set you wish to compare.
2. Click on the arrow icon in the button .
   A selection list containing the comparison options opens:

Mode	Options
Offline	Deactivate comparison
	Offline - Factory settings
Online	Deactivate comparison
	Online - Offline
	Online - Factory settings

3. Select a comparison option.
   The result of the selected comparison option is displayed using icons in the "Comparison" column ③.



① Activate/deactivate the comparison
② Lists of actual values
③ Result of the selected comparison option
④ List of comparison values

As soon as values are changed, the status display of individual values is automatically refreshed (e.g. in the offline mode from to).

Explanation of icons

The following table gives you an overview of the icons 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.

Icon	Meaning
	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).

4.6 Saving settings

To permanently save the settings, you have the following options:

- Saving settings in the project.
- Saving settings (offline/online) on the memory card of the converter.

4.6.1 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.

4.6.2 Saving settings retentively

Overview

The settings during parameterization are only saved volatile. They are lost when you switch off the converter.

To save an online or offline configuration retentively, the settings must be saved to the memory card of the converter.

Requirements

- PG/PC and converter are connected with one another via a LAN cable.

Saving online data

Click the icon in the function view of the active Startdrive project to save the online configuration retentively.

The current project settings are stored retentively on the memory card of the converter.

Saving offline data

Proceed as follows to save the offline configuration retentively:

1. Load the project data into the converter.
   For information on this, see Chapter "Loading the project data into the converter (Page 242)".
2. Click the  icon in the function view of the active Startdrive project.
   The current project settings are stored retentively on the memory card of the converter.

4.7 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 152) to your drive unit.
2. Click the  icon in the function view of the active Startdrive project.
   The factory settings are restored.

4.8 Loading project data from the converter

Overview

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

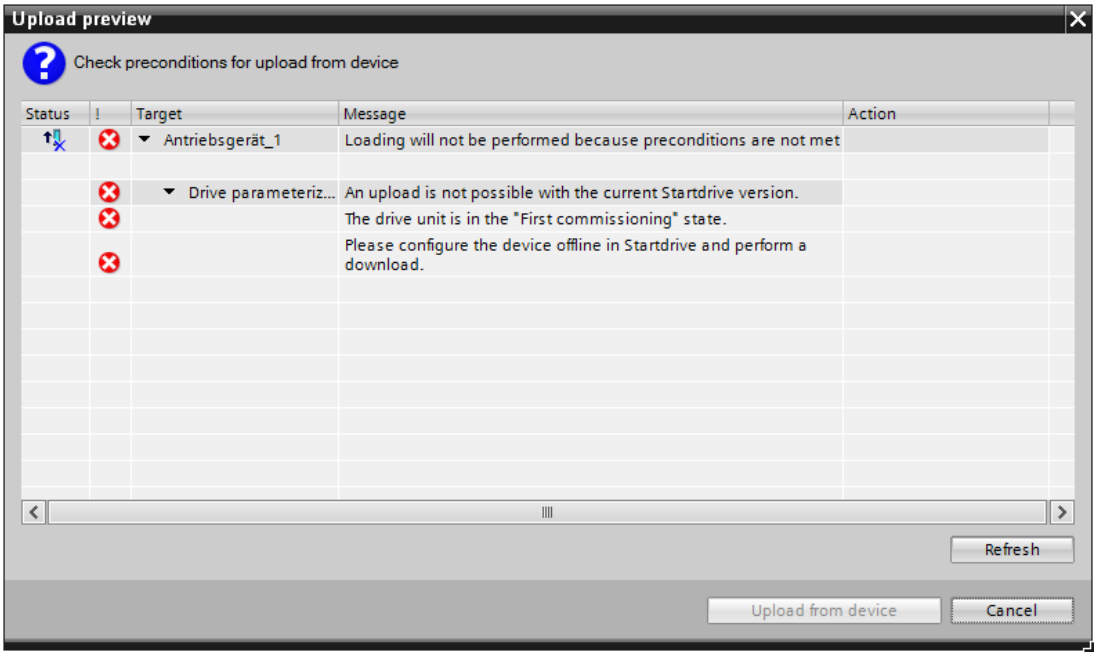
Requirements

- A project is open.
- The hardware configuration and software to be loaded must be compatible with the Startdrive (see Chapter "Checking the firmware version (Page 154)"). If the data on the device was created with a previous program version or with a different configuration software, please make sure they are compatible.

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 requirements for loading have been met. In the event of any obstructions, these are displayed as messages in the dialog.



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.

Result

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

4.9 Updating the firmware

Overview

The firmware for the SINAMICS S120 drive system is distributed in the system. It is installed on the Control Unit and in every individual DRIVE-CLiQ component.

When is a firmware update required?

A firmware update is required if you want to use a new firmware version with an extended range of functions. The available SINAMICS S120 firmware versions can be found on this web page (https://support.industry.siemens.com/cs/ww/en/view/109753109):

Note

Is the firmware version the same in the drive unit and Startdrive?

Online connections between the Startdrive project and drive unit are only possible if the firmware versions of both communication partners are identical (see Chapter "Checking the firmware version (Page 154)").

- If your current Startdrive project is working with an older firmware version than the drive unit, create a new project.
- Set the firmware version of the Startdrive project to the latest updated version of the drive unit and apply all other settings from the old project.
  If you are still using an old version of Startdrive, it may also be necessary under certain circumstances to install a new version of Startdrive that supports the firmware version.

Requirements

- There is a physical connection between the PC/PC and the drive unit via a LAN cable.

Procedure

Proceed as follows to update the firmware:

1. Before the firmware update, back up the configuration data from the "\OEM\SINAMICS\HMI\" directory of the memory card.

   Note

   Saving web server data

   The web server settings saved on the memory card are overwritten and therefore lost when the memory card is overwritten with the new firmware. To prevent this from happening, back up the data and upload it to the memory card again after upgrading the firmware.

2. Disconnect your Control Unit.
3. Remove the memory card with the old firmware version.
4. Overwrite the memory card with the new firmware version.
5. Use the backed-up data from the memory card with the old firmware to overwrite the following directory on the current memory card: \OEM\SINAMICS\HMI\.

6. Insert the memory card with the new firmware version.
7. Turn your Control Unit on again.
   The drive unit now starts with a self-configuration and downloads the firmware data from the memory card to the Control Unit.

RDY	COM	Explanation of LED displays
		Firmware update is active: • Do not disconnect the power supply. • Do not separate the motor from the converter.
		LEDs flashing in sync (1 Hz): Converter waits until the power supply is switched off and switched on again after a firmware update.

   Wait until the Control Unit has completed the transfer of the new firmware.
8. Then load the current Startdrive project data to the drive unit.
   See Chapter "Loading the project data into the converter (Page 242)".
9. Turn the drive unit off and on again.
   The firmware of the connected DRIVE-CLiQ components is updated. A restart may be required to complete the update (see Startdrive alarm messages).

RDY	Explanation of LED displays
 (0.5 Hz)	Firmware update of the connected DRIVE-CLiQ components in progress. • Do not disconnect the power supply. • Do not separate the motor from the converter.
 (2 Hz)	DRIVE-CLiQ component firmware update complete. Waiting for POWER ON of the respective component. **Remedy**: Turn the component off and on again.

4.10 Using libraries

4.10.1 Overview

Function description

In the TIA Portal, libraries are used to archive elements that you wish to reuse in a specific project or across projects.

In a project involving several drives, you can create copies of drives using master copies. You can then insert these elements at the required location in your project.

Library types

The following library variants are available:

- Project libraries:
  You use a project library if you wish to use copied elements in a project.
- Global libraries:
  You use global libraries if you wish to use the copied elements across projects.

Master copies

You can create master copies from the following elements:

- One drive / several drives from the project tree
- One network / several networks from the network view

The master copies include the complete parameterization of the drives and networks, and can be reused as often as required.

Further information

You can find further information about using libraries in the Startdrive information system.

4.10.2 Creating copy templates

Overview

Using master copies, you can create copies of a drive or network in a library.

Folder functions

The folder functions available are shown in the following diagram.

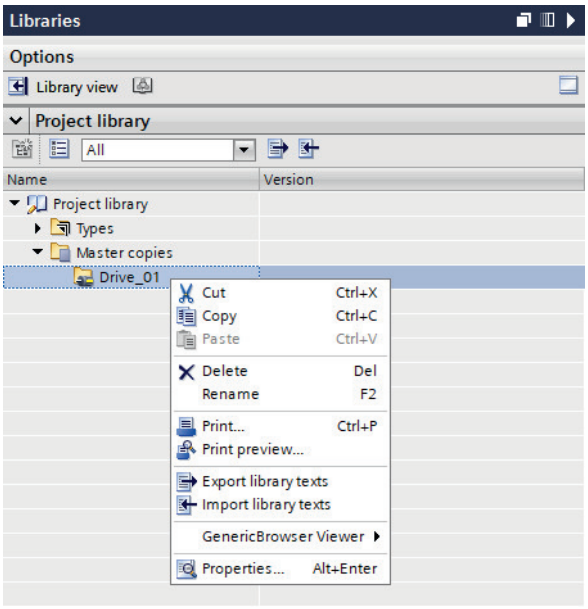


Figure 4-3 Example: Folder functions

Explanation of icons

The following table provides an overview of the icons that are displayed in the "Project library" palette.

Icon	Explanation
	Creating a new folder: Creates a new folder in the selected folder.
	Opening or closing the element view: All elements are displayed in the "Elements" palette when you open this view.
	Exporting library texts
	Importing library texts

You can obtain further information about the icons in the selected palette via tooltips and in the Startdrive information system.

Requirement

- The drives or networks that you wish to create as master copies and reuse are fully configured.

Procedure (project library)

Proceed as follows to create a master copy in a project library:

1. Open task card "Libraries".
2. Click on "Project library" to open the palette.

3. Select a device / several devices in the project tree.
   OR
   Select one network / several networks in the network view.
4. Drag your selection and drop it into folder "Master copies".
   The selected device is inserted as master copy in the library.

Procedure (global libraries)

Proceed as follows to create a master copy in a global library:

1. Open task card "Libraries".
2. Click on "Global libraries" to open the palette.
3. Create a new library.
   OR
4. Open an existing library.
5. Select a device / several devices in the project tree.
   OR
   Select one network / several networks in the network view.
6. Drag your selection and drop it into folder "Master copies".
   The selected device is inserted as master copy in the library.

Important notes

- If several devices have been selected, an entry is created in the library for each device.
- Folders (e.g.  for drives) are represented the same as in the project tree.
- Independent of their name in the project tree/network view, you can rename library elements as required.

4.10.3 Using copy templates

Overview

You can reuse archived libraries in as many projects as required, in order to be able to perform series commissioning, for example.

Procedure

Proceed as follows to use an existing master copy from a library.

1. Open the "Libraries" task card.
2. Click on "Project library" to open the palette.
   OR
3. Click on "Global libraries" to open the palette.

4. Select a master copy.
5. Drag the master copy and drop into the project folder in the project tree.
   OR
6. If the master copy originates from the network view, drag the master copy and drop it into the network view.
   The devices/networks contained in the master copy are created in your currently opened project.

Commissioning

5

Overview

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

Requirements

- TIA Portal is installed on your PG/PC.
  The version of the following software component applies exclusively to the current edition of this documentation:
  - TIA Portal V16 Update 1
- You have all of the required licenses to be able to use Startdrive in the TIA Portal without restrictions (see "Ordering software (Page 35)").
  The versions of the following software components apply exclusively to the current edition of this documentation:
  - SINAMICS Startdrive Advanced V16 Update 3
  - SINAMICS Firmware V5.2.3
  - SIMATIC STEP 7 Professional V16 (optional)
    You require this software component only if you wish to configure a SINAMICS drive together with a control system.

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 100).
2. Perform the basic parameterization of the drive units (Page 180).
3. Establish an online connection to the drive. (Page 152)
4. Download the project to the target device (Page 242).

5. Commission the drive via the control panel. (Page 244)
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 171).
2. Establish an online connection to the drive. (Page 152)
3. Load the configuration of the drive into the project (Page 168).
4. Edit the determined device configuration in Startdrive. (Page 179)
5. Perform the basic parameterization of the drive units. (Page 180)
6. Download the project to the target device (Page 242).
7. Commission the drive via the control panel. (Page 244)
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 171).
2. Optional: Establish an online connection to the drive. (Page 152)
3. Determining the drive configuration. (Page 174)
4. Edit the determined device configuration in Startdrive. (Page 179)
5. Perform the basic parameterization of the drive units. (Page 180)
6. Download the project to the target device (Page 242).
7. Commission the drive via the control panel. (Page 244)
8. Result: The motor turns.

5.1 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.

5.2 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.

5.3 Creating a project offline

The following options are available to you for Startdrive projects:

- You create a new project (see Chapter "Create a new project (Page 100)").
- You open an existing project and subsequently change the project configuration (see Chapter "Opening an existing project (Page 100)").

5.3.1 Create a new project

Overview

You can create new projects once you have opened the Startdrive application in the TIA Portal.

Procedure

Proceed as follows to create a new project:

1. In the secondary navigation of the portal view, click on the entry "Create new project". The input fields for the basic project data are displayed to the right in the detailed view.
2. Record the following project data:
   - **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**
     Brief info about the project can be entered here.
3. Click "Create" to save project data.

The new project is created and simultaneously opened.

5.3.2 Opening an existing project

Overview

You can open an existing project to change or extend the data saved in it.

Requirements

- The TIA Portal and the Startdrive engineering tool are opened (see Chapter "Calling the TIA portal (Page 97)").
- The existing project and the installed Startdrive version are the same version.

Note

Observing version assignments

In Startdrive, the extension of a project indicates the last Startdrive version used to process a project. The extension "*.ap15", for example, indicates the older version V15.

In contrast to G120 projects, S120 projects of version V14 SP1 cannot be opened with a newer version of Startdrive (V15 or higher). If you wish to upgrade older S120 projects of version V14 SP1 to version V15 or higher, proceed as described in the following document:

"Migrating SINAMICS S120 projects in Startdrive from V14 to V15 (https://support.industry.siemens.com/cs/ww/en/view/109755173)"

Procedure

Proceed as follows to open an existing project and to change the project configuration:

1. In the secondary navigation of the portal view, click on the entry "Open existing project". A selection of the projects last used is displayed to the right in the detailed view.
2. Then select the project that you have created and named, and then click on "Open".
   OR
3. Click on "Browse" and then double-click on the project that you have created and named in your directory structure.
4. Then click "Open".

Result

The selected project opens. If another project was previously displayed, then this project is now closed.

- If you have created a new project, the next possible steps for the project that has been opened are displayed in the detailed view.
- If you have opened an existing project, the interconnected modules of this project are displayed in the device view. You can change the interconnected modules as follows:
  - Specify a new module/modules.
  - Remove module(s)
  - Insert and specify a new module/modules.

Project protection

In the TIA Portal, you can also apply project protection to newly created or existing Startdrive projects. If a Startdrive project is protected, you have to enter a password when you try to open it. You require the following information to open a project:

- User name with authorization for this project
- Password

This information is generated and administered in the user administration of the TIA Portal. You can find further information about project protection in the Startdrive information system under "Using user administration".

5.3.3 Sequence when creating drive components

Overview

As a rule, the needed components must be inserted into the device configuration and specified after a new project is created. If the recommended sequence is maintained when inserting the components, then the inserted components are also automatically wired.

Recommended order

We recommend the drive components be inserted in the following order:

1. Control Unit
2. Infeed unit
3. Motor Module or Power Module
4. Motor
5. Encoders or measuring systems
6. Supplementary system components (e.g.: Terminal Module, Terminal Board, Communication Board, Voltage Sensing Module)

If this sequence is not complied with (e.g. because the infeed unit is only subsequently added), then it is possible that the components are not automatically wired. In this case, you must manually establish the wiring in the device view (see Chapter "Editing DRIVE-CLiQ connections (Page 117)").

Note

For some motors, an appropriate encoder is simultaneously created in the device view when creating and specifying a motor. The corresponding encoder is specified together with the motor.

Note

When you use Power Modules, it is usually possible to dispense with an infeed unit. Point 2 in the list above is then no longer applicable.

5.3.4 Inserting the Control Unit

A Control Unit must be inserted as the first component of a drive. You insert a SINAMICS S120 Control Unit into a new project via one of the following described ways:

- **Via the project view (recommended)**
- Via the portal view
- Via the network/topology view
- From existing projects
- From existing libraries

5.3.4.1 Inserting a Control Unit via the project view (recommended)

Overview

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

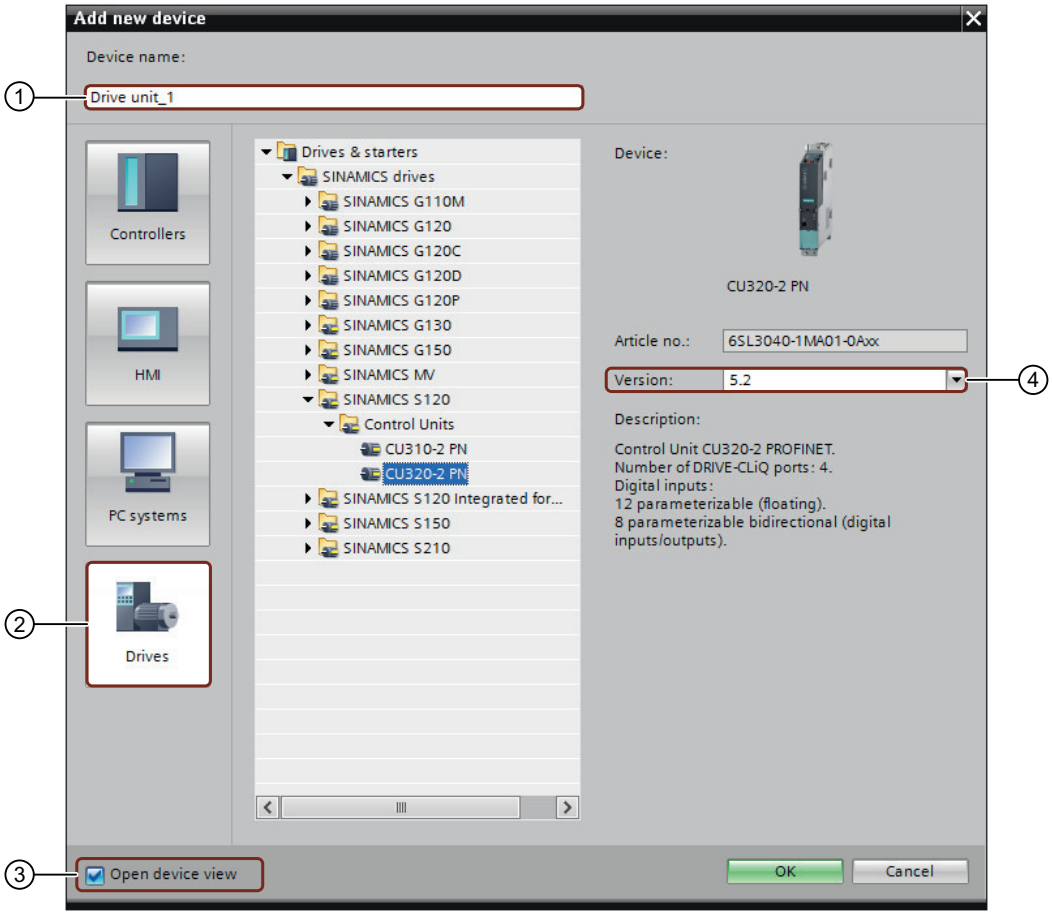
Requirements

- A project has been created, or an existing project is open.
- The online connection to the drive is deactivated.

Procedure

Proceed as follows to insert a Control Unit into the project view:

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



① "Device name" input field (default: Drive unit_x)
② "Drives" button
③ Activate/deactivate "Open device view" option
④ Drop-down list "Version" (here, select the firmware version of your drive device.)

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

3. Click on the required Control Unit in the "Control Units" list.

Note

Comparing and possibly changing version numbers

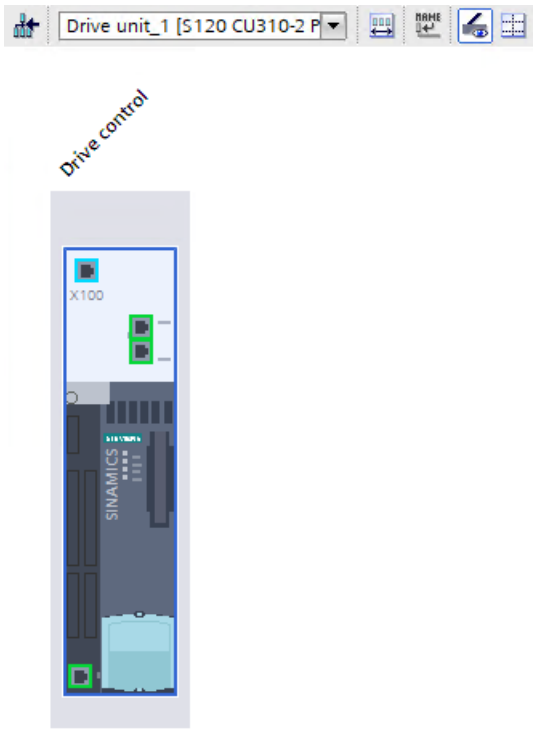
The latest firmware version is always suggested when creating a Control Unit. Under certain circumstances, the recommended firmware version does not match the version number on the memory card of your converter. If the version numbers do not match, it will not be possible to go online later. Therefore, 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 converter.
- If necessary, change the version number via the "Version" drop-down list.

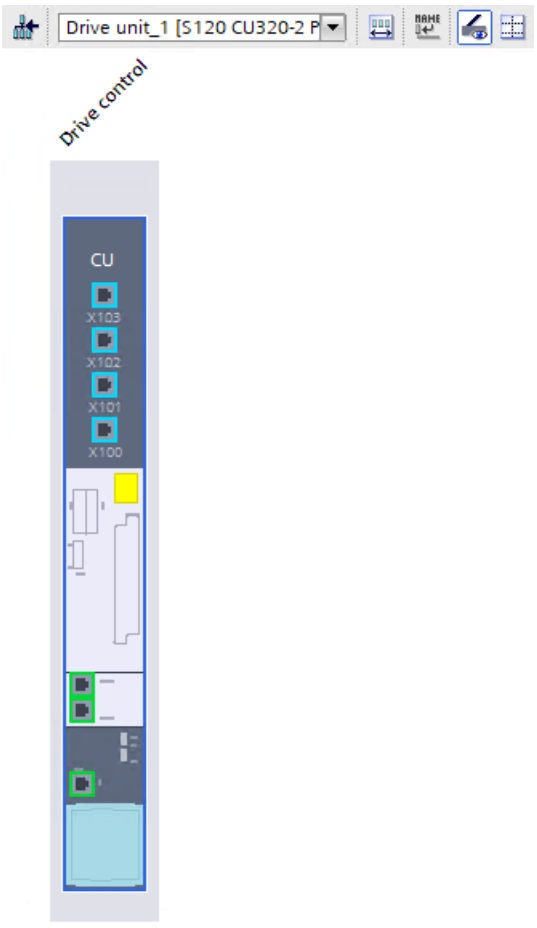
4. Assign a different device name in the input field ① if required.
5. Click "OK".
   OR
   Double-click on the required Control Unit.
   If the "Open device view" option is activated, the Control Unit is displayed in the device view in the next step.

Result

The Control Unit is inserted and can then be configured.



Example: CU310-2 PN inserted



Example: CU320-2 PN inserted

5.3.4.2 Inserting a Control Unit via the portal view

Overview

Alternatively to the recommended main method, you can insert a SINAMICS S120 Control Unit into a new project via the portal view.

Requirements

- A project has been created (Page 100), or an existing project is open.
- The online connection to the drive is deactivated.

Procedure

To insert devices in the portal view, proceed as follows:

1. In the navigation, click "Devices & networks".
2. Click "Add new device" in the secondary navigation.
   The appropriate dialog opens.
3. Click "Drives" to display the drives available.
4. Click on the required Control Unit in the "Control Units" list.

   Note

   Comparing and possibly changing version numbers

   The latest firmware version is always suggested when creating a Control Unit. Under certain circumstances, the recommended firmware version does not match the version number on the memory card of your converter. 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 converter.
   - If necessary, change the version number via the "Version" drop-down list.

5. If required, assign a different device name in the input field.
6. Click on "Add".
   OR
7. Double-click on the required Control Unit.
   If option "Open device view" is activated, then the Control Unit is displayed in the device view in the next step.

The Control Unit is inserted and can then be configured.

5.3.4.3 Inserting a Control Unit via the network/topology view

Overview

Alternatively to the recommended main method, you can insert a SINAMICS S120 Control Unit into a new project via the network or topology view

Requirements

- A project has been created (Page 100), or an existing project is open.
- The online connection to the drive is deactivated.

Procedure

To insert a drive via the network/topology view, proceed as follows:

1. Open the network/topology view in the project view.
2. In the hardware catalog, open entry "Drives & starters > SINAMICS drives > SINAMICS S120 > Control Units".
3. Drag the required Control Unit and drop it into the network/topology view.

The Control Unit is inserted and can then be configured.

5.3.4.4 Copying drives from existing projects

Overview

The following options are available to copy drives from existing projects:

Copy drive using the project tree

Note

Copying and inserting between protected and unprotected projects

Drive parameters and passwords are encrypted if you have activated project protection via the user management in the TIA Portal. Project protection cannot be withdrawn. In this case, it is not possible to copy drives from a protected project to an unprotected project.

Proceed as follows to copy a drive to your target project:

1. Ensure that your target project is open.
2. Open an additional instance of the Startdrive engineering tool.
3. Open the project from which you want to copy a drive.
4. Click the drive you wish to copy in the project tree.
5. In the shortcut menu, select the "Copy" command.
6. Switch to the Startdrive instance in which the open target project is located.
7. In the shortcut menu select the "Paste" command.

The drive is copied to the target project.

As described above, you can also copy the drive to your target project by dragging & dropping.

Copying drives from a reference project

You can also copy drives from a reference project. Additional information about using reference projects is provided in the Startdrive information system under "Editing projects".

Note

Copying and inserting between protected projects

It is not possible to copy and insert drives and drive components between protected projects. You can only copy and insert drives and drive components if one of the projects has been opened as reference project.

5.3.4.5 Copying drives from existing libraries

Procedure

Note

Copying and inserting between protected and unprotected projects

Drive parameters and passwords are encrypted if you have activated project protection via the user management in the TIA Portal. Project protection cannot be withdrawn.

Drives can only be loaded to a global library from unprotected projects. However, drives can be loaded into a protected project from a global library.

You can also load drives and drive components from an existing library. Additional information about using global libraries is provided in Chapter "Using libraries (Page 91)" and in the Startdrive informations system under "Using libraries".

5.3.5 Inserting an infeed unit

As a rule, the infeed unit is inserted directly after the drive in the device configuration and appears as a non-specified component in the device view. You can recognize a non-specified component in the device view by its white field.

Note

Smart Line Modules 5 kW and 10 kW

Smart Line Modules of performance class 5 kW and 10 kW do not have DRIVE-CLiQ interfaces and cannot be configured in the Startdrive engineering tool. The following information must be taken into consideration for the commissioning of SLMs of performance class 5 kW and 10 kW:

- For communicating with the Control Unit, SLMs must be wired with a digital input of the Control Unit via terminals.
- The recommended ON and OFF sequence for activating the SLMs must be adhered to.

You can find further information on the wiring of Smart Line Modules with the Control Unit and for the recommended ON/OFF sequence in the Equipment Manual SINAMICS S120 booksize power units.

The procedure for inserting a drive component into the device view is subsequently shown using an infeed unit as an example and is the same for all of the other components of a device configuration.

Differences between CU310-2 PN and CU320-2 PN

The following table provides an overview of the supported power units.

Power unit	Component	CU310-2 PN[1)]	CU320-2 PN
Line Module	Active Line Module	–	x
	Basic Line Module	–	x
	Smart Line Module	–	x
Power Module	AC Power Module	x	x
	PM240-2[2)]	–	x
Motor Module	Single Motor Module	–	x
	Double Motor Module	–	x

1) When inserted from the hardware catalog, Power Modules are not automatically connected to the CU via DRIVE-CLiQ. The wiring must be manually established.

2) When inserted from the hardware catalog, the PM240-2 is created together with a Control Unit Adapter (CUA). The components must be individually specified.

5.3.5.1 Inserting an infeed unit (placeholder)

Overview

An inserted infeed unit is a non-specified component (placeholder), which must be specified after insertion (see Chapter "Specifying an infeed unit (Page 112)").

Requirements

- A SINAMICS S120 CU320-2 PN Control Unit is inserted in the device configuration.
- Insert an Active, Basic or Smart Line Module in the device configuration.

Restrictions

- The use of a Line Module excludes the use of a PM 240-2 Power Module in a drive configuration.

Important notes

Carefully observe and comply with the following notes before you insert an infeed unit (placeholder) into the device configuration.

Standard

Generally, the infeed is inserted while configuring directly after the drive in the device view. In this case, the infeed unit is automatically wired to the drive via the default interface X100.

Exception

If you insert the infeed unit at a later point in time (e.g. after the Motor Module), then the infeed unit is not automatically connected to the drive. In this case, the default interface X100 provided for the infeed unit is already assigned. Thus the device configuration must be changed manually.

The following options are available to manually change the device configuration:

- You manually wire the infeed unit to a free interface (see Chapter "Editing DRIVE-CLiQ connections (Page 117)").
- You change the wiring of the drive object that is currently linked to the X100 interface of the drive to a different interface. This is automatically linked to the X100 interface when the infeed unit is inserted.

Procedure

To insert a non-specified infeed unit, proceed as follows:

1. Open "Line Modules" in the hardware catalog.
2. Select an infeed unit in the hardware catalog.
3. Drag and drop the infeed unit into the device view.

The component is automatically interconnected with the CU via DRIVE-CLiQ.

5.3.5.2 Specifying an infeed unit

Overview

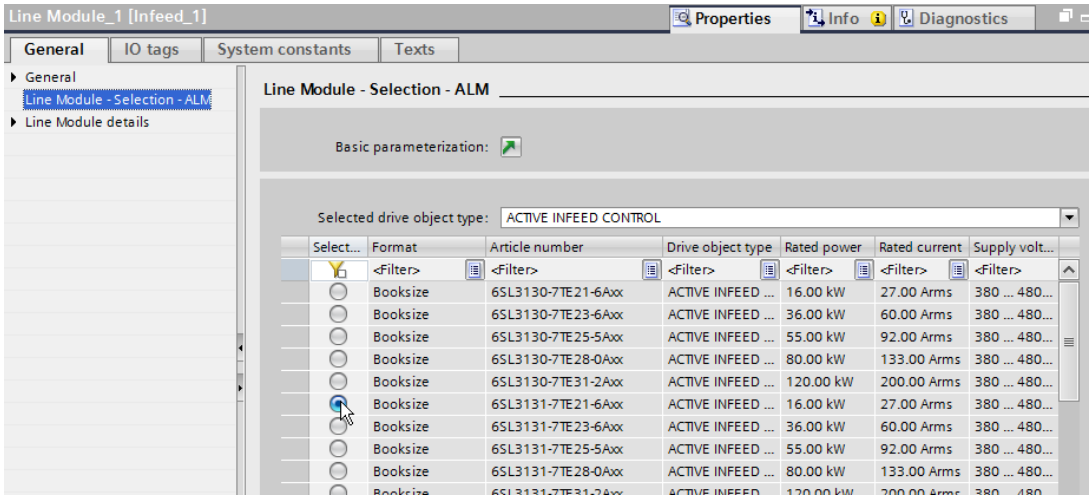
Initially, after creating an infeed unit in the configuration, only one non-specified placeholder is available. Using an article number, this placeholder must be specified in more detail. As a result, you ensure that the component in the device view corresponds to the component that is contained in your drive configuration.

Procedure

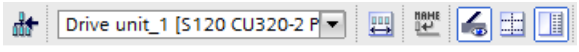
To specify an infeed unit, proceed as follows:

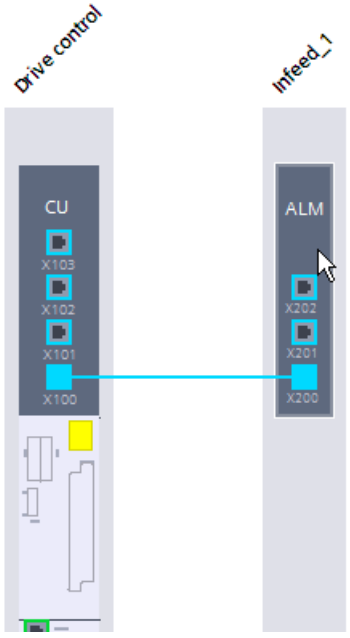
1. Click in the white field of the non-specified infeed unit.
2. Open the inspector window if it is not already open.

3. In the "General" tab, select the entry "Line Module - Selection - xxx".
   A selection of the available infeed units is displayed.



4. Select the required infeed unit based on the article number.
   The following is automatically set based on your selection:
   - The infeed unit is displayed in the device view as specified (the area now has a dark color).
     The data are displayed accordingly in the device overview.





   - Data of the selected infeed unit is assigned to the unspecified infeed unit.
   - The white area turns dark gray.
   - As default setting, a DRIVE-CLiQ connection is established between interfaces X100 and X200.

The infeed unit is inserted and specified in accordance with your drive configuration.

Note

If an Active Line Module or a Smart Line Module with the chassis format was inserted, then a Voltage Sensing Module is automatically added and wired.

5.3.5.3 Connecting infeed units in parallel

Overview

In Startdrive, you can interconnect several infeed units (Line Modules) in parallel. 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.

Requirements

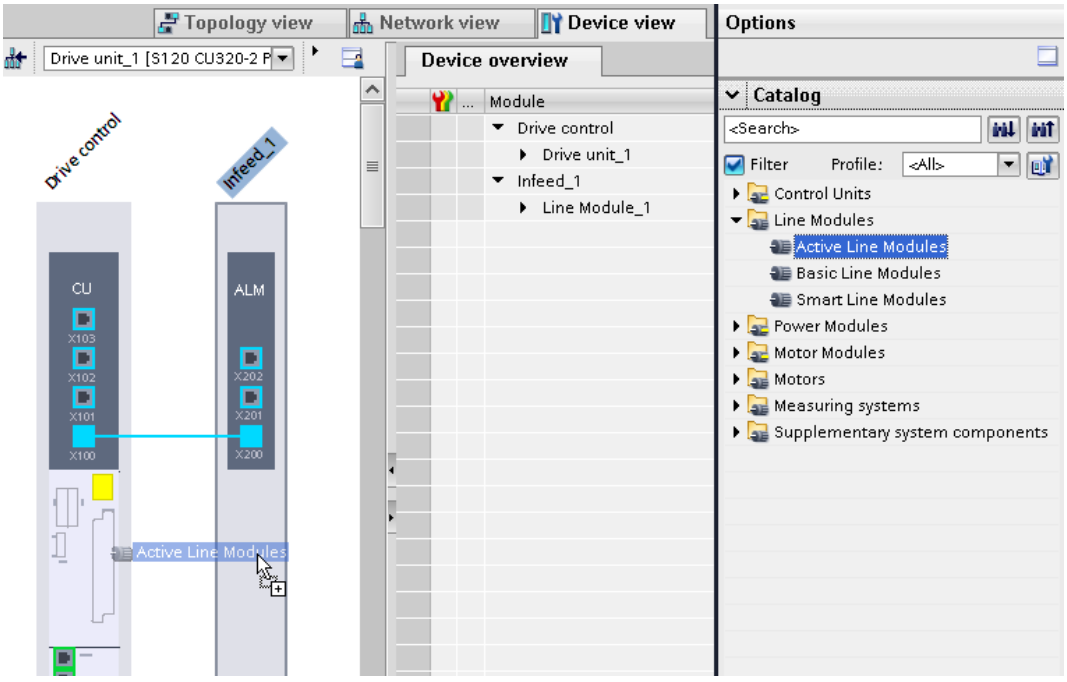
- An Active Interface Module (AIM) with integrated line filter is required to operate an Active Line Module (ALM).
- We recommend external line filters to operate a Basic Line Module (BLM) and a Smart Line Module (SLM). Line filters can be set via the basic parameterization.

Procedure

To connect infeed units in parallel with modules that have already been added, proceed as follows:

1. Open "Line Modules" 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 the inserted infeed unit.

3. Drag a non-specified infeed unit from the hardware catalog into the device view in the light gray area of the existing infeed unit.



Then specify the infeed unit connected in parallel.

4. Repeat step 3 to connect additional infeed units in parallel.

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

Disconnect individual infeed units from the line supply (e.g. using a contactor) to deactivate these. Motor supply lines must be opened.

Further information

Further information on rules, requirements, and restrictions for the parallel connection of Line Modules and Motor Modules can be found in the SINAMICS S120 Function Manual Drive Functions.

5.3.5.4 Editing inserted and specified components

Overview

All of the inserted components are graphically displayed in the device view. The device view provides the following editing options for the inserted components:

- Moving the component
- Deleting component

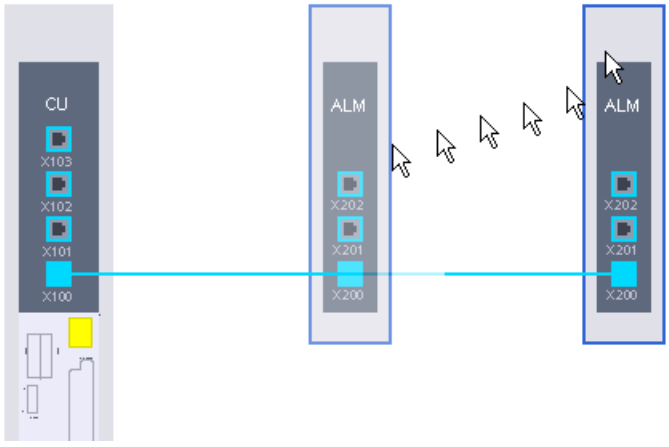
Note

The editing options are shown below using an infeed unit as example and are the same for all of the components in the device configuration.

Moving components

Move components to the left or right in order to create space for an additional component.

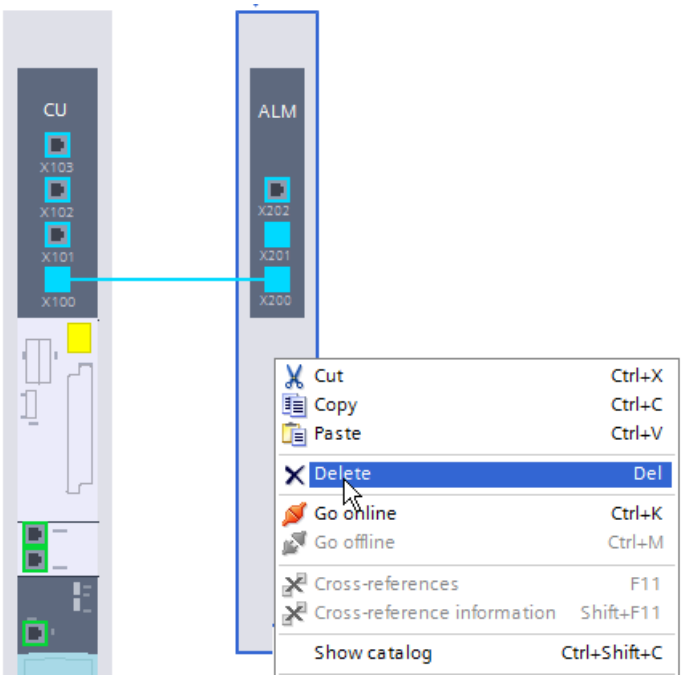
1. To do this, click in the light-gray frame.
2. With the left mouse key pressed, drag the module to the left or right.



Deleting components

Delete the components that you no longer require.

1. Right-click in the gray border.
   A shortcut menu opens.



2. To delete the DRIVE-CLiQ component, select "Delete" from the shortcut menu.
   The component is deleted.

Note

You can undo the deletion via the shortcut <Ctrl> + <Z>.

5.3.5.5 Editing DRIVE-CLiQ connections

Overview

DRIVE-CLiQ connections between the components are displayed in the device view using blue lines.

Automatic wiring of components

With most drive systems, the DRIVE-CLiQ connections are automatically established with the default settings when creating a component.

Note

No automatic wiring

With an S120 drive system with a CU310-2 PN, the components are not automatically wired via DRIVE-CLiQ. In this case, you must create the DRIVE-CLiQ wiring manually.

Adapt the offline configuration

When a component is created in the offline project, the DRIVE-CLiQ connections are created according to the default settings in Startdrive. Here, the wiring of the component in the offline configuration must correspond to the actual wiring in your drive system.

If the DRIVE-CLiQ wiring in the offline project deviates from the the actual wiring, you must manually correct the connections in the device view. The device view provides the following editing options for this:

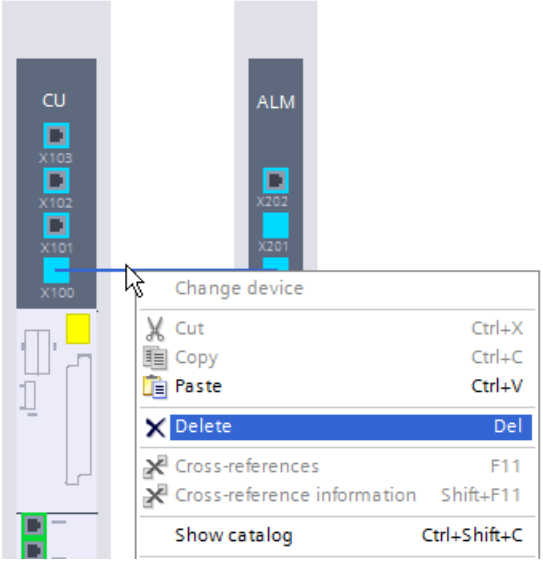
- Deleting a DRIVE-CLiQ connection
- Creating a DRIVE-CLiQ connection

The editing options are shown below using an infeed unit as example and are the same for all of the components in the device configuration.

Deleting a DRIVE-CLiQ connection

Delete a DRIVE-CLiQ connection if you no longer require it.

1. Right click on the DRIVE-CLiQ connection.
   A shortcut menu is opened.

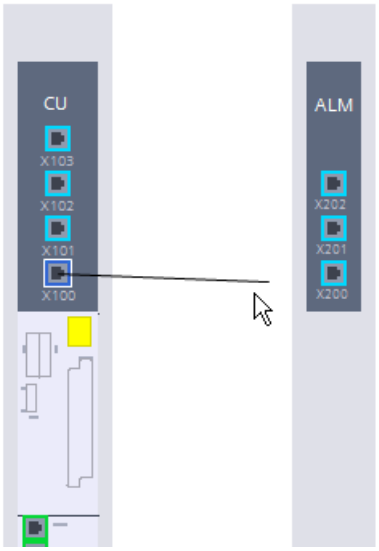


2. To remove the DRIVE-CLiQ component, select "Delete" from the shortcut menu.
   The DRIVE-CLiQ connection is deleted.

Creating a DRIVE-CLiQ connection

To create a DRIVE-CLiQ connection between two DRIVE-CLiQ ports, proceed as follows.

1. Left-click the output port and keep the mouse button pressed.



2. Drag the line displayed to the target port.
   A DRIVE-CLiQ connection is established between the ports and is displayed as a blue line.

5.3.5.6 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

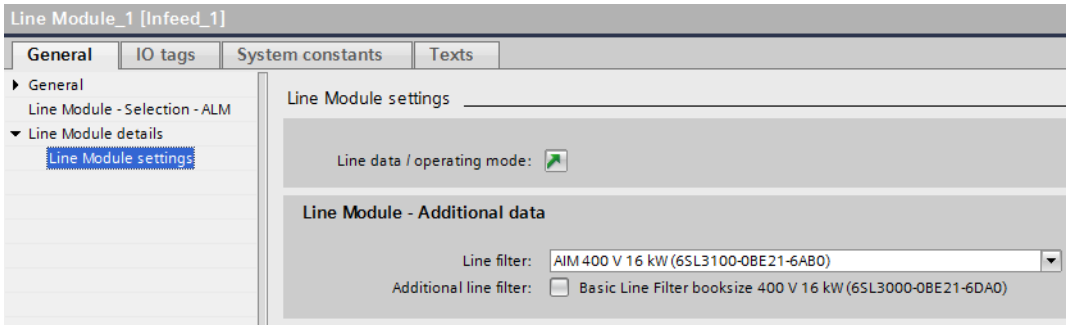
Switching on a new/modified network

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.

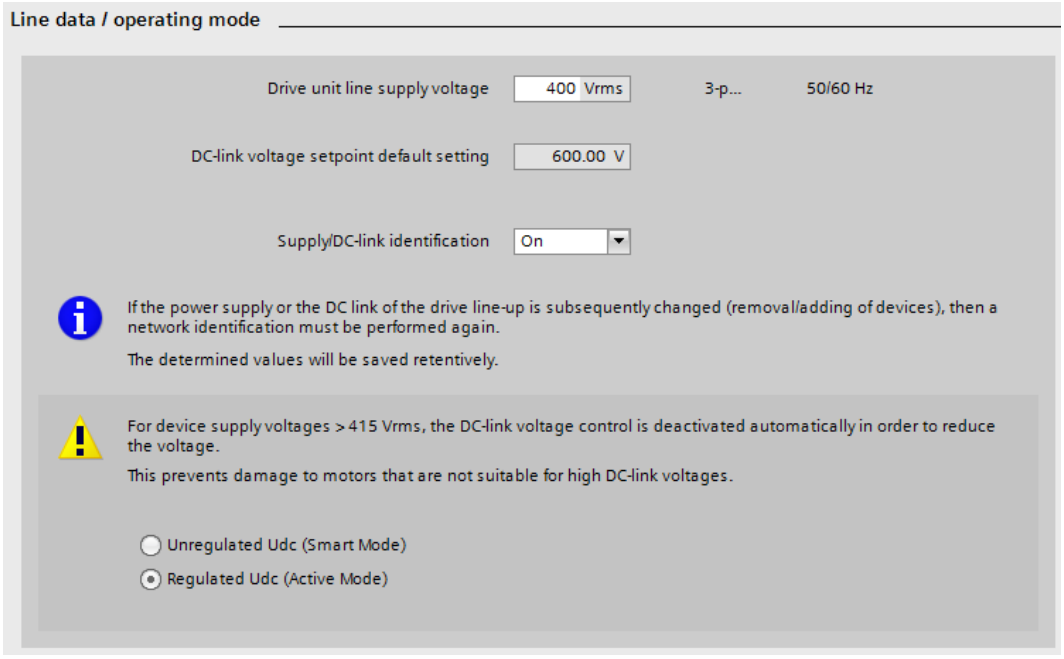
Procedure

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:



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:



   Set the required device supply voltage here (see Chapter "Line data/operating mode (Page 208)"). 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.

5.3.6 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. You can change the drive object type if you want to use the "Universal (Vector)" drive object type in your hardware device configuration.

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 parameterization of the Motor Module or Power Module.

Important notes

- 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.
  Therefore, ensure 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.

Differences between Motor Modules and Power Modules

- **Motor Modules** are intended for single-axis and multi-axis applications.
- **Power Modules** are intended for single-axis applications (generally, without an infeed unit).

Inserting and configuring

In the Startdrive engineering tool, Motor Modules and Power Modules are inserted into the device configuration in almost the same way. The device configuration of the drive requires at least one of the specified modules.

Overview

When creating Motor and Power Modules, the drive object types "Highly dynamic (servo)" and "Universal (vector)" can be selected. With SINAMICS, the terms "servo control" and "vector control" are also used.

Servo control features

The motor connected to servo control is simulated in a vector model based on data from the equivalent circuit diagram. This means that the servo control is also a vector control. However, the servo control optimizes the vector model according to other criteria. In favor of achieving a high dynamic performance, a small deterioration in the control accuracy and control quality is accepted.

Special features of the servo control include:

- Maximum computing speed
- Shortest sampling times
- High dynamic response
- Operation with encoder
  Due to the computing speed required, no model calculation of the actual values is used in the servo control. As a result, only operation with encoders is possible.
- Is used preferably with dynamic, permanent-magnet synchronous motors.

Vector control features

The motor connected to a vector control is simulated in a vector model based on data from the equivalent circuit diagram. The motor module is emulated as precisely as possible to obtain the best results regarding control control accuracy and control quality.

There are 2 types of vector control:

- Vector control without encoder (SLVC) as frequency control
- Vector control with encoder as speed-torque control with speed feedback

The vector control is characterized by the following features:

- Normal computing speed
- Best speed accuracy
- Best speed ripple
- Best torque accuracy
- Best torque ripple
- Operation with / without encoder
  Vector control operation is possible both with or without an actual speed value encoder.

Differences between CU310-2 PN and CU320-2 PN

The following table provides an overview of the supported power units.

Power unit	Component	CU310-2 PN[1)]	CU320-2 PN
Line Module	Active Line Module	–	x
	Basic Line Module	–	x
	Smart Line Module	–	x
Power Module	AC Power Module	x	x
	PM240-2[2)]	–	x
Motor Module	Single Motor Module	–	x
	Double Motor Module	–	x

1) When inserted from the hardware catalog, Power Modules are not automatically connected to the CU via DRIVE-CLiQ. The wiring must be manually established.

2) When inserted from the hardware catalog, the PM240-2 is created together with a Control Unit Adapter (CUA). The components must be individually specified.

5.3.6.1 Inserting and specifying a Motor Module

Overview

You can insert a Motor Module into a device configuration as Single Motor Module (SMM) or as Double Motor Module (DMM).

Requirements

- A SINAMICS S120 CU320-2 PN Control Unit is inserted in the device configuration.
- An infeed unit 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.

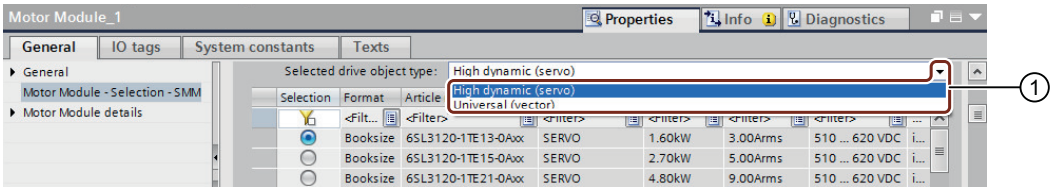
Note

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

Procedure

Proceed as follows to specify and insert a Motor Module:

1. Open "Motor Modules" in the hardware catalog.
2. Select the required component.
3. Drag the unspecified Motor Module and drop it into the device view.
   The Motor Module is automatically interconnected via DRIVE-CLiQ.
4. Click the Motor Module in the device view. Ensure that you click in the white area of the component.
5. Open the inspector window if it has not been opened yet.
6. In the secondary navigation of the inspector window, select "Motor Module - Selection - xxx".
   The available Motor Modules are displayed in the selection list.
   The "High dynamic (servo)" drive object type is preset as default.
7. If you wish to change the drive object type, select the required control mode in the "Selected drive object type" drop-down list:



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

Note

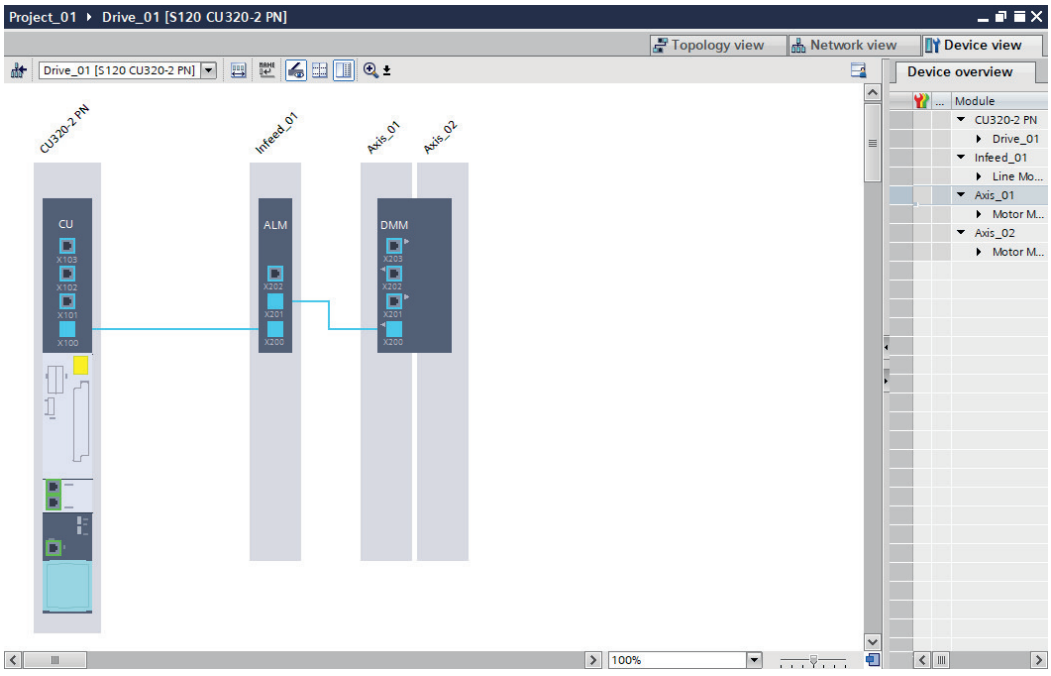
Subsequently changing the drive object type

If you change the drive object type after adding additional components (motor, measuring system, etc.), then there is a risk that the configuration of some components is lost and must be repeated.

As a consequence, first set the drive object type and then add the remaining components.

A confirmation prompt is displayed for the current procedure.

8. Confirm the procedure with "Yes".
   The Motor Module selection list is now refreshed.
9. Select the Motor Module based on the Article No.
   The data of the selected Motor Module is assigned to the Motor Module in the device configuration. The Motor Module has therefore been specified.
   The corresponding component is shown in the device configuration in dark gray.



5.3.6.2 Inserting and specifying an AC Power Module

Overview

Depending on the drive type, when creating an AC Power Module, either drive object type "Highly dynamic (servo)" or "Universal (vector)" is active as default. Many of the following settings depend on the drive object type that has been set.

Requirement

- A SINAMICS S120 Control Unit has been inserted in the device configuration.

Restrictions

- Only **chassis format** AC Power Modules can be specified in the Startdrive engineering tool.

Procedure

Proceed as follows to insert and specify an AC Power Module in the device configuration:

1. Open the "Power Modules" entry in the hardware catalog.
2. Select component "AC Power Module".
3. Drag the unspecified AC Power Module and drop it into the device view.
   The Power Module is automatically interconnected with the Control Unit via DRIVE-CLiQ.

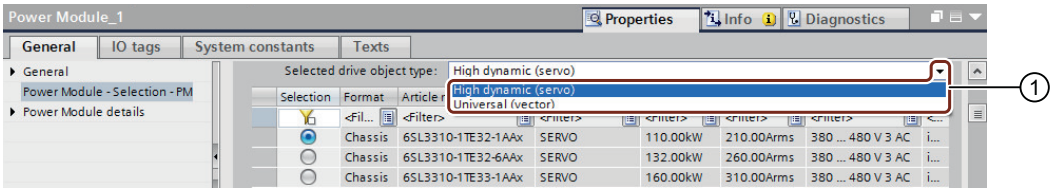
Note

No automatic wiring

With an S120 drive system with a CU310-2 PN, the Power Module is not automatically wired via DRIVE-CLiQ. In this case, you must create the DRIVE-CLiQ wiring manually.

- Click on a DRIVE-CLiQ interface of the AC Power Module and establish a DRIVE-CLiQ connection to the target port of the required component (e.g. the CU).

4. Click on the Power Module in the device view. Ensure that you click in the white area of the component.
5. Select the "Power Module - Selection - PM" entry in the secondary navigation of the inspector window.
   The available Power Modules are displayed in the selection list.
   The "High dynamic (servo)" drive object type is preset as default.
6. If you wish to change the drive object type, select the required control mode in the "Selected drive object type" drop-down list:



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

Note

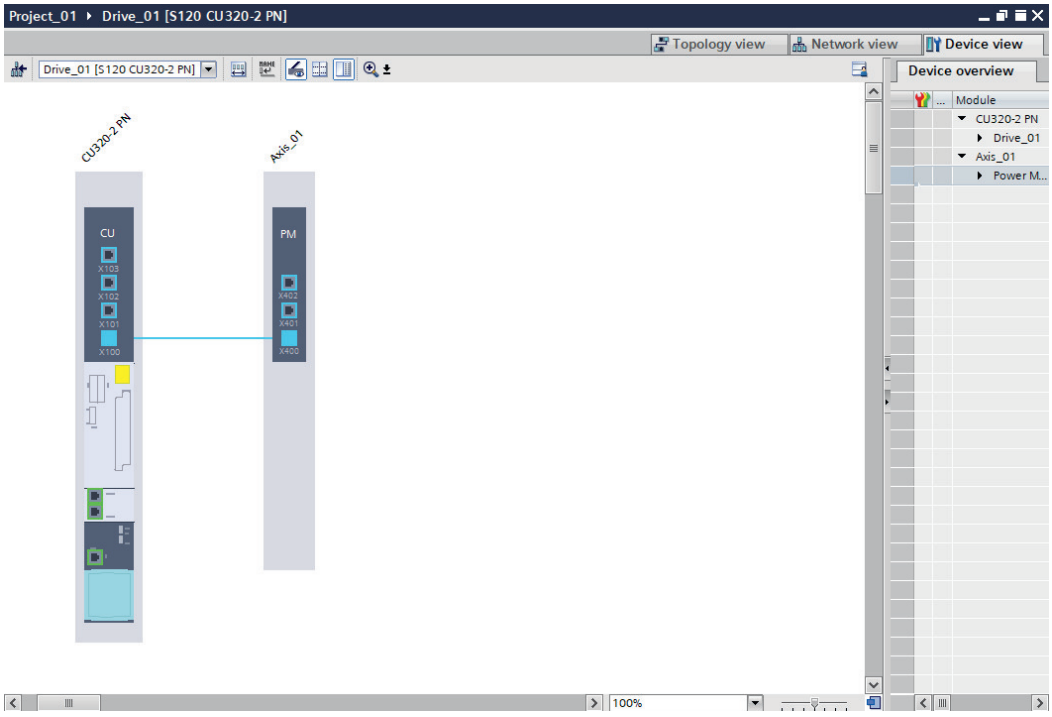
Subsequently changing the drive object type

If you change the drive object type after adding additional components (motor, measuring system, etc.), then there is a risk that the configuration of some components is lost and must be repeated.

As a consequence, first set the drive object type and then add the remaining components.

A confirmation prompt is displayed for the current procedure.

7. Confirm the procedure with "Yes".
   The Power Module selection list is now refreshed.
8. Select the Power Module based on the Article No.
   The data of the selected Power Module is assigned to the Power Module in the device configuration. The Power Module has therefore been specified.
   The corresponding component is shown in the device configuration in dark gray.



5.3.6.3 Inserting and specifying PM240-2

Overview

PM240-2 Power Modules require a Control Unit Adapter (CUA) to establish a connection to a Control Unit. The following adapter types are available:

- CUA31
- CUA32

Depending on the drive type, when creating a PM240-2, either drive object type "Highly dynamic (servo)" or "Universal (vector)" is active as default. Many of the following settings depend on the drive object type that has been set.

Special features

The CUA32 has an integrated encoder evaluation function that can be configured for HTL/TTL or SSI encoders.

Requirement

- A SINAMICS S120 CU320-2 PN Control Unit is inserted in the device configuration.

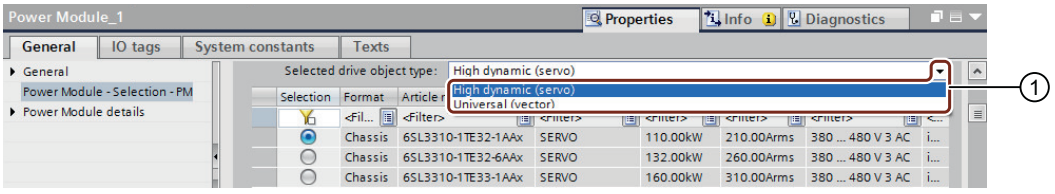
Restrictions

- Only **blocksize format** PM240-2 can be specified in the Startdrive engineering tool.

Procedure

Proceed as follows to insert and specify a PM240-2 together with a Control Unit Adapter (CUA) in the device configuration:

1. Open the "Power Modules" entry in the hardware catalog.
2. Select the component "PM240-2".
3. Drag the unspecified PM240-2 to the device view.
   The PM240-2 is inserted together with a CUA into the device configuration.
   The adapter is automatically interconnected with the CU via a DRIVE-CLiQ connection.
4. Click on the Power Module in the device view. Ensure that you click in the white area of the component.
5. Select the "Power Module - Selection - PM" entry in the secondary navigation of the inspector window.
   The available Power Modules are displayed in the selection list.
   The "High dynamic (servo)" drive object type is preset as default.
6. If you wish to change the drive object type, select the required control mode in the "Selected drive object type" drop-down list:



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

Note

Subsequently changing the drive object type

If you change the drive object type after adding additional components (motor, measuring system, etc.), then there is a risk that the configuration of some components is lost and must be repeated.

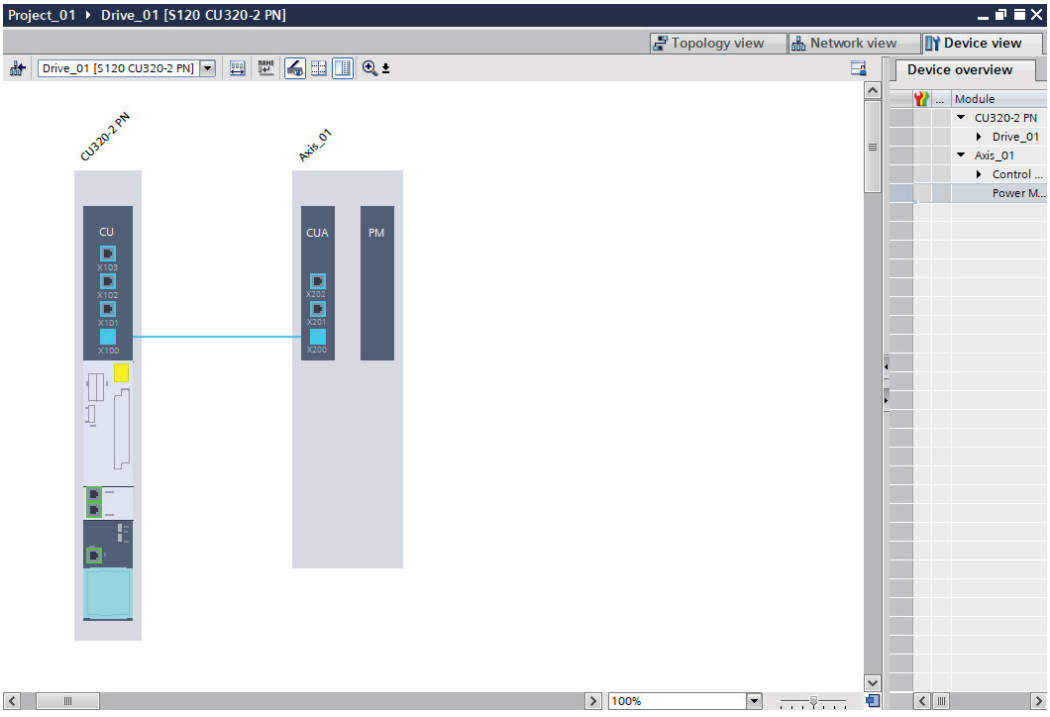
As a consequence, first set the drive object type and then add the remaining components.

A confirmation prompt is displayed for the current procedure.

7. Confirm the procedure with "Yes".
   The Power Module selection list is now refreshed.

8. Select the Power Module based on the Article No.
   The data of the selected Power Module is assigned to the Power Module in the device configuration. The Power Module has therefore been specified.
   The corresponding component is shown in the device configuration in dark gray.
9. To select the adapter in the device view, click on the white area of the "CUA" component.
10. Select the "Control Unit Adapter - Selection - CUA" entry in the secondary navigation of the inspector window.
    The available adapters are displayed in the selection list.
11. Select the required adapter type.
    The data of the selected adapter type is assigned to the adapter in the device configuration. The adapter has therefore been specified.
    The corresponding component is shown in the device configuration in dark gray.

The PM240-2 has been inserted and specified together with the CUA in the device configuration.



5.3.6.4 Making detailed settings

Overview

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

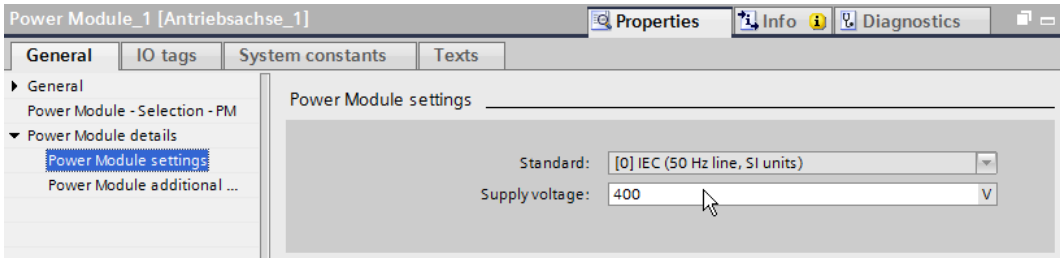
- **Settings**
  - Allows the modification of the preallocated supply voltage.
  - Indicates the standard for power settings of the converter and motor.
- **Supplementary data**
  - Allows filter settings for modules of the "Vector" type drive object.

The procedure described below 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:

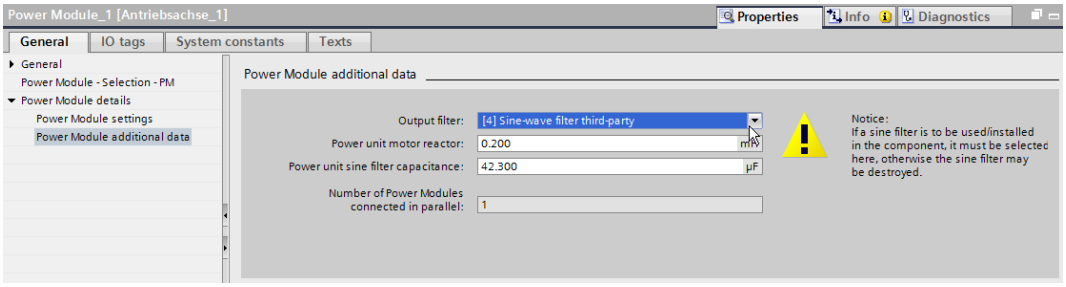


3. Enter a new supply voltage as required.
4. If you use the "Vector" drive object type, then you can set additional data.
   Select the menu "Power Module Details > Power Module Additional Data" in the inspector window.

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 input fields are now unhidden depending on the respective filter selected.



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

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

5.3.6.5 Copying and inserting Motor Modules

Overview

In a project with SINAMICS S120 drives, Motor Modules can be copied and inserted within the same drive or in another drive of the same type. As a consequence, it is only necessary to configure a Motor Module once.

You copy and insert Motor Modules in the following areas of the project view:

- Project tree
- Device view

DRIVE-CLiQ interconnection

When Motor Modules are inserted, they are automatically wired according to DRIVE-CLiQ interconnection rules. The settings of the copy source are applied.

Requirements

- A SINAMICS S120 Control Unit has been inserted in the device configuration.

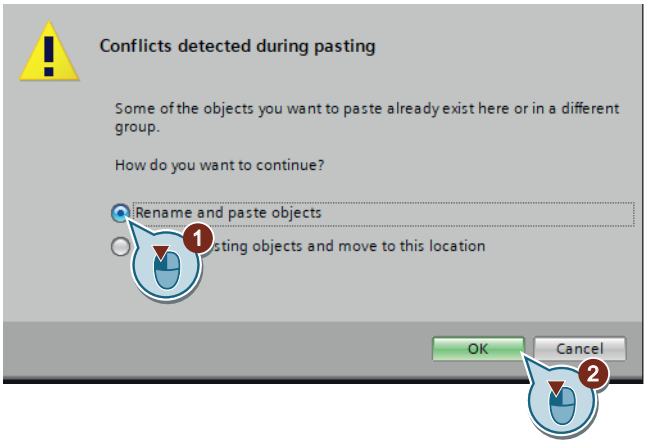
Restrictions

- Command option "Paste" is not listed for Control Units that do not belong to the SINAMICS S120 product category (e.g. G150).
- The procedure is not possible under a SIMATIC Drive Controller.

Procedure (project tree)

Proceed as follows, to copy and insert a configured Motor Module within the project tree.

1. Select the Motor Module to be copied.
2. Open the shortcut menu and click on command "Copy" <Ctrl+C>.
3. Select the drive in which the Motor Module should be inserted.
4. Open the shortcut menu and click on command "Paste" <Ctrl+V>.
   The Motor Module is inserted at the intended location.
5. If you wish to insert the copied Motor Module several times into the same drive, then after insertion, immediately rename the Motor Module using <F2>.
   Otherwise, an error message is displayed when inserting the next time. In this case, proceed as follows:
   – In this case, select option "Rename and paste objects" ① and confirm with "OK" ②.
     The Motor Module is then automatically renamed and inserted at the intended location.



Procedure (device view)

Proceed as follows, to copy and insert a configured Motor Module within the device view.

1. Activate the "Device view" tab in the device navigation of the drive.
2. Select the Motor Module to be copied.
3. Open the shortcut menu and click on command "Copy" <Ctrl+C>.
4. If you wish to insert the Motor Module in the same drive, then click in the working area.
5. Open the shortcut menu and click on command "Paste" <Ctrl+V>.
   The Motor Module is inserted at the intended location.
   OR

6. If you want to insert the Motor Module into a different drive, open the device configuration of the target drive and activate the "Device view" tab.
7. Click in the working area.
8. Open the shortcut menu and click on command "Paste" <Ctrl+V>.
   The Motor Module is inserted at the intended location.

5.3.6.6 Interconnecting Motor Modules in parallel

Overview

Connecting Motor Modules in the booksize format in parallel is possible in the "Vector" control mode.

When commissioning, modules connected in parallel are treated just 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 summed values are formed from the individual values of the power units.

The procedure described below shows the parallel connection using 2 Single Motor Modules. You can interconnect additional Motor Modules in the same way.

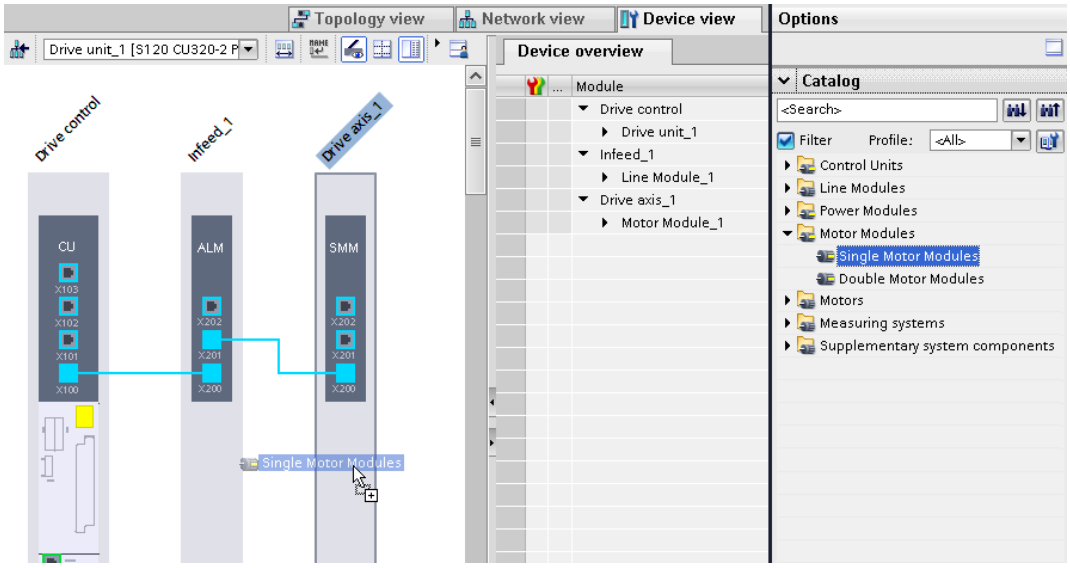
Requirements

- A SINAMICS S120 CU320-2 PN Control Unit is inserted in the device configuration.
- The Motor Module inserted in the device configuration has the following specifications:
  - Format: "Booksize"
  - Control mode: "Vector"

Procedure

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

1. Open "Motor Modules" in the hardware catalog.
2. Drag & drop a Motor Module into the light gray area of the already existing Motor Module.



3. Specify the Motor Modules connected in parallel according to the specifications listed above. Further information on specifying a Motor Module is provided in Chapter "Inserting and specifying a Motor Module (Page 123)".
4. If necessary, add additional Motor Modules to the parallel connection.

Activating / deactivating individual Motor Modules

If required, you can activate or deactivate individual Motor Modules of a parallel connection using the inspector window ("General > Project information > Component activation"). To deactivate, the respective Motor Module must be disconnected from the line supply (using a contactor, for example). Motor supply lines must be opened.

Further information on activating/deactivating Motor Modules in the Startdrive engineering tool is provided in Chapter "Activating / deactivating individual drive components (Page 77)".

5.3.7 Inserting a motor

Overview

Startdrive manages the motor data of numerous motors in a motor list. As a result, motors can 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 Chapter "Inserting and specifying motors that are missing from the motor list (Page 136)").

Requirements

- A SINAMICS S120 Control Unit has been inserted in the device configuration.
- An infeed unit 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 Chapter "Inserting an infeed unit (placeholder) (Page 110)").
- A Motor Module or a Power Module is inserted.
- Optional: An encoder is inserted.

5.3.7.1 Inserting and specifying motors from the motor list

Overview

You insert motors from the hardware catalog into the device configuration and then specify them in the inspector window. The following motor types are available for selection:

- DRIVE-CLiQ motors

  Note

  For DRIVE-CLiQ motors, when loading the project data (see Chapter "Loading the project data into the converter (Page 242)") to the drive device, 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 Chapter "Loading project data from the converter (Page 87)").

- Induction motors
- Synchronous motors
- Reluctance motors
- Motor data input
  Manual recording of the motor data required (see Chapter "Inserting and specifying motors that are missing from the motor list (Page 136)").

Procedure

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

1. Open "Motors" in the hardware catalog.
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 still not been opened or displayed.

6. In the inspector window, select entry "Motor- Selection - xxx".
7. Select your motor with the corresponding motor encoder in the drop-down list based on the article number.
   Motor data
   – The data of the selected motor are assigned to the unspecified motor. The white area turns dark gray.

   Encoder
   – 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.

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

Overview

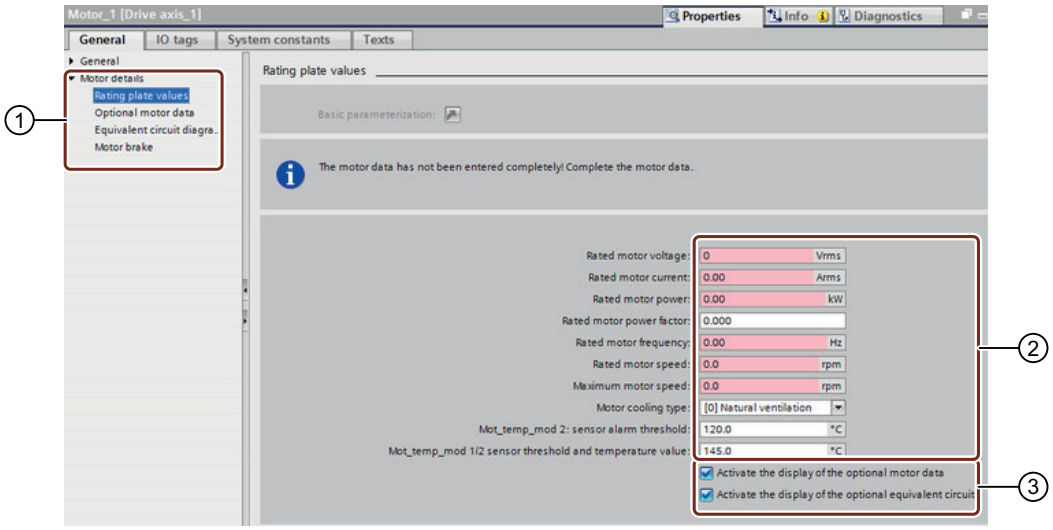
If you want to insert, specify and manage motors in your device configuration, which are not contained in the motor list, you can enter the most important motor data, such as the rating plate values of the motor, manually in the inspector window.

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" entry in the hardware catalog and then the "Motor data input" subentry. 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
   – Optional motor data (can also be activated)
   – Equivalent circuit diagram data (can also be activated)
   – Motor brake

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)

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.

5.3.7.3 Configuring motor details

Overview

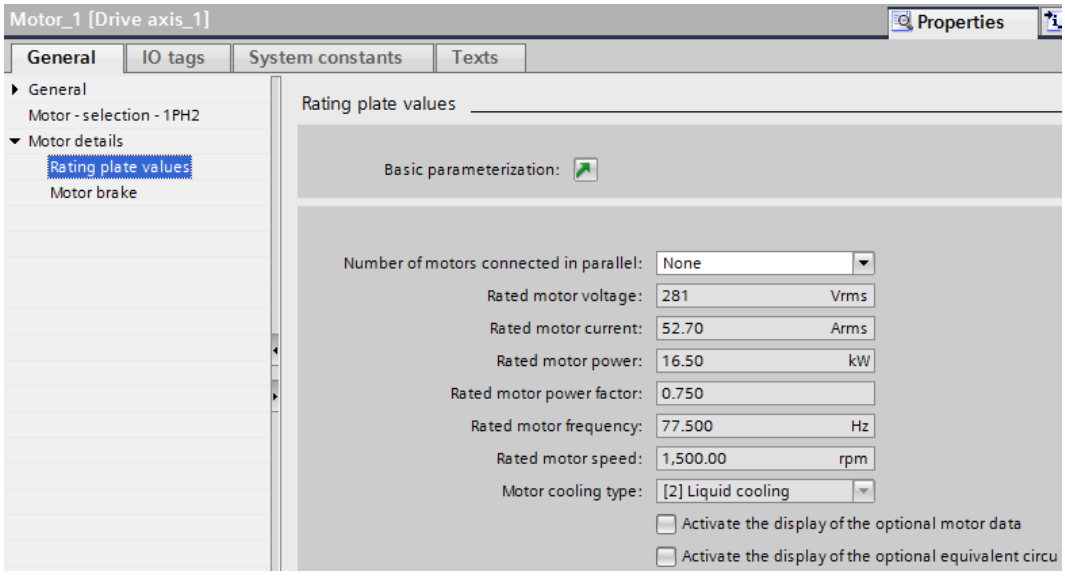
You can configure the following motor details for motors during commissioning:

- Basic parameter assignment
- Rating plate values
- Motor brake

Procedure

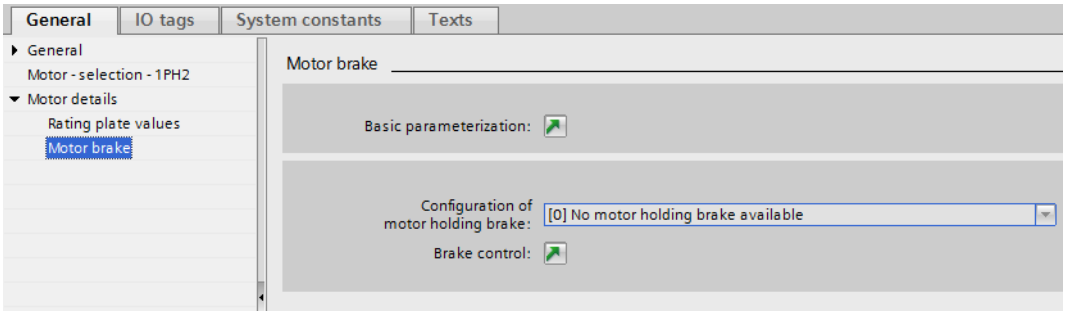
To configure the motor details, proceed as follows:

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:

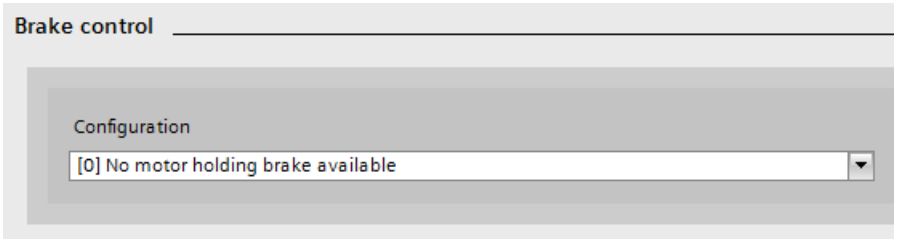


3. To perform the basic parameter assignment for the motor, click the icon next to the "Basic parameterization" entry.
   The function view of the drive axis is opened:
   Make the required settings here (see Chapter "Basic parameter assignment (Page 180)").
4. In the inspector window, select the menu "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.



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.



8. Here you can select the required brake control in the "Configuration" drop-down list and make the necessary detailed settings (see chapter "Brake control (Page 262)").
   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.

5.3.8 Inserting measuring systems (encoders)

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 further information about the encoders in the Chapter "Important measuring systems/encoders" of the SINAMICS S120 Commissioning Manual with STARTER.

5.3.8.1 Inserting an encoder

Overview

You insert encoders from the hardware catalog into the device configuration and then specify them in the inspector window.

Recommended order

In the procedure described below, the encoder is inserted after the motor (see Chapter "Sequence when creating drive components (Page 102)").

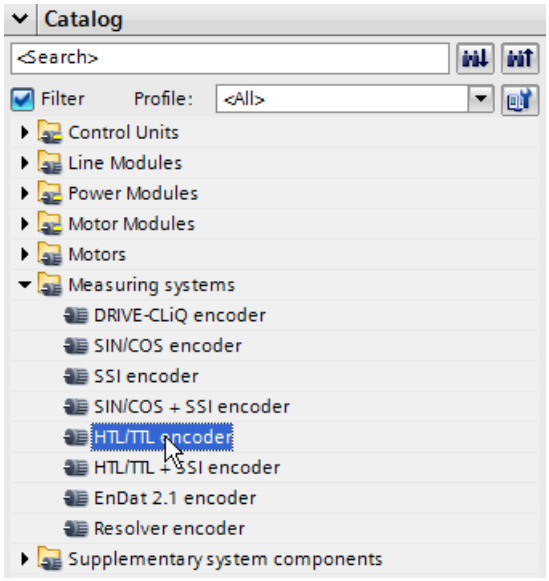
Requirements

- A SINAMICS S120 Control Unit has been inserted in the device configuration.
- An infeed unit 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 Chapter "Inserting an infeed unit (placeholder) (Page 110)").
- A Motor Module and motor have been inserted and specified.

Procedure

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

1. Open "Measuring systems" in the hardware catalog.
2. Select the desired, unspecified encoder in the device overview.



3. Drag the desired, 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 not been opened yet.
6. In the inspector window, select the "Measuring system - Selection - xxx" entry.
7. Select the desired encoder in the 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.

Adding additional encoders

If you need additional encoders for your device configuration, configure them in the same way as described above. These encoders are then generally used as machine encoders.

5.3.8.2 Specifying the encoder evaluation

Overview

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

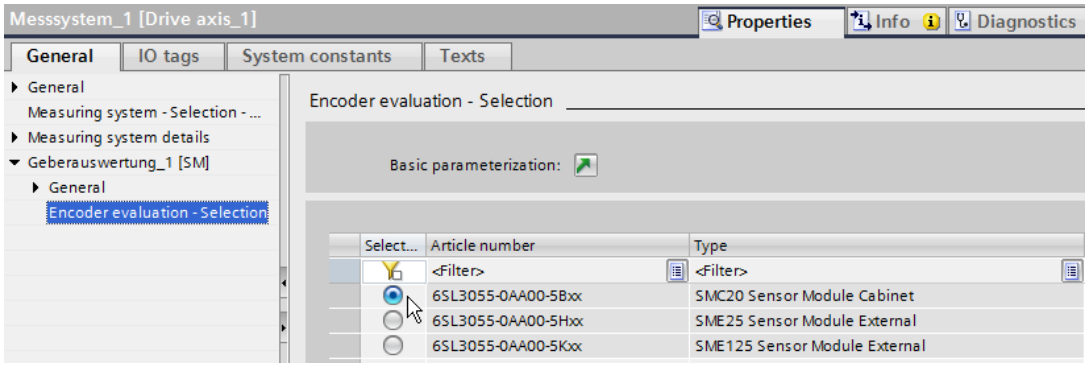
Requirements

- 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.



2. Select your Sensor Module.

Result

The Sensor Module has been specified.

5.3.8.3 Encoder system connection

Overview

Sensor Modules evaluate the signals from the connected motor encoders or external encoders and convert the signals so that they can be evaluated by the Control Unit. The encoder system connection to SINAMICS S120 drives is exclusively done via DRIVE-CLiQ. In conjunction with motor encoders, the motor temperature can also be evaluated using Sensor Modules.

Rules

The following rules apply to connecting encoder systems via DRIVE-CLiQ:

- Motor encoders are connected to the associated Motor Module.
- External encoders are connected to the Control Unit.

Assignment of measuring system to Sensor Modules

The following table gives an overview of the assignment of the various measuring systems to the available Sensor Modules.

	SMC				SME			
Measuring systems	SMC10	SMC20	SMC30	SMC40[1]	SME20	SME25	SME120	SME125
Resolver	x	-	-	-	-	-		
Incremental encoder sin/ cos (1Vpp) with zero pulse	-	x	-	-	x	-	x	
Incremental encoder sin/ cos (1Vpp) without zero pulse	-	x	-	-	x	x	x	x
EnDat absolute encoder	-	x	-	x	-	x		x
Incremental Encoder TTL/HTL	-	-	x	-	-	-		
SSI absolute encoder[2]	-	-	x	-	-	-		
Temperature evaluation	x	x	x	-	-	-	x[3]	x[3]

[1] Only for direct measuring systems.

[2] Only starting at article number 6SL3055-0AA00-5CA1.

[3] Protective separation.

Note

Sensor Modules of the type Sensor Modules Cabinet (SMC) are intended for internal cabinet installation.

Further information

You can find additional information about the Sensor Modules in the "Control Units and Additional System Components" Manual and in the Startdrive information system.

5.3.8.4 Making detailed settings

Overview

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

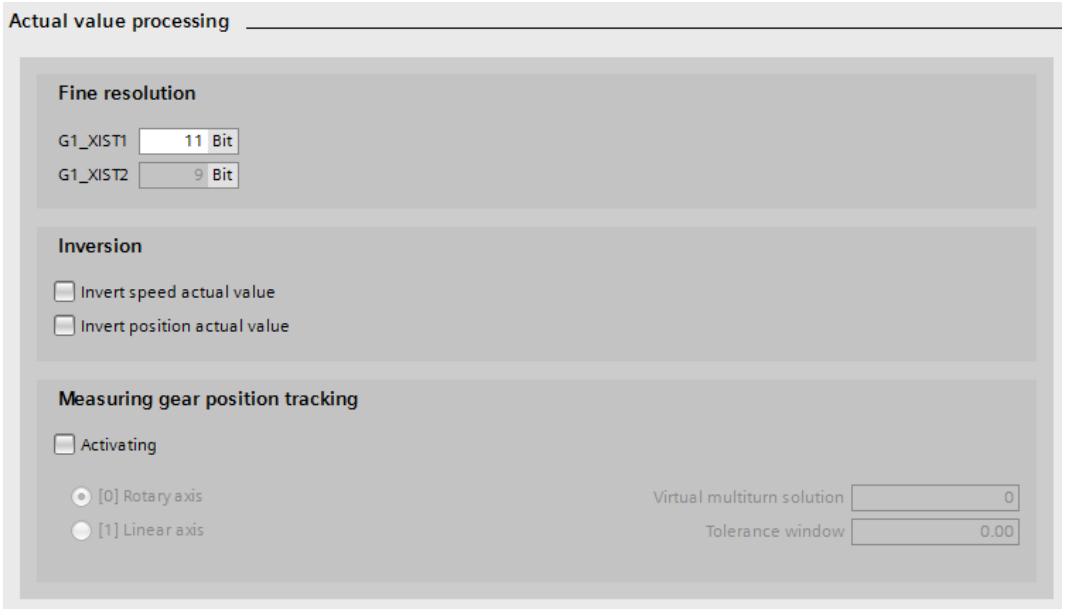
- Actual value processing
- Encoder details (e.g. encoder type, incremental tracks, gear ratio).

Procedure

To configure the encoder details, proceed as follows:

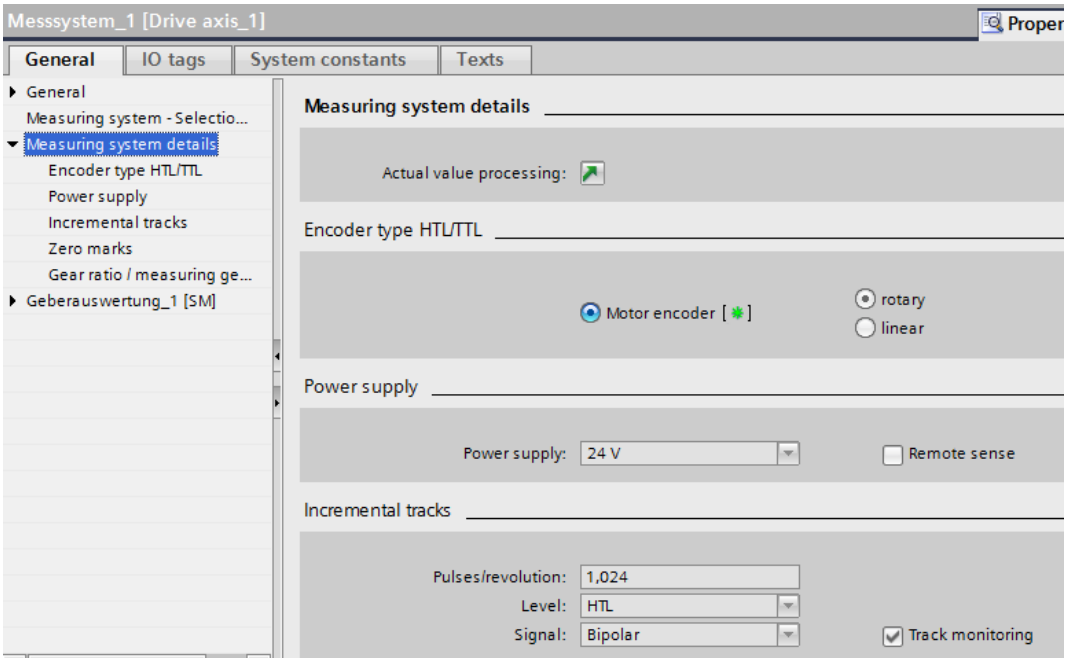
1. Select the encoder in the device view and open the inspector window.
2. In the inspector window, select the "Measuring system details" menu.

3. To configure the actual value processing, click the icon next to the "Actual value processing" entry.
   The "Actual value processing" screen form opens:



   Make the required settings here (see chapter "Actual value processing (Page 218)").

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



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.

5.3.9 Inserting additional system components

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

- DRIVE-CLiQ Hub Module DMC20 / DME20
- 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.

5.3.9.1 Inserting a DRIVE-CLiQ Hub Module

Overview

DRIVE-CLiQ Hub Modules are used to extend and/or multiply DRIVE-CLiQ sockets. The following Hub Modules (star coupler) are available:

- **DMC20** (DRIVE-CLiQ Hub Module **Cabinet**):
  - Expansion module for star-shaped distribution of a DRIVE-CLiQ line. Using the DMC20, you expand an axis grouping by 5 DRIVE-CLiQ sockets for additional subgroups.
  - The DMC20 can be snapped onto a mounting rail according to EN 60715.
- **DME20** (DRIVE-CLiQ Hub Module **External**):
  - Expansion module for star-shaped distribution of a DRIVE-CLiQ line. Using the DME20, you expand an axis grouping by 5 DRIVE-CLiQ sockets for additional subgroups.
  - The DME20 is designed for applications where DRIVE-CLiQ devices are removed in groups without interrupting the DRIVE-CLiQ line and data exchange along the line.
  - The DME20 has degree of protection IP67.

In the Startdrive engineering tool, the "DRIVE-CLiQ HUB Module DMx20" term is generally used for all Hub Modules.

Further information

You can find further information about the Hub Modules in the "Control Units and Additional System Components" Manual. When commissioning the system, take into consideration and comply with the safety instructions there.

Requirement

- A SINAMICS S120 Control Unit (or a SIMATIC Drive Controller) has been inserted in the device configuration.

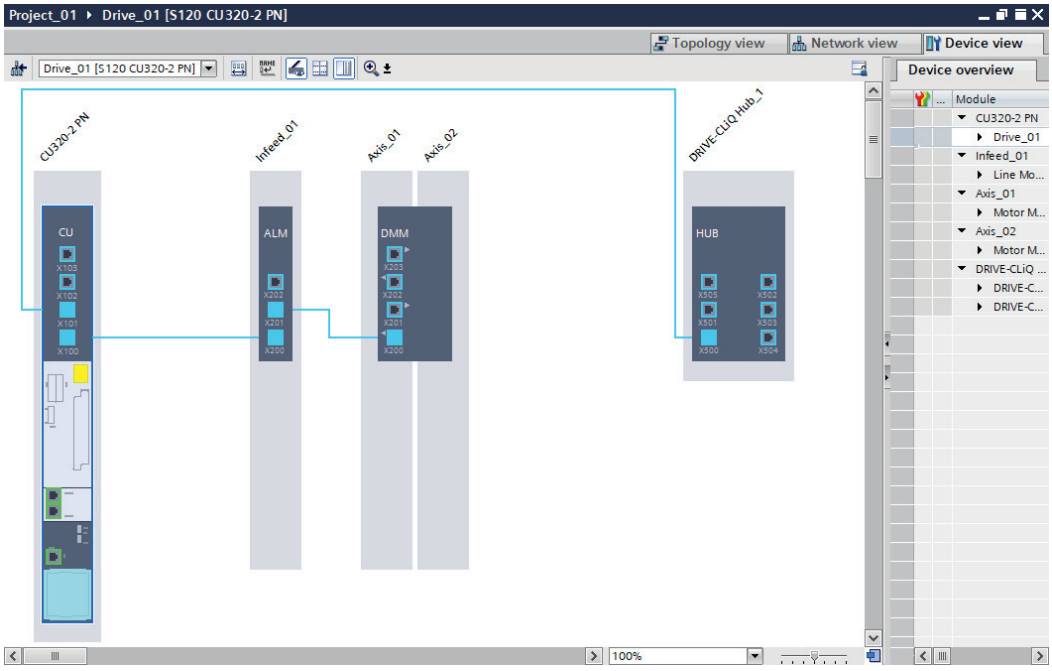
Restriction

- When using a CU310-2 PN, DRIVE-CLiQ Hub Modules inserted in the device configuration are not automatically wired via DRIVE-CLiQ.

Procedure

Proceed as follows to insert a DRIVE-CLiQ Hub Module in your device configuration:

1. Open the "DRIVE-CLiQ Hub Modules" entry in the hardware catalog.
2. Drag the "DRIVE-CLiQ HUB Module DMx20" Hub Module and drop it into the device configuration.
   The component is automatically interconnected with the Control Unit via DRIVE-CLiQ.



Further information on the inserted Hub Module is provided in the inspector window.

Note

No automatic wiring

With an S120 drive system with a CU310-2 PN, the DRIVE-CLiQ Hub Module is not automatically wired via DRIVE-CLiQ. In this case, you must create the DRIVE-CLiQ wiring manually.

- Click on a DRIVE-CLiQ interface of the Hub Module and establish a DRIVE-CLiQ connection to the target port of the required component (e.g. the CU).

Optional steps

You can perform the following optional steps after inserting a Hub Module:

- Close additional components connected at the Hub Module.
- Change automatically created interconnections.
- In the inspector window, change the name of the inserted Hub Module.

Assigning the DRIVE-CLiQ interfaces

If all DRIVE-CLiQ interfaces at the CU are assigned, then additional components are automatically wired to the inserted Hub Module.

When using a CU310-2 PN, this is only applicable for supplementary system components.

5.3.9.2 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.

Requirements

- A SINAMICS S120 Control Unit has been inserted 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.

5.3.9.3 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 SINAMICS S120 Control Unit has been inserted 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 selection list.
3. Drag the Terminal Module to the device view.
   The DRIVE-CLiQ connections are automatically created.

Note

No automatic wiring

With an S120 drive system with a CU310-2 PN, the Terminal Module is not automatically wired via DRIVE-CLiQ. In this case, you must create the DRIVE-CLiQ wiring manually.

- Click on a DRIVE-CLiQ interface of the Terminal Module and establish a DRIVE-CLiQ connection to the target port of the required component (e.g. the CU).

Result

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

5.3.9.4 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.

Requirements

- A SINAMICS S120 Control Unit has been inserted 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.

5.3.9.5 Insert Voltage Sensing Module VSM10

Overview

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

- **Infeed unit**
  - 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**, type vector
  - Required for the functions "synchronize" and "flying restart".

Requirements

- A SINAMICS S120 Control Unit has been inserted in the device configuration.
- An infeed unit is inserted into the device configuration.
  OR
- A Motor Module, type vector 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" to 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.

5.4 Establishing an online connection to the drive

Overview

Most SINAMICS S120 control units (e.g. CU320-2 PN) have 2 interfaces, via which you can connect the drive online.

Industrial security guidelines

Observe the following information and follow the instructions in them when selecting and configuring the interfaces.

Note

Adhere to setup and Industrial Security guidelines - cell protection concept

- Commissioning and Service interface X127:
  Only local access (point-to-point connection) is permitted for the X127 Ethernet interface.
- PROFINET interface X150
  In accordance with the "Defense in Depth" concept, this interface must be isolated from the remaining plant network. Manual access to cables and open connections must be protected – as in a control cabinet.

IP addresses in the delivery condition

SINAMICS S120 Control Units are shipped from the factory with the following IP addresses:

- **Commissioning and service interface X127:**
  - IP address: 169.254.11.22
  - Subnet mask: 255.255.0.0
- **PROFINET interface X150:**
  - IP address: 0.0.0.0
  - Subnet mask: 0.0.0.0

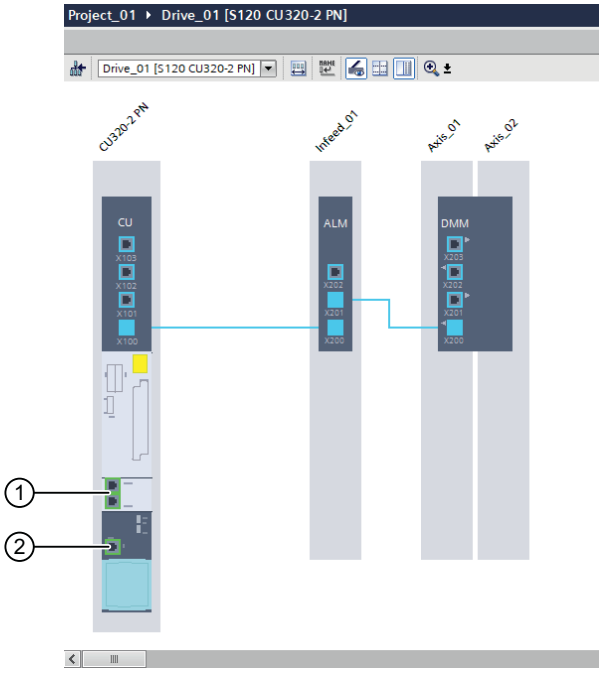
IP addresses in the project

A SINAMICS S120 Control Unit is created with the following IP addresses in a project in the TIA Portal:

- **Commissioning and service interface X127:**
  - IP address: 169.254.11.22
  - Subnet mask: 255.255.0.0

  The addresses correspond to the addresses in the delivery condition.
- **PROFINET interface X150**:
  - IP address: 192.168.1.2
  - Subnet mask: 255.255.255.0

  The PROFINET addresses lie in the area of the PROFINET subnet of a SIMATIC S7 controller. No additional settings are required to establish a network.



① PROFINET interface X150
② Commissioning and service interface X127

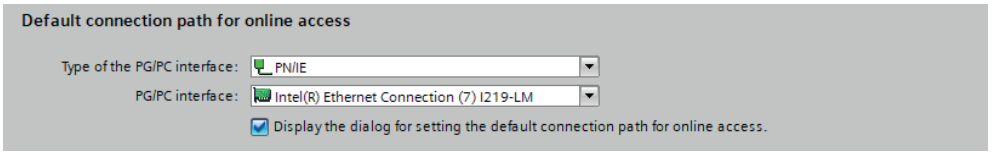
Figure 5-1 Example: CU320-2 PN interfaces

Defining the preferred PG/PC interface

To define the preferred PG/PC interface for the online connection, proceed as follows:

1. In your project, select menu "Options > Settings".
   The settings of the TIA Portal are opened.
2. Select entry "Online & Diagnostics".

3. In display area "Preset connection path for online access", define the interface type and the interface.
4. Enable the option "Display dialog for setting the default connection path for the online access".



The defined connection path is used as the default setting in the dialogs for online access.

5.4.1 Checking the firmware version

Overview

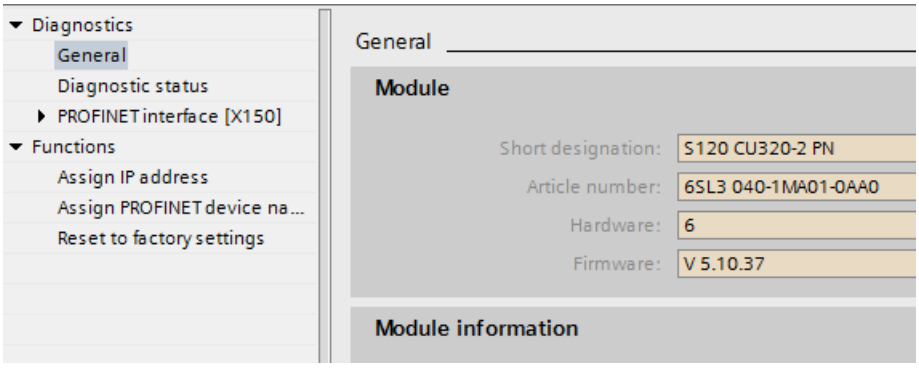
You can only establish an online connection between the PG/PC and drive device if the PG/PC and the drive device are using the same firmware version. Different firmware versions generally occur in the following cases:

- The drive device firmware was in the process of being updated. However, the firmware saved in the Startdrive project is older.
- A new Startdrive version was installed. When creating a new project, the latest firmware version was automatically set. However, your drive device is still using an older version.

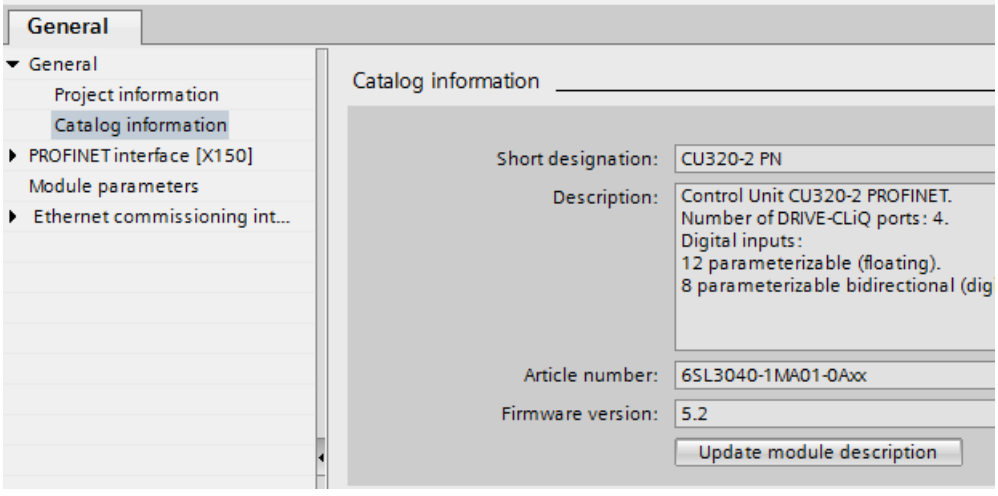
Checking the firmware consistency

To check the firmware consistency between your Startdrive project and drive, proceed as follows:

1. Check the firmware version on your memory card using the "General" diagnostics screen form.
   - Connect your PG/PC to a drive device using a LAN cable, and switch on the drive device.
   - In your Startdrive project, open the "Online access" entry in the project tree.
   - Select the network interface of your PG/PC.
   - Double-click "Update accessible devices".
     The accessible device is displayed with IP address in the project tree.
   - In the project tree call the "Online & diagnostics" function for the displayed device.



2. Check the firmware version in the catalog information of the Control Unit in your current Startdrive project.
   - To do this, call the following menu: "Control Unit > Inspector window > General > Catalog information".



Result:

- An online connection is possible if the firmware versions are identical.
  OR
- If the firmware versions are not identical (see the diagram example above), then the versions must be aligned in order to be able to establish an online connection. We recommend that you upgrade the respective older version.

Remedy:

- Update the firmware of your drive device (see Chapter "Updating the firmware (Page 89)").
  OR
- In Startdrive, create a new Startdrive project for your drive device, and there, set a more recent firmware version for the Control Unit (see Chapter "Inserting the Control Unit (Page 103)"). If you are using an older Startdrive version, it may be necessary to first install a current Startdrive version.

5.4.2 Online connection via standard service interface X127

Overview

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

Requirements

New project

- A SINAMICS S120 Control Unit has been inserted in the device configuration.
- You have connected your PG/PC with the drive via the X127 service interface.

Note

You can go directly online as the service interface X127 has already been assigned an IP address.

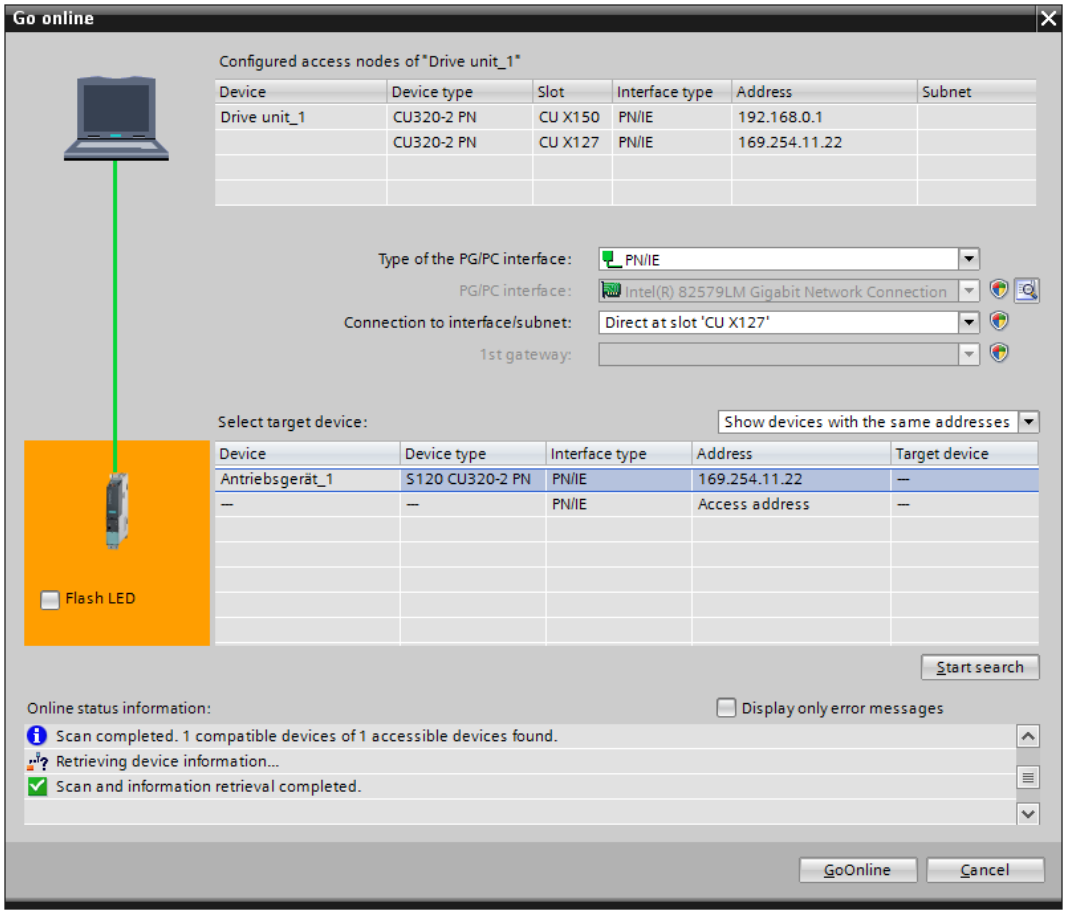
Existing project

- 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.

Procedure

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 tree (or in the device view).
2. Click the "Go online" button.
   The corresponding dialog is opened.



3. In drop-down list "Type of the PG/PC interface", select option "PN/IE".
4. In drop-down list "PG/PC interface", select the interface of your PG/PC.
5. In drop-down list "Connection to interface/subnet", select option "Direct at slot 'CU X127'".
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 devices
   - Display accessible devices
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".
   The online connection between the PG/PC and the drive unit is established.

The settings are used automatically the next time you go online and the "Go online" dialog is no longer displayed.

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.

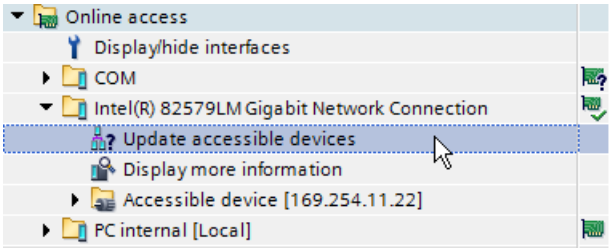


Figure 5-2 Example: Online access

5.4.3 Online connection via PROFINET interface

5.4.3.1 Establishing an online connection between a drive and a PG/PC

Overview

The PROFINET communication between a drive and a PG/PC is accomplished via the PROFINET interface X150. To establish an online connection between a drive and a PG/PC, the drive and PG/PC must be located in the same subnet. The IP address and subnet mask must be selected or adapted accordingly.

Requirements

- The drive and PG/PC are located in the same subnet.

Procedure

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

1. Search for a device via "Online access".
2. Assign the device an IP address and device name.
3. Adapt the IP address and subnet mask of the configured device in the project.
4. Compare the assigned interface data with the configured interface data.

5.4.3.2 Searching for a drive

Overview

You can search for your drive in the TIA Portal using the "Online access" option.

Requirements

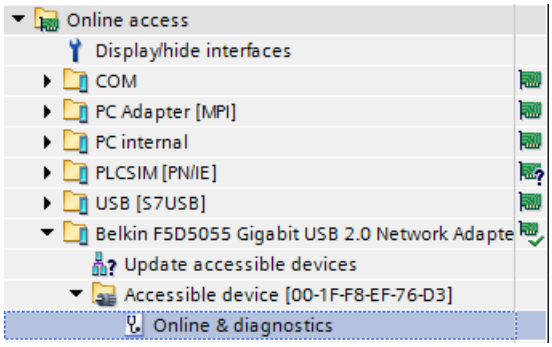
- You have inserted a drive in the project.
- You have established a physical connection (LAN cable) between your PG/PC and the PROFINET interface X150 of your drive.

Procedure

To search for a drive via "Online access", proceed as follows:

1. Open the "Online access" entry in the project tree.
2. Select the network interface of your PG/PC.

3. Double click on "Update accessible devices".
   The drive is displayed in the project tree.



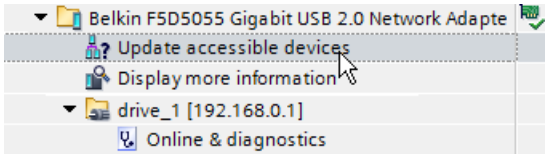
   If the communication parameters of the drive are set to factory settings (IP address 0.0.0., no device name), then the default device name of the TIA Portal (in this case: "Accessible device") and the MAC address are displayed.

Note

Assigning an IP address and device name for a drive

To be able to connect online with the drive, it is necessary to assign an IP address and a device name.

4. Select the drive and, if necessary, assign an IP address and device name (see Chapter "Assigning an IP address (Page 160)" and Chapter "Assigning PROFINET device names (Page 162)").



   The drive is displayed with a device name (here: drive_1) and an IP address.
   If you cannot assign an IP address and device name, you may have to check the IP address of your PG/PC. This must also lie in the same address range as the address of the drive (see also Chapter "Setting up the preferred PG/PC interface (Page 164)").

Result

- You have found the drive in the PROFINET subnet.
- You have assigned an IP address and a device name to the drive.

5.4.3.3 Assigning an IP address

Before you connect your PG/PC with your drive online, you must assign an IP address to the PROFINET interface X150 of your drive.

Overview

Upon delivery, the PROFINET interface X150 of the drive does not have an assigned IP address. If a cyclic connection already exists from SINAMICS to the controller, it is no longer possible to assign an IP address.

The following data is automatically assigned to the X150 PROFINET interface in the project:

- IP address: 192.168.0.1
- Subnet mask: 255.255.255.0

The IP address and subnet mask are located in the subnet of an S71500 controller, which simplifies the linking of the control system and drive.

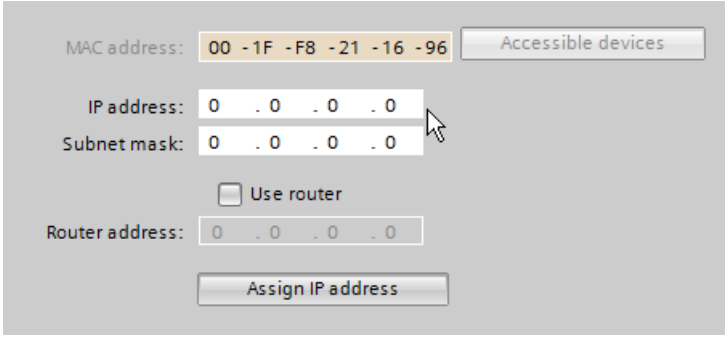
Requirements

- An online connection to the drive exists, and you have made a search for the drives under "Online access" in the appropriate interface with "Update accessible devices".
- The device is displayed.

Procedure

To assign an IP address to the PROFINET interface of your drive, proceed as follows:

1. Double-click "Online & Diagnostics" under "Online access" in the project tree.
2. Double-click the "Functions" entry in the secondary navigation of the working area.
3. Double-click the "Assign IP address" entry.



4. Enter an IP address that matches your project.
5. Enter an appropriate subnet mask.
6. Click on "Assign IP address"
7. Update the display under "Online access"
   The assigned IP address is displayed. The MAC address is read out automatically.

Result

The IP address has been assigned to the drive.

5.4.3.4 Assigning PROFINET device names

You must assign a device name to the drive so that you can operate the drive in a PROFINET subnet.

Assign device name

This name must comply with DNS name conventions. For detailed information, refer to the information system of the TIA Portal.

- When delivered, the drive does not have a device name.
- If the drive already has a name, perform "Restore factory settings". The name is deleted.

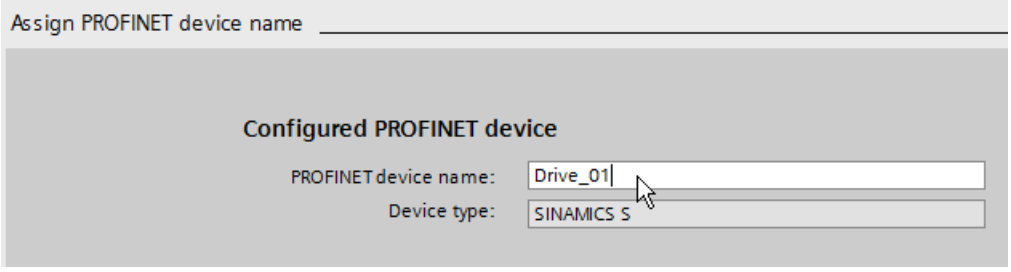
Requirements

- An online connection has been established to the device.

Procedure

To assign a device name, proceed as follows:

1. Select the network interface of your computer.
2. Double click on "Update accessible devices".
   Accessible devices are indicated below the interface.
3. Double-click "Online & Diagnostics" under this device in the project tree.
4. Click the "Functions" entry in the secondary navigation of the working area.
5. Click the "Assign PROFINET device name" entry in the secondary navigation.



6. Enter a device name in the "PROFINET device name" field.
7. Click "Assign name" to assign a name to the drive.
8. Double click on "Update accessible devices".
   The name of the device is then updated in the project tree.

Result

The device name has been assigned to the drive.

5.4.3.5 IP address and the subnet mask in the project

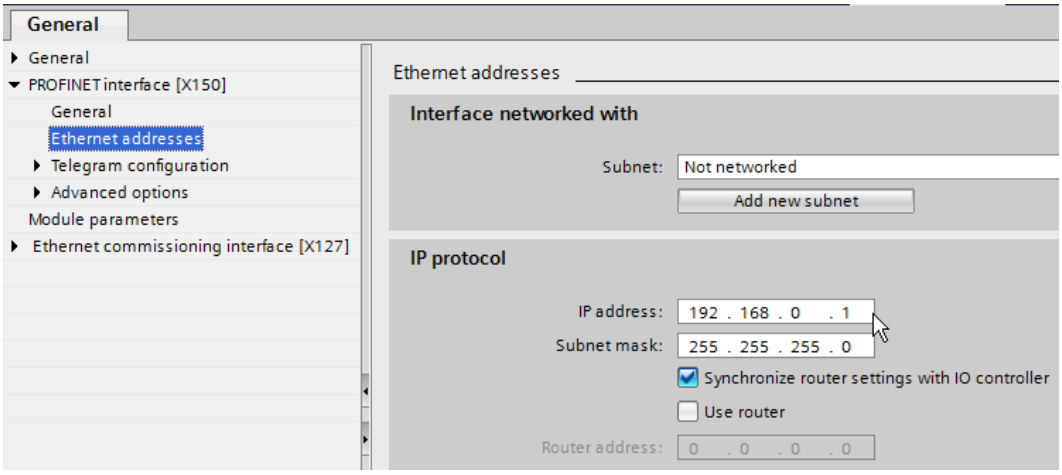
Overview

After you have assigned an IP address to the drive, check the IP address and subnet mask set in the project. An online connection can only be established when the settings in the project and in the drive are identical.

Procedure

To compare the IP address and subnet mask in the project and drive, proceed as follows:

1. Search for the drive under "Online access" and "Update accessible devices".
   The drive is displayed with IP address and subnet mask.
2. Switch to the device view.
3. Select the PROFINET interface.
4. In the inspector window, select "Properties" > "General".
5. Click "Ethernet addresses".
   The properties of the interface are displayed.
6. Compare the IP address and subnet mask with the settings under "Online access".



Result

If both settings are the same, you can establish an online connection.

5.4.3.6 Setting up the preferred PG/PC interface

Overview

The PROFINET communication between the drive and the PG/PC takes place via an Ethernet interface. For the communication via the X150 PROFINET interface, the IP address and subnet mask of the PG/PC interface must lie within the number range of the PROFINET subnet.

Note

Assigning a temporary IP address for PG/PC

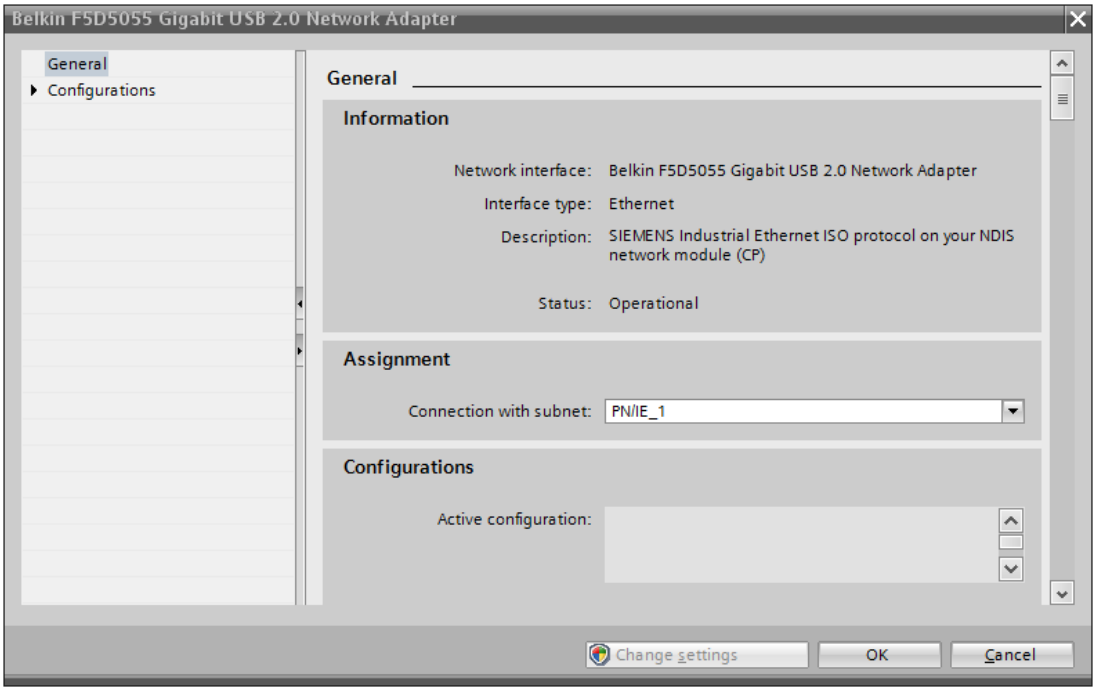
If you search for the device via "Accessible devices" or go online for the first time, the PG/PC can automatically be assigned a temporary IP address in the subnet.

Assigning the PG/PC interface

The procedure describes the process for the "Ethernet" interface type by using the "Online access" function.

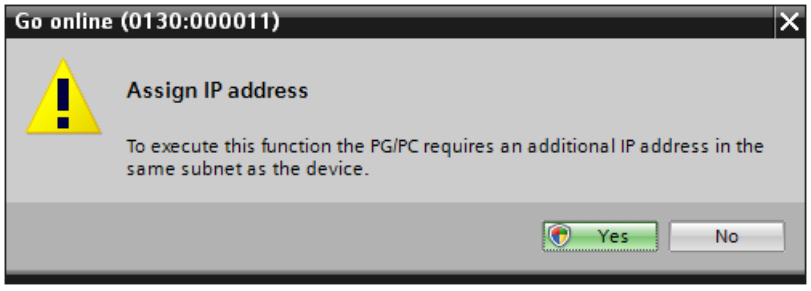
To adapt the IP address and subnet mask of the preferred PG/PC interface, proceed as follows:

1. Navigate in the project tree to the corresponding interface under "Online access".
2. Select the shortcut menu "Properties".
3. In the next step, select the subnet and apply the setting with "OK" where applicable.

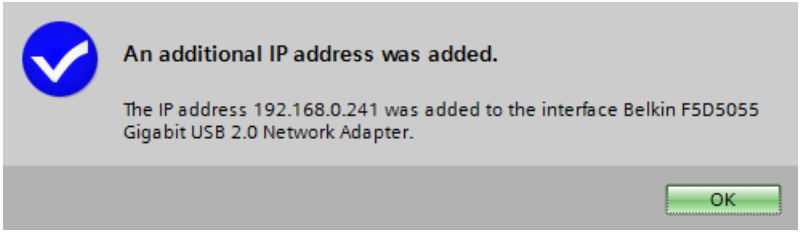


Add IP address for PG/PC interface in the subnet

1. Click in the toolbar on button Go online.
   The "Go online" dialog opens.
2. Select the device and click "Connect" to confirm.
3. Assign an IP address to the PG/PC, which is located in the subnet of the drive.
   If you have not yet done this via the Windows system control, you will be offered at this point to temporarily assign a suitable IP address from the subnet of the drive to your PG/PC.



4. Click "Yes" to assign the IP address.



5. Confirm with "Yes".
   The interface has been assigned the IP address within the PROFINET subnet.

Result

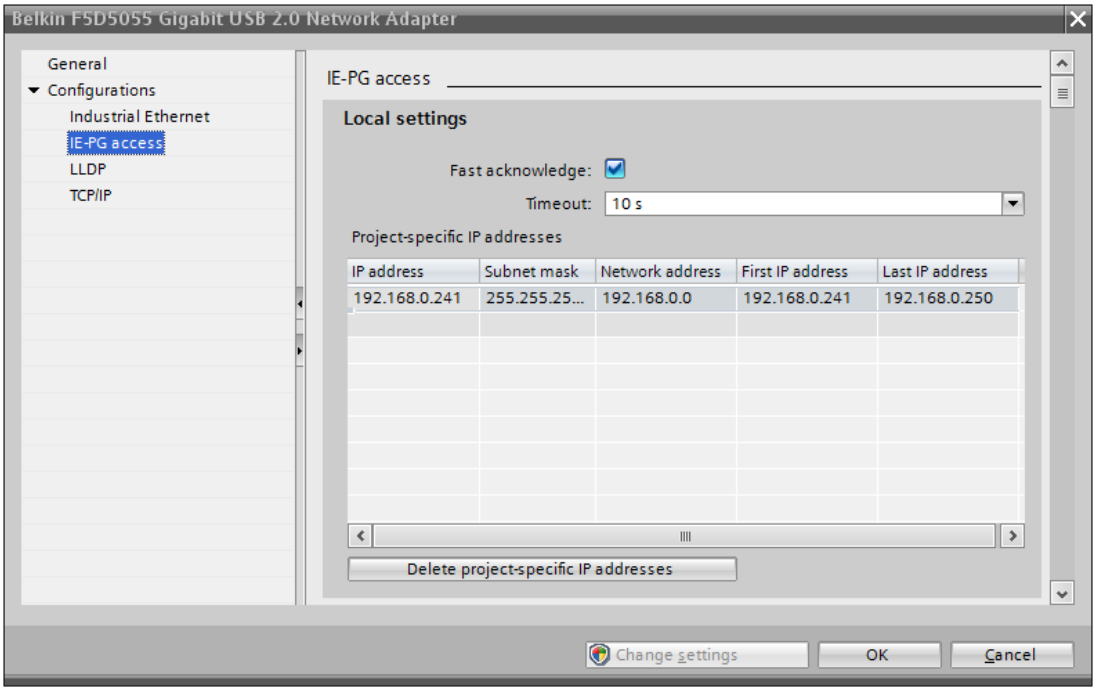
- You have assigned the PG/PC interface.
- The TIA Portal has assigned an IP address within a project.
- The online connection has been established.

Displaying and deleting temporary IP addresses

You can display and also delete all temporarily assigned addresses.

To display the overview of all of the temporary IP addresses and to delete temporary IP addresses, proceed as follows:

1. Navigate in the project tree to "Online access" and from there to the appropriate interface.
2. In the shortcut menu, click "Properties".
3. At Configuration, select "IE-PG Access".



5.4.3.7 Restoring factory settings

Overview

In the event of problems during the commissioning via the PROFINET interface X150, we recommend that you reset the IP settings of the drive to the factory settings. This provides a defined basis for an error-free commissioning.

Requirements

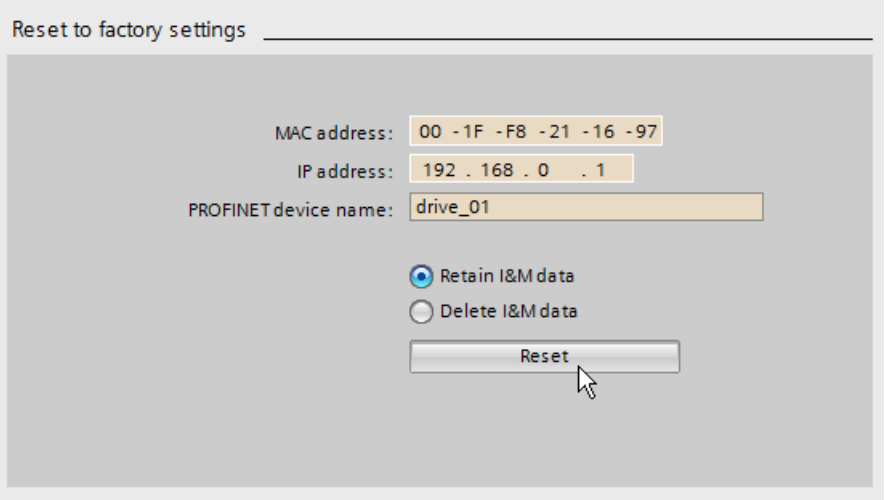
- There is an online connection to the drive unit (see Chapter "Establishing an online connection to the drive (Page 152)").

Procedure

To restore the factory settings, proceed as follows:

1. Open the "Online & diagnostics" entry at "Online access".
2. Open the "Functions" entry in the secondary navigation.

3. Double-click the "Restore factory settings" entry in the secondary navigation.
   The dialog box with the current settings is displayed.



4. Click the "Reset" button.
   The drive communication settings are reset to the factory settings.
5. Go offline and then establish an online connection again.
   The factory settings of the IP address and the device name are displayed at "Online access".

Result

The communication settings show the factory settings again.

Note

After resetting to the factory settings, it makes sense to assign an IP address (see Chapter "Assigning an IP address (Page 160)") and a PROFINET device name (see Chapter "Assigning PROFINET device names (Page 162)") to the drive.

5.5 Alternative 1: Loading the drive configuration into the project

5.5.1 Create a new project

Overview

You can create new projects once you have opened the Startdrive application in the TIA Portal.

Procedure

Proceed as follows to create a new project:

1. In the secondary navigation of the portal view, click on the entry "Create new project". The input fields for the basic project data are displayed to the right in the detailed view.
2. Record the following project data:
   - **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**
     Brief info about the project can be entered here.
3. Click "Create" to save project data.

The new project is created and simultaneously opened.

5.5.2 Uploading a device as a new station

Overview

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

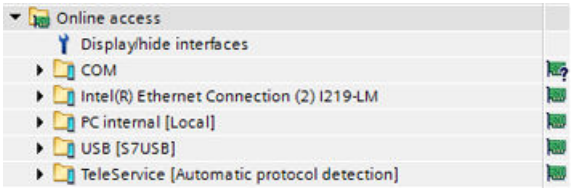
Requirements

- There is a physical LAN connection between the drive and the PG/PC.
- The drive is switched on.
- An IP address has been assigned to the drive.

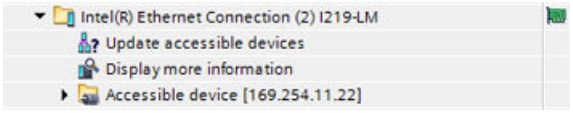
Procedure

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

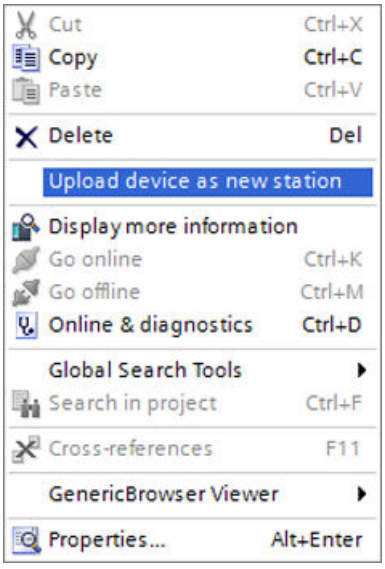
1. In the project tree, click on the arrow icon ▶ next to the "Online access" function.
   The following options are then displayed:



2. Click on the arrow icon ▶ next to the option "Intel(R) Ethernet Connection (2) I219-LM".
   The following 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 possible commands is shown.
5. Select the command "Upload device as new station".



The configuration is loaded from the drive into the project.

5.5.3 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.

5.6 Alternative 2: Creating a project with a determined drive configuration

5.6.1 Create a new project

Overview

You can create new projects once you have opened the Startdrive application in the TIA Portal.

Procedure

Proceed as follows to create a new project:

1. In the secondary navigation of the portal view, click on the entry "Create new project". The input fields for the basic project data are displayed to the right in the detailed view.
2. Record the following project data:
   - **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**
     Brief info about the project can be entered here.
3. Click "Create" to save project data.

The new project is created and simultaneously opened.

5.6.2 Inserting the drive offline

Overview

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

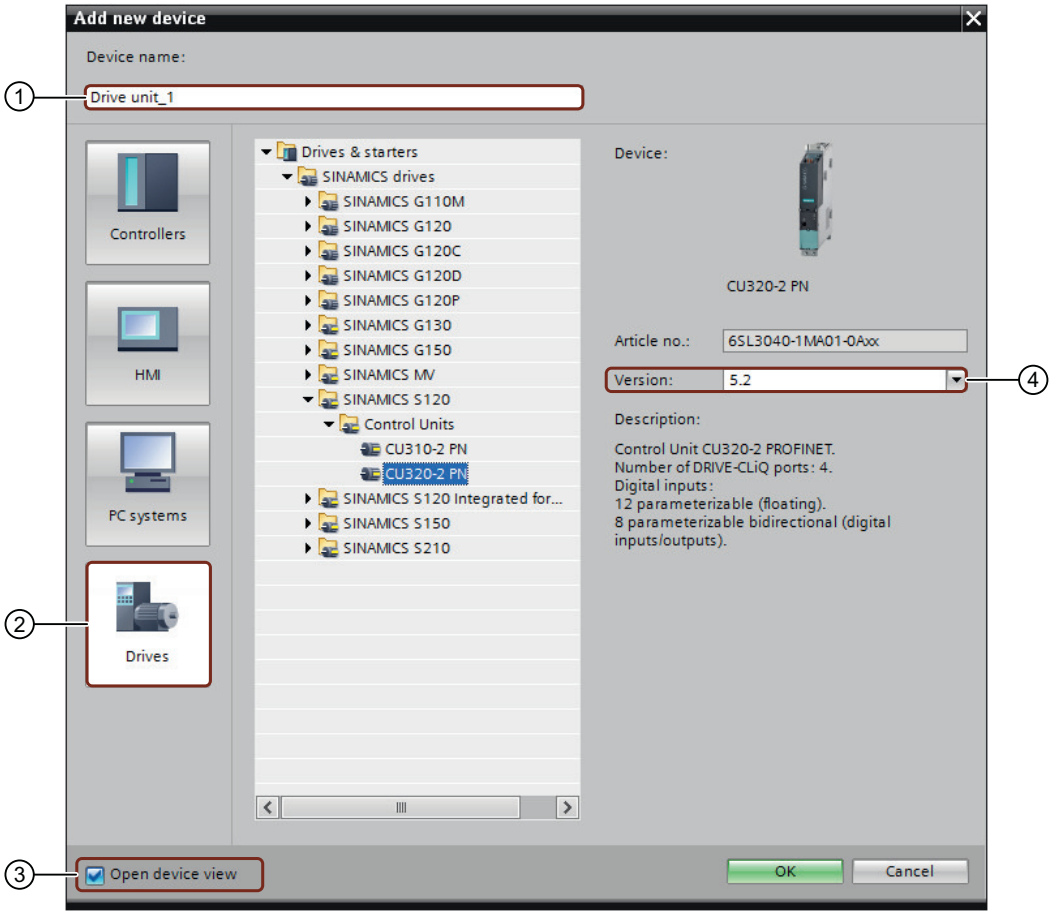
Requirements

- A project has been created, or an existing project is open.
- The online connection to the drive is deactivated.

Procedure

Proceed as follows to insert a Control Unit into the project view:

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



① "Device name" input field (default: Drive unit_x)
② "Drives" button
③ Activate/deactivate "Open device view" option
④ Drop-down list "Version" (here, select the firmware version of your drive device.)

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

3. Click on the required Control Unit in the "Control Units" list.

Note

Comparing and possibly changing version numbers

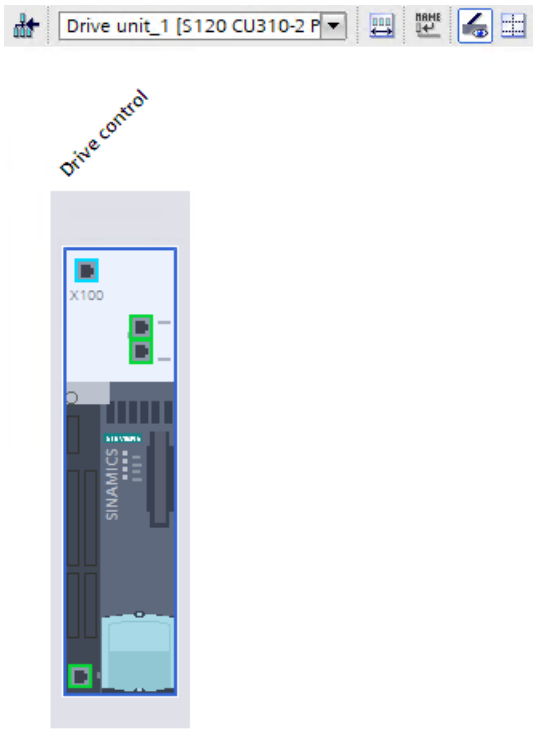
The latest firmware version is always suggested when creating a Control Unit. Under certain circumstances, the recommended firmware version does not match the version number on the memory card of your converter. If the version numbers do not match, it will not be possible to go online later. Therefore, 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 converter.
- If necessary, change the version number via the "Version" drop-down list.

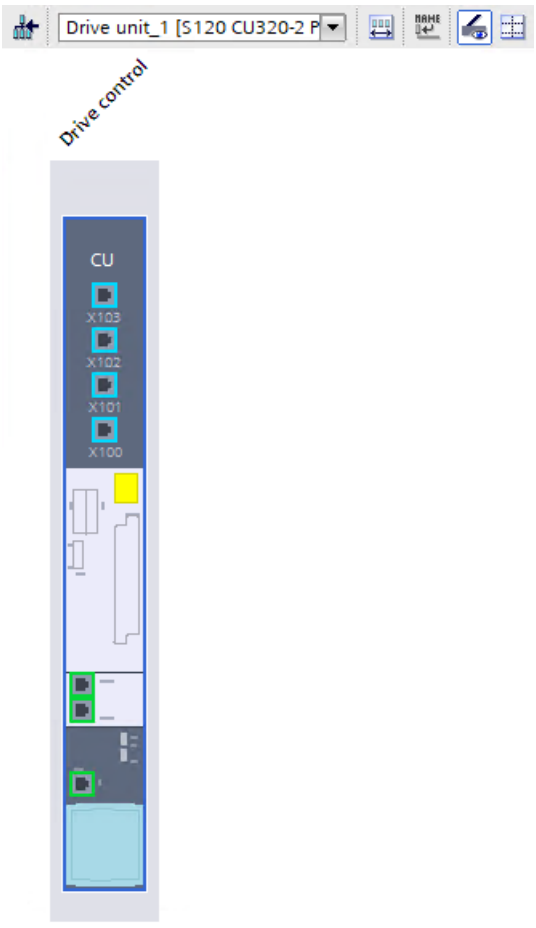
4. Assign a different device name in the input field ① if required.
5. Click "OK".
   OR
   Double-click on the required Control Unit.
   If the "Open device view" option is activated, the Control Unit is displayed in the device view in the next step.

Result

The Control Unit is inserted and can then be configured.



Example: CU310-2 PN inserted



Example: CU320-2 PN inserted

5.6.3 Determining the drive configuration

Overview

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

Requirements

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

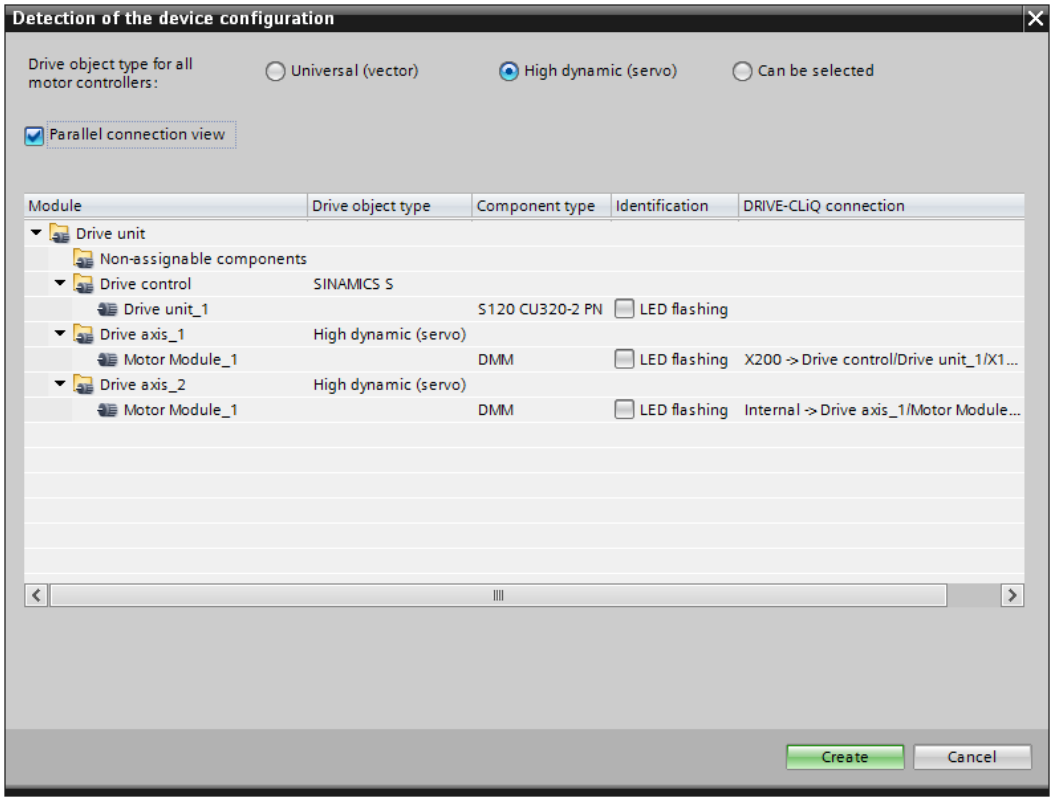
Performing device configuration identification

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 drive has not yet been established.
3. Establish an online connection to the drive.

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.



Overview of the read-out components

All of the read-out components are displayed in an overview. 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)".

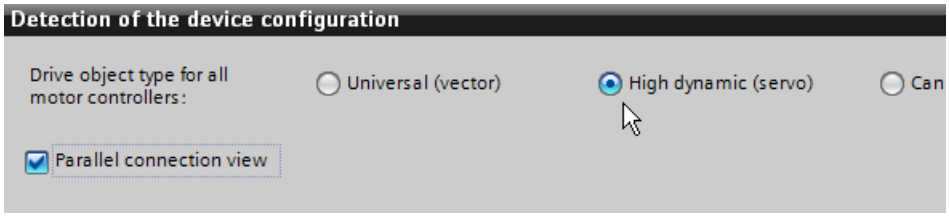


Figure 5-3 Default drive object type

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 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".

5.6.4 Importing the drive configuration into the 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.

Requirements

- 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.
2. Click the "Create" button.

Result

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

5.6.5 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.

5.7 Basic parameterization of the drive objects

5.7.1 Control Unit

5.7.1.1 Activating function modules

Overview

You can activate the "Free function blocks" function module for the Control Unit used.

Using the Technology Extension FBLOCKS, logic operations (e.g. AND, OR) can be implemented via function blocks. The necessary settings can be made exclusively via the parameter view.

Note

You can activate or deactivate function modules only offline.

Procedure

To activate the "Free function blocks" function module, proceed as follows:

1. Activate the "Free function blocks" function module by clicking the option.
2. Save the project to back up the settings.

5.7.1.2 Configuring the web server

Overview

The web server provides information on a SINAMICS S120 device via its web pages. Access is via an Internet browser.

Configuration in Startdrive

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 and in the offline mode of the Startdrive. We recommend that you carry out the configuration of the web server in offline mode.

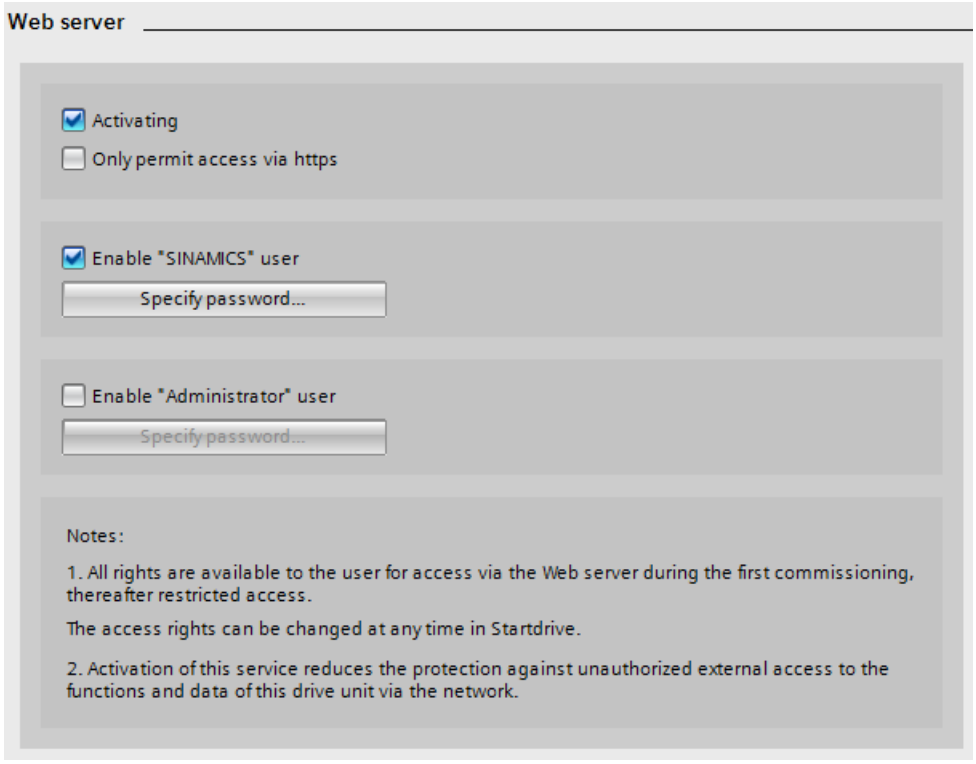


Figure 5-4 Web server configuration with default settings

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
Only permit access via HTTPS	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 created offline must be transferred to the drive before accessing the web server. To transfer the passwords created 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 152)").
2. Load the set project data into your drive unit (see Chapter: "Loading the project data into the converter (Page 242)").

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

To restrict access of the web server to a secure connection, activate the option "Only permit access via HTTPS" in the configuration dialog.

Further information

You can find further information on access to the web server and the functions of the web server in the Chapter "Web server" of the SINAMICS S120 Function Manual Drive Functions.

5.7.1.3 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.

5.7.1.4 Enabling "SINAMICS" and "Administrator" user

Overview

The "SINAMICS" user and the "Administrator" user can be enabled with their own specific rights.

Procedure

To enable a user and activate a password, proceed as follows:

1. Activate the "Enable SINAMICS user" option.
   AND / OR
2. Activate the "Enable administrator user" option.

5.7.1.5 Creating a password for the users "SINAMICS" and "Administrator"

Overview

You can use this function for the users "SINAMICS" and "Administrator" in **online or offline mode**. The procedure is the same for both users.

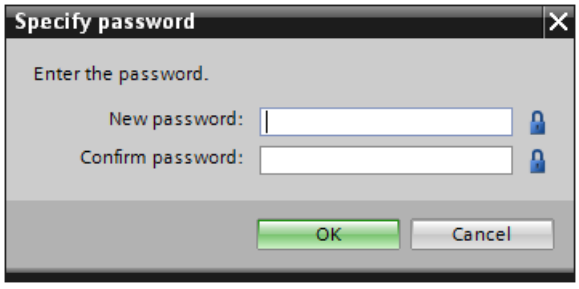
Requirements

- There is an online connection between the Startdrive project and the drive unit.
  This requirement only applies if you create a password in online mode.

Procedure

To create a password for the user "SINAMICS" or "Administrator", proceed as follows:

1. Click on "Specify password".
   The "Specify password" dialog opens.



2. Enter the new password in the "New password" input field. Pay attention to upper and lower case.
3. Repeat the password in the "Confirm password" field.
   For security reasons, the password entries displayed in the input fields are encrypted.
4. Click "OK" to confirm the input in the password dialog.
   The input dialog is closed if both password entries match. If both entries do not match, the input dialog box remains open and an error message is displayed. At the same time, the two entries in the input dialog are cleared. In this case, you must re-enter the password into the input fields.
5. Save the project to accept the settings.

5.7.1.6 Deleting the password for the user "SINAMICS"

Overview

You can only use this function for the user "SINAMICS" and only in **online mode**.

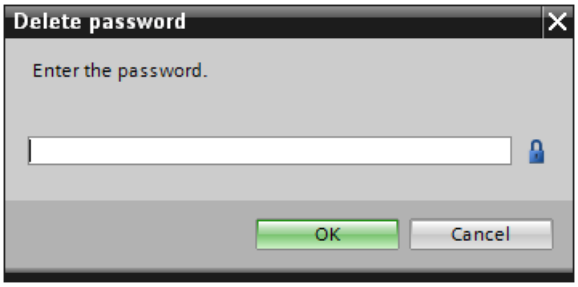
Requirements

- There is an online connection between the Startdrive project and the drive unit.

Procedure

To delete the password for the "SINAMICS" user, proceed as follows:

1. Click the "Delete password" button.
   The "Delete password" dialog opens.



2. Enter the password for the "SINAMICS" user.
   The entry is checked. "Password has been deleted" is displayed if you entered the correct password.
3. Save the project to accept the settings.

Note

The "Administrator" user **must** have a password. If this user is to remain enabled for the web server after the old password has been deleted, a new password must be assigned.

5.7.1.7 Changing the password for the users "SINAMICS" and "Administrator"

Overview

You can only use this function for the users "SINAMICS" and "Administrator" in **online mode**. The procedure is the same for both users.

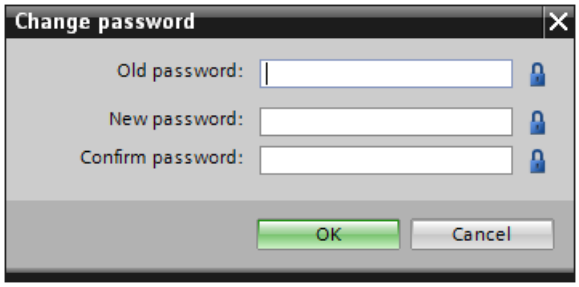
Requirements

- There is an online connection between the Startdrive project and the drive unit.
- The respective user is enabled.

Procedure

To change a password, proceed as follows:

1. Click "Change password".
   The "Change Password" dialog opens.



2. In the "Old password" input field, enter the user's existing password.
3. Enter the new password in the "New password" input field. Pay attention to upper and lower case.
4. Repeat the password in the "Confirm password" field.
   For security reasons, the password entries displayed in the input fields are encrypted.
   The entry is checked. "Password has been changed" is displayed if you entered the correct password.
5. Save the project to accept the settings.

5.7.1.8 Password forgotten?

Overview

A forgotten password results in you no longer being able to access your previously accessible SINAMICS data and functions via the Web server. The procedure is the same for both users.

Procedure

To assign a new password, proceed as follows:

1. Back up the actual configuration of the drive device to Startdrive.
   Load the project data from the drive unit to your PC ("Load from device").
2. Reset the drive unit to the factory settings.
3. Load the backed-up configuration back to the drive unit ("Load to device").
4. Reconfigure the web server login for the user.

5.7.1.9 Write protection

Function description

Write protection prevents unauthorized or inadvertent changes to the settings in the drive.

Activated write protection

Write protection can be activated in offline or online mode. Activated write protection has the following effects:

- Parameters not excluded from write protection cannot be changed.

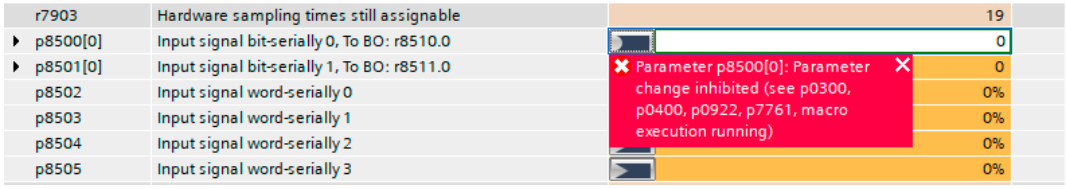


Figure 5-5 Message text when write protection is active

- Information regarding the current status of write protection is displayed in the header line of the working area:
  - In online mode, a note is output stating that write protection is activated and therefore no parameters can be written.

Exceptions to write protection

The following parameters are not affected by write protection:

- Parameters with attribute "WRITE_NO_LOCK" are generally not affected by write protection. You can find a list of parameters with the attribute "WRITE_NO_LOCK" in the chapter "Parameters with "WRITE_NO_LOCK"" of the SINAMICS S120/S150 List Manual.

The following functions are not affected by write protection:

- Activate/deactivate write protection
- Change access level (p0003)
- Save parameters (p0971)
- Safely remove memory card (p9400)
- Restore factory settings
- Import settings from an external storage medium (e.g. upload from a memory card)

Parameters (see SINAMICS S120/S150 List Manual)

- r7760.0...12 Write protection/know-how protection status
- p7761 Write protection

5.7.1.10 Activating/deactivating write protection

Overview

Write protection can be activated in offline or online mode. In online mode, write protection takes effect immediately after activation. We therefore recommend activating write protection in online mode.

Write protection must be deactivated in order to activate or configure know-how protection. However, if necessary, it is possible to activate write protection in addition when know-how protection is activated.

Requirements

- A SINAMICS S120 control module has been inserted in the device configuration.

Procedure

Proceed as follows to activate/deactivate write protection:

1. Establish an online connection to your drive.
2. Call the "Drive control > Parameterization" menu in the project navigator.
3. In the secondary navigation, call "Basic parameterization > Write and know-how protection".
4. Click on "Activate write protection".
   Write protection is activated.
   OR
5. Click on "Deactivate write protection".
   Write protection is deactivated.
6. To save the setting retentively, click  .

5.7.1.11 Know-how protection

Function description

With the know-how protection function, a machine manufacturer can prevent unauthorized persons from reading, changing or copying confidential company know-how on configuring and parameterizing.

Activated know-how protection

Note

Assistance provided by technical support

When know-how protection is activated, assistance can only be provided by Technical Support after prior agreement from the machine manufacturer.

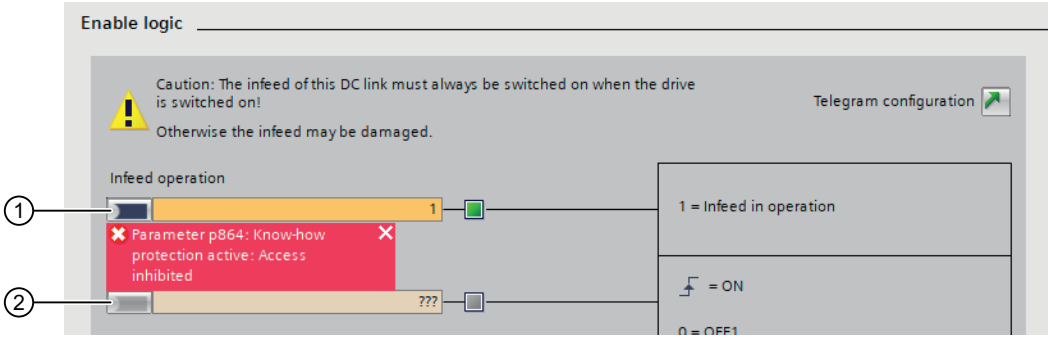
Note

Know-how protection when write protection is active

When write protection is enabled, the protection settings of the know-how protection cannot be changed.

Activated know-how protection has the following effects:

- Parameter view:
  In the parameter view, know-how-protected parameters are not shown in the parameter lists.
- Function view:
  - Know-how-protected parameter values ("KHP_ACTIVE_READ") that can be read but not changed ① are shown but are protected against modification.
  - Know-how protected parameter values that can neither be read nor changed ② are indicated by "???" and are protected against modification.



① Properties: Can be read, cannot be changed (dark orange background)
② Properties: Cannot be changed (light orange background)

- Information regarding the current status of know-how protection is displayed in the header line of the working area:
  - When the "Write and know-how protection" function is called in offline mode, a note is output indicating that know-how protection can only be configured in online mode.
  - In online mode and when know-how protection is activated, a note is output in all screens indicating that know-how protection is active, which means that you cannot read or change all parameters.
- The status of the know-how protection is indicated by the lock icon in the project navigator.

Available protection settings

The following figure shows the protection settings with which drives can be protected against unauthorized access and unauthorized reproduction of the **drive settings (parameter and DCC data)**:

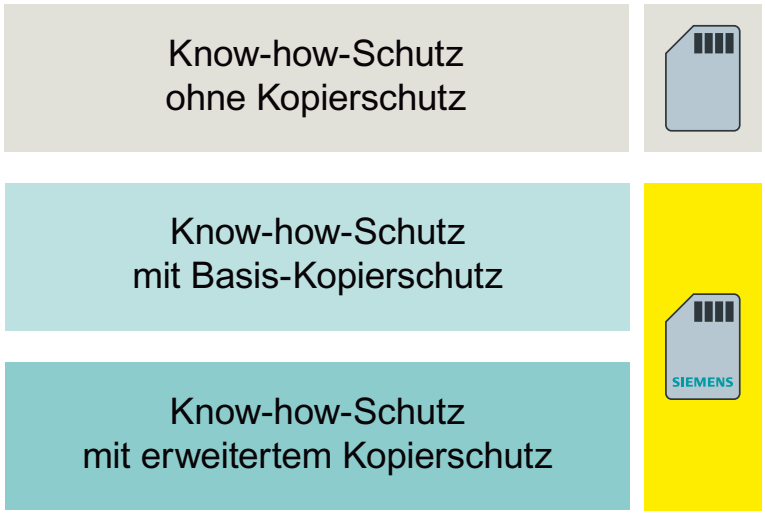


Figure 5-6 Available protection settings

Note

Siemens memory card

Use of know-how protection with basic copy protection and extended copy protection is only possible with a Siemens memory card.

Effects during device replacement

The settings serve to protect confidential company know-how on configuration and parameterization and limit the end user's possibilities as follows, according to the selected setting:

- **Know-how protection without copy protection**
  Despite activated know-how protection, the end user can copy the drive settings and transfer them to further Control Units using any memory card.
- **Know-how protection with basic copy protection**
  Know-how protection is bound to the **serial number of the Siemens memory card**. When know-how protection is activated, the know-how-protected drive settings are protected against copying and use on other memory cards.

  Note

  After a device replacement, the converter can be operated with the Siemens memory card from the defective device without knowing the know-how protection password.

- **Know-how protection with extended copy protection**
  Know-how protection is bound to the **serial number of the Siemens memory card and the Control Unit**. When know-how protection is activated, the know-how-protected drive settings are protected against copying and use on other memory cards and Control Units.

  Note

  After a device replacement, the converter can be operated with the Siemens memory card from the defective device only if the know-how protection password is known.

Effects on parameters and functions

The following table provides a detailed overview of the effects of the individual protection settings on parameters and functions with activated know-how protection:

Affected	Protection settings	Description
Adjustable parameters	Readable, changeable	Adjustable parameters without know-how protection (p...) can be read and changed when know-how protection is active. You can find a list of the adjustable parameters that can be read and changed in the SINAMICS S120/S150 List Manual in the chapter "Parameters with "KHP_WRITE_NO_LOCK"". **Note:** Adjustable parameters without know-how protection cannot be added to an exception list (see Chapter "Managing the exception list (Page 197)").
	Readable	Certain adjustable parameters with know-how protection (p...) can be read but not changed when know-how protection is active. You can find a list of the adjustable parameters that can be read in the SINAMICS S120/S150 List Manual in the chapter "Parameters with "KHP_ACTIVE_READ"".

Affected	Protection settings	Description
Functions	Locked	The following functions are locked when know-how protection is activated: • Loading drive settings into the project (function: "Upload from device") • Automatic controller optimization • Stationary or rotating measurement of the motor data identification • Deleting alarm history and fault history • Generating acceptance documents for safety functions
	Executable	The following functions can be executed when know-how protection is activated: • Restoring factory settings • Acknowledging faults • Displaying faults, alarms, fault history and alarm history • Reading out the diagnostic buffer • Controlling the drive via the control panel • Displaying acceptance documents for safety functions
	Optionally executable	The following functions can be executed if the "Allow diagnostic functions" option is enabled when know-how protection is activated: • Trace function • Measurement function

Parameters (see SINAMICS S120/S150 List Manual)

- r7760.0...12 Write protection/know-how protection status
- p7765 Know-how protection configuration
- p7766[0...29] Know-how protection password input
- p7767[0...29] Know-how protection password new
- p7768[0...29] Know-how protection password confirmation

5.7.1.12 Configuring know-how protection

Overview

Know-how protection can only be activated and configured in online mode. Therefore, always make sure that there is an online connection to your drive unit before calling the configuration screen for know-how protection.

More information on the individual protection settings can be found in Chapter "Know-how protection (Page 189)".

Requirements

- A SINAMICS S120 control module has been inserted in the device configuration.
- An online connection to the drive has been established.
- Write and know-how protection are disabled.

- A Siemens memory card is inserted in the converter. This requirement applies to know-how protection with basic copy protection and extended copy protection.
- **Optional:**
  - The drive unit is fully commissioned.
  - The exception list for know-how protection is created. No critical parameters have been added to the exception list.

Selecting and activating the protection setting

Proceed as follows to select and activate the desired protection setting:

1. If you have already added know-how parameters to the exception list before activating know-how protection, make sure that you have not added any critical parameters (see Chapter "Managing the exception list (Page 197)").

   Note

   Parameters in the exception list can be read and modified

   With activated know-how protection, parameters in the exception list can be read and modified in other commissioning tools and in the web server. Therefore, do not add any critical parameters to the exception list.

2. Establish an online connection to your drive.
3. Select the "Drive control > Parameters" menu in the project navigator.
4. In the secondary navigation, select menu "Basic parameterization > Write and know-how protection".
   The "Write and know-how protection" screen form is displayed with the available protection settings.
5. Select the required setting.
   The following settings are available:
   - Know-how protection without copy protection (default setting)
   - Basic copy protection
   - Extended copy protection
6. To activate use of diagnostic functions with enabled know-how protection, select the option "Permit trace and measuring functions for diagnostic purposes".

7. To activate know-how protection with the selected protection setting, click "Specify password for the activation".
   The corresponding dialog is opened.
8. Assign a password and confirm with "OK".

Note

Recommendation for secure passwords

When assigning a password, make sure that it contains the following:

- At least 8 characters
- Upper and lower case letters
- Numbers and special characters (e.g. ?!%+)

It is not permissible that the password is used elsewhere.

Know-how protection with the desired protection setting is activated. The know-how protected parameters cannot be changed until know-how protection is deactivated.

Important notes

- Write protection can be activated in addition to activated know-how protection. Make sure that write protection is deactivated before you deactivate know-how protection.
- Know-how protection must be deactivated to be able to change a created exception list.

Changing a password

To change an existing password, proceed as follows:

1. Click the "Change password" button.
   The corresponding dialog is opened.
2. Enter the existing and the new password in the appropriate input fields.
3. Confirm your entries with "OK".

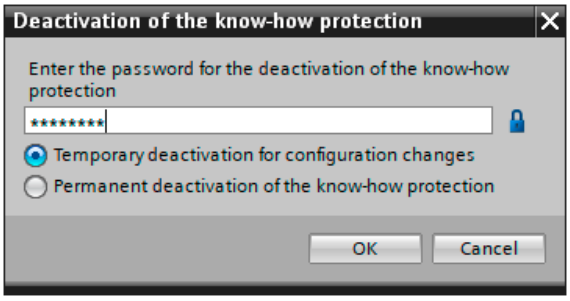
The dialog closes. The new password becomes immediately valid.

Deactivating know-how protection temporarily

Deactivate know-how protection temporarily to change the protection settings and/or the exception list. You can find more information on managing an exception list in Chapter "Managing the exception list (Page 197)".

Proceed as follows to deactivate the know-how protection temporarily:

1. Click on "Deactivation".
   The corresponding dialog is opened. The following options are available:



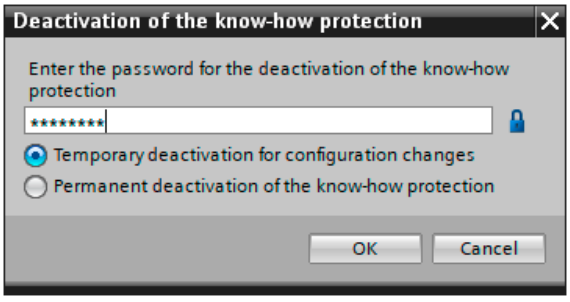
2. Select option "Temporary deactivation for configuration changes" option.
   Know-how protection is deactivated.
3. Enter the existing password for know-how protection.
4. To save the setting retentively, click .

Know-how protection is temporarily deactivated and can be reactivated at any time with the selected protection settings.

Deactivating know-how protection permanently

Proceed as follows to deactivate the know-how protection permanently:

1. Click on "Deactivation".
   The corresponding dialog is opened. The following options are available:



2. Select option "Permanent deactivation of the know-how protection".
   A security prompt is displayed.
3. Enter the existing password for know-how protection.
4. If you want to permanently deactivate know-how protection, confirm the prompt with "Yes".
   Know-how protection is deactivated and the protection settings are reset to the factory settings.
5. To save the setting retentively, click .

Know-how protection is permanently deactivated and can be activated and reconfigured at any time.

Additional protective measures

After configuration of know-how protection, make sure that the Startdrive project file is not retained by the end user.

5.7.1.13 Managing the exception list

Overview

In the exception list, you manage all parameters that are to remain readable and modifiable with activated know-how protection.

Features

- The exception list can be configured in both online and offline mode.
- The exception list can be called via the parameter lists of the individual drive objects. In the factory setting, the exception list that can be called via the parameter list of the "Drive control" drive object only contains the parameter for the know-how protection password (p7766[0]).

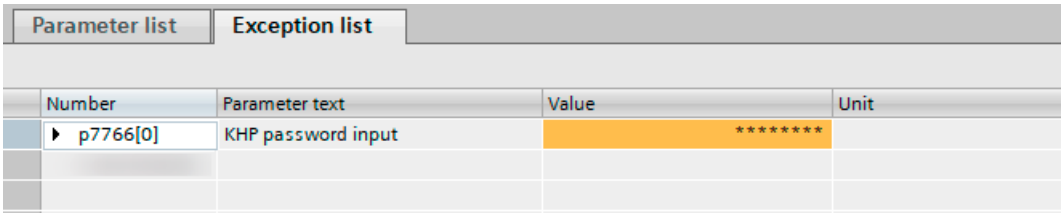


Figure 5-7 Exception list with know-how protection password

Note

Deactivation of know-how protection not possible

The parameter for the know-how protection password (p7766[0]) cannot be deleted from the exception list. If this parameter is deleted, know-how protection will remain permanently activated after activation and can no longer be deactivated. In this case, the drive will need to be restored to the factory settings.

Requirements

- Write protection is deactivated.
- Know-how protection is deactivated (either temporarily or permanently).

Adding parameters to the exception list

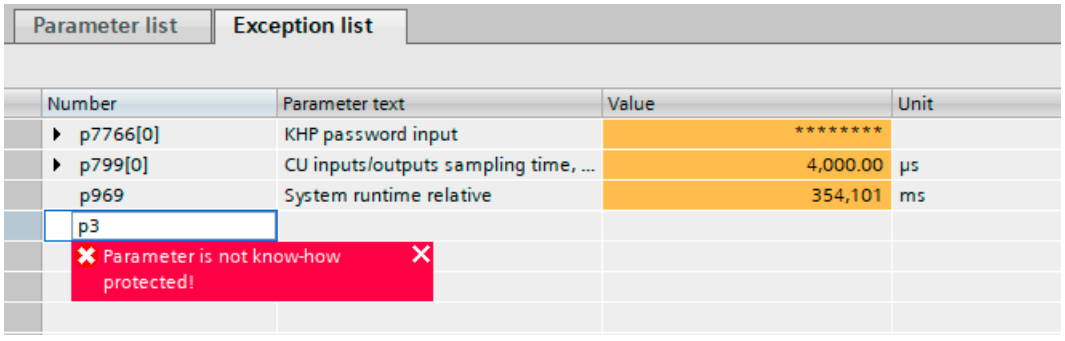
Note

Parameters in the exception list can be read and modified

With activated know-how protection, parameters in the exception list can be read and modified in other commissioning tools and in the web server. Therefore, do not add any critical parameters to the exception list.

Proceed as follows to add individual parameters to the exception list:

1. Establish an online connection to your drive.
2. Call the parameter view of your drive.
3. In the parameter view, click on the icon  .
4. In the "<add new>" input field, enter the parameter number of the know-how protected parameter to be excluded from know-how protection.
   Parameters without know-how protection cannot be added to the exception list.



5. Confirm your entry with Return.
   The most important parameter data is displayed in the exception list.
   The changes in the exception list take effect immediately in online mode.
6. Repeat the process for all other parameters to be excluded from know-how protection.
7. To save the changes in the exception list retentively, click  .
   If you created the exception list in **offline mode**, load the project data into your drive subsequently. The changes in the exception list take effect immediately when you switch to online mode.

After the activation of know-how protection in online mode, only the parameters that were not added to the exception list are know-how protected.

Removing parameters from the exception list

Proceed as follows to remove individual parameters from the exception list:

1. Establish an online connection to your drive.
2. Call the parameter view of your drive.
3. In the parameter view, click on the icon  .
4. In the exception list, select the parameter that you wish to remove from the exception list.

5. Click in the parameter number field, enter "0" and then confirm with Return.
   The complete parameter entry is deleted from the exception list.
   The changes in the exception list take effect immediately in online mode.
6. Repeat the process for all other parameters to be removed from the exception list.
7. To save the changes in the exception list retentively, click .
   If you remove the parameters from the exception list in **offline mode**, load the project data into your drive subsequently. The changes in the exception list take effect immediately when you switch to online mode.

The modified exception list is taken into account after activation of know-how protection in online mode. All of the parameters that were removed from the list are then know-how protected again.

Parameters (see SINAMICS S120/S150 List Manual)

- p7763 Know-how protection OEM exception list, number of indices for p7764
- p7764[0...n] Know-how protection OEM exception list

5.7.1.14 Configuring digital inputs

Overview

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**.

CU310-2 PN

You can change the interconnection of the digital inputs on the CU310-2 PN Control Unit in the "Isolated digital inputs" screen form.

Procedure

Interconnect the signal sources of digital inputs 0 to 3 and 16 to 22 (r0722 and r0723). Several interconnections are possible.

CU320-2 PN

You can change the interconnection of the digital inputs on the CU320-2 PN Control Unit in the "Isolated digital inputs" screen form.

Procedure

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

5.7.1.15 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.

5.7.1.16 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)

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

5.7.1.17 Digital output, isolated (CU310-2 PN)

Overview

The digital output is used for signal feedback (e.g. enable signals). The digital output is interconnected via a BICO interconnection.

Procedure

Proceed as follows to interconnect the digital output:

1. Interconnect the signal sink of digital output 16.
2. If required, invert this output via the icon.
   The icon 1 indicates the inversion.

Control via onboard terminals

You can find additional information about controlling via onboard terminals in the Startdrive information system.

5.7.1.18 Analog input (CU310-2 PN)

Overview

The analog input is used to acquire external analog signals. These signals can be voltages or currents, for example. Analog inputs are used, for example, to be able to enter a speed or torque as analog signal.

Making basic settings

Proceed as follows to make the basic settings for the analog input:

1. Select the basic configuration of the input signal for the analog input:
   - [0] voltage input unipolar (0 V to +10 V
     The analog input is configured as voltage input.
   - [2] current input unipolar (0 mA to +20 mA)
     The analog input is configured as current input.
   - [3] current input unipolar monitored (4 mA to +20 mA)
     The analog input is configured as current input. In addition, wire-break monitoring is active (see further below).
   - [4] voltage input bipolar (-10 V to +10 V
     The analog input is configured as voltage input. The input range is +/-10 V.
   - [5] current input unipolar (-20 mA to +20 mA)
     The analog input is configured as current input. The input range is +/-20 mA.
2. Select the offset value for the analog input.
   The offset value is added to the input signal before the scaling characteristic.

Configure scaling of the analog input

The scaling is used to adapt to the machine or to the existing components. For example, even when the complete input range of the voltage or the current is not utilized, the input value can still be scaled to 100 %.

Procedure

Proceed as follows to configure the scaling:

1. Click on "Scaling".
   The "Scaling TM31 analog input AI 0" dialog opens.
2. Enter the x and y values for 2 points of the scaling line:
   - y2 = upper scaling value as a percentage. y2 = 100 % for x 2 = 10 V means for example, that 10 V at the input corresponds to 100 % at the output.
   - y1 = lower scaling value as a percentage. y1 = -100 % for x1 = -10 V means, for example, that -10 V at the input corresponds to -100 % at the output.
   - x1 = lower, input value to be scaled
   - x2 = upper, input value to be scaled
3. Click on "Close" to confirm the settings.

Define filter for the analog input (optional)

Analog values are always subject to noise and interference. This noise and interference can be suppressed using a filter.

The input signal can also be smoothed to suppress strong fluctuations or short-term peaks.

1. Enter the value for smoothing of the input signal in the "Smoothing" field.
   This value smooths the input signal using a PT1 filter. However, a smoothing value which is excessively high makes the input slow.
2. Enter the value for noise suppression in the "Noise suppression" field .
   This suppresses the input signal noise according to the following function:
   - **|y-x| > noise suppression results in y = x**
     The output value is set to the actual input value.
   - **|y-x| ≤ noise suppression results in y = y_{old}**
     The output value retains its value.

Configuring wire-break monitoring (optional)

Wire-break monitoring is used when the basic configuration "[3] Unipolar current input monitored (4 mA to +20 mA)" is set. In this case, the screen form is extended by 2 additional input fields.

1. Enter the wire-break monitoring response threshold in the "Threshold" field.
   If the threshold value is undershot for longer than the delay time, a wire break is detected.
2. Enter the delay time for wire-break monitoring in the field to the right of the "Threshold" field.
   If the wire-break monitoring response threshold is fallen below for longer than the delay time, then a wire break is detected.

Additional functions (optional)

Function	Description
Absolute-value generation	Activate the absolute-value generation in the screen form if the absolute value of the scaled input value is to be generated. The activated absolute-value generation is indicated by the  icon.
Inversion	The signal source for inverting the analog input signals can be interconnected via a BICO interconnection. As default setting, inversion is **deactivated**. If you want to make an inversion, interconnect the signal source in the "Inversion" field.
Activate	The signal source for enabling the analog input can be interconnected via a BICO interconnection. The enable is **activated as default**. If required, correct the signal source here.
Analog input 0	Here, interconnect the signal sink for the input value of the analog input. Several interconnections are possible.
Simulation mode	A simulation mode can be activated in the online mode.

5.7.2 Infeed unit

5.7.2.1 Overview

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

5.7.2.2 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	
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.

5.7.2.3 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.

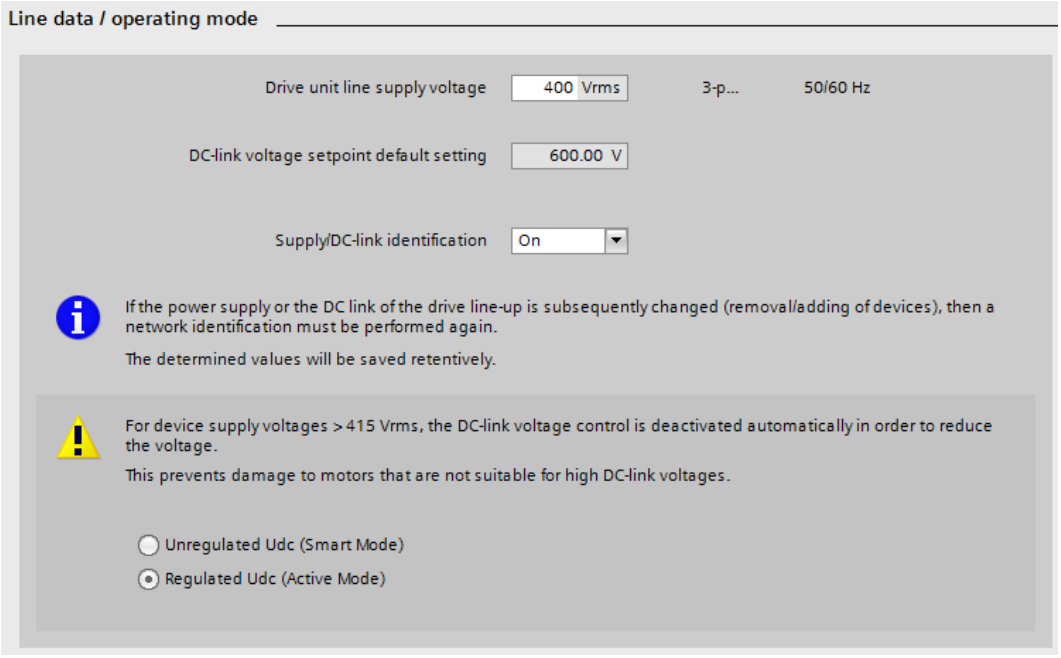


Figure 5-8 Example: line supply data/operating mode for an Active Line Module

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.

5.7.2.4 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".

5.7.2.5 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 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)".

5.7.3 Drive axes (servo)

5.7.3.1 Basic parameterization of the drive axes

Overview

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.

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 5-1 Basic parameterization: selectable options

Option	"Basic parameterization" list	
	Is displayed	Selectable
Function modules	x	x
Control mode	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 the "Position control" function module was activated.

Requirements

- The servo drive axis is offline.

5.7.3.2 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 are available. 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.
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. **Notes:** • Use of this function module **requires a license**. • 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.

Parameters (see SINAMICS S120/S150 List Manual)

- p0108[0..n] Drive objects function module
- p0124[0...n] Main component detection using LED

5.7.3.3 Control mode

Overview

Closed-loop speed control (with and without encoder) and closed-loop 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 mode, the torque is the command variable.

Requirements

- 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 mode

To select a control mode, select one of the following control modes from the drop-down list (p1300):

- Speed control with encoder
- Speed control without encoder
- Torque control with encoder

If you selected a control mode with encoder, then the encoder is now shown in the device configuration.

5.7.3.4 Limits

Overview

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

Parameter	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.

Requirements

- 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.

5.7.3.5 Reference parameters

Overview

The "Reference parameters" screen form shows the most important reference parameters and their values in a table:

- p2000: Reference speed, reference frequency
- p2001: Reference voltage
- p2002: Reference currents
- p2003: Reference torque
- r2004: Reference power
- p2005: Reference angle

- p2006: Reference temperature
- p2007: Reference acceleration

Correct defaults

You can correct the default settings for all p parameters in the table: Proceed as follows:

1. Click in the "Values" field for the corresponding reference parameter.
2. Enter the desired new value.
3. Repeat steps 1 and 2 for the other reference parameters whose default settings you want to change.
4. Finally, save the project.

5.7.3.6 Drive settings

Overview

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

Requirements

- 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 icon).
   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.

5.7.3.7 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.

5.7.3.8 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.

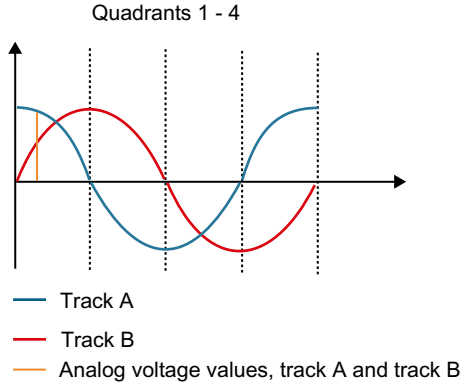


Figure 5-9 Incremental encoders

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.

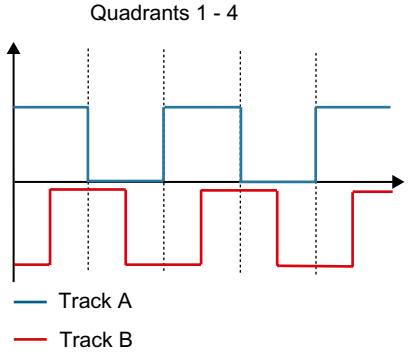


Figure 5-10 TTL/HTL encoders

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.

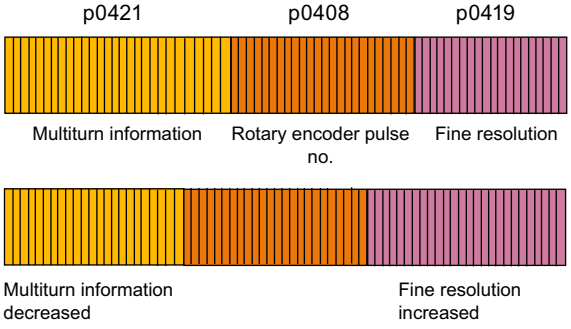


Figure 5-11 Encoder actual values X_IST1

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.

Requirements

- 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 Section "Virtual multiturn resolution" below).

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.

5.7.3.9 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.

Requirements

- 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 motors 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.

Synchronization failed

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 facilitates calibration of the zero mark position, then fine synchronization is recommended (p0404.15 = 1). In this case, fine synchronization avoids measurement scatter and also facilitates an additional check of the determined pole position.

Suitable zero marks are:

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

5.7.3.10 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

5.7.3.11 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.

5.7.4 Drive axes (vector)

5.7.4.1 Basic parameterization of the drive axes

Overview

During the basic configuration, not all of the available options are displayed in the drop-down list "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 the "Basic positioner" function module was activated beforehand.

Requirements

- The vector drive axis is offline.

5.7.4.2 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

  The basic parameterization for the selected drive axis can only be carried out 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	S120 Vector	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
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

Function module	Explanation	S120 Vector	S150	G150	G130
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 "Pre-control" 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	-	-

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.

5.7.4.3 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)

Requirements

- 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 mode

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

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

Note

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

5.7.4.4 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 standstill.

Requirements

- 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.

5.7.4.5 Optimization runs

Overview

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

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

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 136)").

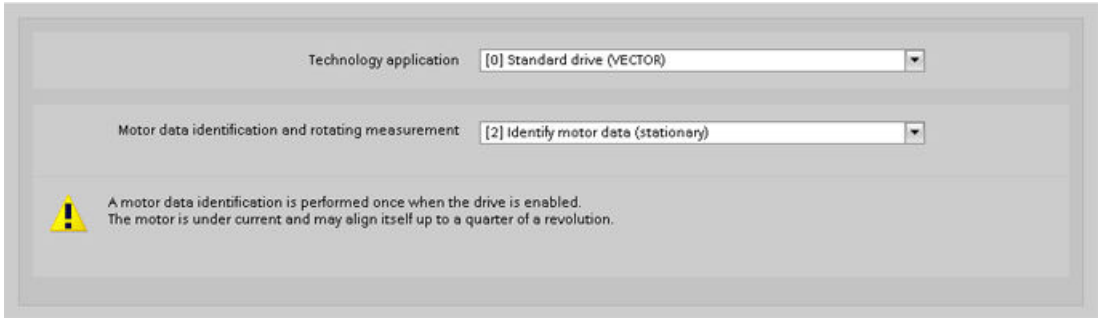
Note

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

Setting the technological application and selection of the motor data identification

To select a technological application and to set the selection of the motor data identification, proceed as follows:

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 135)"), no additional entries are required when automatically calculating the motor/controller parameters.

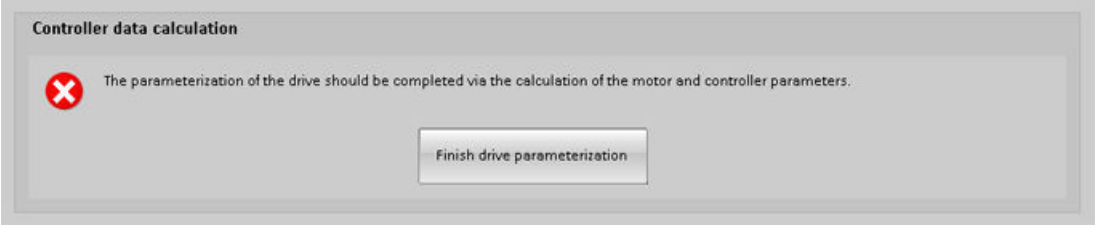
Third-party motors

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

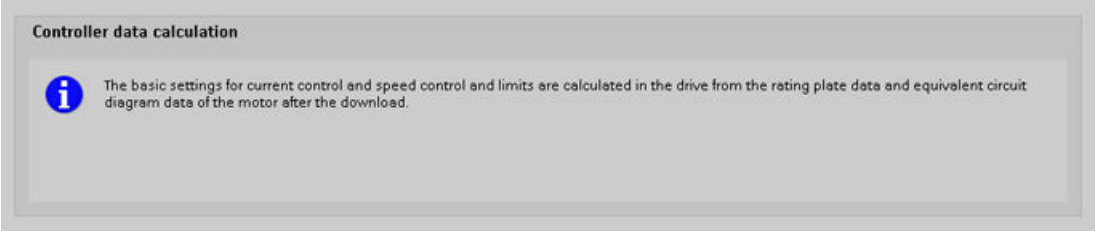
Procedure

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.



5.7.4.6 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.

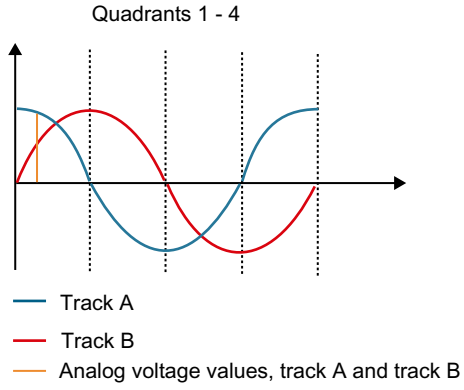


Figure 5-12 Incremental encoders

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.

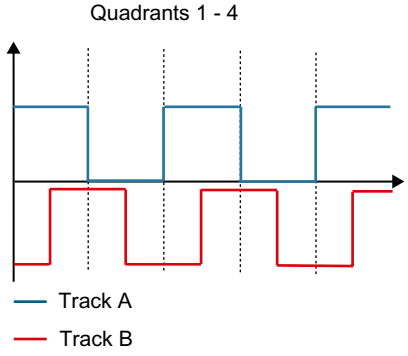


Figure 5-13 TTL/HTL encoders

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.

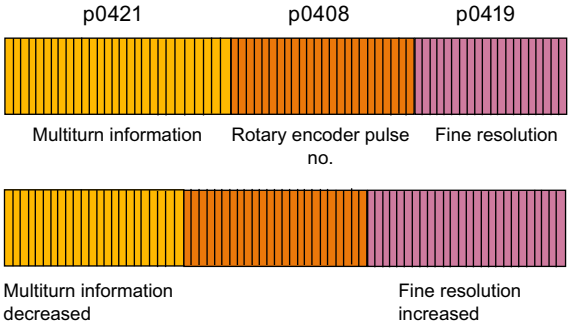


Figure 5-14 Encoder actual values X_IST1

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.

Actual value processing parameter assignment

Parameterizing actual value processing

To parameterize the actual value processing, proceed as follows.

Requirements

- 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 Section "Virtual multiturn resolution" below).

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.

5.7.4.7 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

5.7.4.8 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.

5.8 Loading the project data into the converter

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

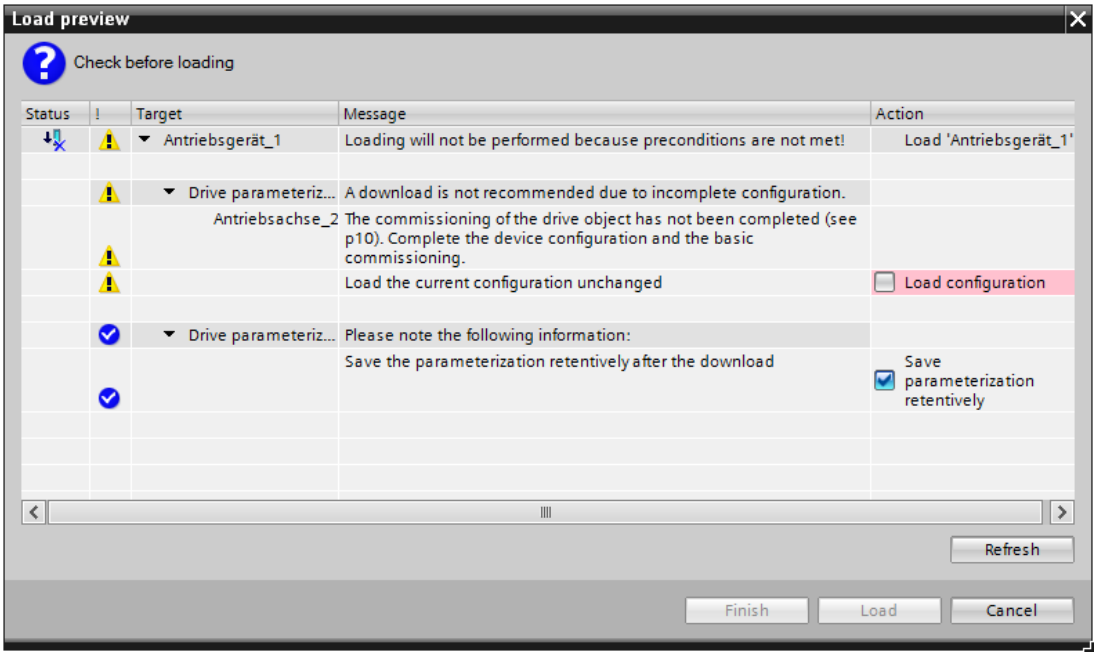
- The project data is consistent.
- Each drive unit to be loaded can be accessed online.

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.

4. Check the messages in the "Load preview" dialog. Activate the required actions in the "Action" column to perform a secure download.



   As soon as downloading becomes possible, the "Load" button is enabled.

5. Click "Load".
   The loading operation is performed.

   – **Synchronization requirement:**
     If the engineering tool detects 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.

5.9 Commissioning a drive

5.9.1 Using the control panel

Overview

You use the control panel to traverse the drive, thus testing the settings that have already been made (see Chapter "User interface - Control panel (Page 51)").

⚠ 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.

Requirements

- 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 of the screen form has a colored background. 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.

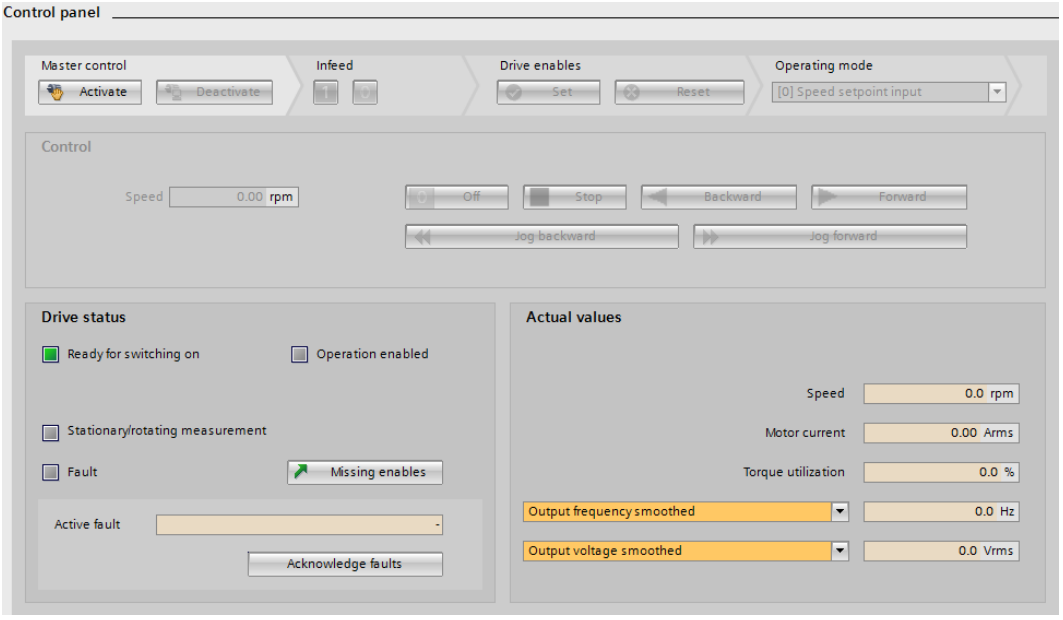


Figure 5-15 Example: Control panel deactivated

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 unit

If an infeed unit 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.

5.9.2 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".

5.9.3 Drive positioning

5.9.3.1 Manual positioning

Overview

With the "manual positioning" function, you traverse the drive endlessly or with jog position-controlled with a defined velocity and acceleration.

Requirements

- There is an online connection to the drive unit.
- The "Basic positioner" function module is activated.
- The drive control panel is called and the master control is activated (see Chapter "Using the control panel (Page 244)").

Procedure

Proceed as follows to traverse the drive using the "Manual positioning" function:

1. Select "Basic positioner" in the "Operating mode" drop-down list.
2. Then select "Manual positioning".
   The "Velocity" and "Acceleration" entries are displayed.
3. At "Velocity", enter a value in LU/min and press the ENTER key. The length unit is an internal length unit of the drive.
4. At "Acceleration", enter a value in LU/s^2 and press the ENTER key.
5. Use the buttons to traverse the motor forward and backward.

Drive status

The status of the various parameters are displayed as LEDs at "Drive status".

Actual values

The values currently active in the drive are displayed at "Actual values" (actual values and current values in the drive). In addition to the default parameter values, additional r-parameters are available for free selection in two drop-down lists.

5.9.3.2 Relative positioning

Overview

With the "Relative positioning" function, you traverse an axis a defined distance using the control panel.

Requirements

- There is an online connection to the drive unit.
- The "Basic positioner" function module is activated.
- The drive control panel is called and the master control is activated (see Chapter "Using the control panel (Page 244)").

Procedure

To traverse the drive via the "Relative positioning" function, proceed as follows:

1. Select "Basic positioner" in the "Operating mode" drop-down list.
2. Then select "Relative positioning".
   The "Distance", "Velocity" and "Acceleration" entries are displayed.
3. At "Distance", enter a value in LU and press the ENTER key.
4. At "Velocity", enter a value in LU/s and press the ENTER key.
5. At "Acceleration", enter a value in LU/s^2 and press the ENTER key. The value is used for acceleration and deceleration.
6. Use the buttons to start the positioning job forward and backward.

Drive status

The status of the various parameters are displayed as LEDs at "Drive status".

Actual values

The values currently active in the drive are displayed at "Actual values" (actual values and current values in the drive). In addition to the default parameter values, additional r-parameters are available for free selection in two drop-down lists.

5.9.3.3 Absolute positioning

Overview

With the "Absolute positioning" function you traverse the axis to an absolute position. The function is oriented towards "Direct setpoint specification / MDI".

Requirements

- There is an online connection to the drive unit.
- The "Basic positioner" function module is activated.
- The drive control panel is called and the master control is activated (see Chapter "Using the control panel (Page 244)").
- The configured encoder system is homed.

Procedure

To traverse the drive via the "Absolute positioning" function, proceed as follows:

1. Select "Basic positioner" in the "Operating mode" drop-down list.
2. Then select "Absolute positioning".
   The "Target position", "Velocity", and "Acceleration" entries are displayed.

3. At "Target position", enter a value in LU and press the ENTER key.
4. At "Velocity", enter a value in LU/s and press the ENTER key.
5. At "Acceleration", enter a value in LU/s^2 and press the ENTER key. The value is used for acceleration and deceleration.
6. Click "Start" to start the positioning job.

Actual values

The values currently active in the drive are displayed at "Actual values" (actual values and current values in the drive). In addition to the default parameter values, additional r-parameters are available for free selection in two drop-down lists.

5.9.3.4 Modify traversing block

Overview

You can traverse the programmed traversing blocks using the "Modify traversing blocks" function. You can test individual traversing blocks or all programmed traversing blocks in an automatic run.

Requirements

- There is an online connection to the drive unit.
- The "Basic positioner" function module is activated.
- The drive control panel is called and the master control is activated (see Chapter "Using the control panel (Page 244)").
- The configured encoder system is homed.

Procedure

To control traversing blocks, proceed as follows:

1. Select "Basic positioner" in the "Operating mode" drop-down list.
2. Then select "Modify traversing blocks".
3. Click the "1" icon to switch on the motor.
   The "Traversing block no." entry is displayed.
4. Enter the number of the traversing block at "Traversing block no.".
5. Click "Start" to start the traversing block.

Drive status

The status of the various parameters are displayed as LEDs at "Drive status".

Actual values

The values currently active in the drive are displayed at "Actual values" (actual values and current values in the drive). In addition to the default parameter values, additional r-parameters are available for free selection in two drop-down lists.

5.9.3.5 Active homing

Overview

With the "Active homing" function you traverse the drive to a home position without using a higher-level control system. The drive itself controls and monitors the homing cycle.

Requirements

- Startdrive is in online mode.
- The "Basic positioner" function module is activated.
- The drive control panel is called and the master control is activated (see Chapter "Using the control panel (Page 244)").

Procedure

To traverse the drive via the "Active homing" function, proceed as follows:

1. Select the "Basic positioner" entry in the "Operating mode" drop-down list.
2. Select the "Active homing" entry in the "Mode" drop-down list.
3. Click "1" in the "Switch on" field to switch on the motor.
   The "Home position coordinates" entry is displayed.
4. Under "Home position coordinate", enter a value in LU/min and press the ENTER key. The length unit is an internal length unit of the drive.

   Note

   You can also parameterize the home position coordinates directly at the homing settings of the basic positioner.

5. Use the "Start" and "Stop" buttons to start or stop active homing.

Drive status

The status of the various parameters are displayed as LEDs at "Drive status".

Actual values

The values currently active in the drive are displayed at "Actual values" (actual values and current values in the drive). In addition to the default parameter values, additional r-parameters are available for free selection in two drop-down lists.

5.9.3.6 Direct homing

Overview

With the "Direct homing" function, you traverse the drive to a defined home position without using a higher-level control system. The drive itself controls and monitors the homing cycle.

Requirements

- Startdrive is in online mode.
- The "Basic positioner" function module is activated.
- The drive control panel is called and the master control is activated (see Chapter "Using the control panel (Page 244)").

Procedure

To traverse the drive via the "Direct homing" function, proceed as follows:

1. Select the "Basic positioner" entry in the "Operating mode" drop-down list.
2. Select the "Direct homing" entry in the "Mode" drop-down list.
3. Click "1" in the "Switch on" field to switch on the motor.
   The "Home position coordinates" entry is displayed.
4. Under "Home position coordinate", enter a value in LU/min and press the ENTER key. The length unit is an internal length unit of the drive.

   Note

   You can also parameterize the home position coordinates directly at the homing settings of the basic positioner.

5. Click the "Set" button to activate the home position coordinate directly.

Drive status

The status of the various parameters are displayed as LEDs at "Drive status".

Actual values

The values currently active in the drive are displayed at "Actual values" (actual values and current values in the drive). In addition to the default parameter values, additional r-parameters are available for free selection in two drop-down lists.

5.9.4 One Button Tuning (OBT)

Overview

Function "One Button Tuning" (OBT) is used to determine the optimum control parameters of a servo drive.

Structure of the screen form

Further information on the structure of the "One Button Tuning" screen form is provided in Chapter "User interface - One Button Tuning (OBT) (Page 53)".

5.9.4.1 Performing One Button Tuning

Overview

The "One Button Tuning" function (OBT) is an important component of basic commissioning. Using this function, the mechanical drive train is measured using short test signals. Using this measurement, the function optimally adapts the controller parameters to the mechanical system being used. Further, this function allows you to determine optimum controller settings with just a few entries.

Requirements

- There is an online connection to the drive unit.
- A servo drive is being used.
  The function is not available for modules with vector control (e.g. S150).
- Function module "Advanced Position Control" (APC) is deactivated. Only use the APC function after the controller optimization.

Restrictions

Observe the following restrictions before you carry out One Button Tuning:

- Only the motor measuring system is used to optimize the position controller. On the other hand, using an external measuring system can result in an unstable controller setting.
- The function does not support different sampling times for the current controller and speed/velocity controller. As a consequence, do not use the function for this type of configuration.

Assume master control

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 "OK" to confirm the monitoring time.
   The message window closes.

The control panel is active.

Activating the infeed unit

Note

Not for CU310-2 PN

In a CU310-2 PN with Power Module, no infeed unit is used in the configuration. In this case, the switch-on/switch-off icons for the infeed unit in the "One Button Tuning" screen form are not available.

If your drive is equipped with an infeed unit, then this must be switched on. If the infeed unit is not switched on, then the controller cannot be optimized.

Procedure

Click the "1" icon at "Infeed" to switch on the infeed.

Making settings for the OBT

To make the settings for the OBT, proceed as follows:

1. Select the dynamic response setting for the OBT function corresponding to the mechanical system of your machine.
   The function optimizes the drive based on the selected dynamic response setting.
   - **Conservative**
     Slow closed-loop control – low stress on the mechanical system
   - **Standard**
     Best compromise between fast speed control and low stress on the mechanical system
   - **Dynamic**
     Fast speed control – high stress on the mechanical system
   - **Dynamic response factor**
     Fast speed control with manual definition of the dynamic response factor (factory setting: 80 %)
2. In the "Distance limit" field, enter the angle through which the motor and the connected machine are permitted to turn for the required measurements (e.g. 360°) without the mechanical system being damaged.
   The angle should be at least 60° in order to be able to obtain practical controller parameters. Generally, longer traversing distances result in better optimization results.
3. Should you wish to perform advanced settings, click on the "Advanced settings" button.
   The "Configuration" dialog box opens. The table in the dialog shows a number of parameters whose default settings you can change.
4. Correct the default settings for each of the required parameters, and then confirm your settings with "OK".

Starting One Button Tuning

After you have made all of the presettings, you can start the OBT. To start the OBT, perform the following steps.

Determining actual values

Click "Activate" in the "Measurement" area to measure the drive for the controller optimization.

The function determines all of the actual drive values required for the tuning.

Starting OBT

Click the "1" icon under "Switch on" to start the function.

The function is started.

Save a project

Save the project if the result was successful.

Result

- OBT has been successful
  The controller optimization result is displayed in the "Status" area. The appropriate LED is lit green if the controller optimization was successful. The modified settings are compared with the settings before tuning in the "Optimization result" list.
- OBT has not been successful
  If the controller optimization was not successful, then you must repeat the optimization with modified entries.

Deactivate the master control

After the controller optimization is completed, you can return the master control. Proceed as follows to return the master control:

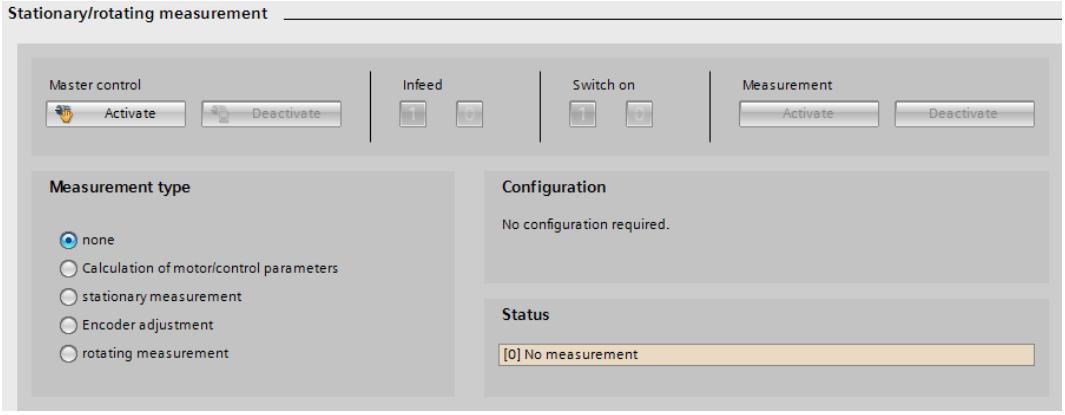
1. Click the "Off" button to switch off the drive.
2. Click the "Deactivate" button at "Master control".
   The "Deactivate master control" message window opens.
3. Click "Yes" to disable the master control.

The master control is deactivated.

5.9.5 Stationary/rotating measurement

Overview

Motor identification (MotID) provides a means of determining motor data, for example, of third-party motors. To improve control properties of the motor, the MotID should be performed. The main motor identification components are the stationary and rotating measurements.



Adjustment range	Explanation
Measurement type	For selecting the measurement type (for experts)
Configuration	For entering configuration data for the selected measurement type (for experts)
Status	Indicates measurement progress
Measurement result	Displays the measurement results of the MotID. The measurement results can be corrected or accepted.

Figure 5-16 Example: stationary/rotating measurement deactivated

NOTICE

Damage to the device as a result of incorrectly selected rated or maximum current values

Incorrect rated or maximum current data can destroy the motor!

- Check that the current values that have been entered are correct.

Note

Loss of the determined motor data during restart

If a power on or a warm restart is performed when the motor data identification is selected, then the motor data identification request is lost. A requested motor data identification must be reselected manually after powering up.

Note

For the duration of the period in which a rotating measurement is selected and running, the following actions or functions cannot be carried out:

- Upload (load configuration from the drive)
- Download (loading the configuration into the drive)
- Save retentively (Copy RAM to ROM)
- Restoring factory settings

Requirements

- There is an online connection to the drive unit.

Assume master control

You require master control for the selected drive to perform the motor identification. Master control has to be activated before the optimization measurements are started.

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 that the connection between the PC and drive is cyclically monitored. The minimum value is 1000 ms.
3. Click "Continue" to confirm the monitoring time.
   The message window closes.

The "Stationary/rotating measurement" screen form is active.

Configuring motor identification

The measurements available are displayed in the "Measurement type" adjustment range. This means that when required, individual measurements can be repeated.

A check is made of whether a measurement is active as soon as the screen form is opened. If a measurement is active, it is also displayed as active. If no measurement is selected, a check is made as to which measurement has already been performed and then used as recommendation.

Note

Manually selecting the measurement type

We only recommend to experienced users that they manually select the measurement type from the list. "Detail values" must be defined in the configuration dialog box for the measurement types "Stationary measurement", "Encoder adjustment", and "Rotating measurement". Precise instructions for making these settings are described further on in this chapter. The results of the respective measurements are displayed in a table in the "Stationary/rotating measurement" screen form.

After the basic parameterization and subsequent download, the "Stationary measurement" measurement type is active as the "Calculation of motor/control parameters" has already been performed.

You perform the configuration of the motor data identification in the following steps:

Activating the infeed unit

Click the "1" icon in the "Infeed" area to switch on the infeed unit.

Setting drive enable signals

To set the drive enable signals, click "Set" in the "Drive enable signals" area.

Switch on motor

Click the "1" icon in the "Switch on" area to switch on the motor.

Start measurement

Click "Activate" in the "Measurement" area to start the measurement.

A status display at the center of the screen form shows how the measurement is progressing (r0047).

The measurement ends automatically, and the message appears that the drive is in the switch-on inhibited state.

After the measurement, the new parameter values are displayed in the results table. You can view and check the new values.

Checking measurement results

Check the values that have been determined to ensure that they are plausible. If the values do not seem appropriate, carry out another measurement.

Close measurement

If you do not want to carry out any further measurements, click the "0" icon in the motor and infeed area. Then click "Deactivate" under "Master control".

5.9.5.1 Parameter values (for experts)

Overview

You will find the mandatory entries for the measurements depending on the type of drive. The results of the respective measurements are displayed in the "Stationary/rotating measurement" screen form after completion of the respective measurement.

Parameter values for stationary measurement

The following table gives an overview of the necessary parameter values for the stationary measurement.

Drive type	Parameter	Explanation
Servo	p0352 Cable resistance	Important for long motor cables
	p0353 Series inductance	Important for long motor cables
	p0640 Current limit	
	p1909 Motor identification control word	
	p1959 Rotating measurement configuration	
	p1780.8 Compensation of the voltage emulation error in the converter	Only for synchronous motors
Vector	p0352 Cable resistance	Important for long motor cables
	p0353 Series inductance	Important for long motor cables
	p0625 Motor ambient temperature	
	p1909 Motor identification control word	

Parameter values for rotating measurement

The following table gives an overview of the necessary parameter values for the rotating measurement.

Drive type	Parameter	Explanation
Servo	p0352 Cable resistance	Important for long motor cables
	p1082 Maximum speed	
	p0640 Current limit	
	p1958 Motor data identification ramp-up/ramp-down time	
	p1959 Rotating measurement configuration	
Vector	p1959 Rotating measurement configuration	
	p1961 Saturation characteristic speed for calculation	
	p1965 Speed_ctrl_opt speed	
	p1967 Speed_ctrl_opt dynamic response factor	

Encoder adjustment configuration data

The following table gives an overview of the necessary parameter values for the encoder adjustment for servo drives.

Drive type	Parameter
Servo	p0325 Motor pole position identification current 1. Phase
	p0329 Motor pole position identification current
	p1980 Pole position identification procedure
	p1981 Pole position identification maximum movement
	p1993 Pole position identification current, motion based
	p1994 Pole position identification rise time motion based
	p1995 Pole position identification gain, motion based
	p1996 Pole position identification integral time, motion based
	p1997 Pole position identification smoothing time, motion based
	p3090 PolID elasticity-based configuration
	p3091 PolID elasticity-based ramp time
	p3092 PolID elasticity-based wait time
	p3093 PolID elasticity-based measurement count
	p3094 PolID elasticity-based deflection expected
	p3095 PolID elasticity-based deflection permitted
	p3095 PolID elasticity-based current

5.10 Configuring brake control

Overview

The SINAMICS S120 drives are equipped with a brake control for motor holding brakes. The brake control is only used for the control of motor holding brakes.

Generally, a motor is switched off at standstill in order to save energy and so that the motor temperature is not unnecessarily increased. Drives that have been switched off, can be secured against unwanted motion by the holding brake.

The motor holding brake control in the inverter is suitable typically for horizontal, inclined and vertical conveyors. A motor holding brake can also be useful in several applications for pumps or fans to ensure that the switched-off motor does not rotate in the wrong direction due to a liquid or air flow.

⚠ WARNING

Danger as a result of a damaged holding brake caused by incorrect parameter assignment

If the drive moves against the closed holding brake, this can destroy the holding brake and as a consequence result in death or severe injury.

- Do not set the parameter assignment p1215 = 0 when there is a holding brake.
- Set all the relevant parameters correctly.

Brake types

A differentiation is generally made between mechanically braking and electrically braking a motor.

Mechanical braking

- Motor holding brakes
  Mechanical brakes which are closed while the motor is at a standstill.
- Service brakes
  Mechanical brakes that are closed while the motor is rotating are subject to a high wear and are therefore often only used as an emergency brake.

Electrical braking

- The motor is electrically braked by the converter. An electrical braking is completely wear-free.

5.10.1 Simple brake control

Overview

The "Simple brake control" is used exclusively for the control of holding brakes. Drives that have been switched off, can be secured against unwanted motion by the holding brake.

Activation and response

The control command for opening and closing the holding brake is transferred directly via DRIVE-CLiQ to the Motor Module by the Control Unit that logically links and monitors the signals with the system-internal processes. The Motor Module then performs the action and activates the output for the holding brake. The exact sequence control is shown in function diagram 2701 and 2704. The operating principle of the holding brake can be configured via parameter p1215.

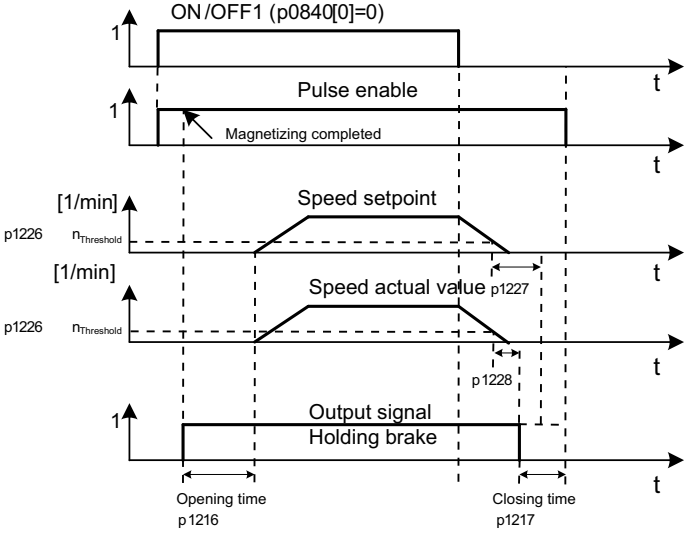


Figure 5-17 Flow diagram: Simple brake control

The start of the closing time for the brake depends on the expiration of the shorter of the two times p1227 (standstill detection monitoring time) and p1228 (pulse cancellation delay time).

Features

The "Simple brake control" function is characterized by the following features:

- Automatic activation by means of sequence control
- Standstill monitoring
- Forced brake opening (p0855, p1215)
- Closing of brake for a 1 signal "unconditionally close holding brake" (p0858)
- Closing of brake after the "Enable speed controller" signal has been canceled (p0856)

Commissioning the brake control

Simple brake control is activated automatically (p1215 = 1) when the Motor Module has an internal brake control and a connected brake has been found. If no internal brake control is available, the control can be activated via parameter (p1215 = 3).

⚠ WARNING

Danger as a result of a damaged holding brake caused by incorrect parameter assignment

If the drive moves against the closed holding brake, this can destroy the holding brake and as a consequence result in death or severe injury.

- If a holding brake is being used, do **not** set the parameter assignment p1215 = 0.
- Set all the relevant parameters correctly.

Note

It is only permissible to activate brake control monitoring for booksize power units and blocksize power units with Safe Brake Relay (p1278 = 0).

5.10.1.1 Parameterizing the simple brake control

Overview

The following options are available to you for setting the type of brake control:

- Motor holding brake like sequence control
- Motor holding brake always open
- Motor holding brake like sequence control, connection via BICO

⚠ WARNING

Danger as a result of a damaged holding brake caused by incorrect parameter assignment

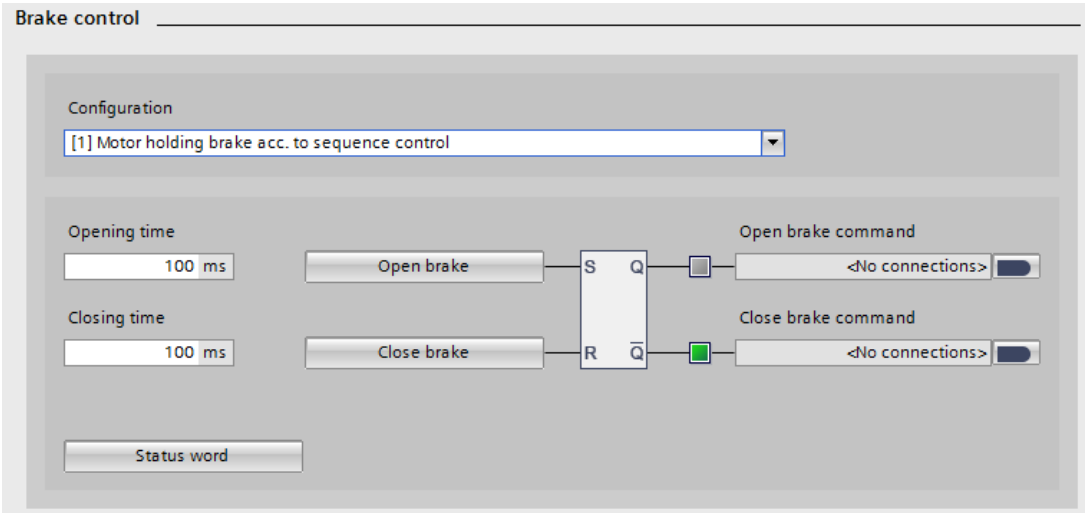
If the drive moves against the closed holding brake, this can destroy the holding brake and cause death or serious injury.

- If a holding brake is being used, do **not** set the parameter assignment p1215 = 0.
- Set all the relevant parameters correctly.

Selecting the type of brake control

To select the type of brake control, proceed as follows:

1. Select the "Drive functions > Brake control" menu in the project navigator.
   The corresponding screen form is opened.



2. Select one of the following entries from the drop-down list:
   - **Motor holding brake like sequence control** (p1215 = 1)
     If the configuration is set to "No motor holding brake available" during ramp-up, then an automatic identification of the motor holding brake is performed. If a motor holding brake is detected, the configuration is set to "Motor holding brake like sequence control".
   - **Motor holding brake always open** (p1215 = 2)
     There are no further setting options for this option. The state of the holding brake is displayed in the dialog.
   - **Motor holding brake like sequence control, connection via BICO** (p1215 = 3)
     If a motor holding brake is used via the drive-integrated brake connection of the Motor Module, this option must not be set. If an external motor holding brake is used, p1215 = 3 should be set and r0899.12 connected as control signal. With activated "Extended brake control" (r0108.14 = 1) function module, r1229.1 should be connected as control signal.

Parameterizing "Motor holding brake acc. to sequence control"

To parameterize the "Motor holding brake acc. to sequence control" option, proceed as follows:

1. Set the opening time of the brake (p1216).
   After activating the holding brake (opening), the speed/velocity setpoint zero is active during this time. The speed/velocity setpoint is then enabled after this time.
   The time should be set greater than the actual opening time of the brake. The drive does not then accelerate when the brake is closed.
2. Set the closing time of the brake (p1217).
   The drive still remains in closed-loop control at standstill with speed/velocity setpoint zero after OFF1 or OFF3 and activation of the holding brake (closing). The pulses are suppressed when this time expires.
   The time should be set greater than the actual closing time of the brake. In this way, the pulses are only suppressed when the brake is closed.
3. To open the "Opening the brake (Page 267)" dialog, click "Open brake".
   Make the required settings in the dialog.
4. Interconnect the "Open brake command" (p0899.12) signal source to the required parameters. Several connections are possible.
5. To open the "Closing the brake (Page 268)" dialog, click "Close brake".
   Make the required settings in the dialog.
6. Interconnect the "Close brake command" (p0899.13) signal source to the required parameters. Several connections are possible.

The "Open brake" and "Close brake" settings are processed logically via the flip-flop. The "Open brake" and "Close brake" signals are then present at the outputs of the flip-flop.

Parameterizing "Motor holding brake always open"

There are no further setting options for this option. The state of the holding brake is displayed in the dialog.

Parameterizing "Motor holding brake like sequence control connection via BICO"

To parameterize the "Motor holding brake like sequence control connection via BICO" option, proceed as follows:

1. Set the opening time of the brake (p1216).
   After activating the holding brake (opening), the speed/velocity setpoint zero is active during this time. The speed/velocity setpoint is then enabled after this time.
   The time should be set greater than the actual opening time of the brake. The drive does not then accelerate when the brake is closed.
2. Set the closing time of the brake (p1217).
   The drive still remains in closed-loop control at standstill with speed/velocity setpoint zero after OFF1 or OFF3 and activation of the holding brake (closing). The pulses are suppressed when this time expires.
   The time should be set greater than the actual closing time of the brake. In this way, the pulses are only suppressed when the brake is closed.
3. To open the "Opening the brake (Page 267)" dialog, click "Open brake".
   Make the required settings in the dialog.

4. Interconnect the "Open brake command" (p0899.12) signal source to the required parameters. Several connections are possible.
5. To open the "Closing the brake (Page 268)" dialog, click "Close brake".
   Make the required settings in the dialog.
6. Interconnect the "Close brake command" (p0899.13) signal source to the required parameters. Several connections are possible.

The "Open brake" and "Close brake" settings are processed logically via the flip-flop. The "Open brake" and "Close brake" signals are then present at the outputs of the flip-flop.

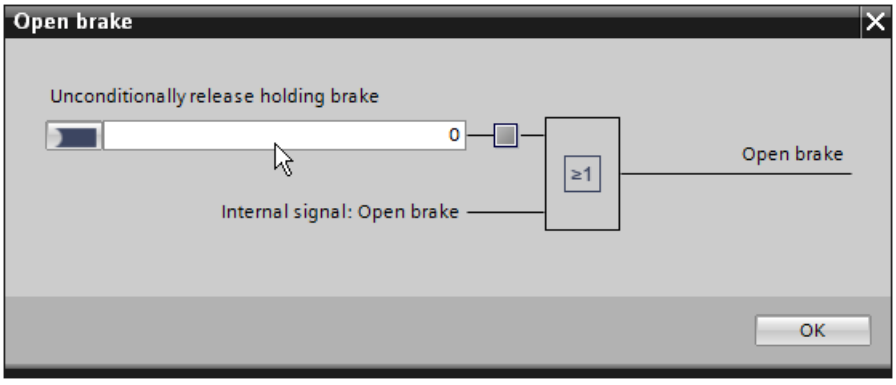
5.10.1.2 Opening the brake

Overview

The following describes how you can set the command for the forced opening of the holding brake.

Parameterizing the "Open brake" command

To parameterize the command for the forced opening of the holding brake, interconnect the signal sink "Unconditionally open holding brake" (p0855) for the command that is to unconditionally open the brake.



The brake opens when this signal or the internal signal "Open brake" has the value "1".

Note

Prioritization of the commands

The "Unconditionally close brake" signal has a higher priority than the "Unconditionally open holding brake" signal.

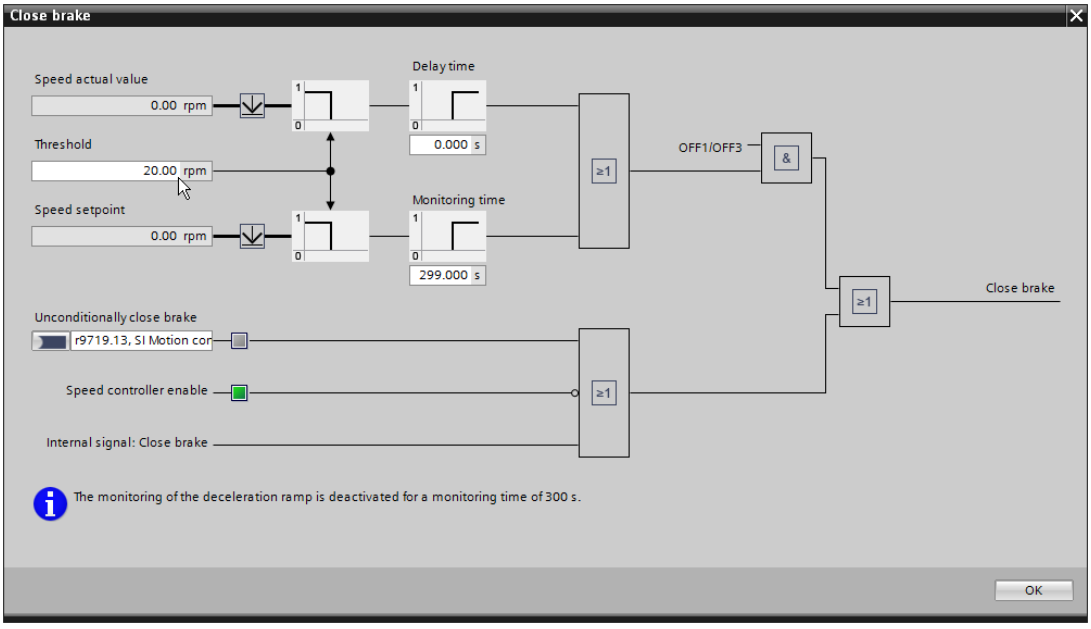
5.10.1.3 Closing the brake

Overview

The following describes how you can set conditions and commands for the forced closing of the holding brake.

Parameterizing the "Close brake" command

To set the parameters that influence the closing of the brake, proceed as follows:



1. Enter the speed threshold at which "Standstill" is identified when the threshold is undershot in the "Threshold" (p1226) field.
   When this threshold is undershot, the brake control is started and the closing time in p1217 awaited. The pulses are then suppressed.
2. Enter the delay time for pulse suppression in the "Delay time" (p1228) field.
   The pulses are suppressed after OFF1 or OFF3 when at least one of the following conditions has been satisfied:
   - The actual speed value falls below the threshold in p1226 and the time started in p1228 has expired.
   - The speed setpoint falls below the threshold in p1226 and the time started in p1227 has expired.
3. Enter the monitoring time for standstill detection in the "Monitoring time" (p1227) field.
   When braking with OFF1 or OFF3, standstill is detected after this time has expired, after the set speed has fallen below p1226. The brake control is then started, the closing time in p1217 awaited and the pulses suppressed.
4. Interconnect the "Unconditionally close brake" (p0858) signal sink for the command to unconditionally close the brake.

Note

Prioritization of the commands

The "Unconditionally close brake" signal has a higher priority than the "Unconditionally open holding brake" signal.

5.10.2 Extended brake control

Overview

The "Extended brake control" allows complex brake controls, such as for motor holding brakes and service brakes. The brake is controlled in the following manner. The order represents the priority:

- Via parameter p1215
- Via binectors p1219[0...3] and p0855
- Via standstill detection
- Via the connector connection threshold

Requirements

- The "Extended brake control" function module is activated (see Chapter "Function modules (Page 211)").

Features

The "Extended brake control" function is characterized by the following features:

- Forced brake opening (p0855, p1215)
- Closing of brake for a 1 signal "unconditionally close holding brake" (p0858)
- Binector inputs for opening or closing the brake (p1218, p1219)
- Connector input for the threshold for opening and closing the brake (p1220)
- OR/AND block each with two inputs (p1279, r1229.10, r1229.11)
- Holding and service brakes can be activated
- Monitoring of the brake feedback signals (r1229.4, r1229.5)
- Configurable responses (A07931, A07932)
- Closing of brake after the "Enable speed controller" signal has been canceled (p0856)

5.10.2.1 Parameterizing extended brake control

Overview

For braking with feedback (p1275.5 = 1), the brake control reacts to the feedback signal contacts of the brake. If the period p1216 is longer than the time until the feedback signal comes, the startup is delayed by the associated time difference.

In order to startup without delay when possible, the set period p1216 must be shorter than the time until the feedback signal comes. If the period is set shorter, the alarm "A07931, brake does not open" appears, however.

Selecting the type of brake control

⚠ WARNING

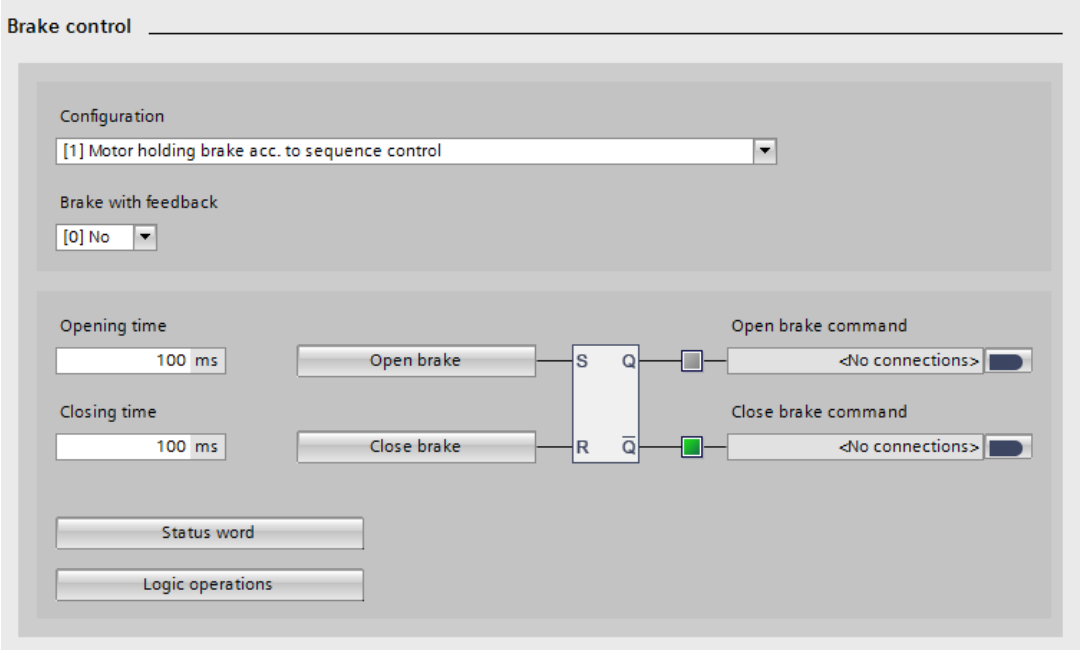
Danger as a result of a damaged holding brake caused by incorrect parameter assignment

If the drive moves against the closed holding brake, this can destroy the holding brake and cause death or serious injury.

- If a holding brake is being used, do **not** set the parameter assignment p1215 = 0.
- Set all the relevant parameters correctly.

To select the type of brake control, select one of the following entries from the drop-down list:

- Motor holding brake like sequence control (p1215 = 1)
- Motor holding brake like sequence control, connection via BICO (p1215 = 3)



Parameterizing the selected brake control

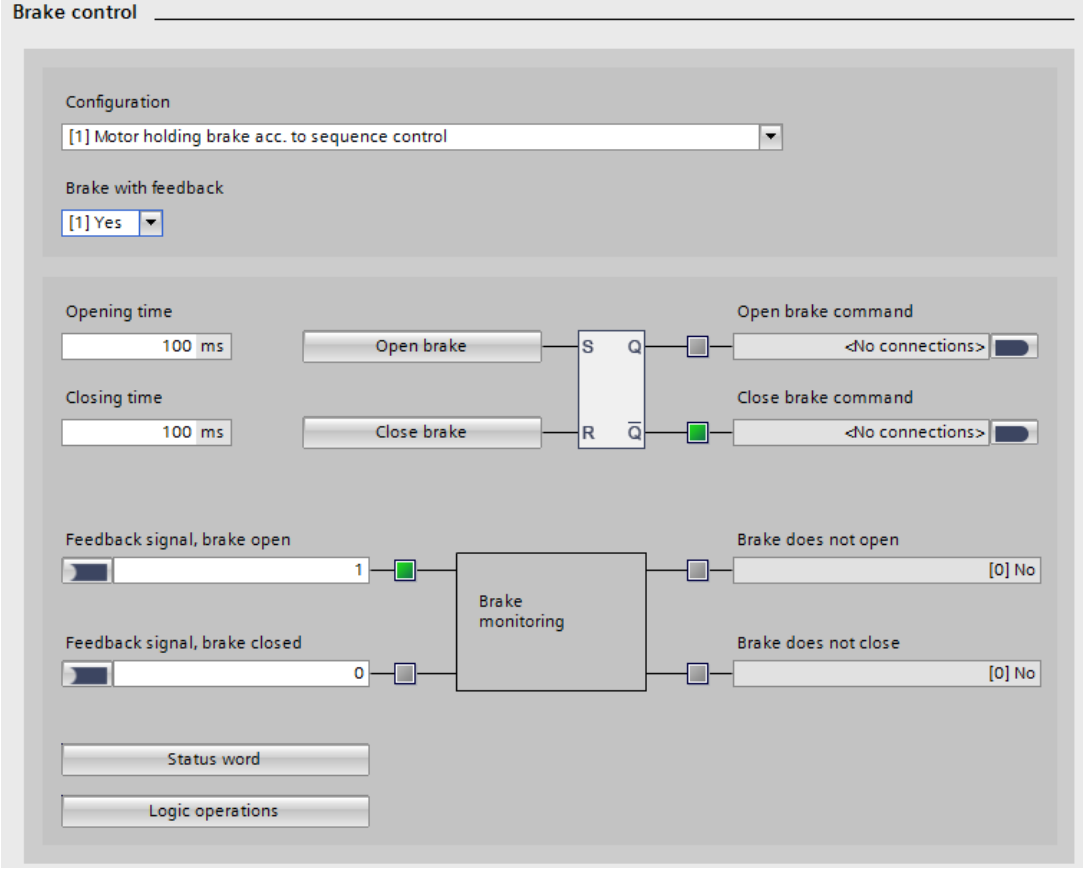
To parameterize the selected brake control, proceed as follows:

1. Set the opening time of the brake (p1216).
   After activating the holding brake (opening), the speed/velocity setpoint zero is active during this time. The speed/velocity setpoint is then enabled after this time.
   The time should be set greater than the actual opening time of the brake. The drive does not then accelerate when the brake is closed.
2. Set the closing time of the brake (p1217).
   The drive still remains in closed-loop control at standstill with speed/velocity setpoint zero after OFF1 or OFF3 and activation of the holding brake (closing). The pulses are suppressed when this time expires.
   The time should be set greater than the actual closing time of the brake. In this way, the pulses are only suppressed when the brake is closed.
3. To open the "Opening the brake (Page 273)" dialog, click "Open brake".
   Make the required settings in the dialog.
4. Interconnect the "Open brake command" (p0899.12) signal source to the required parameters. Several connections are possible.
5. To open the "Closing the brake (Page 274)" dialog, click "Close brake".
   Make the required settings in the dialog.
6. Interconnect the "Close brake command" (p0899.13) signal source to the required parameters. Several connections are possible.

Making settings for the brake feedback

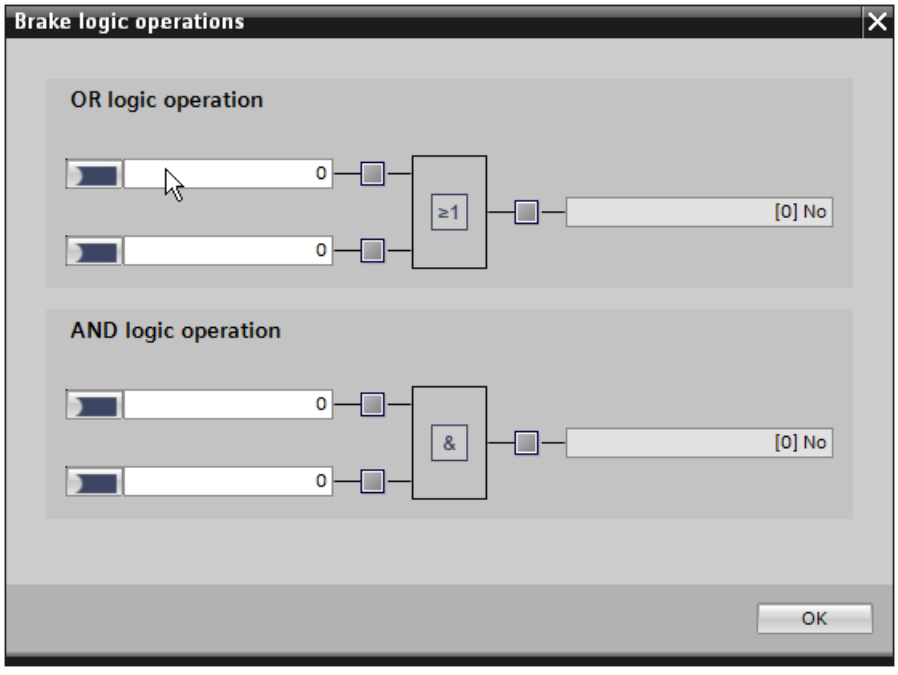
To make the settings for the brake feedback, proceed as follows:

1. Select the "[1] Yes" setting in the "Brake with feedback" (p1275.5) drop-down list.
   The mask then expands downwards with the additional settings.



2. Interconnect the "Brake open feedback" (p1223) signal sink for the "Brake open" feedback.
3. Interconnect the "Brake closed feedback" (p1222) signal sink for the "Brake closed" feedback.

4. Click "Status word". A mask with the same name opens.
   Connect the signal sources for the following areas:
   - Sequence control status word (r0899)
   - Motor holding brake status word (r1229)
5. Click "Logic operations" in the "Brake control" mask.
   The corresponding dialog is opened.



   - Interconnect the signal sink for "OR operation" or for "AND operations".
   - Click "OK" to confirm the settings and so close the dialog.

5.10.2.2 Opening the brake

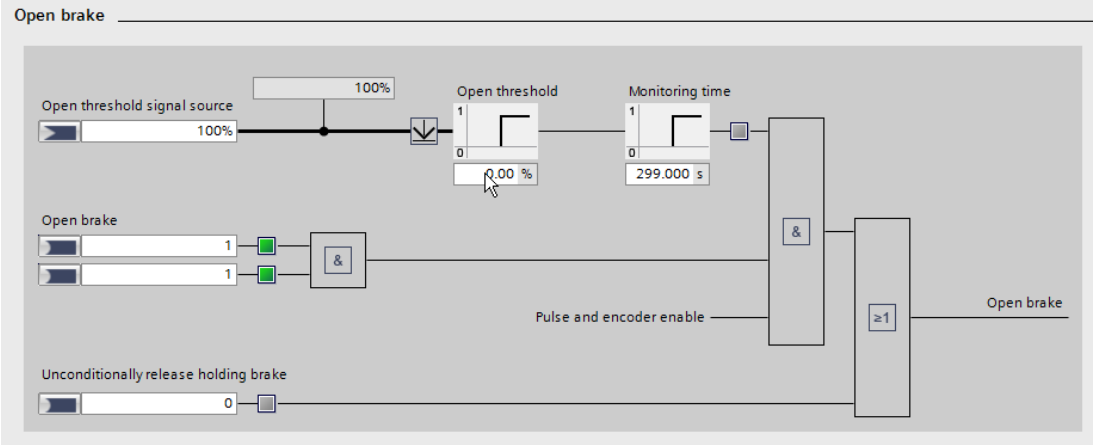
Overview

The following describes how you can set the command for the forced opening of the holding brake.

Parameterizing the "Open brake" command

To parameterize the command for the forced opening of the holding brake, proceed as follows:

1. Interconnect the "Open threshold signal source" (p1220) signal sink for the "Open brake" command.



2. Enter the threshold for the "Open brake" command in the "Open threshold" (p1221) field.
3. Enter the monitoring time for standstill detection in the "Monitoring time" (p1227) field. When braking with OFF1 or OFF3, standstill is detected after this time has expired, after the set speed has fallen below p1226.
4. Interconnect the "Open brake" (p1218[0]) signal sink for conditional opening operation of the motor holding brake and also an AND operation with input 1.
   OR / AND
5. Interconnect the "Open brake" (p1218[1]) signal sink for conditional opening operation of the motor holding brake and an AND operation with input 2.
6. Interconnect the "Unconditionally open holding brake" (p0855) signal sink for the command to open the brake unconditionally.
   The brake opens when this signal or the internal signal "Open brake" has the value "1".

Note

Prioritization of the commands

The "Unconditionally close holding brake" signal has a higher priority than the "Unconditionally open holding brake" signal.

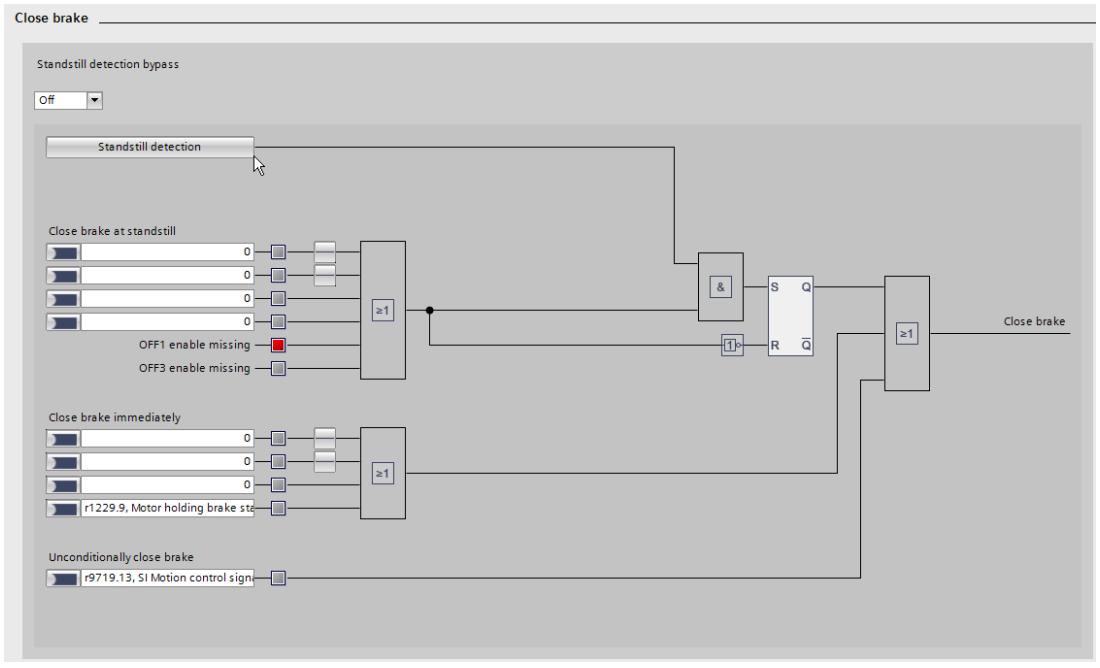
5.10.2.3 Closing the brake

Overview

The following describes how you can set conditions and commands for the forced closing of the holding brake.

Parameterizing the "Close brake" command

To set the parameters that influence the closing of the brake, proceed as follows:



1. Interconnect the signal sinks for the following options of the "Close brake at standstill" function:
   - p1224[0]: Close brake at standstill signal, inversion via p1275.2
   - p1224[1]: Close brake at standstill signal, inversion via p1275.3
   - p1224[2]: Close brake at standstill signal
   - p1224[3]: Close brake at standstill signal

   These four signals form an OR operation.
2. Interconnect the signal sinks for the following options of the "Close brake immediately" function:
   - p1219[0]: Close brake immediately signal, inversion via p1275.0
   - p1219[1]: Close brake immediately signal, inversion via p1275.1
   - p1219[2]: Close brake immediately signal
   - p1219[3]: Close brake immediately signal according to r1229.9
   - These four signals form an OR operation.
3. Interconnect the "Unconditionally close brake" (p0858[0]) signal sinks for the "Unconditionally close brake" command.

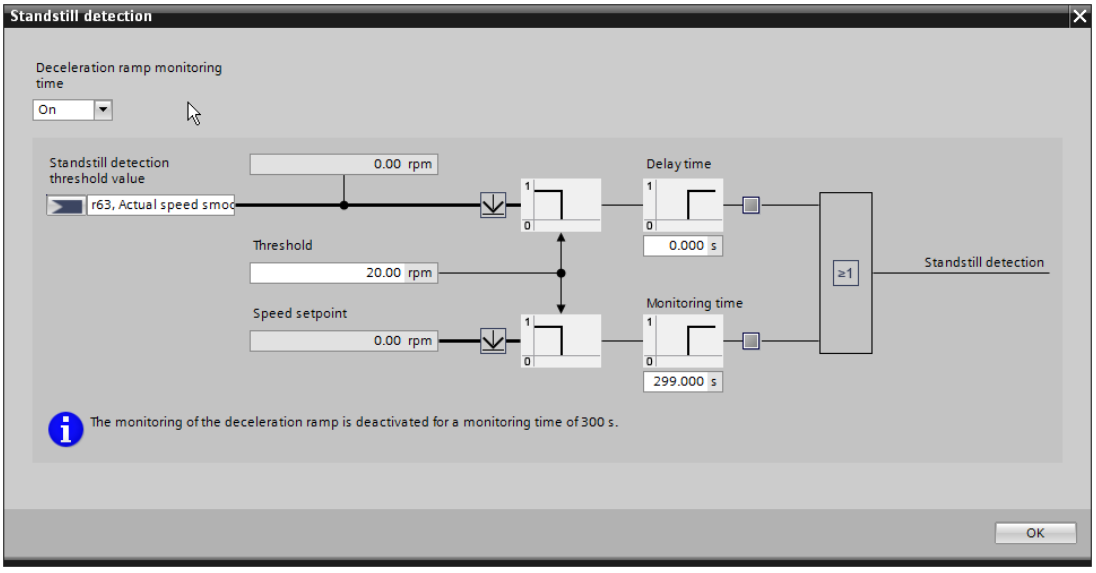
Note

Prioritization of the commands

The "Unconditionally close holding brake" signal has a higher priority than the "Unconditionally open holding brake" signal.

Configuring standstill detection

The standstill detection is configured in a separate dialog. You can decide for the standstill detection whether a deceleration ramp for the monitoring time is to be used in addition. In the latter case, the brake, however, can close for a turning motor.



1. Click "Standstill detection" on the "Close brake" screen form.
   A setting dialog with the same name opens. The "Deceleration ramp monitoring time" option is initialized with the "ON" option.
2. Optional: Select the "OFF" option in the "Deceleration ramp monitoring time" drop-down list.
   In this case, the input field for the monitoring time is hidden.
3. Interconnect the "Standstill detection threshold" (p1225) signal sink for the standstill detection.
4. Enter the speed threshold for standstill detection in the "Threshold" (p1226[0]) field.
5. Enter the delay time for pulse suppression in the "Delay time" (p1228) field.
6. Enter the monitoring time for standstill detection in the "Monitoring time" (p1227) field.
   This step is omitted if the deceleration ramp has been switched off in step 2.
7. Click "OK" to confirm the entries.
   The dialog closes.

Configuring disable standstill detection

If you want to disable the standstill detection, proceed as follows:

1. Select the "ON" entry in the "Disable standstill detection" drop-down list.
2. Enter the deceleration time for closing the brake at standstill in the "Disable standstill detection" (p1276) input field below the graphic.

5.10.3 Function diagrams and parameters

Overview

Below, you will find a list of the relevant function diagrams and an overview of important parameters for configuring the brake control.

Function diagrams (see SINAMICS S120/S150 List Manual)

- 2701 Brake control - Simple brake control (r0108.14 = 0)
- 2704 Brake control - Extended brake control, stationary state detection (r0108.14 = 1)
- 2707 Brake control - Extended brake control, open/close brake (r0108.14 = 1)
- 2711 Brake control - Extended brake control, signal outputs (r0108.14 = 1)

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

- r0108.14 Drive objects, function module; Extended brake control
- r0899.0...15 CO/BO: Status word, sequence control

Standstill monitoring

- r0060 CO: Speed setpoint before the setpoint filter
- r0063 CO: Actual speed value smoothed (for servo)
- r0063[0...2] CO: Actual speed value (for vector)
- p1224[0...3] BI: Close motor holding brake at standstill
- p1225 CI: Standstill detection threshold value
- p1226[0...n] Standstill monitoring speed threshold
- p1227 Standstill detection monitoring time
- p1228 Pulse suppression delay time
- p1276 Motor holding brake standstill detection bypass

Open and close the brake

- p0855[0...n] BI: Unconditionally open holding brake
- p0856[0...n] BI: Speed controller enabled
- p0858[0...n] BI: Unconditionally close holding brake
- p1216 Motor holding brake opening time
- p1217 Motor holding brake closing time
- p1218[0...1] BI: Open motor holding brake
- p1219[0...3] BI: Immediately close motor holding brake
- p1220 CI: Open motor holding brake, signal source, threshold

- p1221 Open motor holding brake, threshold
- p1277 Motor holding brake, delay, braking threshold exceeded
- p1279[0...3] BI: Motor holding brake, OR/AND logic operation

Free blocks

- p1279[0...3] BI: Motor holding brake, OR/AND logic operation

Brake monitoring functions

- p1222 BI: Motor holding brake, feedback signal, brake closed
- p1223 BI: Motor holding brake, feedback signal, brake open

Configuration, control/status words

- p1215 Motor holding brake configuration
- r1229.1...11 CO/BO: Motor holding brake status word
- p1275 Motor holding brake control word
- p1276 Motor holding brake standstill detection bypass
- p1278 Brake control diagnostics evaluation

Diagnostics

6

This chapter describes the following diagnostic features of the SINAMICS S120 drive system:

- Diagnostics via LEDs
  - Control Units
  - Power units
  - Additional modules
  - Terminal Modules
- Diagnostics via Startdrive
  - Device diagnostics
  - Trace function
  - Online diagnostics
  - Diagnostics information about the infeed unit
  - Diagnostics information for drive axis/axes
- Fault and alarm messages

6.1 Diagnostics using LEDs

Table 6-1 Appearance of the LEDs for the display of the operating states

	LED is on. (Steady light) Possible colors: Red, green, orange or yellow.
	LED is off. Is partly indicated by hyphens in the following tables in the "Color" column.
	LED flashes slowly. (Flashing light 0.5 Hz)
	LED flashes quickly. (Flashing light 2 Hz)
	LED flashes with variable frequency. (Flashing light)
	LED flashes slowly alternately in two different colors (for example red/green). (Flashing light 0.5 Hz)
	LED flashes quickly alternately in two different colors (for example red/green). (Flashing light 2 Hz)

6.1.1 Control Units

6.1.1.1 LED states of a CU310-2 PN

There are four LEDs on the front of the CU310-2 housing.

Table 6-2 LEDs

RDY	Ready
COM	Option Board
OUT > 5V	Encoder current supply > 5 V (TTL/HTL)
MOD	Operating mode (reserved)

The various LEDs are switched either on or off as the Control Unit powers up (depending on the phase that the system is currently in). When switched on, the color of the LEDs shows the status of the corresponding power-up phase.

In the event of a fault, power up will be ended in the corresponding phase. The LEDs that are switched on retain their colors so that the fault can be determined on the basis of the combination of the color LEDs that are lit and unlit.

All the LEDs go out briefly if the CU310-2 has ramped up without error. The system is ready for operation when the LED "RDY" is permanently green.

All the LEDs are controlled by the loaded software during operation.

Control Unit 310-2 during ramp-up

Table 6-3 CU310-2 Control Unit – description of the LEDs during ramp-up

LED	Color	Display	State, description, cause
RDY COM OUT > V MOD	Orange Orange Orange Orange	Continuous light	POWER ON All LEDs light up for approx. 1 s.
RDY COM	Red Red	Continuous light	Hardware reset After pressing the RESET button, the LEDs light up for approx. 1 s.
RDY COM	Red Red	Continuous light	BIOS loaded
RDY COM	Red Red	Flashing light 2 Hz Continuous light	BIOS error: "An error occurred while loading the BIOS".
RDY COM	Red Orange	Continuous light Flashing light	Loading firmware: RDY LED lights up red, COM LED flashes orange without fixed frequency.
RDY	Red	Continuous light	Firmware has been loaded.
RDY COM	Red Red	Flashing light 2 Hz	File error: • Memory card not available or faulty. • Software on memory card not available or faulty.
COM	Red	Continuous light	Firmware has been checked. No CRC error detected.
RDY COM	Red Red	Flashing light 0.5 Hz	Firmware has been checked. CRC error detected.
RDY	Orange	Continuous light	Initializing firmware

CU310-2 Control Unit in operation

Table 6-4 Description of the LEDs during operation of the CU310-2

LED	Color	State	Description, cause, remedy
RDY	-	Off	Electronic power supply is missing or outside permissible tolerance range. **Remedy**: Check the power supply.
	Green	Continuous light	The unit is ready for operation. Cyclic DRIVE-CLiQ communication is in progress.
		Flashing light 0.5 Hz	Commissioning/reset
		Flashing light 2 Hz	Writing to the memory card.
		Flashing light with switch-on/off ratio 0.5 s = On 3 s = Off	Shows the PROFIenergy energy-saving mode.
	Red	Flashing light 2 Hz	General errors **Remedy**: Check the parameterization/configuration.
	Red/green	Flashing light 0.5 Hz	The control unit is ready for operation, but there are no software licenses. **Remedy**: Install the missing licenses.
	Orange	Flashing light 0.5 Hz	Updating the firmware of the DRIVE-CLiQ components.
		Flashing light 2 Hz	DRIVE-CLiQ component firmware update completed. Waiting for POWER ON of the corresponding components. **Remedy**: Switch on the component.
	Green/ orange or red/ orange	Flashing light 2 Hz	Component detection via LED is activated (p0124[0]). **Remark:** Both options depend on the LED status when activating via p0124[0] = 1.
	Green/ orange or red/ orange	Flashing light 1 Hz	CU detection via DCP flashing. **Remark**: Both options depend on the LED status when component recognition is activated via DCP.
	Green	Flashing light: Switch-on/off ratio: 500 ms on 3000 ms off	PROFIenergy energy-saving mode is active.

LED	Color	State	Description, cause, remedy
COM	-	Off	Cyclic communication has not (yet) taken place. **Remark:** PROFIdrive is ready for communication when the Control Unit is ready for operation (see LED: RDY).
	Green	Continuous light	Cyclic communication is taking place.
		Flashing light 0.5 Hz	Full cyclic communication is not yet taking place. **Possible causes:** • The controller is not transferring any setpoints. • During isochronous operation, the controller is transmitting no GC (Global Control) or a faulty GC.
	Red	Flashing light 0.5 Hz	Bus fault, faulty parameterization/configuration **Remedy**: Modify the configuration between the master/controller and the Control unit.
		Flashing light 2 Hz	Cyclic bus communication has been interrupted or could not be established. **Remedy**: Rectify the fault in bus communication.
MOD	-	Off	-
OUT > 5 V	-	Off	-
	Orange	Continuous light	The voltage of the electronics power supply for the measuring system is 24 V.

6.1.1.2 LED statuses of a CU320-2 PN

Overview

The various states of the CU320-2 PN Control Unit when powering up and in operation are displayed using LEDs on the Control Unit. The duration of the individual statuses varies.

Table 6-5 LEDs

LED	Function
RDY	Ready
COM	PROFIdrive cyclic operation via PROFINET (PN)
OPT	OPTION

- If an error occurs, the power-up procedure is terminated and the cause is indicated accordingly via the LEDs.
- Once the unit has successfully powered up, all the LEDs are switched off briefly.
- Once the unit has powered up, the LEDs are controlled via the loaded software.

Control Unit 320-2 PN during run-up

Table 6-6 Control Unit CU320-2 – description of the LEDs during ramp-up

LED	Color	Display	State, description, cause
RDY COM OPT	Red Orange Orange	Continuous light	Hardware reset
RDY COM	Red Red	Continuous light	BIOS loaded
RDY COM	Red Red	Flashing light 2 Hz Continuous light	BIOS error: "An error occurred while loading the BIOS".
RDY COM	Red Orange	Continuous light Flashing light	Loading firmware: RDY LED lights up red, COM LED flashes orange without fixed frequency.
RDY	Red	Continuous light	Firmware has been loaded.
RDY COM	Red Red	Flashing light 2 Hz	File error: • Memory card not available or faulty. • Software on memory card not available or faulty.
COM	Red	Continuous light	Firmware has been checked. No CRC error detected.
RDY COM	Red Red	Flashing light 0.5 Hz	Firmware has been checked. CRC error detected.
RDY	Orange	Continuous light	Initializing firmware

Control Unit 320-2 PN during operation

Table 6-7 CU320-2 PN Control Unit – description of the LEDs after powering up

LED	Color	Display	Description, cause, remedy
RDY	–	OFF	Electronics power supply is missing or outside permissible tolerance range. **Remedy**: Check the power supply.
	Green	Continuous light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
		Flashing light 0.5 Hz	Commissioning/reset
		Flashing light 2 Hz	Writing to the memory card
		Flashing light with the on/off ratio 0.5 s = On 3 s = Off	Indicates PROFIenergy energy-saving mode.
	Red	Flashing light 2 Hz	General errors **Remedy**: Check parameterization / configuration data
	Red/ green	Flashing light 0.5 Hz	Control Unit is ready. However, software licenses are missing. **Remedy**: Obtain licenses.
	Orange	Flashing light 0.5 Hz	Updating the firmware of the DRIVE-CLiQ components
		Flashing light 2 Hz	DRIVE-CLiQ component firmware update complete. Wait for POWER ON for the components in question. **Remedy**: Carry out a POWER ON for the components in question
	Green/ orange or red/ orange	Flashing light 1 Hz	Control Unit detection via DCP flashing[1)]. **Remark**: Both options depend on the LED status when component recognition is activated via DCP.
	Green/ orange or red/ orange	Flashing light 2 Hz	LED-supported detection of Control Unit is activated (p0124[0] = 1). **Remark**: Both options depend on the LED status when component recognition is activated via p0124[0] → 1.

LED	Color	Display	Description, cause, remedy
COM PROFIdrive cyclic operation	–	Off	Cyclic communication has not (yet) taken place. **Remark:** PROFIdrive is ready for communication when the Control Unit is ready (see LED RDY).
	Green	Continuous light	Cyclic communication is taking place.
		Flashing light 0.5 Hz	Full cyclic communication has not yet taken place. **Possible causes:** • The controller is not transferring any setpoints. • During isochronous operation, no global control (GC) or a faulty global control (GC) is transferred by the controller. • Only possible for CU320-2 PN: "Shared Device" is selected (p8929=2) and only one controller connected.
	Red	Flashing light 0.5 Hz	Bus fault, incorrect parameterization/configuration **Remedy**: Adapt configuration between master/controller and CU.
		Flashing light 2 Hz	Cyclic bus communication has been interrupted or could not be established. **Remedy**: Correct fault.
OPT	–	Off	Electronics power supply is missing or outside permissible tolerance range. Component is not ready. Option board not installed or no associated drive object has been created. **Remedy**: Check power supply and/or component
	Green	Continuous light	Option board is ready.
		Flashing light 0.5 Hz	Depends on the Option Board used.[2)]
	Red	Continuous light	Depends on the Option Board used.[2)]
		Flashing light 0.5 Hz	Depends on the Option Board used.[2)]
		Flashing light 2 Hz	This component has at least one fault. The Option Board is not ready (e.g. after switching on). **Remedy**: Correct fault and acknowledge.
RDY and COM	Red	Flashing light 2 Hz	Bus error – communication has been interrupted. **Remedy**: Correct fault.
RDY and OPT	Orange	Flashing light 0.5 Hz	Firmware update in progress for connected Option Board CBE20.

[1)] DCP = Discovery and Configuration Protocol

DCP is used by PROFINET to determine PROFINET devices and to make basic settings. More detailed information can be found in the SINAMICS S120 Function Manual Communication.

[2)] Individual behaviors of the LED OPT are described for the respective Option Boards in the SINAMICS S120 Manual Control Units and supplemental system components.

6.1.2 Power units

6.1.2.1 Safety instructions for diagnostic LEDs of the power units

⚠ 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

Electric shock when live parts of the DC link are touched

Irrespective of the status of the "DC LINK" LED, hazardous DC link voltages can be present. This means that the touching of live parts can result in death or serious injury.

- Observe the warning information on the component.

6.1.2.2 Active Line Module booksize

Table 6-8 Meaning of the LEDs on the Active Line Module

State		Description, cause	Remedy
Ready	**DC link**		
Off	Off	Electronic power supply is missing or outside permissible tolerance range.	–
Green	Off	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.	–
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is present.	–
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is too high.	Check the line voltage
Orange	Orange	DRIVE-CLiQ communication is being established.	–
Red	–	At least one fault is present in this component. **Note:** LED is controlled irrespective of the corresponding messages being reconfigured.	Remedy and acknowledge fault
Green / red flashing light 0.5 Hz	–	Firmware is being downloaded.	–

State		Description, cause	Remedy
Ready	DC link		
Green / red flashing light 2 Hz	–	Firmware download is complete. Wait for POWER ON.	Carry out a POWER ON
Green / orange or Red / orange	–	Component detection via LED is activated (p0124). **Note:** Both options depend on the LED status when module recognition is activated via p0124 = 1.	–

6.1.2.3 Basic Line Module booksize

Table 6-9 Meaning of the LEDs on the Basic Line Module

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

6.1.2.4 Smart Line Modules booksize 5 kW and 10 kW

Table 6-10 Meaning of the LEDs at the Smart Line Modules 5 kW and 10 kW

LED	Color	State	Description, cause	Remedy
READY	–	Off	Electronic power supply is missing or outside permissible tolerance range.	–
	Green	Continuous light	Component is ready to operate.	–
	Yellow	Continuous light	Pre-charging not completed. Bypass relay dropped out EP terminals not supplied with 24 VDC.	–
	Red	Continuous light	Overtemperature Overcurrent	Diagnose fault (via output terminals) and acknowledge it (via input terminal)
DC LINK	–	Off	Electronic power supply is missing or outside permissible tolerance range.	–
	Yellow	Continuous light	DC link voltage within permissible tolerance range.	–
	Red	Continuous light	DC link voltage outside permissible tolerance range. Line supply fault.	Check the line voltage.

6.1.2.5 Smart Line Modules booksize 16 kW to 55 kW

Table 6-11 Meaning of the LEDs at the Smart Line Modules ≥ 16 kW

State		Description, cause	Remedy
Ready	DC link		
Off	Off	Electronic power supply is missing or outside permissible tolerance range.	–
Green	Off	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.	–
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is present.	–
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is too high.	Check the line voltage
Orange	Orange	DRIVE-CLiQ communication is being established.	–
Red	–	At least one fault is present in this component. **Note:** LED is controlled irrespective of the corresponding messages being reconfigured.	Remedy and acknowledge fault
Green / red flashing light 0.5 Hz	–	Firmware is being downloaded.	–

State		Description, cause	Remedy
Ready	**DC link**		
Green / red flashing light 2 Hz	–	Firmware download is complete. Wait for POWER ON.	Carry out a POWER ON
Green / orange or Red / orange flashing light	–	Component detection via LED is activated (p0124). **Note:** Both options depend on the LED status when module recognition is activated via p0124 = 1.	–

6.1.2.6 Single Motor Module / Double Motor Module / Power Module

Table 6-12 Meaning of the LEDs on the Motor Module

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

6.1.2.7 Smart Line Module booksize compact format

Table 6-13 Meaning of the LEDs on the Smart Line Module booksize compact

State		Description, cause	Remedy
RDY	DC LINK		
Off	Off	Electronic power supply is missing or outside permissible tolerance range.	–
Green	–	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.	–
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is present.	–
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is too high.	Check the line voltage
Orange	Orange	DRIVE-CLiQ communication is being established.	–
Red	–	At least one fault is present in this component. **Note:** LED is controlled irrespective of the corresponding messages being reconfigured.	Remedy and acknowledge fault
Green/red (0.5 Hz)	–	Firmware is being downloaded.	–
Green/red (2 Hz)	–	Firmware download is complete. Wait for POWER ON.	Carry out a POWER ON
Green/ orange or red/orange	–	Identifying whether the component is activated using the LED (p0124) **Note:** Both options depend on the LED status when module recognition is activated via p0124 = 1.	–

6.1.2.8 Motor Module booksize compact format

Table 6-14 Meaning of the LEDs on the Motor Module booksize compact

Status		Description, cause	Remedy
RDY	DC LINK		
Off	Off	The electronics power supply is missing or outside the permissible tolerance range.	–
Green	–	The component is ready for operation. Cyclic DRIVE-CLiQ communication is taking place.	–
	Orange	The component is ready for operation. Cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is present.	–
	Red	The component is ready for operation. Cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is outside the permissible tolerance range.	Check the line supply voltage.
Orange	Orange	DRIVE-CLiQ communication is being established.	–

Status		Description, cause	Remedy
RDY	**DC LINK**		
Red	–	This component has at least one fault. **Note:** The LED is activated regardless of whether the corresponding messages have been reconfigured.	Resolve and acknowledge the fault.
Green/red (0.5 Hz)	–	Firmware is being downloaded.	–
Green/red (2 Hz)	–	Firmware download has been completed. The system waits for POWER ON.	Carry out a POWER ON.
Green/ orange or red/orange	–	Component recognition via LED is activated[1]. **Note:** Both options depend on the LED status when component recognition is activated using the parameter.	–

[1] See SINAMICS S120/S150 List Manual for the parameters to activate the recognition of components via LED

6.1.2.9 Control Interface Module in the Active Line Module chassis format

Table 6-15 Meaning of the LEDs "READY" and "DC LINK" on the Control Interface Module in the Active Line Module

LED, state		Description
Ready	**DC link**	
Off	Off	The electronic power supply is missing or lies outside the permissible tolerance range.
Green	Off	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is present.
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is too high.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	---	At least one fault is present in this component. Note: LED is activated irrespective of any reconfiguring of the corresponding messages.
Green / red flashing light 0.5 Hz	---	Firmware is being downloaded.
Green / red flashing light 2 Hz	---	Firmware download is complete. Wait for POWER ON.
Green / orange or red / orange flashing light 2 Hz	---	Component detection using LED is activated (p0124). Note: Both options depend on the LED state when module recognition is activated via p0124 = 1.

Table 6-16 Meaning of the LED "POWER OK" on the Control Interface Module in the Active Line Module

LED	Color	State	Description
POWER OK	Green	Off	DC link voltage < 100 V and voltage at -X9:1/2 less than 12 V.
		On	The component is ready for operation.
		Flashing light	There is a fault. If the LED continues to flash after you have performed a POWER ON, please contact your Siemens service center.

6.1.2.10 Control Interface Module in the Basic Line Module chassis format

Table 6-17 Meaning of the LEDs "Ready" and "DC Link" on the Control Interface Module in the Basic Line Module

LED, state		Description
Ready	DC link	
Off	Off	The electronic power supply is missing or lies outside the permissible tolerance range.
Green	Off	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is present.
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is too high.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	---	At least one fault is present in this component. Note: LED is activated irrespective of any reconfiguring of the corresponding messages.
Green / red flashing light 0.5 Hz	---	Firmware is being downloaded.
Green / red flashing light 2 Hz	---	Firmware download is complete. Wait for POWER ON.
Green / orange or red / orange flashing light 2 Hz	---	Component detection using LED is activated (p0124). Note: Both options depend on the LED state when module recognition is activated via p0124 = 1.

Table 6-18 Meaning of the LED "POWER OK" on the Control Interface Module in the Basic Line Module

LED	Color	State	Description
POWER OK	Green	Off	DC link voltage < 100 V and voltage at -X9:1/2 less than 12 V.
		On	The component is ready for operation.
		Flashing light	There is a fault. If the LED continues to flash after you have performed a POWER ON, please contact your Siemens service center.

6.1.2.11 Control Interface Module in the Smart Line Module chassis format

Table 6-19 Meaning of the LEDs "READY" and "DC LINK" on the Control Interface Module in the Smart Line Module

LED, state		Description
READY	**DC LINK**	
Off	Off	The electronic power supply is missing or lies outside the permissible tolerance range.
Green	Off	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is present.
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is too high.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	---	At least one fault is present in this component. Note: LED is activated irrespective of any reconfiguring of the corresponding messages.
Flashing light 0.5 Hz: Green / red	---	Firmware is being downloaded.
Flashing light 2 Hz: Green / red	---	Firmware download is complete. Wait for POWER ON.
Flashing light 2 Hz: Green / orange or red / orange	---	Component detection using LED is activated (p0124). Note: Both options depend on the LED state when module recognition is activated via p0124 = 1.

Table 6-20 Meaning of the LED "POWER OK" on the Control Interface Module in the Smart Line Module

LED	Color	State	Description
POWER OK	Green	Off	DC link voltage < 100 V and voltage at -X9:1/2 less than 12 V.
		On	The component is ready for operation.
		Flashing light	There is a fault. If the LED continues to flash after you have performed a POWER ON, please contact your Siemens service center.

6.1.2.12 Control Interface Module in the Motor Module chassis format

Table 6-21 Meaning of the LEDs "Ready" and "DC Link" on the Control Interface Module in the Motor Module

LED, state		Description
Ready	**DC link**	
Off	Off	The electronic power supply is missing or lies outside the permissible tolerance range.
Green	Off	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is present.
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is too high.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	---	At least one fault is present in this component. Note: LED is activated irrespective of any reconfiguring of the corresponding messages.
Green / red flashing light 0.5 Hz	---	Firmware is being downloaded.
Green / red flashing light 2 Hz	---	Firmware download is complete. Wait for POWER ON.
Green / orange or red / orange flashing light 2 Hz	---	Component detection using LED is activated (p0124). **Note**: Both options depend on the LED status when module recognition is activated via p0124 = 1.

Table 6-22 Meaning of the LED "POWER OK" on the Control Interface Module in the Motor Module

LED	Color	State	Description
POWER OK	Green	Off	DC link voltage < 100 V and voltage at -X9:1/2 less than 12 V.
		On	The component is ready for operation.
		Flashing light	There is a fault. If the LED continues to flash after you have performed a POWER ON, please contact your Siemens service center.

6.1.2.13 Control Interface Module in the Power Module chassis format

Table 6-23 Meaning of the LEDs "READY" and "DC LINK" on the Control Interface Module in the Power Module

LED, state		Description
READY	**DC LINK**	
Off	Off	The electronic power supply is missing or lies outside the permissible tolerance range.
Green	Off	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is present.
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is too high.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	---	At least one fault is present in this component. **Note**: LED is controlled irrespective of the corresponding messages being reconfigured.
Flashing light 0.5 Hz: Green / red	---	Firmware is being downloaded.
Flashing light 2 Hz: Green / red	---	Firmware download is complete. Wait for POWER ON.
Flashing light 2 Hz: Green / orange or red / orange	---	Component detection using LED is activated (p0124). **Note**: Both options depend on the LED status when module recognition is activated via p0124 = 1.

Table 6-24 Meaning of the LED "POWER OK" on the Control Interface Module in the Power Module

LED	Color	State	Description
POWER OK	Green	Off	DC link voltage < 100 V and voltage at -X9:1/2 less than 12 V.
		On	The component is ready for operation.
		Flashing light	There is a fault. If the LED continues to flash after you have performed a POWER ON, please contact your Siemens service center.

6.1.3 Additional modules

6.1.3.1 Control Supply Module

Table 6-25 Control Supply Module – description of the LEDs

LED	Color	State	Description, cause	Remedy
READY	–	off	Electronic power supply is missing or outside permissible tolerance range.	–
	Green	Continuous light	Component is ready to operate.	–
DC LINK	–	off	Electronic power supply is missing or outside permissible tolerance range.	–
	Orange	Continuous light	DC link voltage within permissible tolerance range.	–
	Red	Continuous light	DC link voltage outside permissible tolerance range.	–

6.1.3.2 SMC10/SMC20 Sensor Module Cabinet

Table 6-26 Sensor Module Cabinet 10/20 (SMC10/SMC20) – description of the LEDs

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

6.1.3.3 SMC30 Sensor Module Cabinet

Table 6-27 Meaning of LEDs on the Sensor Module Cabinet SMC30

LED	Color	Status	Description, cause	Remedy
RDY READY	–	Off	The electronics power supply is missing or outside the permissible tolerance range.	–
	Green	Continuous light	The component is ready for operation. Cyclic DRIVE-CLiQ communication is taking place.	–
	Orange	Continuous light	DRIVE-CLiQ communication is being established.	–
	Red	Continuous light	This component has at least one fault. **Note:** LED is controlled irrespective of the corresponding messages being reconfigured.	Correct fault and acknowledge
	Green/red	Flashing light 0.5 Hz	Firmware is being downloaded.	–
	Green/red	Flashing light 2 Hz	Firmware download is complete. The system waits for POWER ON.	Carry out a POWER ON
	Green/ orange or Red/ orange	Flashing light	Component recognition via LED is activated[1)]. **Note:** Both options depend on the LED status when component recognition is activated.	–
OUT > 5 V	–	Off	The electronics power supply is missing or outside permissible tolerance range. Power supply ≤ 5 V.	–
	Orange	Continuous light	The electronics power supply for the encoder system is available. Power supply > 5 V	–

[1)] The parameters for activating component recognition using LEDs can be taken from the following reference:
Reference: SINAMICS S120/S150 List Manual

6.1.3.4 SMC40 Sensor Module Cabinet (only for direct measuring systems)

Table 6-28 Meaning of the LEDs on the Sensor Module Cabinet-Mounted SMC40

LED	Color	Status	Description, cause	Remedy
RDY READY	–	Off	The electronics power supply is missing or outside the permissible tolerance range.	–
	Green	Continuous light	The component is ready for operation. Cyclic DRIVE-CLiQ communication is taking place.	–
	Orange	Continuous light	DRIVE-CLiQ communication is being established.	–
	Red	Continuous light	This component has at least one fault. **Note:** LED is controlled irrespective of the corresponding messages being reconfigured.	Correct and acknowledge the fault.
	Green/red	Flashing light 2 Hz	Firmware download is complete. The system waits for POWER ON.	Carry out a POWER ON.
	Green/ orange or Red/ orange	Flashing light	Component recognition via LED is activated[1]. **Note:** Both options depend on the LED status when component recognition is activated.	–

[1] The parameters for activating component recognition can be taken from the following reference:
Reference: SINAMICS S120/S150 List Manual

Each channel has a multifunction LED.

6.1.3.5 Communication Board Ethernet CBE20

Table 6-29 Meaning of the LEDs at ports 1 to 4 of the X1400 interface

LED	Color	Status	Description
Link port	–	Off	The electronics power supply is missing or outside the permissible tolerance range (link missing or defective).
	Green	Continuous light	A different device is connected to port x and a physical connection exists.
Activity port	–	Off	The electronics power supply is missing or outside the permissible tolerance range (no activity).
	Yellow	Flashing light	Data is being received or sent at port x.

Table 6-30 Meaning of the Sync and Fault LEDs on the CBE20

LED	Color	Status	Description
Fault	–	Off	If the link port LED is green: The CBE20 is operating normally, data is being exchanged with the configured IO Controller.
	Red	Flashing light	• The response monitoring interval has elapsed. • Communications is interrupted. • The IP address is incorrect. • Incorrect or no configuration. • Incorrect parameter settings. • Incorrect or missing device name. • IO Controller not connected/switched off, although an Ethernet connection has been established. • Other CBE20 faults
		Continuous light	CBE20 fault error • No physical connection to a subnet/switch. • Incorrect transmission rate • Full duplex transmission is not activated.
Sync	–	Off	If the link port LED is green: The Control Unit task system is not synchronized with the IRT clock. An internal substitute clock is generated.
	Green	Flashing light	The Control Unit task system has synchronized with the IRT clock and data is being exchanged.
		Continuous light	The Task system and the MC-PLL have synchronized with the IRT clock.

Table 6-31 Meaning of the OPT LED on the Control Unit

LED	Color	Status	Description, cause	Remedy
OPT	–	OFF	Electronics power supply is missing or outside the permissible tolerance range. CBE20 either defective or not inserted.	–
	Green	Continuous light	CBE20 is ready and cyclic communication is taking place.	–
		Flashing light 0.5 Hz	CBE20 is ready but cyclic communication is not running. Possible causes: • Communication is being established. • At least one fault is present.	–
	Red	Continuous light	Cyclic communication via PROFINET has not yet been established. However, non-cyclic communications are possible. SINAMICS is waiting for a parameterization/configuration telegram.	–
		Flashing light 0.5 Hz	The firmware update into the CBE20 has been completed with an error. Possible causes: • The memory card for the control unit is defective. • The CBE20 is defective. In this state CBE20 cannot be used.	–
		Flashing light 2 Hz	There is a communications error between the Control Unit and the CBE20. Possible causes: • The CBE20 was withdrawn after booting. • The CBE20 is defective.	Correctly insert the board, if required, replace.
	Orange	Flashing light 0.5 Hz	Firmware of the CBE20 currently being updated.	–

6.1.3.6 Voltage Sensing Module VSM10

Table 6-32 Meanings of the LEDs on the Voltage Sensing Module VSM10

LED	Color	Status	Description, cause	Remedy
READY	–	Off	The electronics power supply is missing or outside the permissible tolerance range.	–
	Green	Continuous light	The component is ready for operation. Cyclic DRIVE-CLiQ communication is taking place.	–
	Orange	Continuous light	DRIVE-CLiQ communication is being established.	–
	Red	Continuous light	This component has at least one fault. **Note:** LED is controlled irrespective of the corresponding messages being reconfigured.	Remove and acknowledge the fault.
	Green/red	Flashing light 0.5 Hz	Firmware is being downloaded.	–
		Flashing light 2 Hz	Firmware download is complete. The system waits for POWER ON.	Carry out a POWER ON.
	Green/ orange or Red/ orange	Flashing light	Detection of the component via LED is activated (p0144 = 1). **Note:** Both options depend on the LED status when component recognition is activated.	–

6.1.3.7 DRIVE-CLiQ Hub Module DMC20

Table 6-33 Description of the LEDs on the DRIVE-CLiQ Hub Module DMC20

LED	Color	Status	Description, cause	Remedy
READY	–	Off	The electronics power supply is missing or outside the permissible tolerance range.	–
	Green	Continuous light	The component is ready for operation. Cyclic DRIVE-CLiQ communication is taking place.	–
	Orange	Continuous light	DRIVE-CLiQ communication is being established.	–
	Red	Continuous light	This component has at least one fault. **Note:** LED is controlled irrespective of the corresponding messages being reconfigured.	Remove and acknowledge the fault.
	Green/red	Flashing light 0.5 Hz	Firmware is being downloaded.	–
		Flashing light 2 Hz	Firmware download is complete. The system waits for POWER ON.	Carry out a POWER ON.
	Green/orange or Red/orange	Flashing light	Component recognition via LED is activated (p0154 = 1). **Note:** Both options depend on the LED status when component recognition is activated.	–

6.1.4 Terminal Modules

6.1.4.1 Terminal Module TM15

Table 6-34 Meanings of the LEDs on the Terminal Module TM15

LED	Color	Status	Description, cause	Remedy
READY	-	Off	The electronics power supply is missing or outside the permissible tolerance range.	–
	Green	Continuous light	The component is ready for operation. Cyclic DRIVE-CLiQ communication is taking place.	–
	Orange	Continuous light	DRIVE-CLiQ communication is being established.	–
	Red	Continuous light	This component has at least one fault. **Note:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.	Correct and acknowledge the fault.
	Green/red	Flashing light 0.5 Hz	Firmware is being downloaded.	–
		Flashing light 2 Hz	Firmware download is complete. The system waits for POWER ON.	Carry out a POWER ON.
	Green/orange or Red/orange	Flashing light	Component recognition via LED is activated[1)]. **Note:** Both options depend on the LED status when component recognition is activated.	–

[1)] The parameters for activating component recognition using LEDs can be taken from the following reference:
Reference: SINAMICS S120/S150 List Manual

6.1.4.2 Terminal Module TM31

Table 6-35 Meanings of the LEDs on the Terminal Module TM31

LED	Color	Status	Description, cause	Remedy
READY	-	Off	The electronics power supply is missing or outside the permissible tolerance range.	–
	Green	Continuous light	The component is ready for operation. Cyclic DRIVE-CLiQ communication is taking place.	–
	Orange	Continuous light	DRIVE-CLiQ communication is being established.	–
	Red	Continuous light	This component has at least one fault. **Note:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.	Correct and acknowledge the fault.
	Green/red	Flashing light 0.5 Hz	Firmware is being downloaded.	–
		Flashing light 2 Hz	Firmware download is complete. The system waits for POWER ON.	Carry out a POWER ON.
	Green/orange or Red/orange	Flashing light	Component recognition via LED is activated[1]. **Note:** Both options depend on the LED status when component recognition is activated.	–

[1] The parameters for activating component recognition using LEDs can be taken from the following reference:
Reference: SINAMICS S120/S150 List Manual

6.1.4.3 Terminal Module TM41

Table 6-36 Meaning of the LEDs on the Terminal Module TM41

LED	Color	Status	Description, cause	Remedy
READY	-	Off	The electronics power supply is missing or outside the permissible tolerance range.	–
	Green	Continuous light	The component is ready for operation. Cyclic DRIVE-CLiQ communication is taking place.	–
	Orange	Continuous light	DRIVE-CLiQ communication is being established.	–
	Red	Continuous light	This component has at least one fault. **Note:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.	Correct and acknowledge the fault.
	Green/red	Flashing light 0.5 Hz	Firmware is being downloaded.	–
		Flashing light 2 Hz	Firmware download is complete. The system waits for POWER ON.	Carry out a POWER ON.
	Green/orange or Red/orange	Flashing light	Component recognition via LED is activated[1]. **Note:** Both options depend on the LED status when component recognition is activated.	–
Z pulses	–	Off	The zero mark was found and the system waits for the zero mark output. OR The component is switched off.	–
	Red	Continuous light	The zero mark has not been released, or the zero mark search is running.	–
	Green	Continuous light	The system stops at the zero mark.	–
		Flashing light	The zero mark is output at each virtual revolution.	–

[1] The parameters for activating component recognition using LEDs can be taken from the following reference:
Reference: SINAMICS S120/S150 List Manual

6.1.4.4 Terminal Module TM120

Table 6-37 Meaning of the LEDs on the Terminal Module TM120

LED	Color	Status	Description, cause	Remedy
READY	-	Off	The electronics power supply is missing or outside the permissible tolerance range.	Check the power supply.
	Green	Continuous light	The component is ready for operation. Cyclic DRIVE-CLiQ communication is taking place.	-
	Orange	Continuous light	DRIVE-CLiQ communication is being established.	-
	Red	Continuous light	This component has at least one fault. **Note:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.	Remove and acknowledge the fault.
	Green/ red	Flashing light 0.5 Hz	Firmware is being downloaded.	-
		Flashing light 2 Hz	Firmware download is complete. The system waits for POWER ON.	Carry out a POWER ON.
	Green/ orange or red/ orange	Flashing light 2 Hz	Component recognition via LED is activated[1)]. **Note:** Both options depend on the LED status when component recognition is activated.	-

[1)] The parameter for activating component recognition using LEDs can be taken from the following reference:
Reference: SINAMICS S120/S150 List Manual

6.1.4.5 Terminal Module TM150

Table 6-38 Meaning of the LEDs at the Terminal Module TM150

LED	Color	State	Description, cause	Remedy
READY	–	Off	Electronic power supply is missing or outside permissible tolerance range.	Check power supply
	Green	Continuous light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.	–
	Orange	Continuous light	DRIVE-CLiQ communication is being established.	–
	Red	Continuous light	This component has at least one fault. **Remark:** LED is controlled irrespective of the corresponding messages being reconfigured.	Remedy and acknowledge fault
	Green/ Red	Flashing light 0.5 Hz	Firmware is being downloaded.	–
		Flashing light 2 Hz	Firmware has been downloaded. Wait for POWER ON.	Carry out a POWER ON
	Green/ orange or red/ orange	Flashing light 2 Hz	Component recognition via LED is activated (p0154). **Remark:** Both options depend on the LED status when module recognition is activated via p0154 = 1.	–

6.2 Diagnostics via Startdrive

6.2.1 Device diagnostics

Display of alarms and faults

If the device outputs faults or alarms, or if maintenance is required, then the appropriate messages are displayed in Startdrive using various icons. The icons have different colors according to the seriousness of a fault or alarm.

The icons are displayed in the following areas of the TIA Portal:

- Project navigator
- Device view
- Device overview

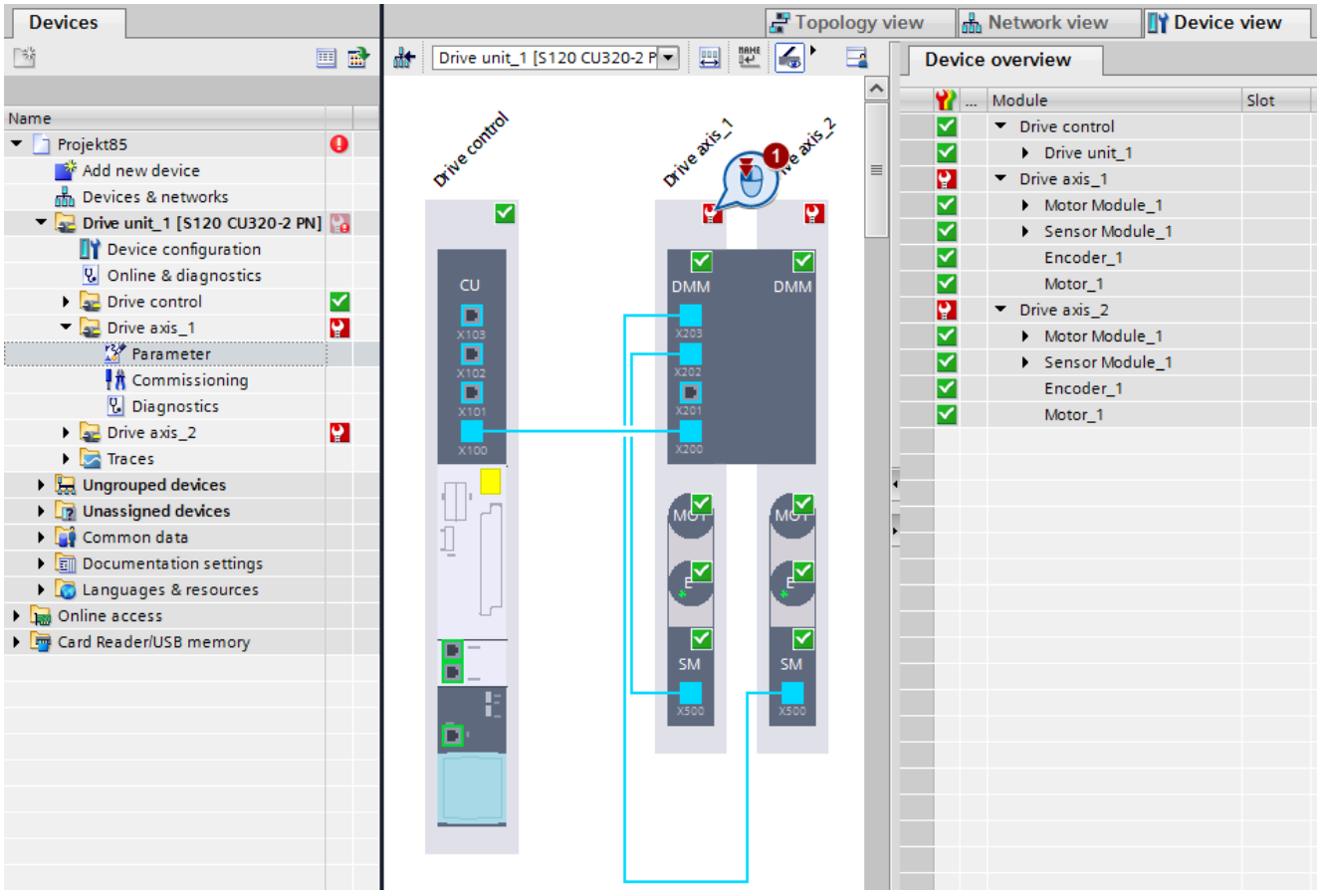


Figure 6-1 Example: Diagnostics icons in Startdrive

The following table lists the possible icon colors and their respective meaning.

Icon	Meaning
	OK = no fault active or maintenance is required
	Maintenance is required
	Maintenance is required for a subordinate component
	Maintenance request
	Maintenance request for a subordinate component
	Fault/error
	Fault/error on a subordinate component
	Connection error to the device
	Connection establishment
	Diagnostic status is determined
	The configured device and the actual device are incompatible types.
	The device is only available in the offline configured device configuration and has been deactivated.

Further information

You can call up further information on the icons and their meanings via the tooltips of the icons.

Display messages

To display messages that are assigned to an icon, double-click on the icon.

The messages are then displayed in the "Message display" tab of the inspector window.

Diagnostics for DRIVE-CLiQ connections

Errors in the DRIVE-CLiQ wiring of a drive line-up are displayed in the device view. You can display a description of the cause of the error via the tooltip of a displayed error. Then you must adapt the wiring either directly at the drive line-up by moving cable connections around on the available ports or in the device view by deleting and creating new connections.

Offline mode

If the DRIVE-CLiQ connections of the offline configuration differ from the actual wiring, then these errors are displayed in the device view.

Online mode

A setpoint-actual comparison of the DRIVE-CLiQ wiring takes place in online mode.

Examples

The following examples show how you can detect and eliminate topology errors in online mode with the aid of the displayed diagnostics icons.

Detecting and correcting a topology error

Operationally ready drive objects (DOs) are displayed with a green checkmark in online mode. Erroneous port assignments are marked in red.

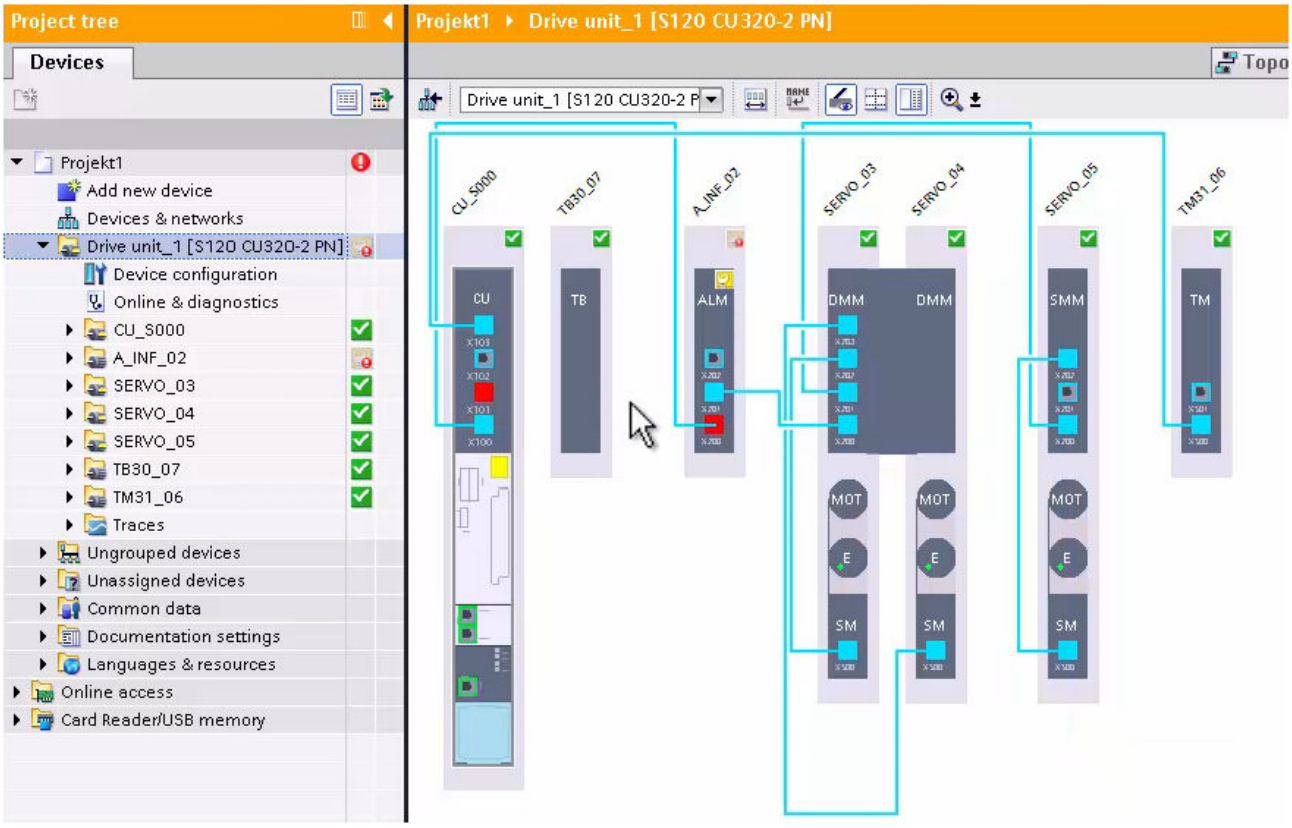


Figure 6-2 Example: topology error for DRIVE-CLiQ connections

The following describes 3 error scenarios, which illustrate the detection and elimination of topology errors.

Fault scenario 1: DRIVE-CLiQ connection on the interface of a DO not inserted

1. Position the cursor over the interface that is marked in red on the first drive object (in this case: Control Unit).
   A tooltip is displayed.
2. To open the tooltip, click on the black triangle.
   The tooltip shows the target connection compared with the currently available connection and a brief description of the error. For example, the connection of the interface X103 of the CU is not plugged into the interface X500 of the TM31.
3. Display the tooltip of the partner port marked red on the TM31. The error describes that there is no connection at interface X500 of the TM31.

Note

If several interface are marked red, starting from the left and moving to the right, check all error descriptions using the tooltips.

4. Check the DRIVE-CLiQ wiring on the real hardware. Insert the connection according to the target topology.
5. Acknowledge the active errors in the message view.

If the actual and setpoint topology then match, the interfaces are displayed in the device view in light blue.

Fault scenario 2: Two interfaces interchanged for a DRIVE-CLiQ connection

1. Check the interface marked in red on the first drive object.
   Typically, it is displayed that no connection should be inserted. However, in the actual topology, there is a connection to a different interface. For example, a connection exists from X101 to X200 of the Line Module, which is not configured.
2. Check the partner interface marked in red of the other drive object (here: Line Module).
   It is displayed that a connection should exist to X100 – however it goes to X101. When connecting up, the two interfaces were interchanged.
3. Change over the connection at the first drive object from X101 to X100.

Note

When switching over connections in the online mode, several errors can be briefly displayed, as certain drive objects can no longer be accessed. You only see the updated view without any errors once the target topology has been completely wired and is accessible.

As a result, the actual and setpoint topologies are identical and the interfaces are displayed in light blue.

Fault scenario 3: DRIVE-CLiQ connection inserted on the interface of an incorrect drive object

If more complex topology errors are present, correct them step-by-step and note the following changes in the device view. As a result of the error combinations, not all errors can be directly analyzed and displayed.

1. Check the interface that is marked in red on the first drive object (e.g. Single Motor Module).
   The tooltip displays that a connection, which is not configured, is inserted at interface X201.
2. Disconnect the connection from interface X201. The interface is displayed as being error-free after the device view has been updated. In addition, errors are displayed on the Double Motor Module and on the Sensor Module.

Note

If the device view is not automatically updated after changing the wiring, switch to network view and then back to device view.

3. Check the red interfaces on the Motor Module and on the Sensor Module.
   The tooltip displays that the Sensor Module is not inserted on the Double Motor Module.
4. Insert the connection and acknowledge the pending messages.

The topology is displayed as being error-free.

6.2.2 Trace function

Overview

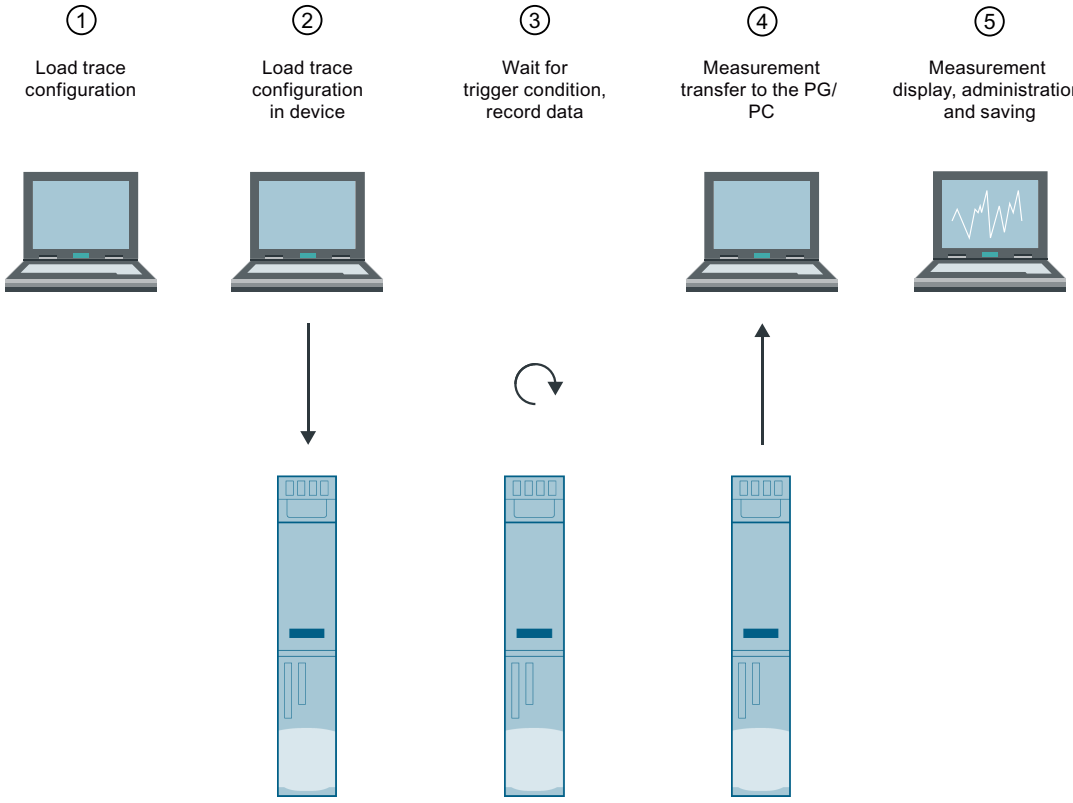
Using the trace function, you can record the variables of a S120 drive, and then subsequently evaluate them. Variables are, for example, drive parameters or system and user variables of a Control Unit. The maximum recording duration of a trace is limited by, among other things, the size of the memory and the cycle.

Table 6-39 Explanation of icons

Icon	Term	Meaning
	Trace configuration	Settings for the signals to be recorded and the recording conditions are defined in the trace configuration.
-	(Trace) recording	A trace is being recorded in the device. One recording exists in the drive for each trace configuration. Each new recording overwrites an existing recording. A recording in the drive is lost after each switch-off/switch-on operation, however, the measurement can be permanently saved in the project.
	Trace in the device	A trace in the drive comprises a trace configuration and optionally, one recording.
	Measurement	A measurement always comprises one trace configuration and the associated recording. The recording of a measurement can also be viewed offline.
	Measurement on the device (memory card)	Measurements are archived in the folder which are saved in the device (e.g. on the memory card). These measurements are retentive and can only be deleted by the user. The measurements in the device can be imported into the folder via drag and drop and thus be saved in the project as measurement.
	Trace configuration with the same name in the drive and in the project.	Generally, for a trace configuration in the drive, there is also a trace configuration of the same name in the PG/PC project.

Basic procedure

The following figure shows the basic process when applying the trace function.



① The signals to be recorded, the recording time and the trigger conditions are defined in the trace configuration.

② If an online connection exists, you transfer the complete trace configuration from the PG/PC to the device.

The transfer can also be started offline. When starting the transfer, a connection dialog is opened via which the online connection can be activated.

③ If the trace configuration is activated, then the recording is carried out independent of the PG/PC. The recording is started in the device as soon as the trigger condition has been fulfilled.

④ When you save the measurement, then the measurement is saved to the opened PG/PC project. Saving the measurement is independent of when the measurement was actually made.

⑤ After the measurement has been saved in the PG/PC, it can be displayed and evaluated there. From the PG/PC, you can export the measurement data as file - and subsequently import it again.

Number of traces

The trace quantity structure allows the recording of up to 8 individual channels. The recordings are directly saved to the drive, and when required, can be read out and permanently saved using the engineering system (ES). As a result, the trace function is suitable for recording and monitoring highly dynamic processes. The recorded values are overwritten when the trace function is reactivated.

An unlimited number of recordings cannot be made in Startdrive for SINAMICS S120 as a result of the restricted memory capacity:

- 2 traces can be recorded for each drive.
- A maximum of 8 signals can be recorded for each trace recording.
  - 1 to 4 signals for a minimum recording cycle of 0.125 ms
  - 5 to 8 signals for a minimum recording cycle of 4.0 ms

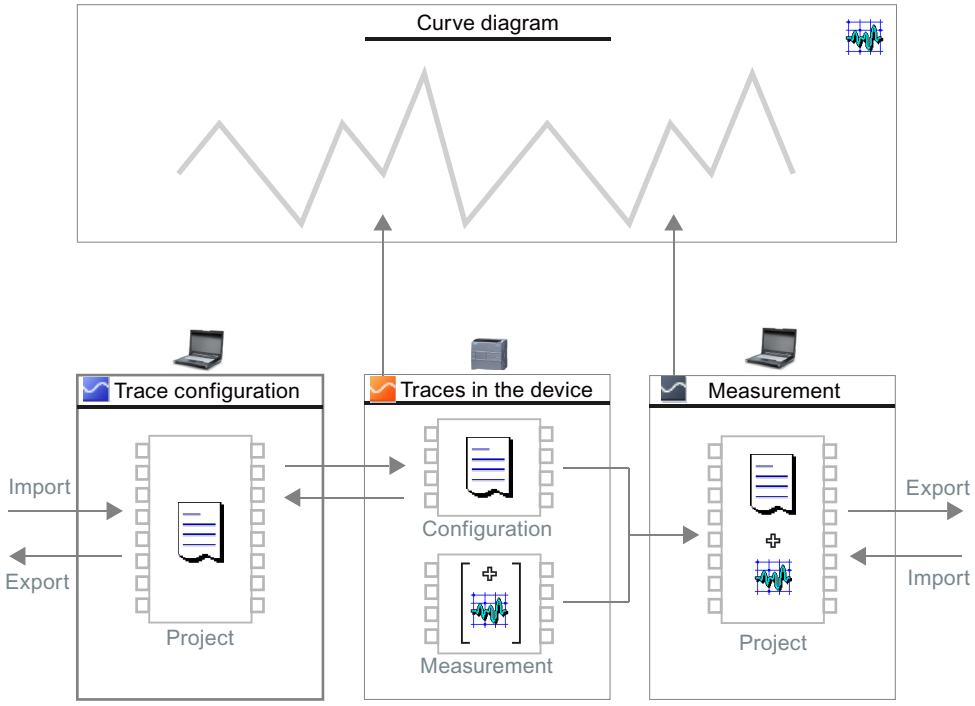
Trace configuration

The signals to be recorded, the recording time and the trigger conditions are defined in the trace configuration.

Data storage (toolbar and curve diagram)

The trace toolbar and the curve diagram also allow the trace configuration and the analysis of the recording to be transferred.

The data archive is schematically shown in the following diagram:



Note

Saving a trace configuration and recording

You save the trace configuration and record together with the project in Startdrive.

If you close the project without saving it, then the trace configurations and the measurements transferred into the project are rejected. Until the project is closed, the trace can be closed and re-opened without any data being lost.

Further information

The most important functions and settings for the trace function are explained in the following chapters. Furthermore, you receive further information about the trace in the information system of the Startdrive.

User interface elements

You can find an overview of the most important user interface elements of the trace function here: "User interface - trace function (Page 55)".

6.2.2.1 Creating or calling a trace

Overview

Traces in the form of trace configurations can be created in the project tree. Trace configurations that have been saved can be called and modified.

Below it is described how you create a trace configuration under the system folder "Traces" - and how you display a trace configuration that has been saved.

Requirements

- A drive has been configured that supports the trace function.

Creating a new trace

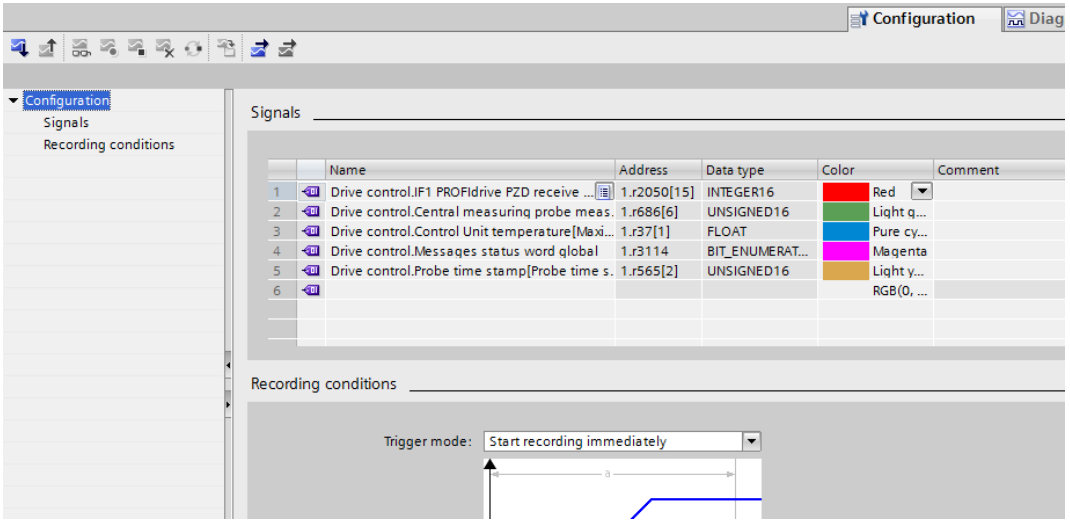
To create a new trace, double-click on the entry "Add new trace".

A new trace configuration is created.

Displaying a saved trace configuration or an appropriate curve diagram

To display a saved trace configuration, proceed as follows:

1. In the project tree, double-click on the appropriate icon (offline / online) of the trace configuration, a trace in the drive or a measurement.
   The "Configuration" or "Diagram" tab is opened in the working area.



2. If necessary, click on the "Configuration" tab to display it.
   OR
3. If, instead of the trace configuration, you wish to display the curve diagram, then click on the "Diagram" tab.

6.2.2.2 Configuring a trace

Overview

A trace configuration is made up of the following subsections in which settings must be made:

- Selecting and configuring signals
- Configuring recording conditions

Note

Backing up the trace data

The trace configuration is saved power-independently. The data is kept even when switching off and switching on.

Records are not automatically saved, and are therefore lost when the system is switched off. As a consequence, trace recordings must be manually saved in the project (see Chapter "Saving a trace recording in the project (Page 325)") - or exported in a file structure (see Chapter "Importing and exporting a trace recording (Page 326)").

Requirement

- With a double-click a new trace configuration is created and selected in the project tree.

Selecting and configuring signals

Note
Maximum number of signals

You can configure a maximum of 8 signals per trace.

To configure the signals to be recorded, proceed as follows:

1. Click on the first empty cell in the "Name" column.
2. Select a signal. The following options are available:
   – In the "Name" column, click on the icon and select a parameter.
   – Enter the parameter name in the "Name" column - or part of the name in the cell. The field shows the possible parameters in the drop-down list.
   – To see the selection of parameters from all drive objects of the drive unit, put an asterisk and a period - "*." - in front of the search term, e.g. "*.r0063".
   The "Address" column shows the parameter number. A color is recommended in the "Color" column.
3. If you wish to assign another color to the signal, then select another color from the drop-down list in the "Color" column.
4. Click in the "Comment" column and enter a comment for the signal.
5. Repeat the procedure from step 1 until all of the signals to be recorded have been entered into the table.

Configuring recording conditions

To configure the recording conditions for a measurement, select the desired trigger condition in the "Trigger mode" drop-down list in the 1st step. You then carry out the subsequent configuration of the recording conditions depending on the selected trigger condition as follows:

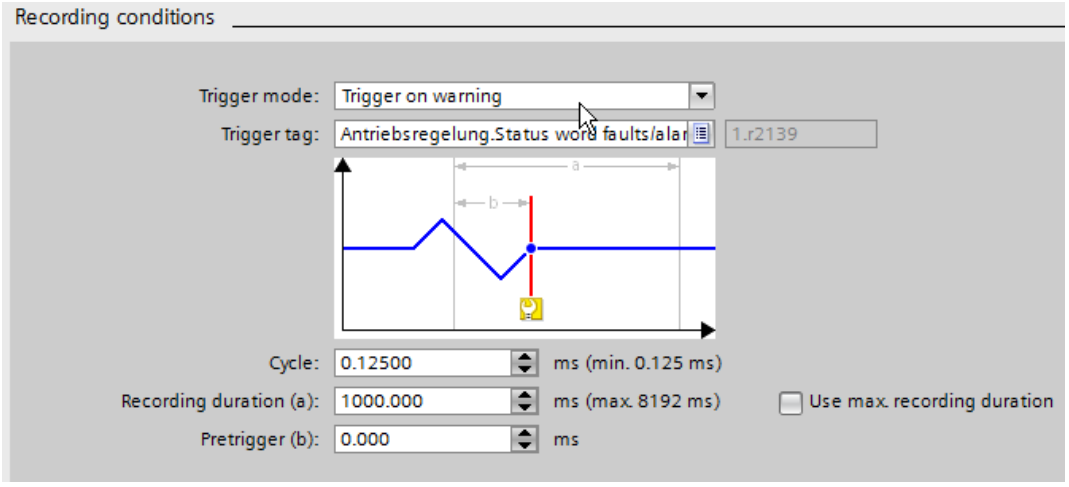


Figure 6-3 Example: Configuring recording conditions

Trigger condition: Start recording immediately

1. Enter the recording time under "Recording duration". The maximum possible recording duration is displayed to the right.
2. Should you wish to set the maximum recording time, activate the option "Use max. recording duration".
3. Enter a recording cycle under "Cycle" The possible cycle settings depend on the number of signals.

Trigger condition: Trigger on variable

1. Select a trigger parameter from the "Trigger variable" field. The following options are available:
   - Click on the icon for the trigger parameter and select a parameter.
   - Enter the name or the parameter number into the input field for the trigger parameter.

   Additional specific setting options are shown in accordance with the data type of the selected trigger variables. If a trigger variable of the FLOAT data type was selected, for example, a drop-down list, a diagram and an input field for a threshold value appear. The following settings can be selected in the drop-down list for the "result":

"Rising signal"	The recording starts if the falling value of the trigger reaches or exceeds the configured value. After activating the trace, at least 2 cycles are required in order to identify the signal edge.
"Falling signal"	The recording starts if the falling value of the trigger reaches or falls below the configured value. After activating the trace, at least 2 cycles are required in order to identify the signal edge.
"Within the tolerance band"	Recording starts as soon as the value of the trigger lies within the configured value range.
"Outside the tolerance band"	Recording starts as soon as the value of the trigger lies outside the configured value range.
"= TRUE"	Recording starts when the status of the trigger is TRUE.
"= FALSE"	Recording starts when the status of the trigger is FALSE.
"= Bit pattern"	The recording starts when the value of the trigger coincides with the bit pattern configured for this event. The individual bit allocation is displayed using a tooltip, which means that the relevant bits can be more easily identified. **Further information** You can find further information on the setting options for the trigger event " = bit pattern" in the information system of the Startdrive.

2. Select the required event in the "Event" drop-down list.
   Depending on the selected event, additional settings may be required (see input fields to the right of the curve diagram). Make the specific event settings.
3. In order to record a time period before the trigger event, enter a value greater than "0" in the input field for the pre-trigger.
4. Enter the recording time under "Recording duration". The maximum possible recording duration is displayed to the right.
5. Should you wish to set the maximum recording time, activate the option "Use max. recording duration".
6. Enter a recording cycle under "Cycle" The possible cycle settings depend on the number of signals.

Trigger condition: Trigger on alarm

1. Select a trigger parameter from the "Trigger variable" field (see "Trigger on variable").
2. In order to record a time period before the trigger event, enter a value greater than 0 in the input field for the pre-trigger.
3. Enter the recording time under "Recording duration". The maximum possible recording duration is displayed to the right.

4. Should you wish to set the maximum recording time, activate the option "Use max. recording duration".
5. Enter a recording cycle under "Cycle" The possible cycle settings depend on the number of signals.

Trigger condition: Trigger on fault

1. Select a trigger parameter from the "Trigger variable" field (see "Trigger on variable").
2. In order to record a time period before the trigger event, enter a value greater than 0 in the input field for the pre-trigger.
3. Enter the recording time under "Recording duration". The maximum possible recording duration is displayed to the right.
4. Should you wish to set the maximum recording time, activate the option "Use max. recording duration".
5. Enter a recording cycle under "Cycle" The possible cycle settings depend on the number of signals.

Further information

Further information on handling the trace function and the configuration and evaluation of the trace is provided in the information system of the Startdrive.

6.2.2.3 Transferring the trace configuration to the device

Overview

The following describes how you can transfer a trace configuration into the drive.

Requirements

- A valid trace configuration is provided in the "Traces" system folder.
- The maximum number of traces has still not been reached.

Procedure

Proceed as follows to transfer a trace configuration to the drive:

1. Open a valid trace configuration in the working area.
2. Click on icon .
   The "Go online" dialog is displayed if an online connection to the drive has not been active up until now.
   Here, make the settings for the online connection (see Chapter "Establishing an online connection to the drive (Page 152)") and click on "Connect".

The trace configuration is transferred to the drive.

6.2.2.4 Activating the trace recording

Overview

The following describes how you can activate a trace in the drive.

Requirements

- An online connection has been established to the drive.
- A trace is saved in the drive.
- The trace configuration in the drive is displayed in the working area (see Chapter "Creating or calling a trace (Page 318)").
- The icon for monitoring the displayed trace is enabled.

Activating the trace recording

To activate the trace recording in the drive, click on the icon.

The trace is activated in the drive and starts the recording corresponding to the configured trigger condition.

The current status of the recording is displayed in the status display of the trace.

Note

When a recording is restarted, the previously recorded values are lost. To save the values that have been recorded, save the measurement in the project (see Chapter "Saving a trace recording in the project (Page 325)"), before you reactivate the recording.

6.2.2.5 Deactivating the trace recording

Overview

The following describes how you can deactivate a trace in the drive.

Requirements

- An online connection has been established to the drive.
- A trace is saved in the drive.
- The trace configuration in the drive is displayed in the working area (see Chapter "Creating or calling a trace (Page 318)").
- The icon for monitoring the displayed trace is enabled.

Procedure

To end an activated trace recording in the drive, click on the icon.

The trace in the drive is deactivated and the status display of the trace switches to "inactive".

6.2.2.6 Displaying the trace recording

Overview

The following describes how you can display the trace recording.

Requirements

- There is an online connection to the drive unit.
- A recorded trace is saved in the drive unit.
  OR
- A measurement is in the "Measurements" system folder.

Procedure

To display the recording, proceed as follows:

1. Select a trace in the drive.
   OR
   In the "Measurements" system folder, select a measurement.
2. Double-click the selected trace or measurement.
3. If required, activate the icon for monitoring.
4. Check to ensure that the signals ( ) are shown in the "Diagram" tab in the signal table. You can display the signals via the shortcut menu.

The recording is displayed in the "Diagram" tab.

6.2.2.7 Saving a trace recording in the project

Overview

The following describes how you can save the trace recording in the project.

Requirements

- An online connection has been established to the drive.
- A recorded trace is saved in the drive.
- The data of the trace in the drive must of been displayed at least once in the curve diagram. For display, the recorded data are loaded from the drive.

Procedure

To save a trace recording in the project, proceed as follows:

1. Open the trace in the drive with the recorded data (see Chapter "Creating or calling a trace (Page 318)").
2. Ensure that the actual data from the drive are loaded by activating icon .
3. After activating icon wait until all data have been loaded and displayed.
4. Click on icon .
   The trace recording is added in the system folder "Measurements".
5. Save the project in Startdrive.

The trace recording is saved in the project.

6.2.2.8 Importing and exporting a trace recording

Overview

The following describes how you can import or export a trace recording.

Requirement

- At least one measurement is in the system folder "Measurements" for export.

Exporting a trace recording

To export a trace recording, proceed as follows:

1. Display the measurement in the working area (see Chapter "Creating or calling a trace (Page 318)").
2. Click on the icon or select the "Export measurement" shortcut menu.
   The "Save as..." dialog box opens.
3. Select a folder, file name and possibly a file type to save the trace recording.
4. Click the "Save" button.

The selected trace recording is saved in the specified folder.

Importing a trace recording

To import a trace recording, proceed as follows:

1. Select the "Measurements" system folder and select the "Import measurement" shortcut menu.
   The "Open" dialog box is opened.
2. Select the file of the "*.ttrecx" file type with the trace recording to be imported.
3. Click the "Open" button.

The selected trace recording is imported into the project.

6.2.2.9 Transferring the trace configuration from the drive to the project

Overview

The following describes how you can transfer a trace configuration into the project.

Requirements

- An online connection has been established to the drive.
- A trace is saved in the drive.

Procedure

Proceed as follows to transfer a trace configuration to the project:

1. Open a trace in the drive (see Chapter "Creating or calling a trace (Page 318)").
2. If required, activate the icon for monitoring.
3. Click on icon to transfer the trace configuration from the drive into the project.

The configuration is transferred as new trace configuration into the "Traces" system folder.

A trace configuration with the same name in the system folder is overwritten.

6.2.2.10 Deleting a trace configuration

Overview

The following describes how you can delete a trace configuration in the drive.

Requirements

- There is an online connection to the drive unit.
- A trace is saved in the drive.

Procedure

To delete a trace configuration in the drive, proceed as follows:

1. Open a trace configuration in the drive (see Chapter "Creating or calling a trace (Page 318)").
2. If required, activate the icon for monitoring.
3. Click on icon to delete the selected trace configuration.
   A confirmation prompt opens.
4. To confirm the deletion, in the query, click on "Yes".

OR

1. In the project tree, select one or several trace configurations in the drive / .
2. Call the "Delete" shortcut menu to delete the trace configurations in the drive.
   A confirmation prompt opens.
3. To confirm the deletion, in the query, click on "Yes".

The selected trace configuration is deleted.

6.2.3 Online diagnostics

Overview

In the diagnostics view, you are working in online mode and see the most important drive information or make important basic settings.

Requirements

- There is a physical connection between the Ethernet interface of your PG/PC and the Ethernet or PROFINET interface of your drive.

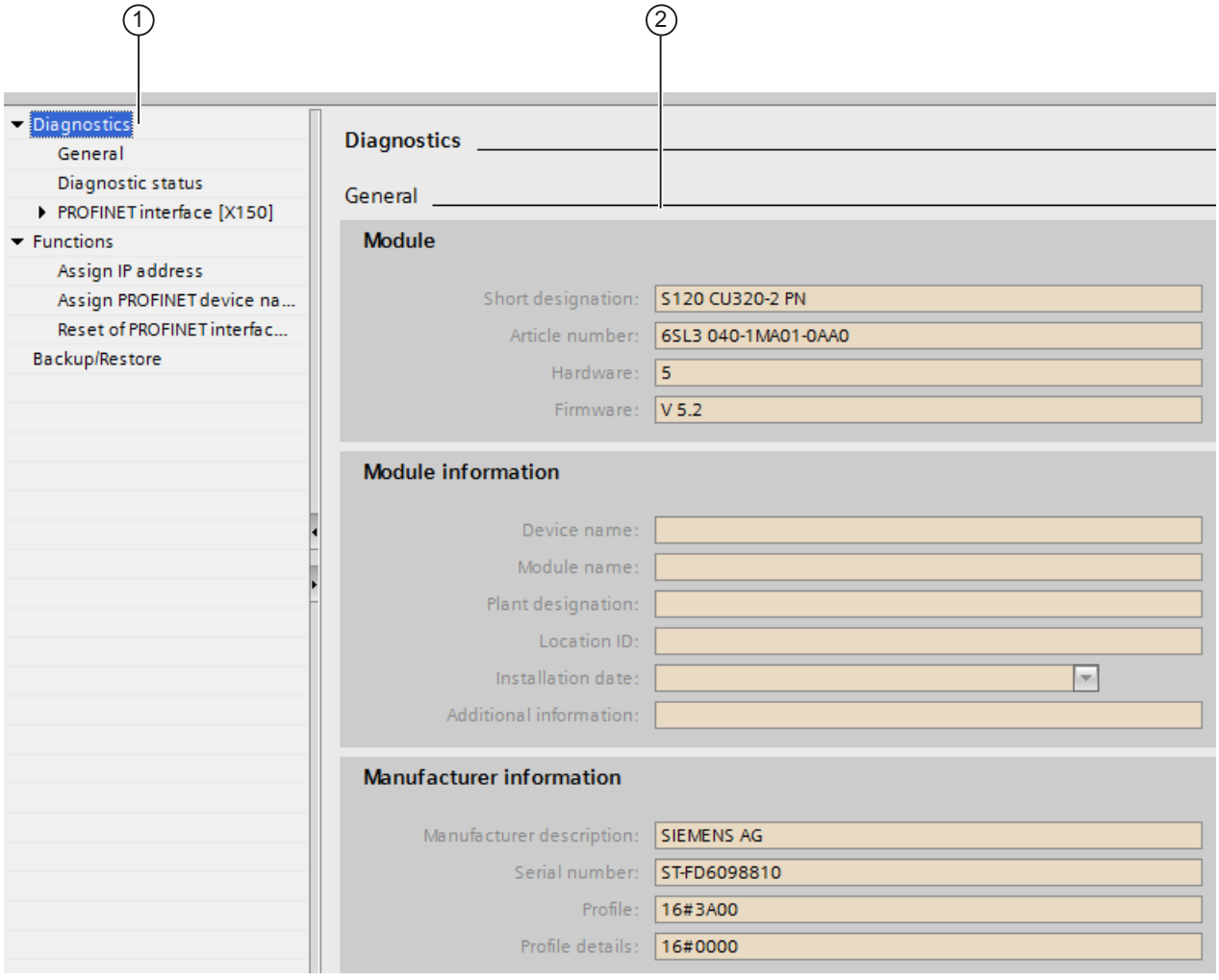
Calling diagnostics

Proceed as follows to display diagnostics and diagnostic functions for a drive unit connected online:

1. Open the "Online access" entry in the project tree.
2. Select the network interface of your PG/PC.
3. Double-click "Update accessible devices".
   The accessible device is displayed with IP address in the project tree.
4. Establish an online connection to the device.
   You can also establish the online connection beforehand.
5. In the project tree call the "Online & diagnostics" function for the displayed device.

The diagnostics view is displayed in the Startdrive working area. From the secondary navigation of the diagnostics view, you can call up some diagnostic information and data for the drive device and perform several important basic functions.

The following illustration shows the structure of a diagnostics view:



① Secondary navigation

② Screen form for online diagnostics and important basic functions

6.2.3.1 Diagnostics

The following diagnostics information on the connected drive device is provided in the diagnostics view:

- General
  Information on module and manufacturer
- Diagnostics status
  Information on status and standard diagnostics
- PROFINET interface
  - IO controller
    Information on the PROFINET device name
  - Ethernet address
    Information on the network connection and the IP parameters
  - Ports
    Information on the two ports of the drive unit
  - Domain
    Information on sync and MRP domain

You call the individual diagnostic information in the secondary navigation of the diagnostics view.

6.2.3.2 Functions

The diagnostics view also provides important diagnostic information on the direct functions of the drive unit. You can change the settings of these direct functions in the online mode in the diagnostics view, as you do the settings for going online with the drive unit. You can also configure the following functions in the diagnostics view:

- Assigning an IP address (Page 160)
- Assigning PROFINET device names (Page 162)
- Restoring factory settings (Page 166)

You call the individual functions in the secondary navigation of the diagnostics view.

6.2.4 Diagnostic information: Infeed unit and drive axes

The following information is applicable for both the infeed unit and drive axis.

6.2.4.1 Missing enables

The infeed unit / drive axis does not change into the "Operation" state until all the enable signals are available. In the "Missing enable signals" screen form, the LEDs in the function view indicate which enable signals are still missing.

6.2.4.2 Displaying control/status words

Overview

The control and status words are displayed in the function view in 2 adjacent lists for diagnostic purposes in the "Control/status words" screen form.

Procedure

To select the group of control and status words, proceed as follows:

1. In one of the 2 drop-down lists, select the required group of control and status words.
   The corresponding display and interconnection fields are displayed on the side of the screen form on which you made the setting in the drop-down list.
   An illuminated LED display means that the appropriate bit of the control or status word is set.
2. If you want to display the values of several groups next to one another, set the other desired groups in the other two drop-down lists

6.2.4.3 Status parameters

The status parameters with the associated numeric values are displayed in the function view in the "Status parameters" screen form.

Column	Meaning of the instruction
Number	Number of the parameter
Parameter text	Complete parameter text in the long form
Value	Numerical value of the parameter
Unit	Unit of the parameter

6.3 Fault and alarm messages

Overview

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

Note

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

Note

Additional support for faults and alarms

The Startdrive information system allows you to call additional help for every displayed message via the question mark icon in the inspector window on the "Diagnostics" tab (see section "Help for messages and diagnostics").

Properties of faults and alarms

- Faults (code F01234)
  - Are identified by Fxxxxx.
  - Can lead to a fault reaction.
  - Must be acknowledged once the cause has been remedied.
  - Status via Control Unit and LED RDY.
  - Status via PROFIdrive status signal ZSW1.3 (fault active).
  - Entry in the fault buffer.
- Alarms (code A56789)
  - Are identified by Axxxxx.
  - Have no further effect on the drive.
  - The alarms are automatically reset once the cause has been remedied. No acknowledgement is required.
  - Status via PROFIdrive status signal ZSW1.7 (alarm active).
  - Entry in the alarm buffer.
- General properties of faults and alarms
  - Can be configured (e.g. change fault to alarm, fault reaction).
  - Triggering on selected messages possible.
  - Initiation of messages possible via an external signal.
  - Contains the component number for identifying the SINAMICS component involved
  - Contains diagnostic information on the message involved

Acknowledging faults

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

- Acknowledgement of faults by "POWER ON"
  - Switch the drive on/off (POWER ON)
  - Press the RESET button on the Control Unit
- Acknowledgement of faults by "IMMEDIATE"
  - Via a PROFIdrive control signal:
    STW1.7 (reset fault memory): 0/1 edge
    Set STW1.0 (ON/OFF1) = "0" and "1"
  - Via external input signal
    Binector input and interconnection with digital input
    p2103 = "Requested signal source"
    p2104 = "Requested signal source"
    p2105 = "Requested signal source"
    Across all of the drive objects (DO) of a Control Unit
    p2102 = "Requested signal source"
- Acknowledge faults with "PULSE INHIBIT"
  - The fault can only be acknowledged with a pulse inhibit (r0899.11 = 0).
  - The same possibilities are available for acknowledging as described under acknowledge IMMEDIATELY.

Note

The drive can only resume operation after all active faults have been acknowledged.

6.3.1 Buffer for faults and alarms

Overview

A fault and alarm buffer is provided for each drive. The drive and device-specific messages are entered in these buffers. The contents of the fault buffer are saved to **non-volatile** memory when the Control Unit is powered down, i.e. the fault buffer history is still available when the unit is powered up again.

Note

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

Fault buffer

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

		Fault code	Fault value	Fault time "arrived"	Fault time "cleared"	Fault drive object triggering	Component number fault	Diagnostics attributes fault
Current fault	Fault 1	r0945[0]	r0949[0] [I32] r2133[0] [Float]	r0948[0] [ms] r2130[0] [d]	r2109[0] [ms] r2136[0] [d]	r3115[0]	r3120[0]	r3122[0]
	Fault 2	r0945[1]	r0949[1] [I32] r2133[1] [Float]	r0948[1] [ms] r2130[1] [d]	r2109[1] [ms] r2136[1] [d]	r3115[1]	r3120[1]	r3122[1]
	...							
	Fault 8	r0945[7]	r0949[7] [I32] r2133[7] [Float]	r0948[7] [ms] r2130[7] [d]	r2109[7] [ms] r2136[7] [d]	r3115[7]<1>	r3120[7]<1>	r3122[7]<1>
1st acknowledged fault	Fault 1	r0945[8]	r0949[8] [I32] r2133[8] [Float]	r0948[8] [ms] r2130[8] [d]	r2109[8] [ms] r2136[8] [d]	r3115[8]	r3120[8]	r3122[8]
	Fault 2	r0945[9]	r0949[9] [I32] r2133[9] [Float]	r0948[9] [ms] r2130[9] [d]	r2109[9] [ms] r2136[9] [d]	r3115[9]	r3120[9]	r3122[9]
	...							
	Fault 8	r0945[15]	r0949[15] [I32] r2133[15] [Float]	r0948[15] [ms] r2130[15] [d]	r2109[15] [ms] r2136[15] [d]	r3115[15]	r3120[15]	r3122[15]
...								
7th acknowledged fault (oldest)	Fault 1	r0945[56]	r0949[56] [I32] r2133[56] [Float]	r0948[56] [ms] r2130[56] [d]	r2109[56] [ms] r2136[56] [d]	r3115[56]	r3120[56]	r3122[56]
	Fault 2	r0945[57]	r0949[57] [I32] r2133[57] [Float]	r0948[57] [ms] r2130[57] [d]	r2109[57] [ms] r2136[57] [d]	r3115[57]	r3120[57]	r3122[57]
	...							
	Fault 8	r0945[63]	r0949[63] [I32] r2133[63] [Float]	r0948[63] [ms] r2130[63] [d]	r2109[63] [ms] r2136[63] [d]	r3115[63]	r3120[63]	r3122[63]

<1> This fault is overwritten when more current faults occur (except in the case of "Safety faults").

Figure 6-4 Structure of the fault buffer

Properties of the fault buffer

The fault buffer has the following characteristics:

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

Clear fault buffer

To delete the fault buffer, proceed as follows:

- Deleting the fault buffer for all drive objects:
  p2147 = 1 → p2147 = 0 is automatically set after execution.
- Deleting the fault buffer for a specific drive object:
  p0952 = 0 → The parameter belongs to the specified drive object.

The fault buffer contents are automatically deleted for the following events:

- Restore factory setting (p0009 = 30 and p0976 = 1).
- Changing the drive object type.
- Upgrade firmware to later version.

Alarm buffer, alarm history

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

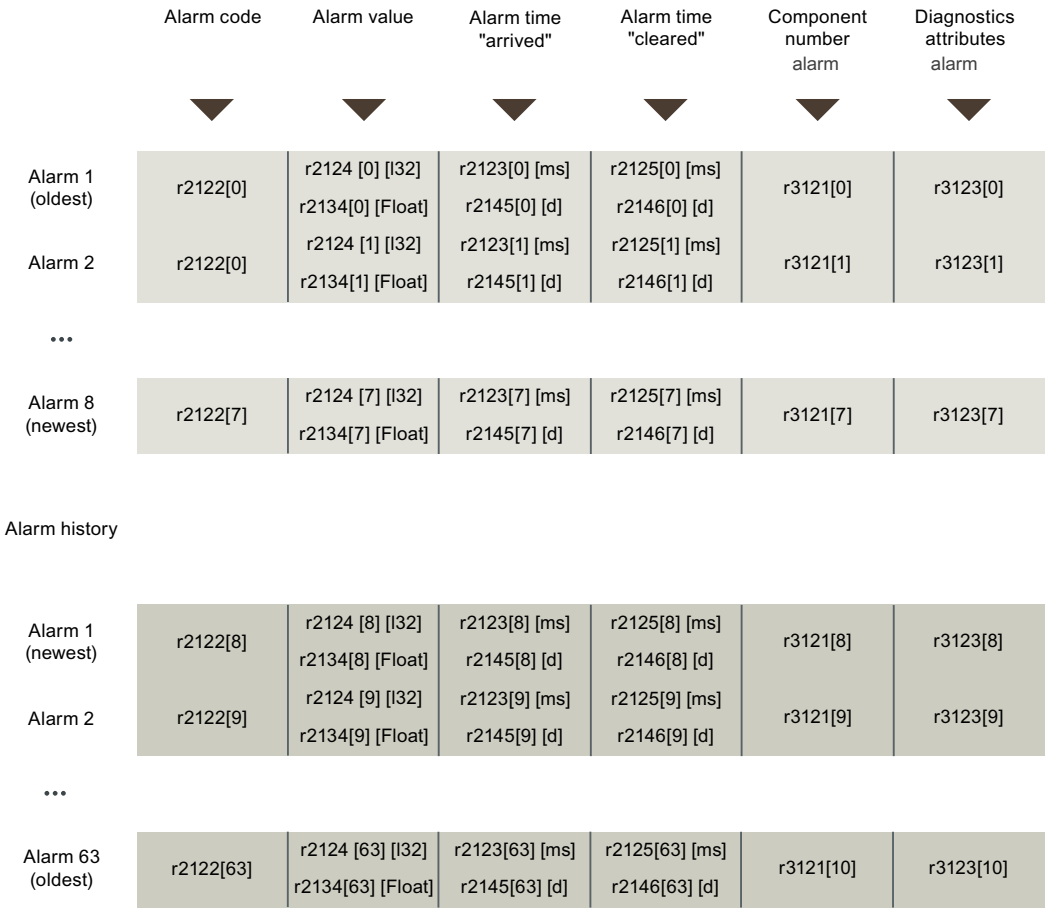


Figure 6-5 Structure of alarm buffer

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

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

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

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

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

Properties of the alarm buffer/alarm history

The alarm buffer/alarm history has the following characteristics:

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

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

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

6.3.2 Configuring messages

Overview

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

For several messages, in a specific scope defined by the drive system, the properties can be changed as follows:

Change message type (example)

Select message	Set message type	
p2118[5] = 1001	p2119[5]	= 1: Fault (F)
		= 2: Alarm (A)
		= 3: No message (N)

Change fault reaction (example)

Select message	Set fault response	
p2100[3] = 1002	p2101[3]	= 0: None
		= 1: OFF1
		= 2: OFF2
		= 3: OFF3
		= 4: STOP1 (available soon)
		= 5: STOP2
		= 6: IASC/DC brake Internal armature short-circuit braking or DC brake
		= 7: ENCODER (p0491)

Change acknowledgement (example)

Select message	Set acknowledgement	
p2126[4] = 1003	p2127[4]	= 1: POWER ON

= 2: IMMEDIATELY
= 3: PULSE INHIBIT

19 message types per drive object can be changed.

Note

If BICO interconnections exist between drive objects, all interconnected objects must be configured.

Example:

The TM31 has BICO interconnections with drive 1 and 2 and F35207 is to be reconfigured as an alarm.

- p2118[n] = 35207 and p2119[n] = 2
- These settings are required for for TM31, drive 1 and drive 2.

Note

Only those messages which are listed in the indexed parameters can be changed as desired. All other message settings retain their factory settings or are reset to the factory settings.

Examples:

- In the case of messages listed via p2128[0...19], the message type can be changed. The factory setting is set for all other messages.
- The fault response of fault F12345 has been changed via p2100[n]. The factory settings should be restored (p2100[n] = 0).

Triggering on messages (example)

Select message	Trigger signal
p2128[0] = 1001	BO: r2129.0
or	
p2128[1] = 1002	BO: r2129.1

Note

The value from CO: r2129 can be used as group trigger.

CO: r2129 = 0 No selected message has been output.

CO: r2129 > 0 Group trigger.
At least one selected message has been output.
The individual binector outputs BO: r2129 should be investigated.

External triggering messages

If the appropriate binector input is interconnected with an input signal, fault 1, 2 or 3 or alarm 1, 2 or 3 can be triggered via an external input signal.

Once an external fault (1 to 3) has been triggered on the Control Unit drive object, this fault is also present on all associated drive objects. If one of these external faults is triggered on a different drive object, it is only present on that particular drive object.

BI: p2106	–> External fault 1	–> F07860(A)
BI: p2107	–> External fault 2	–> F07861(A)
BI: p2108	–> External fault 3	–> F07862(A)
BI: p2112	–> External alarm 1	–> A07850(F)
BI: p2116	–> External alarm 2	–> A07851(F)
BI: p2117	–> External alarm 3	–> A07852(F)

Note

An external fault or alarm is triggered by a 1/0 signal.

An external fault and alarm do not usually mean that an internal drive message has been generated. The cause of an external fault and alarm should, therefore, be remedied outside the drive.

6.3.3 Propagation of faults

Overview

In the case of faults that are, for example, triggered by the Control Unit or a Terminal Module, central functions of the drive are also often affected. As a result of propagation, faults that are triggered by one drive object are therefore transferred to other drive objects. This response also applies to the faults that are set in a DCC chart on the Control Unit using a DCC block.

Propagation types

The following types of propagation are available:

- BICO
  The fault is propagated to all active drive objects with closed-loop control functions (infeed, drive) to which there is a BICO interconnection.
- DRIVE
  The fault is propagated to all active drive objects with closed-loop control functions.
- GLOBAL
  The fault is propagated to all active drive objects.
- LOCAL
  The behavior of this propagation type is dependent on parameter p3116.
  - For binector input p3116 = 0 signal, the following applies (factory setting):
    The fault is propagated to the first active drive object with closed-loop control functions.
  - For binector input p3116 = 1 signal, the following applies:
    The fault is not propagated.

6.3.4 Alarm classes

Overview

The function permits a higher-level control (SIMATIC, SIMOTION, SINUMERIK, etc.) to have a differentiated control response to alarm messages that are issued on the drive side.

The new statuses act as alarms for the drive, therefore there is **no** immediate reaction from the drive (like for the former level "alarm").

The information regarding the alarm class for SINAMICS S120 drives is illustrated in status word ZSW2 on the bit positions bit 5/6.

Further information

You can find further information on the ZSW2 in Chapter "Cyclic communication" in the SINAMICS S120 Function Manual Communication.

ZSW2 (valid for SINAMICS Interface Mode p2038 = 0; function diagram 2454)

Bit 5 - 6 Alarm classes alarms

- = 0: Alarm (former alarm level)
- = 1: Alarm class A alarms
- = 2: Alarm class B alarms
- = 3: Alarm class C alarms

These attributes for differentiating the alarms are assigned to the appropriate alarm numbers. The reaction to the existing alarm classes in the alarm is defined by the user program in the higher-level control.

Explanations of the alarm classes

- Alarm class A: Drive operation currently not limited
  - E.g. alarm when measurement systems inactive
  - No limitation on current movement
  - Prevent possible switching to the defective measuring system
- Alarm class B: Time-limited operation
  - E.g. prewarning temperature: Without further action the drive may need to be switched off
  - After a timer stage -> additional fault
  - After exceeding a switch-off threshold -> additional fault
- Alarm class C: Functionally limited operation
  - E.g. reduced voltage/current/torque/speed limits (i2t)
  - E.g. continue with reduced accuracy / resolution
  - E.g. continue without encoder

6.3.5 Function diagrams and parameters

Overview

In the following, you will find a list of the relevant function diagrams and an overview of important parameters for messages that are output by an S120 drive.

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

- 8050 Diagnosis - Overview
- 8060 Diagnostics - fault buffer
- 8065 Diagnostics - alarm buffer
- 8070 Diagnostics - faults/alarms trigger word (r2129)
- 8075 Diagnostics - faults/alarms configuration
- 8134 Diagnostics - measuring sockets (T0, T1, T2)

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

- r0944 CO: Counter for fault buffer changes
- p0952 Fault cases, counter
- p2038 IF1 PROFIdrive STW/ZSW interface mode
- p2100[0...19] Changing the fault reaction, fault number
- r2139.0...15 CO/BO: Status word, faults/alarms 1
- p3116 BI: Suppress automatic acknowledgment
- r3120[0...63] Component fault
- r3121[0...63] Component alarm
- r3122[0...63] Diagnostic attribute fault
- r3123[0...63] Diagnostic attribute alarm

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	Gerätestammdaten	Device master data: Describe 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
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	Interessengemeinschaft Automatisierungstechnik der Prozessindustrie	User association of automation technology in the process industry
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
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

Abbreviation	Derivation of abbreviation	Meaning
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
RESM	Reluctance synchronous motor	Synchronous reluctance motor
RFG	Ramp-Function Generator	Ramp-function generator

Abbreviation	Derivation of abbreviation	Meaning
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
SIL	Safety Integrity Level	Safety Integrity Level
SITOP	-	Siemens power supply system

Abbreviation	Derivation of abbreviation	Meaning
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
TN	Terre Neutre	Grounded three-phase line supply
Tn	-	Integral time

Abbreviation	Derivation of abbreviation	Meaning
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 der Elektrotechnik, Elektronik und Informationstechnik	Association of Electrical Engineering, Electronics and Information Technology
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 21.3	- 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 Supplementary System Components - Equipment Manual for Booksize Power Units - 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 System rules, sampling times, DRIVE-CLiQ wiring and number of controllable drives

Overview

The number of controllable drives, infeed units and Terminal Modules that can be operated with the selected Control Unit depends on several system rules, the set sampling times, the control type and the activated additional functions.

There are also still dependencies and rules for the components used and the selected DRIVE-CLiQ wiring.

Further information

Additional information on system rules, rules for DRIVE-CLiQ wiring and the number of controllable drives is provided in the SINAMICS S120 Function Manual, Drive Functions.

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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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