

Edition

12/2023

FUNCTION MANUAL

SINAMICS

SERVO COUP

Technology Extension
SERVO COUPLING (SERVO coupling)

SIEMENS

SINAMICS

Technology Extension SERVCOUP

Function Manual

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Valid for
Technology Extension SERVCOUP,
firmware version 1.2 SP1
for the SINAMICS / SINAMICS Integrated drive
from V4.7, V4.6 HF13, V4.5 HF21

12/2023 V1.2 SP1
A5E38012711B AG

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
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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.
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Disclaimer of Liability

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

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Introduction

1.1 About SINAMICS

Description

With the SINAMICS converter series you can solve drive tasks in the low, medium and DC voltage range. All Siemens drive components, such as converters, motors, and controls, are matched to each other and can be integrated into your existing automation systems.

You can find more information via the SINAMICS YouTube playlist (<https://www.youtube.com/playlist?list=PLw7lLwXw4H53rtHeTeifKtVMr2aXTYt0X>).

1.2 About this manual

1.2.1 Content

Overview

This Function Manual provides a summary of all of the information required to safely and reliably use the Technology Extension.

The Function Manual enables the addressed target groups to commission the Technology Extension and to adapt it to the particular circumstances if necessary.

To illustrate possible application areas for our products, typical use cases are listed in this product documentation and in the online help. These are purely exemplary and do not constitute a statement on the suitability of the respective product for applications in specific individual cases. Unless explicitly contractually agreed, Siemens assumes no liability for such suitability. Suitability for a particular application in specific individual cases must be assessed by the user, taking into account all technical, legal, and other requirements on a case-by-case basis. Always observe the descriptions of the technical properties and the relevant constraints of the respective product contained in the product documentation.

1.2.2 Target group

Overview

This Function Manual addresses the following target groups:

- Project engineers
- Technologists

- Commissioning engineers
- Programmers
- Service and maintenance personnel

1.2.3 Standard scope

Description

This documentation describes the functionality of the standard scope. This scope may differ from the scope of the functionality of the system that is actually supplied. Please refer to the ordering documentation only for the functionality of the supplied drive system.

Further functions may be executable in the system, which are not explained in this documentation. However, there is no entitlement to these functions in the case of a new delivery or service.

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

The machine manufacturer must document any additions or modifications they make to the product themselves.

1.2.4 Websites of third-party companies

Description

This document may contain hyperlinks to third-party websites. Siemens is not responsible for and shall not be liable for these websites and their content. Siemens has no control over the information which appears on these websites and is not responsible for the content and information provided there. The user bears the risk for their use.

1.3 SINAMICS documentation

Description

Comprehensive documentation on the SINAMICS converter series can be found at Siemens Industry Online Support (<https://support.industry.siemens.com/cs/ww/en/view/109807358>).



Figure 1-1 The SINAMICS converter family

You can display documents or download them in PDF and HTML5 format.

The SINAMICS documentation is divided into the following categories:

Table 1-1 SINAMICS documentation

Information	Documentation class	Content
General information	Function Manual	Description, commissioning, and optionally the application (programming or configuring) of functions that can be used in the system or on a machine
	List Manual	Significance, setting options and dependencies of the parameters and messages of the converter
	Commissioning Manual	Complete and detailed description for commissioning a product, system, or plant
	Configuration Manual	Rules, guidelines, and tools for configuring products, systems, and plants. Also contains information on the operating and ambient conditions for hardware and software, the use of functions, as well as on circuit diagrams and terminal diagrams and the installation of software insofar as this is necessary for commissioning.
Device information	Equipment Manual	Compact description of module-specific information, such as properties, connection diagrams, characteristics, technical specifications

Information	Documentation class	Content
Basic information	System Manual	Configuring, installation, wiring and commissioning
	Product Information	Information that only becomes known shortly before or even after start of delivery and is therefore not included in the associated user documentation

1.4 Service and Support

1.4.1 Siemens Industry Online Support on the Web

Important product information is available through Siemens Industry Online Support using the following options:

- Website: SIOS (<https://support.industry.siemens.com/cs/ww/en/>)
- App Industry Online Support (for Apple iOS and Android)

Content of Siemens Online Support

- Product support
- Global forum for information and best practice sharing between users and specialists
- Local contact persons via the contact person database (→ Contact)
- Product information
- FAQs (frequently asked questions)
- Application examples
- Manuals
- Downloads
- Compatibility tool
- Newsletter with product selection
- Catalogs/brochures
- Certificates

For products with QR code, the manual and certificate can be directly called.



1.4.2 Siemens Industry Online Support on the road

Description



Figure 1-2 "Siemens Industry Online Support" app



The "Industry Online Support" 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

There is a data matrix code or QR code on the nameplate of your product. Scan the code using the "Industry Online Support" app (<https://support.industry.siemens.com/cs/ww/en/sc/2067>) to obtain technical information about the device.

The app is available for Apple iOS and Android.

1.4.3 Getting information about the product

Overview

You can use the ID link to get information about your product.

The ID link is a globally unique identifier according to IEC 61406-1.

Requirement

There is a QR code on the product and on the product packaging.



Figure 1-3 QR code with ID link included

You can recognize the ID link by the frame with a black frame corner at the bottom right.

Procedure

Scan the QR code using either a standard code scanner or the "Industry Online Support" app.

When using a standard code scanner, you open the scanned ID link in an Internet browser that is provided on your device.

Result

You can use the ID link to get product data, manuals, declarations of conformity, certificates and other information about your product.

1.4.4 Feedback on the technical documentation

Description

We welcome your questions, suggestions, and corrections for this technical documentation. Please use the "Provide feedback" link at the end of the entries in Siemens Industry Online Support.

Requests and feedback

What do you want to do?

- You have a technical question / problem: Ask the Technical Support
> [Create support request](#)
- You want to discuss in our forum and exchange experiences with other users
> [Go to the Forum](#)
- You want to create CAX data for one or more products
> [Go to the CAX download manager](#)
- You would like to send us feedback on this Entry
> [Provide feedback](#)

Note: The feedback always relates to the current entry / product. Your message will be forwarded to our technical editors working in the Online Support. In a few days, you will receive a response if your feedback requires one. If we have no further questions, you will not

Figure 1-4 Requests and feedback

1.4.5 mySupport documentation

Description

With the "mySupport documentation" web-based system, you can compile your own individual documentation based on Siemens content and adapt this for your own machine documentation.

To start the application, click the "My Documentation" tile on the mySupport homepage (<https://support.industry.siemens.com/cs/ww/en/my>):

mySupport Links and Tools

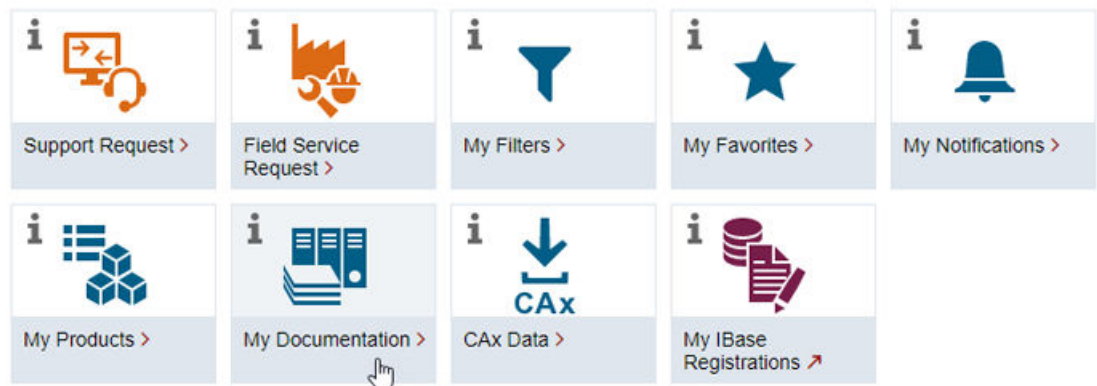


Figure 1-5 mySupport

The configured manual can be exported in the PDF or XML format.

Siemens content that supports the mySupport documentation can be identified by the "Configure" link.

1.4.6 Technical support

Description

Your routes to technical support (<https://support.industry.siemens.com/cs/ww/en/sc/4868>):

- Support Request (<https://www.siemens.com/SupportRequest>)
- Contact person database (https://www.automation.siemens.com/aspa_app)
- "Industry Online Support" mobile app

The Support Request is the most important input channel for questions relating to products from Siemens Industry. This will assign your request a unique ticket number for tracking purposes. The Support Request offers you:

- Direct access to technical experts
- Recommended solutions for various questions (e.g. FAQs)
- Status tracking of your requests

Technical support also assists you in some cases via remote support (<https://support.industry.siemens.com/cs/de/en/view/106665159>) to resolve your requests. A Support representative will assist you in diagnosing or resolving the problem through screen transfer.

More information on the Support service packages is available on the Internet via the following address (<https://support.industry.siemens.com/cs/ww/en/sc/4869>).

1.4.7 Training

Description

SITRAIN – Digital Industry Academy offers a comprehensive range of training courses on Siemens industrial products – directly from the manufacturer, for all industries and use cases, for all knowledge levels from beginner to expert.

More information can be found on the Internet via the following address (<https://www.siemens.com/sitrain>).

1.5 Important product information

1.5.1 Updates and constraints

Description

Please refer to the relevant standards list for constraints applicable to the Technology Extension. Please refer to SIOS for updates to the Technology Extension.

1.5.2 Open-source software (OSS)

Description

The license conditions and copyright information of the open-source software components used by Technology Extensions are contained in the readme.

1.5.3 Compliance with the General Data Protection Regulation

Siemens observes standard data protection principles, in particular the data minimization rules (privacy by design).

For this product, this means:

The product does not process or store any personal data, only technical function data (e.g. time stamps). If the user links this data with other data (e.g. shift plans) or if he/she stores person-related data on the same data medium (e.g. hard disk), thus personalizing this data, he/she must ensure compliance with the applicable data protection stipulations.

Fundamental safety instructions

2.1 General safety instructions

 WARNING
Danger to life if the safety instructions and residual risks are not observed If the safety instructions and residual risks in the associated hardware documentation are not observed, accidents involving severe injuries or death can occur. • Observe the safety instructions given in the hardware documentation. • Consider the residual risks for the risk evaluation.

 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 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.

2.3 Securing data integrity

Securing the integrity of the data required for installation

When installing the Technology Extension, the Startdrive commissioning tool checks the integrity of all data that are required to install the Startdrive commissioning tool.

You can only carry out a successful installation if the integrity of all data has been verified.

Securing the integrity of data during operation

Once you have successfully installed the Technology Extension, the continuous integrity and authenticity of the data generated by and transferred by the Startdrive commissioning tool is ensured.

In operation, at each power on, the device checks the integrity of the technology packages that were loaded into the device.

2.4 Cybersecurity information

Siemens provides products and solutions with industrial cybersecurity 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 cybersecurity 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 cybersecurity measures that may be implemented, please visit
<https://www.siemens.com/cybersecurity-industry>.

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 Cybersecurity RSS Feed under
<https://new.siemens.com/cert>.

Further information is provided on the Internet:

Industrial Security Configuration Manual

**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 state-of-the-art, integrated industrial cybersecurity concept for the installation or machine.
- Make sure that you include all installed products in the integrated industrial cybersecurity concept.
- Protect files stored on exchangeable storage media from malicious software by with suitable protection measures, e.g. virus scanners.
- Carefully check all cybersecurity-related settings once commissioning has been completed.

Applications and features

3.1 Applications

SERVCOUP

Technology Extension SERVCOUP (SERVO COUPLING) is a SINAMICS extension for the SERVO drive object.

In the SERVO control mode, SERVCOUP allows motors to be operated which, as a result of their size and/or type of construction, cannot be operated from an individual SINAMICS power unit. These motors are split up into several drive objects, each of which can be operated on a Motor Module, and can be coupled with one another. As a consequence, the individual drive objects can be seen as section motors with their own winding and terminals.

Irrespective of the number of coupled drive objects, only one encoder is required for the operation of the motor because Technology Extension SERVCOUP implements a digital encoder splitter in the Control Unit. The encoder actual values, together with the setpoints, are transferred to all coupled follower drive objects in this way.

When compared to hardware-based solutions, this provides advantages regarding wiring costs, degree of ruggedness and the number of hardware components required.

Supported motors

Similar motors must be rigidly mechanically coupled with one another when using the SERVO coupling.

Fundamentally, operation is possible with the following motors:

- Segment motors (axial and radial)
- Direct drives (linear and rotary)
- Double and multi-winding motors (induction and synchronous)
- Mechanically coupled complete motors (induction and synchronous)

Technology Extension SERVCOUP is generally released for the following SIMOTICS motors:

- 1FE2 (built-in spindle motor)
- 1FN3 (linear motor)
- 1FW4 (torque motor)
- 1FW6 (torque motor)
- 1FW68 (segment motor)
- 1FW3 (torque motor)
- 1PH8 (induction and synchronous)

3.2 Features

The following applies to third-party motors:

- The motors always must comply with the specifications of the system manual "Requirements placed on third-party motors".
- In addition, the constraints applicable to SERVCUP must be checked and complied with, see "Function description (Page 25)".

3.2 Features

Attributes of the Technology Extension SERVCUP

In comparison to closed-loop control via analog encoder splitter, Technology Extension SERVCUP offers the following advantages:

- Simpler to use
- Higher degree of ruggedness
- Fewer hardware components

Additional functional attributes:

- Support of incremental and absolute encoders
- Safety Basic Functions possible on all drive objects and Safety Extended Functions on the master drive object
- Drive integrated diagnostic function Safe Brake Test possible
- Automatic fault handling between master and follower drive objects
- The angular offset between master and follower drive objects can be set to compensate for a difference in the electrical position or a mechanical offset.
- Check of torque coupling for a specified tolerance window
- Support of induction motors through integrated slip controller

System integration

Technology Extension SERVCUP is used for servo control in conjunction with the following systems:

- SINAMICS S120/S150 (CU320-2)
- SINAMICS Integrated (SINUMERIK ONE, SINUMERIK 840D sl, SIMATIC DC, SIMOTION D4x5-2)

The following SINAMICS firmware versions support Technology Extension SERVCOUPL:

- SINAMICS S120/S150
 - from V4.5 HF21 or from V4.6 HF13 or from V4.7 and higher with STARTER
 - from V5.2 and higher with Startdrive
- SINAMICS Integrated
 - SINAMICS V5.2 and higher with SINUMERIK ONE (SINUMERIK SW V6.13 and higher)
 - SINAMICS V4.5 HF21 and higher with SINUMERIK 840D sl (SINUMERIK SW V4.5 SP3 and higher)
 - SINAMICS V5.2 and higher with SIMATIC Drive Controller (SIMATIC Drive Controller V2.9 and higher)
 - SINAMICS V4.5 and higher with SIMOTION D4x5-2 (SIMOTION SW V4.3 SP1 and higher)

Commissioning tools

The following commissioning tools are supported:

- SINAMICS Startdrive, V16 and higher
- SINUMERIK Operate version 4.4 or 6.13 or higher
- STARTER version 4.3 SP1 or higher
- Create MyConfig version 4.6 or higher

License key

You require a license key for Technology Extension SERVCOUPL.

Further information is available in Section "Overview for commissioning TEC SERVCOUPL (Page 117)".

Terms in this manual

Drive object

The term "drive object" covers individual segments of segment or linear motors, windings of double- and multi-winding motors and individual primary sections / stators of large direct motors.

Master drive object

Drive object to which the encoder (motor encoder) is assigned. In Technology Extension SERVCOUPL, this drive object is parameterized as MASTER. Of all of the coupled drive objects, the master drive object must have the lowest drive object number.

Follower drive object

Drive object with deactivated encoder interface, which receives setpoints and actual encoder values from the Technology Extension SERVCOUPL, and which is parameterized as FOLLOWER in it.

3.2 Features

Motor

The motor encompasses all of the coupled drive objects, comprising a minimum of one master drive object and up to 5 follower drive objects. The type of motor is irrelevant - the term encompasses segment motors, direct drives and double/multi-winding motors.

SINUMERIK HMI

In this manual, SINUMERIK HMI refers generally to the interface between the user and the control system. When commissioning, the HMI appropriate for the associated SINUMERIK version must have been installed (e.g. HMI Operate or HMI-Advanced).

Torque/force

In this Function Manual, it is assumed that a rotary motor will be used, and therefore the term "torque" has been chosen. If a linear motor is used, this term should be replaced with "force" at the relevant places.

4.2 Supported motors

For motors with fewer drive objects, several SERVO couplings can be operated on one Control Unit. One possible application is operating two SERVCOUPL-controlled double-winding motors on one Control Unit.

Reference

The functionality of Technology Extension SERVCOUPL can be seen in function diagram "Figure 8-1 7335 – SERVO coupling structure (Page 154)".

4.2 Supported motors

In principle, direct drives, double and multi-winding motors as well as segment motors are supported.

Carefully observe the motor specifics listed here when operating Technology Extension SERVCOUPL.

4.2.1 Segment motors

For segment motors, several motor segments can be connected to one Motor Module. The number of segments per Motor Module is specified in p0306 (configuration example: p0306 = 3).

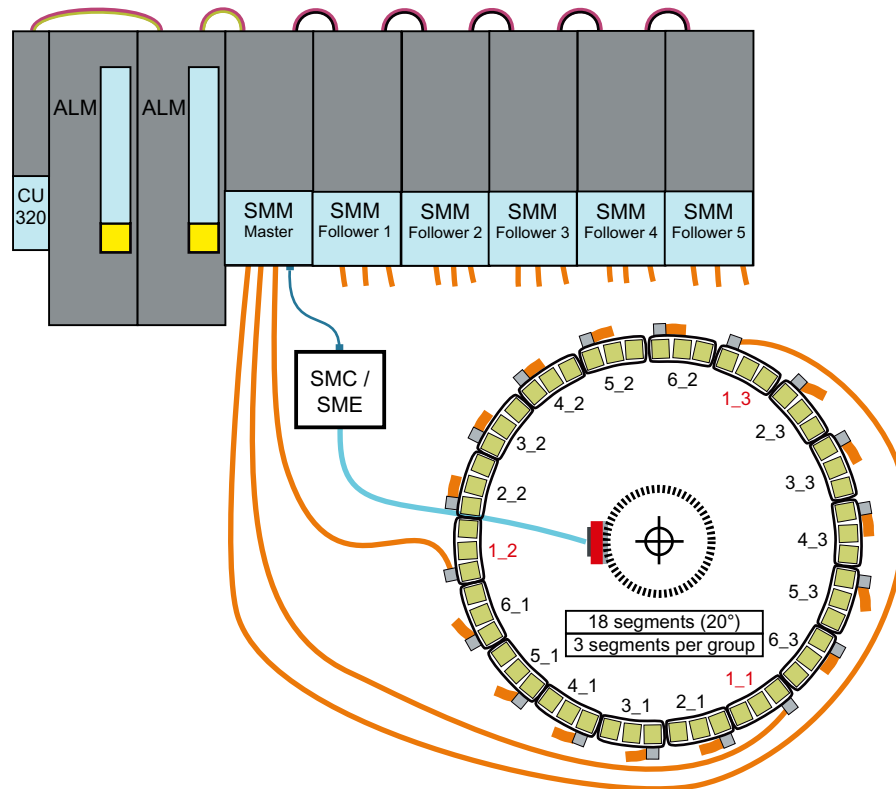


Figure 4-2 Configuration for segment motors

4.2.2 Direct drives

With Technology Extension SERVCOU, direct drives can be operated, which can no longer be connected in parallel to a Motor Module. Instead, the individual drives are coupled in the Technology Extension SERVCOU and operated as a motor group.

Precondition

The following preconditions apply when using direct drives with Technology Extension SERVCOU:

- A rigid mechanical coupling
- The same number of pole pairs or pole pair width

Linear motors

Examples of Technology Extension SERVOCOUP applications with linear motors:

- Operation on a common secondary section track
- Operation on the other track for linear motors in a double-comb arrangement

Torque motors

Examples of Technology Extension SERVOCOUP applications with torque motors:

- Operation on a common shaft
- Operation involving very large swiveling axes on an extremely rigid cast iron rocker assembly

If the coupled motors are arranged opposing one another, then you must adapt the motor direction of rotation so that the SERVOCOUP setpoints act in the same direction. To do this, either set parameter p1821 (direction of rotation), or adapt the phase sequence in the motor feeder cable.

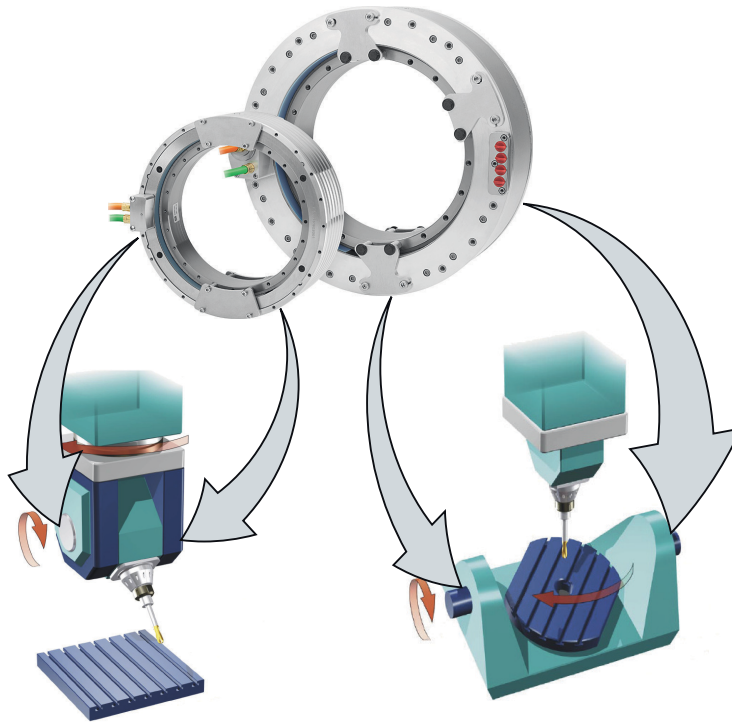


Figure 4-3 Application example SERVOCOUP (left: Fork-type milling head, right: swiveling table)

4.2.3 Double- and multi-winding motors

With Technology Extension SERVOCOUP, synchronous and induction motors can be used.

Motors with several winding systems in a common enclosure

For motors with overlapping or adjacent winding systems in a common enclosure ensure the following:

- p31743 must be set to a value of "0" (p31743 = 0).
- All windings are electrically isolated (each winding has its own neutral point).
- The degree of magnetic coupling is less than 10%.
 - For motors with a degree of magnetic coupling between 10% and 20%, the following applies:
Contact Siemens Support, to clarify as to whether the motors can be used.
 - For motors with a degree of magnetic coupling > 20%, the following applies:
It is not permissible that the motor is used.
- Offset clocking has not been parameterized, see the appropriate section below and "No offset clocking for multi-winding motors (Page 119)".
- The commutation angle offset p31748 is set corresponding to the motor being used.
 - The following applies for synchronous motors: The commutation angle offset has been determined, and set corresponding to the follower drive objects, see "Determining the commutation angle offset (Page 119)".
 - The following applies for induction motors: The commutation angle offset p31748 must be set to 0. Exception: For an inverse polarity at the segment transitions, p31748 = 180 must be set.

Synchronous motors

For synchronous motors equipped with incremental encoders, before the follower drive objects are switched on for the first time, perform a pole position identification at the master drive object. Take this into consideration later for the switch-on sequence of the drive objects, see "Table 6-6 Switch-on sequence of the drive objects (Page 131)".

If a commutation angle offset is obtained as a result of the mechanical arrangement, then this must be corrected using angle offset p31748, see "Determining the commutation angle offset (Page 119)".

Induction motors

Induction motors, also those that can be operated using a conventional encoder splitter, are suitable for operation with the Technology Extension SERVOUP. The section motors that are used should be identical, and should not differ regarding the motor pole pair number (p0314) and motor rotor time constant (r0384).

For induction motors, the pole position angle changes continuously as it is formed from the rotor angle and slip velocity; however, these change as a function of the current and temperature actual values. Without applying dynamic correction, the pole position angle between the master and follower drive objects would drift in operation; this could result in problems, especially for motors with overlapping windings in a common enclosure. For induction motors, Technology Extension SERVOUP dynamically controls the commutation angle offset, and ensures that the pole position angle between the master and follower drive objects is controlled to obtain the lowest possible deviation.

Setting p31748:

- For induction motors with windings in a separate enclosure (p31743 = 1), it is recommended that p31748 is kept = 0.
- For induction motors with overlapping winding systems or winding systems that are adjacent to one another in a common enclosure (p31743 = 0), then p31743 = 0, or p31743 = 180 (for inverse polarity of the windings) must be set.

Note

Correction for an inverse polarity at the segment transitions, e.g. as a result of a winding that has been rotated.

Infrequently, it can occur that the same poles are created at the segment transitions of the section motors. In this case, the polarity of the follower drive object can be corrected using p31748 = 180.

Offset clocking for double/multi-winding motors

You must ensure that no offset clocking is parameterized for motors with overlapping or adjacent winding systems in a common enclosure. As a consequence, carefully observe the following settings when commissioning the system:

- p1800, p1810, p1816 and p1819 must have identical settings on all drive objects.
- p1815.0 must have a value of "1" on all drive objects.
- p31743 must be set and remain at a value of "0".

When commissioning the Single Motor Modules described in this manual, the follower drive objects are created as copies of the master drive object. This procedure ensures that the parameter settings on all drive objects and in all data sets are identical.

When using Double Motor Modules, the commissioning differs, see "Using Double Motor Modules (Page 91)". The drive objects are not copied, and the user must manually assign the correct parameters when commissioning the hardware.

When commissioning Technology Extension SERVCUP, users must carefully set and check the parameters relevant for offset clocking, see "No offset clocking for multi-winding motors (Page 119)". In addition, TEC SERVCUP checks the corresponding parameters and possibly outputs A53470 with the corresponding alarm value.

4.2.4 Coupled complete motors

If the torque of a single motor is not sufficient for the drive requirement, distribute the required torque over two or more motors. The motors must be coupled mechanically, i.e. mounted on the same shaft or interconnected via gearing with the same gear ratio. Motor coupling is carried out via the Technology Extension SERVCUP.

Precondition

The following prerequisites apply when using the Technology Extension SERVCOUPL with multiple complete motors:

- A rigid mechanical coupling
- Use of suitable motors
 - Recommendation: Use of identical motors
 - Alternative: Motors with the same number of pole pairs or pole pair width

Examples

Examples of applications with coupled complete motors:

- Operation of built-in motors, for example 1FW6 and 1FE2, mounted on a common shaft, e.g. a fork-type milling head.
If the coupled motors are arranged opposite each other on a single shaft, then you must adapt the direction of rotation of one motor so that the SERVCOUPL setpoints act in the same direction. To do this, either set parameter p1821 (direction of rotation), or adapt the phase sequence in the motor feeder cable.
- Operation of complete motors such as the 1PH8 on coupled, opposed shafts, e.g. for paper crosscutting machines.

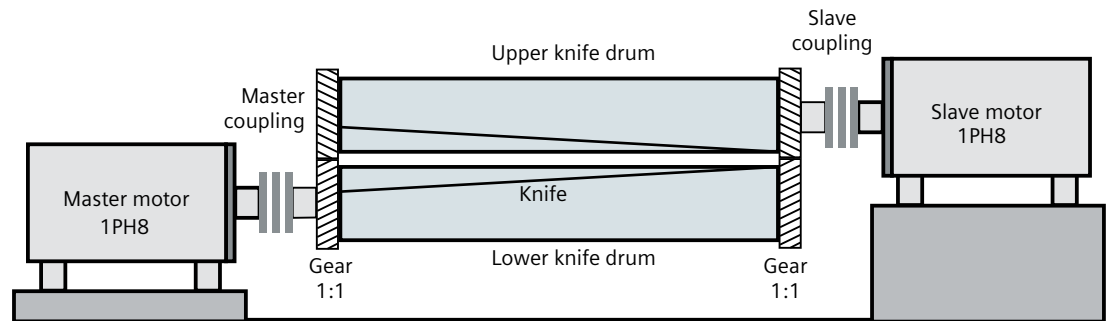


Figure 4-4 Application example for SERVCOUPL: Paper crosscutting machine with two 1PH8 motors

4.3 Notes for commissioning motors

General information

Of all of the coupled SERVO drive objects, the master drive object must have the lowest drive object number. All drive objects must always be identically parameterized - the decisive criterion is the parameterization of the master drive object. The important parameters that must be taken into account are in Appendix "Parameters relevant for operation of Technology Extension SERVCOUPL (Page 161)".

Identical parameterization means that on coupled axes, the same number of data sets are set - and the various indices are parameterized the same. This is guaranteed when commissioning the hardware as described here using STARTER and CMC-Topo / CMC-Expert,

4.3 Notes for commissioning motors

as the follower drive objects are created as copies of the master drive object. This must be especially taken into account when commissioning using SINUMERIK HMI.

"Temperature sensor via encoder" (p0600 = 1) can be used to monitor the temperature of the master drive object. A TM120 Terminal Module must be used to evaluate the temperature of follower drive objects, see also "Temperature evaluation (Page 90)".

When commissioning the motor, note that a distinction must be made as to whether the motor is defined using the motor data as complete motor (e.g. 1FE2) - or as section motor (e.g. 1FN3).

Description as complete motor (double and multi-winding motors)

If the motor is defined as complete motor using the motor data (e.g. 1FE2), then you must parameterize the motor, which is split up into n drive objects and operated at n Motor Modules, according to the following mapping rule:

- All current, torque, power and inertia data of the motor must be divided by the number of drive objects n.
This also applies to the specified current, torque and power limits as well as to the reference variables p2002 and p2003.
- All resistance and inductance values must be multiplied by the number of drive objects n.
- All other variables remain the same.

For these motors, when commissioning, the motor values must always be adapted. There are two ways of doing this:

	Parameterization as listed motor	Parameterization as third-party motor
Advantage	When commissioning, all of the relevant parameters for the complete motor are correctly set. Some of these values can be adopted without any changes.	Motor parameters have to be entered once; subsequent adaptation not required.
Disadvantage	After completing the commissioning wizard, the write protection must be cancelled via the expert list and some default settings corrected (see above).	All of the motor data must be known and must be manually entered.

Description as section motor (e.g. linear motor, segment motor)

If the motor is defined as section motor via the motor data (e.g. 1FN3 linear motor), then the section motors correspond to the SERVCUP drive objects. This means that the motor data does not have to be converted and adapted in the expert list, which is necessary when commissioning motors defined as complete motor.

Special issue when commissioning segment motors

Segment motors can be commissioned using the data sheet provided, which refers to the individual segments. If several motor segments are connected to one Motor Module, then the number of segments per Motor Module must be specified in p0306. It is not necessary to convert or adapt the motor data.

Special features when using SERVCOU

"Cogging torque compensation" function module

With this software release, only the master drive object allows simultaneous use of the "Cogging torque compensation" (r0108.22) function module and Technology Extension SERVCOU.

If necessary, please contact Siemens Support for possible solutions for the entire drive line-up, e.g. using the Technology Extension POLYGON (Polygonal Line) in conjunction with the supplementary torque input p31756.

Using tuning functions

Tuning function "Auto Servo Tuning (AST)" was tested with Technology Extension SERVCOU, and has been released for use. You can find notes on use in "Using automatic servo tuning (Auto Servo Tuning - AST) (Page 133)".

As a consequence, the use of Technology Extension SERVCOU with other tuning functions (for example One Button Tuning (OBT) or online tuning) has not been tested, and is therefore not permissible.

4.4 SINAMICS Safety Integrated / SINUMERIK Safety Integrated

The functions of Technology Extension SERVCOU are not part of the "Safety Integrated Functions"; they influence neither SINAMICS nor SINUMERIK Safety Integrated Functions.

Common terminology associated with SINAMICS is used in the following. An overview of "SINAMICS Safety Integrated Functions" and their equivalent for SINUMERIK are provided in the Appendix "Function designations of Safety Integrated for SINAMICS and SINUMERIK (Page 165)".

Note

You can find further information about "Safety Integrated" in the following references:

- SINAMICS S120 Safety Integrated Function Manual
 - SINUMERIK ONE Safety Integrated Function Manual
 - SINUMERIK 840D sl/SINAMICS S120 SINUMERIK Safety Integrated Function Manual
-

Safety Integrated with Technology Extension SERVCOU

When using Safety Integrated with Technology Extension SERVCOU, the following applies:

- "SINAMICS Safety Integrated Basic Functions" are possible on all drive objects and must be identically parameterized and synchronously triggered on all drive objects.
- "SINAMICS Safety Integrated Extended Functions" - or the system-integrated safety functions of SINUMERIK - are only possible on the master drive object as an encoder is only connected to this.

- If an STO is triggered on the master drive object (either directly or as a subsequent response of another safety function), the STO must be passed on to the follower drive objects on an application-specific basis. This is implemented via PROFIsafe using an F-PLC or a safely programmable logic, and there is an example in Chapter "Example of transferring Safety Integrated Functions from the master drive object to the follower drive objects. (Page 34)".
- The diagnostic function "Safe Brake Test" (SBT) can be executed as a "SINAMICS Safety Integrated Extended Function" only on the master drive object. During the test, SERVCOUPL takes control of the coupled follower drive objects. More detailed information is provided in Chapter "Safe Brake Test (Page 37)".

4.4.1 Example of transferring Safety Integrated Functions from the master drive object to the follower drive objects.

Internal SERVCOUPL transfer of Safety Functions (e.g. SS1)

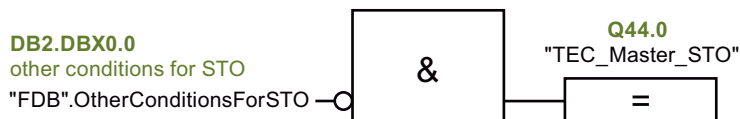
If the monitoring speed of the Safely-Limited Speed (SLS) is violated at the master drive object, the parameterized safety stop response SS1 is triggered at the master drive object. The follower drive objects of the master braking response and the complete drive line-up are subsequently shut down by the torque/force setpoint coupling of SERVCOUPL.

Transferring Safety Functions via a safety program (e.g. STO)

If an STO is active at the master after a safety stop response (e.g. SS1), then STO must be transferred to the follower drive objects via the safety program. This transfer can be realized as follows:

I44 is the PROFIsafe status word S_ZSW1 of the SERVCOUPL master drive object
 Q44 is the PROFIsafe control word S_STW1 of the SERVCOUPL master drive object
 Q50 is the PROFIsafe control word S_STW1 of the SERVCOUPL follower drive object

□ **Network 1:** STO for the SERVCOUPL master drive object



□ **Network 2:** STO for the SERVCOUPL follower drive object

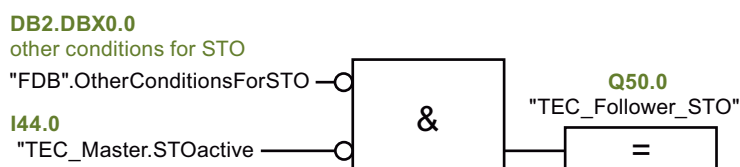


Figure 4-5 Example for transferring STO via the safety program

The following maximum response times must be carefully observed:

$$s = t_Bus1 + t_Fplc + t_Bus2 + t_K + t_Resp$$

- t_Bus1 = maximum transfer time from SINAMICS to F-PLC
- t_Bus2 = maximum transfer time from the F-PLC to SINAMICS
For t_Bus1 and t_Bus2 , you must take into account that faults in the communication between the F-CPU and the converter can result in a safety function only being selected after the PROFIsafe monitoring time (F_WD_Time) has expired.
- t_Fplc = maximum processing time of the safety program in the F-host
- t_K = time for internal communication within the SINAMICS module
- t_Resp = response time of the requested stop response

Note

For a detailed description of the response times, please refer to the following documentation:

- SINAMICS S120 Safety Integrated Function Manual, Chapter on "Response times"
-

4.4.2 Using the drive integrated diagnostic function "SBT"

4.4.2.1 Overview

This chapter describes the use of SERVCUP with the drive integrated SBT (Safe Brake Test).

The diagnostic function SBT can only be configured and executed at the master drive object because only this drive object has an encoder. For this reason, there are some differences (described below) in the preparation and evaluation of the SBT compared to single-axis applications. The actual performance of a drive integrated SBT at the master drive object remains unchanged. SERVCUP internally calculates the brake test torque of the follower drive objects and outputs additional information.

Note

There is more information about performing a drive integrated "Safe Brake Test" in the following references:

- SINAMICS S120 Safety Integrated Function Manual
Chapter on "Safety Integrated Extended Functions/SBT"
 - SINAMICS S120 List Manual
Function diagram 2836
 - SINUMERIK ONE Safety Integrated Commissioning Manual
Chapter on "Drive Integrated Safety Functions/SBT"
 - SINUMERIK 840D sl Safety Integrated plus Commissioning Manual
Chapter on "Drive Integrated Safety Functions/Safe Brake Test (SBT)"
-

Note**Differences with SINUMERIK-based SBT**

The SINUMERIK-based SBT works for SINUMERIK 840D sl if SERVCUP is used because in terms of the numerical control, all SERVCUP drive objects are excited in parallel.

There is more information about performing a SINUMERIK-based "Safe Brake Test" in the following reference:

- SINUMERIK 840D sl Safety Integrated (system integrated) Function Manual Chapter on "Sensor/Actuator Integration/SBT"
-

The notes below apply to the following drive/brake combinations:

- coupled drive objects with one shared motor holding brake
- coupled drive objects with one shared external holding brake
- coupled motors each with its own motor holding brake

4.4.2.2 Preparation

It is a basic prerequisite that the drive and Technology Extension SERVCUP have been fully commissioned.

To perform the SBT, the master driver object and all coupled follower drive objects must be enabled.

Brake control

It is a prerequisite that the brakes have been fully and correctly commissioned, taking account of any special circumstances. In a gantry line-up with 2 motors and 2 brakes, for example, make sure before starting the SBT that the brake of the follower drive object closes and opens synchronously with the brake of the master drive object. Note that the brake closing time of the drive must cover the closing times of all brakes that will close synchronously. However, the brake closing time of the drive should not be set too high in order to avoid excessive brake wear.

Setting the torque tolerance and the brake holding torque

All the settings with relevance for the SBT take place at the master drive object.

The brake holding torque p10209[0...1] depends on the number of SERVCUP drive objects. For this reason, the holding torque for the SBT must be set as a proportion at the master drive object. Using the scaling settings in p31744 of the follower drive objects, Technology Extension SERVCUP internally calculates the torque of the follower drive objects.

The example below shows how to calculate the value for p10209[0...1] "SBT brake holding torque" that must be set at the master drive object. Generally:

$$p10209[0...1] = \text{Holding torque_total} / (r31753 / 100\%)$$
Example:

The motor consists of 1 master and 1 follower drive object with a shared mechanical brake. A scaling factor of p31744 = 100% is set for the follower drive object and the motor brake must be able to handle the maximum holding torque of 500 Nm.

In this case, the holding torque to be set for the master drive object is calculated as follows:
 $\text{Master_p10209[0]} = 500 \text{ Nm} / (200\% / 100\%) = 500 \text{ Nm} / 2 = 250 \text{ Nm}$

OPTIONAL: interconnect parameters to be recorded

If the SBT will be evaluated in a higher-level control system, apply the settings described at the end of this chapter.

For analysis purposes, it is also recommended to record the parameter r31752 "torque actual value total".

4.4.2.3 Safe Brake Test

Performance

Technology Extension SERVCUP detects the request for a brake test via the "SI Safety Info Channel status word S_ZSW3B" and therefore independently of the setting in p10203 ("SI Motion SBT control selection").

If r10234.1 = 1 signal is present ("setpoint entry drive") at the master drive object, SERVCUP carries out these steps:

- When a safety cycle ends (p9500), the follower drive objects are loaded with the relevant p31744-scaled brake test torque of the master drive object (r1651).
- The r31750.7 bit is set to = 1 signal ("Copy follower torque setpoint function generator / SBT").

Evaluation

The SBT checks the movement at the physical encoder of the master drive object and checks whether the holding torque Master_p10209[0...1] has been reached. In a drive line-up with mechanical coupling, a movement initiated from the follower drive object is also detected at the master drive object and is included in the evaluation of the position tolerance (p10212/p10222).

The SBT is successful from the point of view of SERVCUP if

- the brake test completed successfully at the master (r10234.4 = 1 signal)
- the sum of test torque (shown in r31752) and static load torque (r10241) was large enough for the brake test
(see also the function diagram/the relevant chapters of the books listed as references)
- the torque tolerance between master and follower(s) was respected. The r31750.10 status bit "Master torque coupling tolerance OK" must be = 1 signal throughout the SBT. If the r31750.10 bit changes to = 0 signal during the SBT, the torque actual value at a follower drive object was outside the tolerances defined by p31758.
For possible causes and remedies, see Chapter "Setting the torque tolerance (Page 136)".

4.4.2.4 Optional: interconnect the evaluation to a higher-level control system with cyclical PROFIdrive telegrams

Note

The following description is only valid for SINAMICS version V5.2 SP3 or higher

The manufacturer-specific PROFIdrive telegrams 146, 148 and 149 are not available until SINAMICS version V5.2 SP3 and SINUMERIK version 6.14 (for SINUMERIK ONE) or 4.94 (for SINUMERIK 840D sl).

The r31750.10 status bit can be interconnected to an input signal of the AND or OR logic operation in the drive object. The result of these logic operations is automatically interconnected in status word ZSW7 in the manufacturer-specific PROFIdrive telegrams 146, 148 and 149 and can be read out by the higher-level control system using corresponding axis interface bits.

Example 1: Interconnection via "OR operation"

- p2816[0] = Master_r31750.10 "Master torque coupling tolerance OK"
- p2816[1] = 0 signal (factory setting)

The result of the operation is contained in r2817.0 (1 = "OR condition satisfied").

In the manufacturer-specific PROFIdrive telegrams 146, 148 and 149, the r2817.0 signal is automatically interconnected to status word 7 (ZSW7.7). For further processing in the higher-level control system, the signal is available in the interface bit Achs-DB.DBX191.7.

Example 2: Interconnection via "AND operation"

- p2810[0] = Master_r31750.10 "Master torque coupling tolerance OK"
- p2810[1] = 1 signal

The result of the operation is contained in r2811.0 (1 = "AND condition satisfied").

In the manufacturer-specific PROFIdrive telegrams 146, 148 and 149, the r2811.0 signal is automatically interconnected to status word 6 (ZSW7.6). For further processing in the higher-level control system, the signal is available in the interface bit Achs-DB.DBX191.6.

Further processing in the higher-level control system

In addition to the status bit "Master torque coupling tolerance OK", the status bit "Brake test active" (r10234.3) must also be evaluated. This status bit is contained in the Safety Info Channel status word SIC S_ZSW3B and is therefore available to the higher-level control system in the interface bit Achs-DB.DBX173.3.

The SBT is **not** successful from the point of view of the control system if during an active brake test (Achs-DB.DBX173.3 = 1 signal) the tolerance of the torque coupling was not respected (Achs-DB.DBX191.7 or Achs-DB.DBX191.6 = 0 signal). In this situation, a user-specific response should be created.

Installing and activating

5.1 Overview of installation and activation

The subsequent installation descriptions in this chapter refer to the fictitious Technology Extension "ABC_OA". The procedure described can be analogously applied to any real Technology Extension.

Precondition

- The basic commissioning of the control system and the drive or drive object has been completed.
- The Technology Extension requires additional CPU time. Therefore, verify that there are sufficient resources available before activating the Technology Extension. Do this by checking the system utilization (r9976).
The table for the additional CPU time utilization by the Technology Extension can be found in Chapter "Sampling times and number of controllable drives (Page 87)".

Commissioning tools

A Technology Extension (TEC) can be installed in the following ways:

- Startdrive commissioning tool
- SINUMERIK Operate (SINUMERIK control system with SINAMICS Integrated)
- STARTER commissioning tool
- SIMOTION SCOUT engineering software with integrated STARTER

Refer to the readme file for suitable commissioning tools to install the Technology Extension described in this manual.

Terms

Technology Extension (TEC)

Software component that is installed as an additional technology function and that expands the functionality of the SINAMICS drive system. A Technology Extension is also known as an OA application (OA, Open Architecture).

Installation package

The Technology Extension is supplied in a software package, which in turn comprises several installation packages for different target systems and commissioning tools.

The following installation packages can be included:

- ABC_OA_V1_1.tec for installation with Startdrive
- rmed_abc_oa_v1_1_oaif04402300.tgz for installation with SINUMERIK Operate
- oasp_abc_oa_v1_1_oaif04402300.zip for installation with STARTER (SIMOTION SCOUT)

The file name of the installation package for the fictitious Technology Extension ABC_OA comprises the following elements:

- oasp = OA Support Package (only for STARTER / SIMOTION SCOUT)
- rmed = RunMyEngineeredDrive (only for SINUMERIK)
- abc_oa = name of the Technology Extension
- v1_1 = version of the Technology Extension
- oaif04402300 = OA interface version (OA interfaces version, only for STARTER and SINUMERIK)
Version of the SINAMICS firmware from which this Technology Extension can be used (04402300 = V4.4).

5.2 SINAMICS Startdrive

5.2.1 Requirements for installation using Startdrive

This description on how to install and commission a Technology Extension is applicable when using the Startdrive commissioning tool (Basic or Advanced).

Devices

This general description applies to:

- SINAMICS S120, S150, G130, G150, MV (CU320-2)
- SINAMICS S120 (CU310-2)
- SIMATIC Drive Controller

Preconditions

1. The Startdrive commissioning tool must be installed with version V16 or higher.
2. The installation package for Technology Extension ABC_OA (ABC_OA_V1_2.tec) must be in a known directory.

5.2.2 Installing and activating the Technology Extension

5.2.2.1 Installing Technology Extension

In the following, the Technology Extension ABC_OA (version V1.2) is installed in the Startdrive.

After the installation, Technology Extension ABC_OA is available for all projects and drive objects.

Preconditions

1. The Startdrive commissioning tool is open.
2. A project has been created, or an existing project is open.

Procedure

Proceed as follows to open the screen form for the Technology Extension:

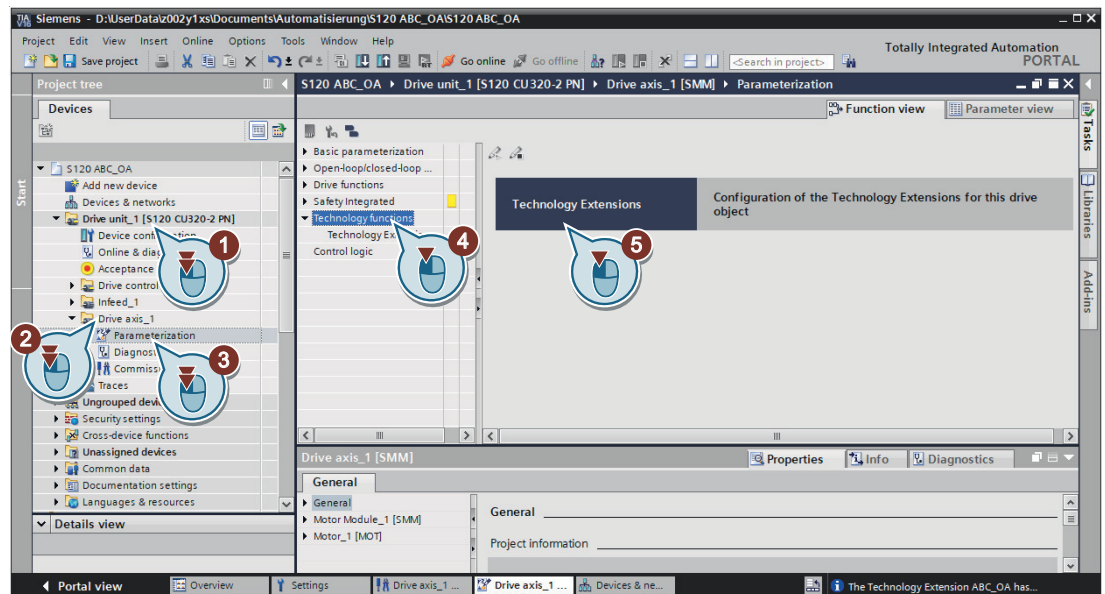
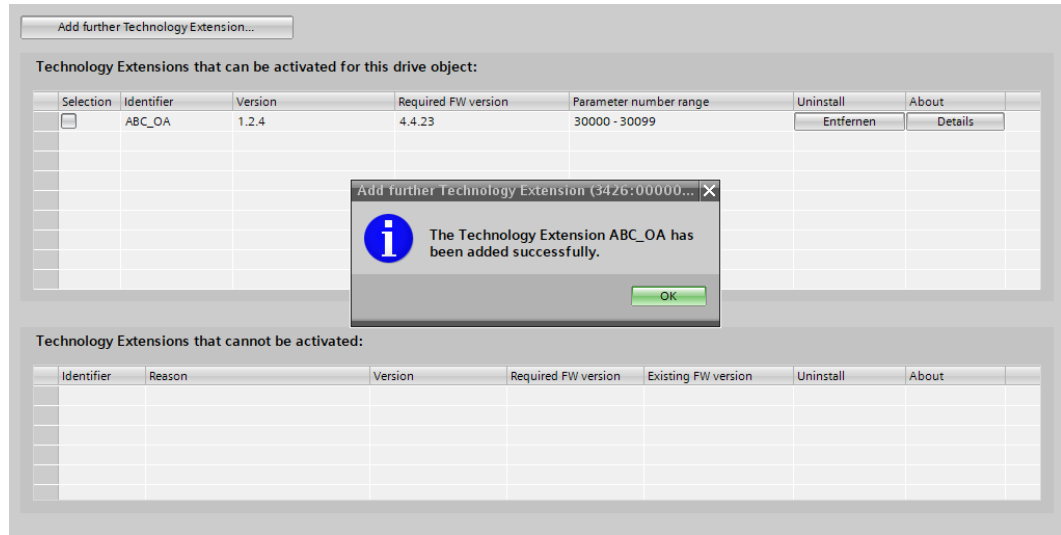


Figure 5-1 Overview

1. In the "Project tree" window, double-click on "Drive unit" ① > "Drive axis" ② > "Parameterization" ③.
The function view for parameterization opens in the "Working area" window.
2. In the "Working area" window, double-click on "Technology functions" ④ and click on "Technology Extensions" ⑤.
The screen form for "Technology Extensions" opens.

Proceed as follows to add Technology Extension "ABC_OA":

1. In the "Technology Extensions" screen form, click on "Add further Technology Extension...". An "Open file" dialog window opens.
2. Navigate to the folder in which the installation package for Technology Extension "ABC_OA" is located, select file "ABC_OA_V1_2.tec" and click on "Open".
Technology Extension "ABC_OA" is added to your Startdrive installation, and a dialog window informs you whether the operation was successful.
Click on "OK" to close the dialog window.



If the Technology Extension can be activated at this drive object, then the Technology Extension is displayed in the upper overview.

If the Technology Extension is run in the lower overview "Technology Extensions that cannot be activated", then check the specified cause. Additional information is provided in the Startdrive online help.

5.2.2.2 Activating Technology Extension

In the following, the Technology Extension is assigned to a drive object.

Preconditions

1. The Startdrive commissioning tool is open.
2. A project has been created, or an existing project is open.
3. Technology Extension "ABC_OA" has been installed.
4. Technology Extension "ABC_OA" is run in overview "Technology Extensions that can be activated for this drive object".

Procedure

1. To activate Technology Extension "ABC_OA" for this drive object, in the "Selection" column, click on the checkbox of the appropriate TEC.
The TEC is activated and the associated parameters are displayed in the parameter view.
Active Technology Extensions are marked by a check symbol in the checkbox.

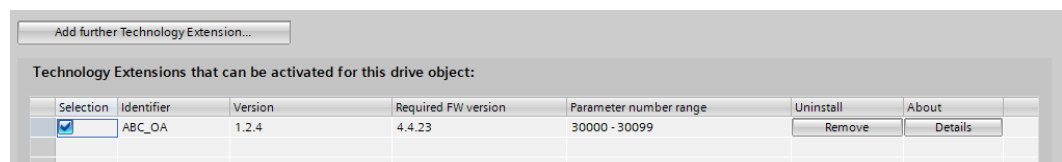


Figure 5-2 Technology Extension is activated

2. Check the parameter list of the drive object.
The additional parameters of the installed Technology Extension must now be visible in the parameter list of the corresponding drive object.

All parameters	Number	Parameter text	Value	Unit
Interlocking parameters	r10231	SI Motion SBT control word diagnostics		0H
Commissioning	r10234	SI Safety Information Channel status word S_ZSW9B		0H
Save & reset	p10235	SI Safety Control Channel control word S_STW9B	☒	0%
System identification	r10240	SI Motion SBT test torque diagnostics		0.00 Nm
Universal settings	r10241	SI Motion SBT load torque diagnostics		0.00 Nm
Inputs/outputs	r10242	SI Motion SBT state diagnostics		
Communication	p10250	SI Safety Control Channel control word S_STW1B	☒	0%
Power unit	r10251	SI Safety Control Channel control word S_STW1B diagnostics		0H
Motor	p30000	ABC_OA switch-on mode		[0] Reset messages
Setpoint channel	p30001	ABC_OA P controller input signal source	☒	0%
Drive control	r30002	ABC_OA P controller output signal		0.00
Drive functions	p30003	ABC_OA P controller gain factor		1.00
Safety integrated	p30004	ABC_OA fixed setpoints		1
Technology functions	p60000	PROFIdrive reference speed reference frequency		3,000.00 rpm
Diagnostics	p60022	PROFIsafe telegram selection	☒	[0] No PROFIsafe telegram selected
	p60122	IF1 PROFIdrive SIC/SCC telegram selection	☒	[999] No telegram

Figure 5-3 Parameters of the Technology Extension in the parameter view

- To activate the Technology Extension for the drive object, download the project. Click on "Go online" and then on "Load to device". The "Load preview" dialog opens:

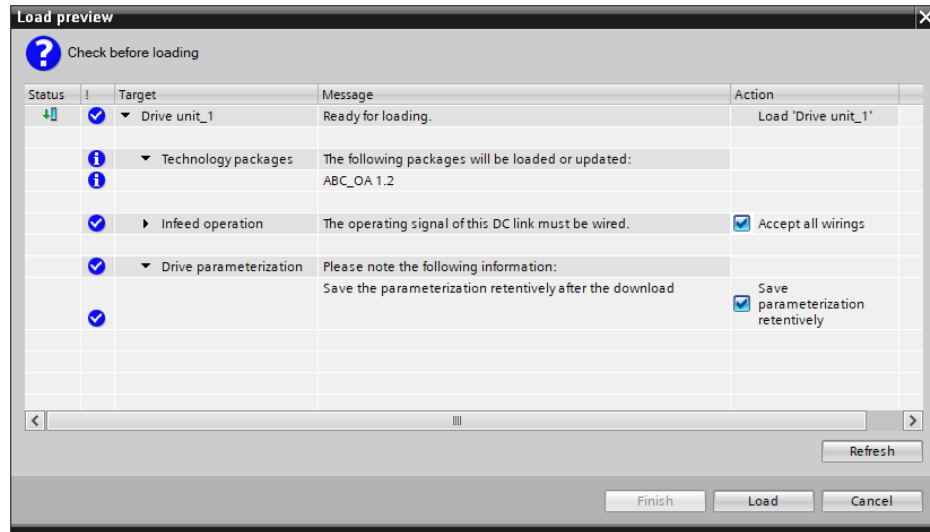


Figure 5-4 Loading ABC_OA to the device

- Activate checkbox "Save parameterization retentively" and then click on "Load". After the load operation has been completed, Technology Extension "ABC_OA" is activated in the drive object and can be used.

5.2.2.3 Commissioning Technology Extension SERVCUP

Precondition

To commission Technology Extension SERVCUP, it is assumed that the hardware has been fully commissioned "Commissioning the hardware (Page 88)".

When commissioning the hardware, you create the drive objects on which you wish to operate the Technology Extension.

Commissioning SERVCUP

To commission the Technology Extension SERVCUP, set the additional parameters in the Startdrive commissioning tool.

For Technology Extension SERVCUP, parameters starting at p31740 are available, see "Parameter (Page 139)".

The commissioning is described in detail in Chapter "Commissioning (Page 85)".

5.2.3 Upgrading Technology Extension

Technology Extension "ABC_OA" is upgraded from version V1.2.4 to version V1.2.5 in the following. When doing this, the new version of the Technology Extension is installed in Startdrive as an additional technology package.

Preconditions

The following preconditions must be satisfied:

- The Startdrive commissioning tool is open.
- A project has been created, or an existing project is open.
- Installation package "ABC_OA_V1_2_4.tec" has been installed and activated.
- The installation package with the new version "ABC_OA_V1_2_5.tec" is available in a known directory.

Procedure

To use a higher version of an already installed Technology Extension, you must also install and activate the higher version.

1. Carry out the installation as described in Chapter "Installing Technology Extension (Page 41)".
2. Click in the "Version" column on the version number to display all of the installed versions.

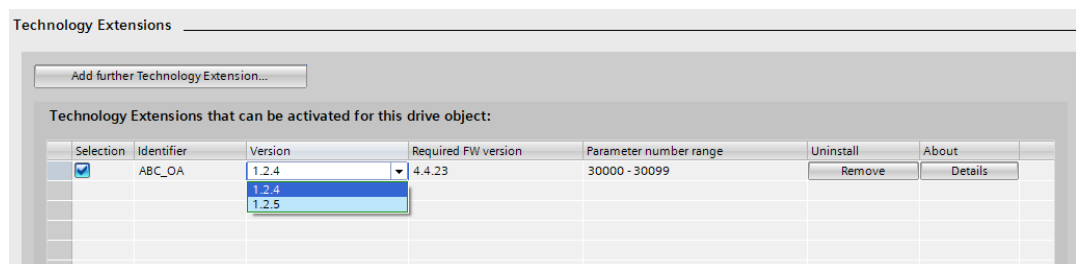


Figure 5-5 Upgrading the Technology Extension in Startdrive

3. To use the higher version of the "ABC_OA" Technology Extension, click on Version "1.2.5".

For Startdrive version from V17:

The parameters from the previous version are applied with the already set values. As a result of the new version, newly introduced parameters are added with the factory setting.

For Startdrive version < V17:

NOTICE

Parameters are reset to the default setting

When upgrading, all parameters of the Technology Extension are reset to the default setting.

More information about upgrading

Pay particular attention to the following information about upgrading:

1. The drive objects activated in the previous version of the Technology Extension remain activated.
Procedure for activating/deactivating the Technology Extension in additional drive objects, see "Activating Technology Extension (Page 43)".
2. Depending on the Startdrive version being used, parameters that have already been set are handled differently:
 - For Startdrive version from V17:
Existing parameters keep their set values.
 - For Startdrive version < V17:
All parameters are set to the factory settings of the new TEC.
3. New parameters of the newly installed version of the Technology Extension are preassigned the default settings and may have to be set.
4. The installation package of the previous version of the Technology Extension can be deleted from Startdrive if it can no longer be used for other projects or drive units.
For the procedure for deleting/uninstalling, see "Deactivating/uninstalling the Technology Extension (Page 47)".

5.2.4 Deactivating/uninstalling the Technology Extension

NOTICE

Invalid BICO interconnections after deactivating a Technology Extension.

When deactivating a Technology Extension, existing BICO interconnections between the basis system and Technology Extension are disconnected. When doing this, the parameters of the basis system are restored to the factory settings. The factory setting is not always the correct setting for fault-free operation.

1. When deactivating the Technology Extension, check whether a message is displayed in the inspector window regarding invalid BICO interconnections.
2. Check the parameters specified in the message, and if necessary, correct their interconnection.

Procedure

To uninstall a Technology Extension using Startdrive, proceed as follows:

1. In the "Project tree" window, double-click on "Drive unit" --> " Drive axis" --> "Parameterization".
The function view for parameterization opens in the "Working area" window.
2. In the "Working area" window, double-click on Technology functions and click on "Technology Extensions".
The screen form for "Technology Extensions" opens.
3. To deactivate Technology Extension "ABC_OA" for this project, in the "Selection" column, click on the checkbox of the corresponding TEC.

4. After deactivating, check whether a message is displayed in the inspector window regarding invalid BICO interconnections.

If a message is displayed:

- Double-click on the message to open window "BICO interconnections".

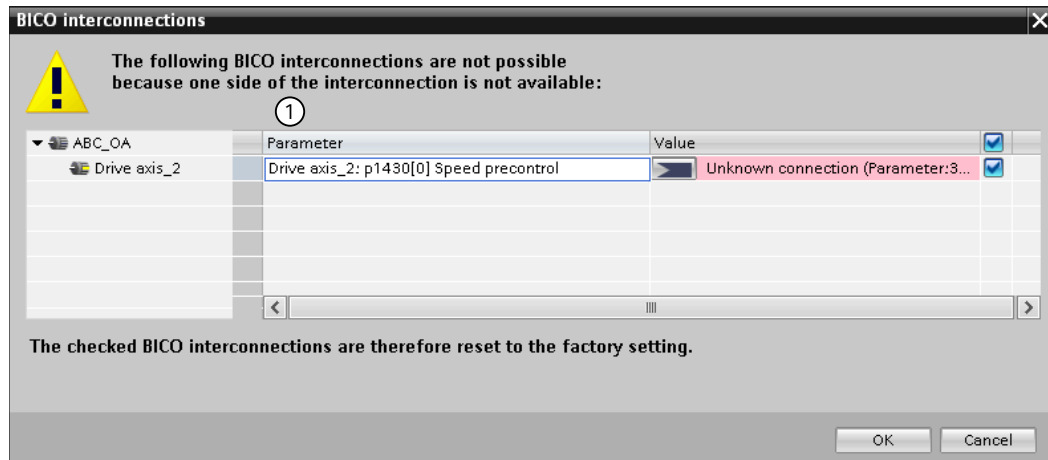


Figure 5-6 Overview: Restore BICO interconnections to the factory settings

- Check the parameters specified under ①, and correct the interconnection of these parameters. Notes regarding correct interconnection are provided for example in parameter descriptions, function diagrams or projects, which were commissioned without a Technology Extension.
 - Click "OK" to close the "BICO interconnections" window.
5. To uninstall Technology Extension "ABC_OA" in Startdrive, click on "Remove" in the "Technology Extensions" screen form.

5.2.5 Scripting with Startdrive

5.2.5.1 Information about scripting

Preconditions

Using TIA Portal-Openness, you automate the engineering and control the TIA Portal using a program that you created yourself. In Startdrive version V18 or higher, you can also use scripting to generate and use your own programs for the TIA Portal "Startdrive" application.

To use Startdrive's scripting functionality, you need to be familiar with script programming and also experienced with Startdrive. This section provides a general introduction to the topic.

Note**Information about Startdrive, scripting and sample codes**

See these references for more information about handling Startdrive and scripting in particular:

- Startdrive online help
- Programming and Operating Manual "Functions for Startdrive"

Before you create your own program for Startdrive, read the Programming and Operating Manual and note:

- the information about "activated project protection (UMAC)"
 - the security information about "SecureString passwords"
 - the information about "passwords in TIA Openness"
 - additional sample codes not directly related to Technology Extensions
-

The following information and sample codes relate primarily to Technology Extensions.

Devices

This description applies to:

- SINAMICS S120, S150, G130, G150, MV (CU320-2)
- SINAMICS S120 (CU310-2)
- SIMOTION D4x5-2 with SINAMICS Integrated
- SIMOTION D410-2 with SINAMICS Integrated
- SINAMICS DCM, DCP

Working with scripting functionality

Using the scripting functionality, you can automate the configuration. Drive objects (DOs), e.g. SINAMICS drives and SIMOTION technology objects (TOs), for example axes, can be configured.

Standard scripts can be adapted to specific situations during the runtime using interactive queries, which means that the scripts are executed dependent on query results. This

simplifies and speeds up commissioning. Other possible applications include documenting settings that have been made and repeating application of complex settings, for example.



WARNING

Malfunctions as a result of incorrect scripts

Scripting provides extensive automation options that are required to be able to automate manual operator actions in Startdrive, therefore optimizing the time required for the recurring configuration of projects and tasks. Incorrect configurations that are not identified in tests can result in property damage, serious injury or death! The script programmer and the script user are responsible for the operator actions implemented in the scripting.

- Run systematic tests on new and modified scripts to verify and validate them.
- Before running a script, carefully ensure it has the correct content. Verify and validate the results when running a script by performing tests on the machine.

5.2.5.2 Component identification (TypeIdentifier)

Each version of any Startdrive component has a unique number, which is known as the TypeIdentifier. In the Openness program code, you can use this TypeIdentifier in order to uniquely identify and name a component.

In Startdrive, the TypeIdentifier can be optionally displayed and in the default setting, is deactivated.

Activating the display of the TypeIdentifier in Startdrive

1. In the Startdrive project view, select menu "Options > Settings".
The "Settings" configuration area opens.
2. Select "Hardware configuration" in the secondary navigation.
3. Activate the option "Activate display of the Type Identifier for devices and modules".
The TypeIdentifier display is now active.

Reading out the TypeIdentifier in Startdrive

In a Startdrive project, the TypeIdentifier can be read out at the following locations when the display is active:

- For all components (in the inspector window):
- For Control Units (when creating a drive device)

5.2.5.3 References for Technology Extensions

DriveObjectContainer

The `DriveObjectContainer` is a service of the drive object (`DeviceItem`) for the current device (`Device`).

The following table describes the **navigators** of the `DriveObjectContainer`:

Name	Data type	Description
<code>DriveObjects</code>	<code>DriveObjectComposition</code>	Returns a list with the available drive objects. The drive objects allow access to the drive parameters and telegrams.
<code>Parent</code>	<code>IEngineeringObject</code>	Engineering Object model-parent element of this object.

TechnologyExtension

The following table describes the **properties** of the class:

Name	Data type	Access	Description
<code>Identifier</code>	<code>string</code>	Read only	Returns the identifier for the Technology Extension.
<code>Name</code>	<code>string</code>	Read only	Returns the name of the Technology Extension.
<code>DisplayName</code>	<code>string</code>	Read only	Returns the display name of the Technology Extension.
<code>IsActivated</code>	<code>boolean</code>	Read only	Returns the activation status of the Technology Extension.

The following table describes the **navigators** of the class:

Name	Type	Access	Description
<code>Parent</code>	<code>IEngineeringObject</code>	Read only	Engineering Object model-parent element of this object.

The following table describes the **methods** of the class:

Name	Return value	Parameter	Description
<code>Activate</code>	<code>bool</code>	-	Activates the Technology Extension.
<code>Deactivate</code>	<code>bool</code>	-	Deactivates the Technology Extension.

TechnologyExtensionComposition

The `TechnologyExtensionComposition` class includes all Technology Extensions assigned to a particular `DriveObject`. All Technology Extensions are handled in the same way.

The following table describes the **properties** of the class:

Name	Data type	Access	Description
<code>Count</code>	<code>int</code>	Read only	Returns the number of elements included in <code>TechnologyExtensionComposition</code> .

The following table describes the **navigators** of the class:

Name	Type	Access	Description
Parent	IEngineeringObject	Read only	Engineering Object model-parent element of this object.

The following table describes the **methods** of the class:

Name	Return value	Parameter	Description
Find	TechnologyExtension item	string name/ identifier	Finds a Technology Extension using the name/ identifier.
Contains	bool	TechnologyExtension item	Determines whether an element is included in TechnologyExtensionComposition.
GetEnumerator	IEnumerator<TechnologyExtension>	-	Returns an enumerator which runs through a list of available Technology Extensions.

TechnologyExtensionPackage

The TechnologyExtensionPackage class allows access to Technology Extensions.

The following table describes the **properties** of the class:

Name	Data type	Access	Description
Identifier	string	Read only	Returns the identifier of the TechnologyExtensionPackage. The syntax for definition is: <name>/<version>
Name	string	Read only	Returns the name of the TechnologyExtensionPackage.
DisplayName	string	Read only	Returns the DisplayName of the TechnologyExtensionPackage.

The following table describes the **navigators** of the class:

Name	Type	Access	Description
Parent	IEngineeringObject	Read only	Engineering Object model-parent element of this object.

TechnologyExtensionInstallationProvider

The TechnologyExtensionInstallationProvider class is a function of the TIA Portal and enables a TechnologyExtensionPackage to be installed.

The following table describes the **navigators** of the class:

Name	Type	Access	Description
TechnologyExtensionPackages	TechnologyExtensionPackageComposition	Read only	Compilation of TechnologyExtensionPackages.

The following table describes the **methods** of the class:

Name	Type of return value	Parameter	Description	Exceptions
Install	bool	Read only	This method installs a <code>TechnologyExtensionPackage</code>. Parameter description <code>filePath</code>: Fully qualified path name of the .tec file to be installed.	EngineeringException
Uninstall	bool	Read only	This method uninstalls a <code>TechnologyExtensionPackage</code>. Parameter description <code>packageIdentifier</code>: Identifier to determine the <code>TechnologyExtensionPackage</code> to be uninstalled. <code>confirmUninstallInUse</code>: This option is used to confirm uninstallation of a Technology Extension used in the open project.	EngineeringException

5.2.5.4 Valid for Technology Extensions

The following examples show how you can use Technology Extensions.

Install TechnologyExtensionPackage

```
string packageFilePath=@"Y:\\ABC_OA_V1_1_0_0.tec";

TechnologyExtensionInstallationProvider tecInstallationProvider =
TiaPortal.GetService<TechnologyExtensionInstallationProvider>();
FileInfo packageFile = new FileInfo(packageFilePath);

try
{
tecInstallationProvider.Install(packageFile);
}
catch (EngineeringException ex)
{
Console.WriteLine(ex.Message + "\n" + ex.StackTrace);
}
```

Activate Technology Extension

```
TechnologyExtension tecExtension = ...
tecExtension.Activate();
return tecExtension.IsActivated;
```

Deactivate Technology Extension

```
TechnologyExtension tecExtension = ...
tecExtension.Deactivate();
return tecExtension.IsActivated;
```

Uninstall TechnologyExtensionPackage

```
string tecPackageIdentifier = "ABC_OA/1100100";
bool confirmUninstallInUse = true;
TechnologyExtensionInstallation ProvidertecInstallationProvider =
TiaPortal.GetService<TechnologyExtensionInstallationProvider>();
TechnologyExtensionPackage tecPackage =
tecInstallationProvider.TechnologyExtensionPackages.Find(tecPackageIdentifier);

if (tecPackage == null)
{
    Console.WriteLine("the specified TechnologyExtensionPackage '{tecPackageIdentifier}' was
not found");
    return;
}

try
{
    tecInstallationProvider.Uninstall(tecPackage.Identifier, confirmUninstallInUse);
}
catch (EngineeringException ex)
{
    Console.WriteLine(ex.Message + "\n" + ex.StackTrace);
}
```

Read out DriveObjectContainer of a SINAMICS device

```
using Siemens.Engineering;
using Siemens.Engineering.HW;
using Siemens.Engineering.MC.Drives

Device device = ...;
foreach (DeviceItem deviceItem in device.DeviceItems)
{
    DriveObjectContainer doContainer = deviceItem.GetService<DriveObjectContainer>();
    // do something
}
```

Navigate to a DriveObject

```
Device device = ...;
foreach (DeviceItem deviceItem in device.DeviceItems)
{
    DriveObjectContainer doContainer = deviceItem.GetService<DriveObjectContainer>();
    DriveObjectComposition driveObjects = doContainer.DriveObjects;
    foreach (DriveObject driveObject in driveObjects)
    {
        // do something with the DriveObject
    }
}
```

Navigate to a Technology Extension

```
DriveObject driveObject = ...
TechnologyExtensionContainer tecContainer =
driveObject.GetService<TechnologyExtensionContainer>();
TechnologyExtensionComposition tecExtensions = tecContainer.TechnologyExtensions;
foreach (TechnologyExtension tecExtension in tecExtensions)
{
    // do something with the TechnologyExtensions
}
```

Find TechnologyExtension using TechnologyExtension.Name

```
DriveObject driveObject = ...;
TechnologyExtensionContainer tecContainer =
driveObject.GetService<TechnologyExtensionContainer>();
TechnologyExtension tecExtension = tecContainer.TechnologyExtensions.FirstOrDefault(x =>
x.Name == tecExtensionName);
// do something with the TechnologyExtension
```

5.3 SINUMERIK Operate

This description of how to install and commission a Technology Extension is applicable for commissioning via SINUMERIK Operate.

Form-based assistance for installing Technology Extensions is provided with SINUMERIK Versions 6.15 SP1 and higher for SINUMERIK ONE and 4.95 SP1 and higher for SINUMERIK 840D sl. Installation with and without form assistance is described with examples:

- SINUMERIK Operate with form assistance (Page 56)
- SINUMERIK Operate with no form assistance (Page 64)

5.3.1 SINUMERIK Operate with form assistance

5.3.1.1 Preconditions for installation using SINUMERIK Operate

The following description illustrates commissioning via SINUMERIK Operate with form assistance. This commissioning option is available with SINUMERIK Versions 6.15 SP1 and higher for SINUMERIK ONE and 4.95 SP1 and higher for SINUMERIK 840D sl.

Devices

This general description is valid for SINUMERIK control systems with SINAMICS Integrated:

- SINUMERIK 840D sl Version 4.95 SP1 and higher
- SINUMERIK ONE Version 6.15 SP1 and higher

General requirements

Access level "Manufacturer" must be set in SINUMERIK Operate.

Requirements for installation using USB memory

1. The installation package for the ABC_OA Technology Extension has been copied to a USB memory.
2. The front USB port is configured as a logical drive.

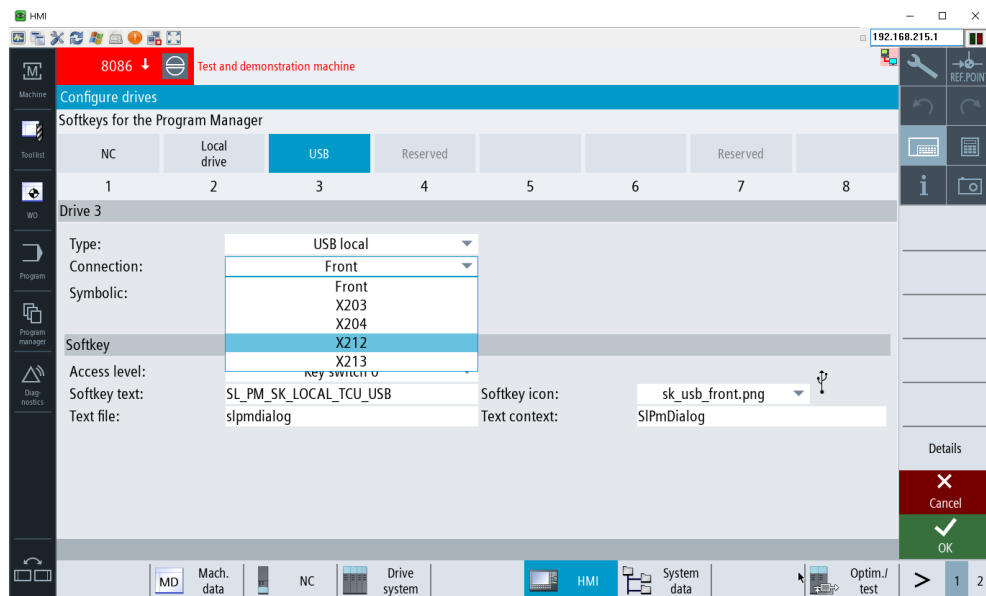


Figure 5-7 Front USB configuration

5.3.1.2 Installing and activating a Technology Extension

Installing Technology Extension on the drive unit

In the description below, the Technology Extension is installed on the drive unit.

Installation using a USB memory

Install the Technology Extension as follows:

1. Connect the USB memory to the SINUMERIK front USB interface.
2. Perform the following actions one after the other:
 - In the main menu, select the menu command "Setup".
 - Select the menu command "Drive system".
 - Select the menu command "Technology Extensions".
The overview of the Technology Extensions already installed is displayed.

3. In the "Technology Extensions" menu, perform the following actions one after the other:
 - Select the menu command "Add".
 - Navigate to the installation package for the ABC_OA Technology Extension.
 - Select "OK" and confirm the following messages.

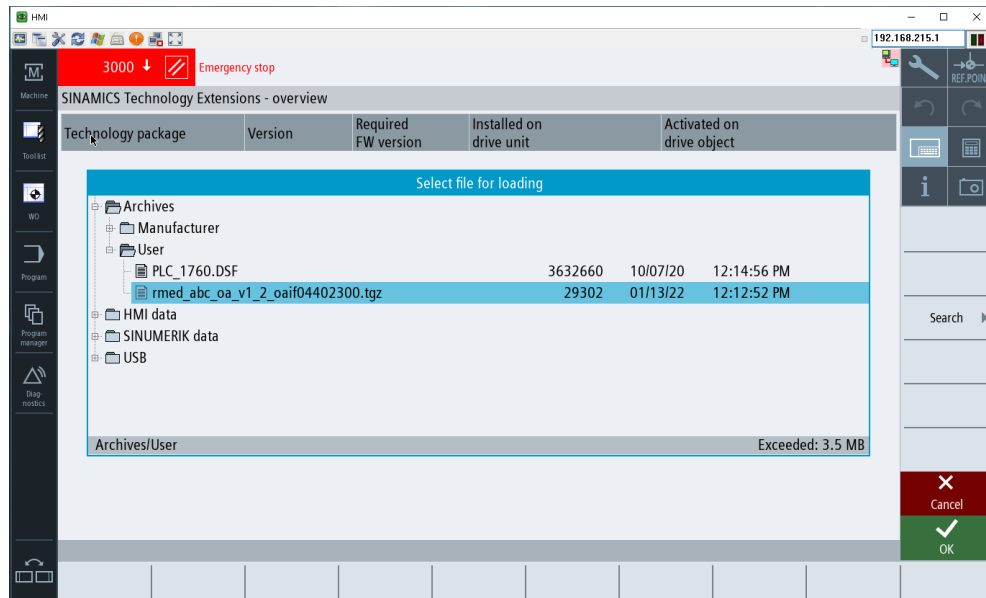


Figure 5-8 Installation using USB memory

File "abc_oa.cfs" is extracted from the installation package and saved to directory "/oem/sinamics/oa". The NCK and the drive system perform a reset/warm restart. The installed ABC_OA Technology Extension is displayed in the Technology Extensions overview:

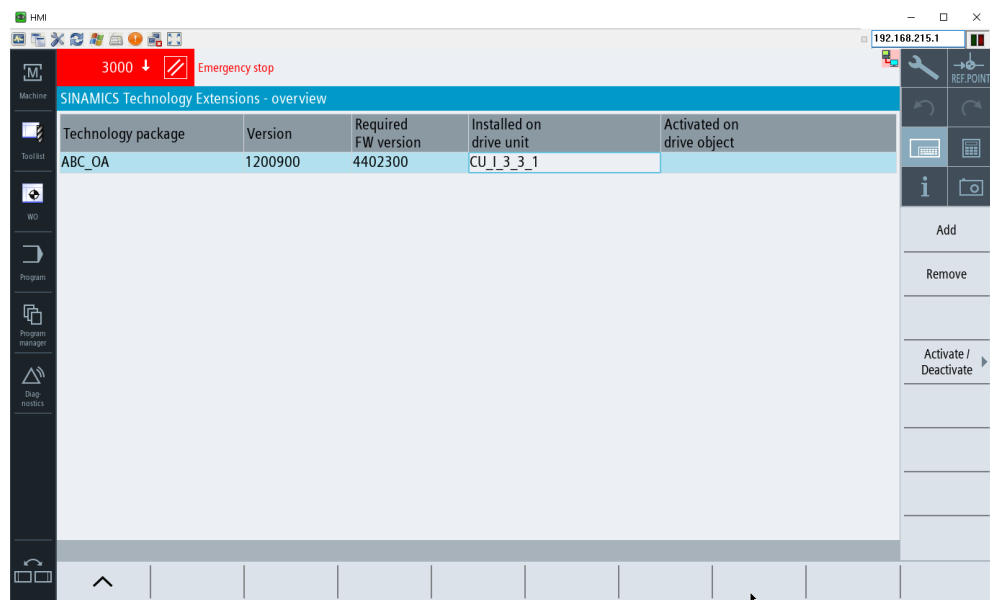


Figure 5-9 Technology Extensions overview

- Restart SINUMERIK Operate to transfer the parameter and alarm texts and the online help correctly to Operate.

Activating Technology Extension on the drive object

In the following, the Technology Extension ABC_OA is assigned to the desired axes and the appropriate drive objects.

Configuration example

A 3-axis SINUMERIK system comprises the following drive objects:

- Control Unit (CU_I_3.3:1 / DO_1)
- Power supply (ALM_3.3:2 / DO_2)
- X axis (SERVO_3.3:3 / DO_3, AX1)
- Y axis (SERVO_3.3:4 / DO_4, AX2)
- Z axis (SERVO_3.3:5 / DO_5, AX3)

Activation of the ABC_OA Technology Extension

Activate the Technology Extension on the required axes or drive objects as follows:

1. Deactivate the pulse enable for SINAMICS (e.g. via the EP terminal)
2. In the "Technology Extensions" menu, perform the following actions one after the other:
 - Select menu item "Activate/Deactivate".
 - Select the "Active (setpoint)" checkboxes for the axes or drive objects on which the ABC_OA Technology Extension is to be activated.
 - Select "OK" and confirm the following messages.

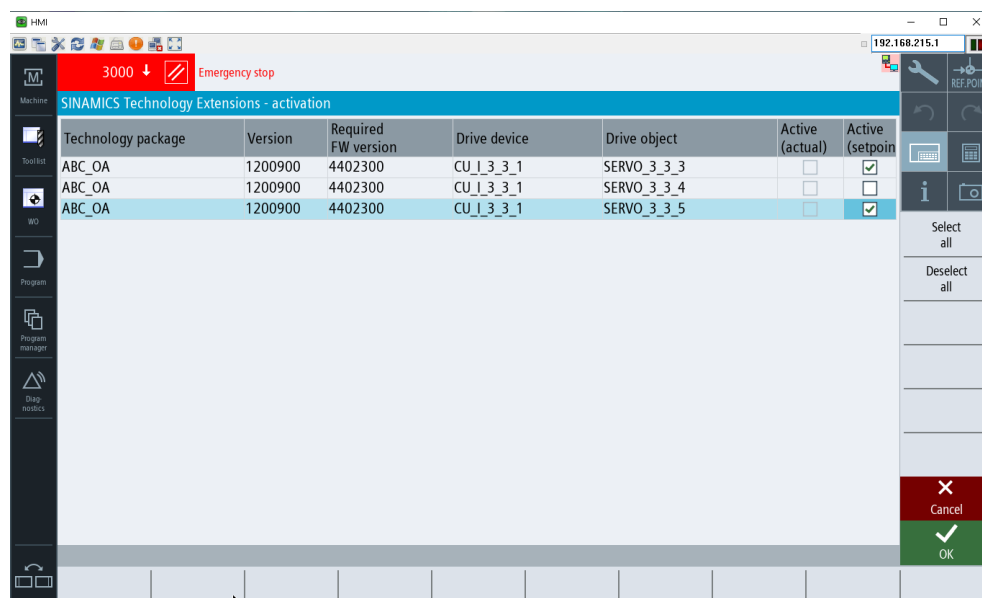


Figure 5-10 Technology Extension activation

The drive unit performs a warm restart and enables the TEC on the selected axes or drive objects.

3. Check the parameter list.

The additional parameters must now be visible in the parameter list on the axes or drive objects with activated Technology Extension:

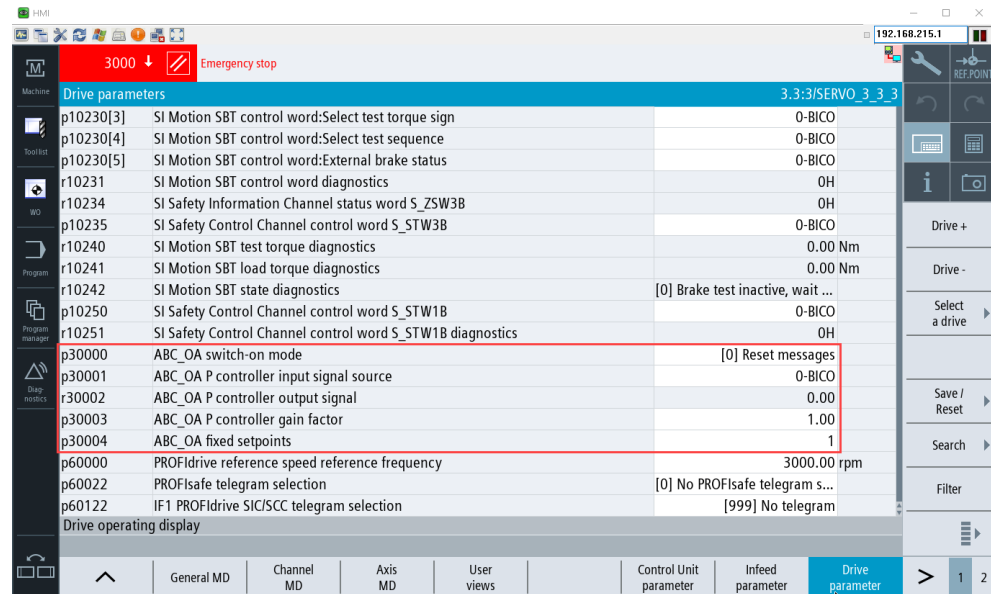


Figure 5-11 ABC_OA in the parameter list

4. If necessary, carry out a RAM-to-ROM or save the drive parameters.

Commissioning Technology Extension SERVCUP

Precondition

It is a prerequisite for commissioning of the TEC SERVCUP that the hardware has been fully commissioned, see "Commissioning the hardware (Page 88)".

When commissioning the hardware, you create the drive objects on which you wish to operate the Technology Extension.

Commissioning SERVCUP

To commission Technology Extension SERVCUP using SINUMERIK Operate, set the additional parameters accordingly.

For Technology Extension SERVCUP, parameters starting at p31740 are available, see "Parameter (Page 139)".

The commissioning is described in detail in Chapter "Commissioning (Page 85)".

5.3.1.3 Upgrading Technology Extension

Technology Extension "ABC_OA" is upgraded from version V1.1 to version V1.2 in the following. When doing this, the old version of Technology Extension is overwritten.

The upgrade is essentially a new installation of the latest version of the Technology Extension. When upgrading, the previously used version of the Technology Extension is overwritten.

Preconditions

- The installation package for Technology Extension ABC_OA "abc_oa_v1_1_oaif04402300.tgz" has been installed and assigned to the required drive objects, see "Installing and activating a Technology Extension (Page 57)".
- The installation package with the new version of the Technology Extension "abc_oa_v1_2_oaif04402300.tgz" is ready.

Procedure

Install the Technology Extension as described in the following chapters:

- "Installing Technology Extension on the drive unit (Page 57)"
- "Activating Technology Extension on the drive object (Page 59)"

During this procedure, the previously used version of the Technology Extension is overwritten.

More information about upgrading

Pay particular attention to the following information about upgrading:

1. The data from the previous version of the Technology Extension saved to folder "/oem/sinamics/oa/abc_oa/" - as well as file "/oem/sinamics/oa/abc_oa.cfs" - are overwritten.
 - Parallel operation of drive objects with active Technology Extension "ABC_OA" Version V1.1 and other drive objects with active version V1.2 is **not** possible.
 - You must reinstall Technology Extension "ABC_OA" Version V1.1 to switch back to version V1.1.
2. The drive objects activated in the previous version of the Technology Extension remain activated.
3. The parameters set in a drive object in the previous version of the Technology Extension and their values are retained.
4. New parameters of the newly installed version of the Technology Extension are preassigned the default settings and may have to be set.

5.3.1.4 Uninstalling Technology Extension

Uninstalling the ABC_OA Technology Extension

To remove a Technology Extension, disable it on all drive objects and then delete it.

1. In the "Technology Extensions" menu, perform the following actions one after the other:
 - Select menu item "Activate/Deactivate".
 - Disable all "Active (setpoint)" checkboxes on which the ABC_OA Technology Extension is enabled.
 - Select "OK" and confirm the following messages.

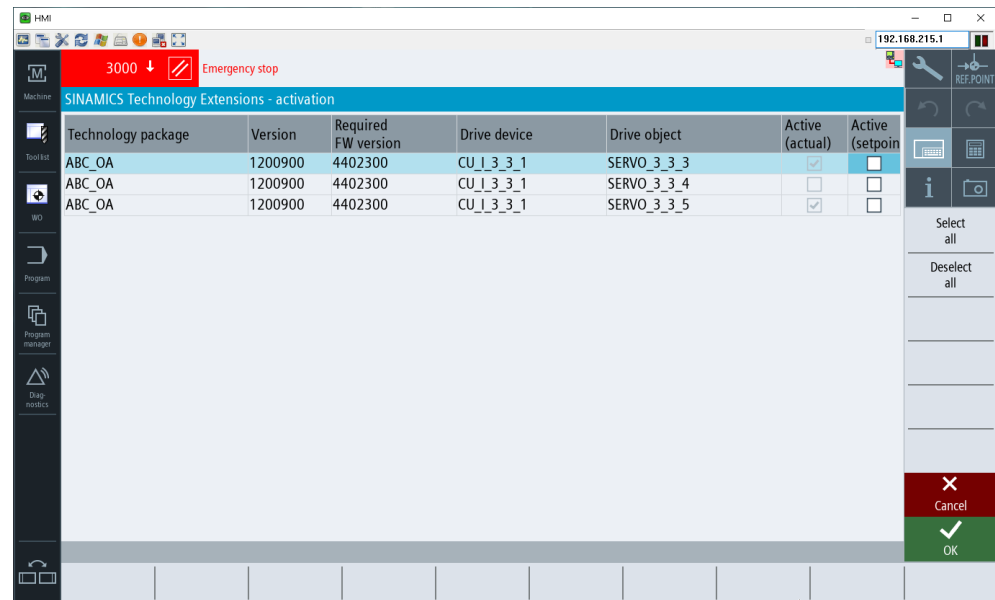


Figure 5-12 Disabling the Technology Extension

2. In the "Technology Extensions" menu, perform the following actions one after the other:
 - Choose the ABC_OA technology package and select the menu item "Remove".

- Select "Yes", confirm the subsequent messages and follow all of the instructions from Operate.

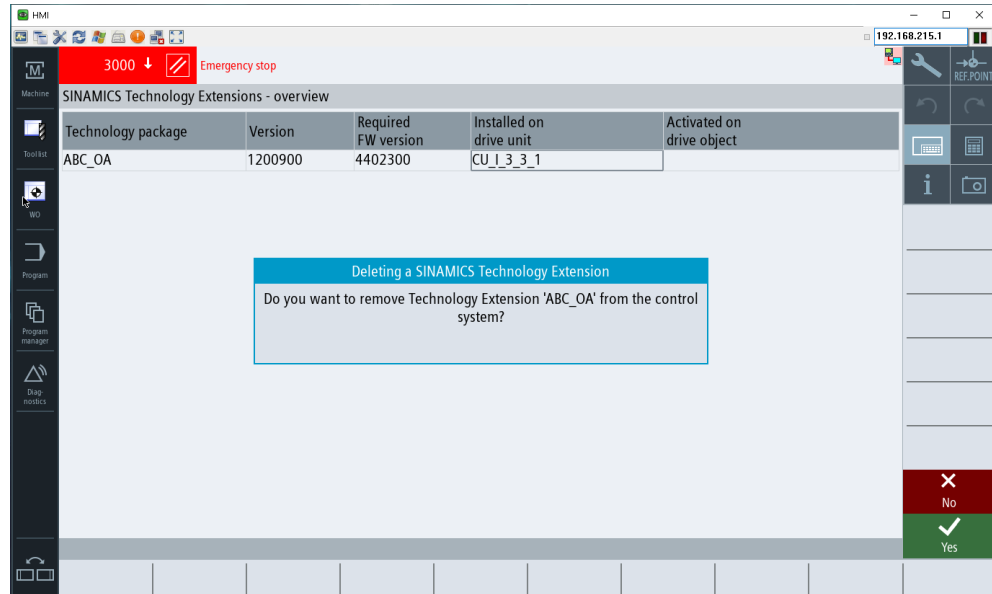


Figure 5-13 Deleting the Technology Extension

3. If necessary, carry out a RAM-to-ROM or save the drive parameters.

5.3.2 SINUMERIK Operate with no form assistance

5.3.2.1 Preconditions for installation using SINUMERIK Operate

The following description illustrates commissioning via SINUMERIK Operate with no form assistance. This commissioning option must be used for SINUMERIK Versions < 6.15 SP1 for SINUMERIK ONE and < 4.95 SP1 for SINUMERIK 840D sl.

Devices

This general description is valid for SINUMERIK control systems with SINAMICS Integrated:

- SINUMERIK 840D sl versions earlier than Version 4.95 SP1
- SINUMERIK ONE versions earlier than Version 6.15 SP1

General requirements

Access level "Manufacturer" must be set in SINUMERIK Operate.

Requirements for installation using USB memory with service system

1. A USB memory, which is installed on the portable service system for the NCU, is available.

Note

The SINUMERIK service system, as well as the procedure to generate it on a USB memory, is described in detail in the following references:

- SINUMERIK ONE New Installation and Upgrade, Installation Manual
 - SINUMERIK 840D sl operating system NCU, Commissioning Manual
-

2. The installation package for the ABC_OA Technology Extension is copied to the FAT partition of the USB memory using the SINUMERIK service system.

5.3.2.2 Installing and activating a Technology Extension

Installing Technology Extension on the drive unit

In the description below, the Technology Extension is installed on the drive unit.

Installation using a USB memory with service system

Install the Technology Extension as follows:

1. Connect the USB memory with portable service system to USB interface X125 or X135 of the SINUMERIK NCU.
2. Restart SINUMERIK NCU:
 - Switch the device off and then on again or
 - Press the "Reset" button.SINUMERIK NCU starts with the service system.

3. In the service system, execute the following actions one after the other:

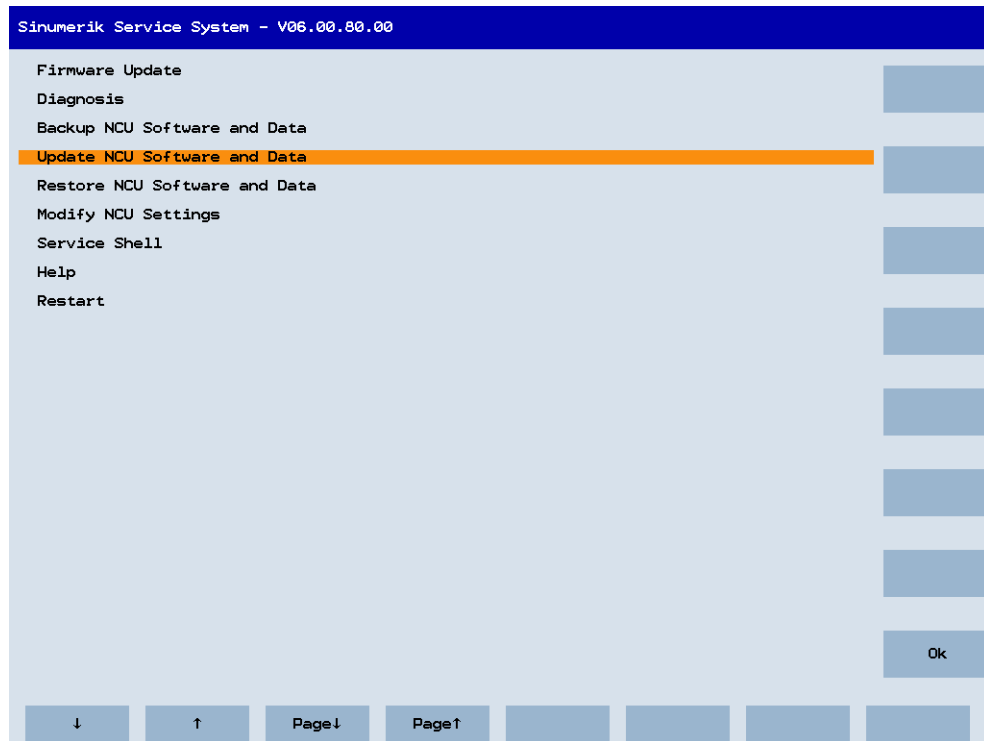


Figure 5-14 Installation using the service system

- In the main menu, select menu item "Update NCU Software and Data".
- Then select menu item "Update system software from USB memory stick".
- Select the ABC_OA Technology Extension installation package and then confirm with "OK".

File "abc_oa.cfs" is extracted from the installation package and saved to directory "/oem/sinamics/oa".

4. Switch the SINUMERIK NCU off and remove the USB memory.
5. Start SINUMERIK NCU.

Technology Extension ABC_OA is installed in directory "/oem/sinamics/oa" when the system runs up. The appropriate data is made available in the "abc_oa" subdirectory.

Alternative: Installation using an SFTP client for Windows (e.g. WinSCP)

Alternatively, installation can also be performed using an SFTP client for Windows based on SSH. The client permits a secure data and file transfer between different computers. The freely available software WinSCP (Windows Secure Copy) meets these preconditions.

Install the Technology Extension as follows:

1. Start WinSCP and connect to the NCU using the relevant IP address.
2. Copy the installation package (for example "rmed_abc_oa_v1_2_oaif04402300.tgz") to a target directory on the device (for example /tmp).

3. Mark the window with the target directory and open the input console from the "Commands > Open Terminal" menu.
4. Enter the following commands in the "Enter command" field and to confirm, click the "Execute" button:
 - `sc stop all`
Wait until the command has been executed in full.
 - `sc restore -update -force rmed_abc_oa_v1_2_oaif04402300.tgz`
The "abc_oa.cfs" file is extracted from the "rmed_abc_oa_v1_2_oaif04402300.tgz" file and stored in the following directory:
`/card/oem/sinamics/oa`
 - `sc reboot`
When the system runs up, Technology Extension ABC_OA is installed in directory `/oem/sinamics/oa`. The appropriate data is made available in the "abc_oa" subdirectory.

Note

Any error messages that appear can normally be ignored.

If file "rmed_abc_oa_v1_2_oaif04402300.tgz" has been copied to the `/tmp` directory, it is stored in a volatile memory and will be deleted when the "sc reboot" command is executed or on POWER ON (switch off/switch on).

Activating Technology Extension on the drive object

In the following, the Technology Extension ABC_OA is assigned to the desired axes and the appropriate drive objects.

Configuration example

A 3-axis SINUMERIK system comprises the following drive objects:

- Control Unit (CU_I_3.3:1 / DO_1)
- Power supply (ALM_3.3:2 / DO_2)
- X axis (SERVO_3.3:3 / DO_3, AX1)
- Y axis (SERVO_3.3:4 / DO_4, AX2)
- Z axis (SERVO_3.3:5 / DO_5, AX3)

Activation of the ABC_OA Technology Extension with no form assistance

Activate Technology Extension on the required axes as follows:

1. Deactivate the pulse enable for SINAMICS (e.g. via the EP terminal)
2. Set "Configure Technology Extension" on the Control Unit:
`p0009 = 0 → 50`

- Perform the following tasks for the first axis or drive object on which this Technology Extension should be activated (e.g. DO_3, AX1):

p4956[0] = 0 → 1

For SINUMERIK, this is displayed as follows in the drive machine data:

Drive parameters			AX1: X1/SERVO_3.3.3	Drive +
r4950	OA DO-specific number		1	
r4951	OA DO-specific identifier total length		9	
r4952	OA DO-specific GUID total length		18	Drive -
r4955[0]	OA DO-specific identifier		'A'	Select a drive
r4955[1]	OA DO-specific identifier		'B'	
r4955[2]	OA DO-specific identifier		'C'	
r4955[3]	OA DO-specific identifier		' '	
r4955[4]	OA DO-specific identifier		'O'	Search
r4955[5]	OA DO-specific identifier		'A'	
r4955[6]	OA DO-specific identifier		0	
r4955[7]	OA DO-specific identifier		0	
r4955[8]	OA DO-specific identifier		0	
p4956[0]	OA DO-specific activation	[1] OA applicati...		
r4957[0]	OA DO-specific version		91200400	
r4958[0]	OA DO-specific interface version		4402300	
r4959[0]	OA DO-specific GUID		C7H	
r4959[1]	OA DO-specific GUID		59H	
r4959[2]	OA DO-specific GUID		D3H	
OA DO-specific activation				Continue search
General MD Channel MD Axis MD User views Control Unit parameter Infeed parameter Drive parameter				Cancel

Figure 5-15 Activated Technology Extension in the drive machine data

Note

The number of Technology Extensions is displayed in r4950.

r4955[0...8] contains the identifier for Technology Extension 1.

r4955[9...17] contains the identifier for Technology Extension 2, etc.

r4950 = 1 means:

- Only one Technology Extension is available.
- In this case, p4956[0] is used to activate a Technology Extension.

r4950 > 1 means:

- Several Technology Extensions are available.
- The associated index for activating Technology Extension ABC_OA depends on the designation.
 - If r4955[0...8] contains "ABC_OA", p4956[0] applies.
 - If r4955[9...17] contains "ABC_OA", p4956[1] applies, etc.

- Repeat step 3 for all further axes on which this Technology Extension is to be activated (e.g. DO_4, AX2).

5. End the configuration for the Technology Extension on the Control Unit:
p0009 = 50 → 0

Note

If extension modules (e.g. NX assembly units) are present, the following is true for axes calculated on these modules:

For these modules, commissioning mode (p0009 = 50) must be set before the Technology Extension for these axes can be activated.

6. Back up parameters, for example by setting p0977 = 1.
7. If necessary, carry out an NCK reset or POWER ON.
8. Check the parameter list for AX1.
The additional parameters of the installed Technology Extension must now be visible in the parameter list for the axis AX1 (DO_3).

Drive parameters		AX1:X1/SERVO_3.3:3
p10230[1]	SI Motion SBT control word:Start brake test	0-BICO
p10230[2]	SI Motion SBT control word:Select brake	0-BICO
p10230[3]	SI Motion SBT control word:Select test torque ...	0-BICO
p10230[4]	SI Motion SBT control word:Select test sequence	0-BICO
p10230[5]	SI Motion SBT control word:External brake status	0-BICO
r10231	SI Motion SBT control word diagnostics	0H
r10234	SI Safety Info Channel status word S_ZSW3B	0H
p10235	SI Safety Control Channel control word S_STW...	0-BICO
r10240	SI Motion SBT test torque diagnostics	0.00 Nm
r10241	SI Motion SBT load torque diagnostics	0.00 Nm
r10242	SI Motion SBT state diagnostics	[0] Brake test i...
p10250	SI Safety Control Channel control word S_STW...	0-BICO
p10251	SI Safety Control Channel control word S_STW...	0H
p30000	ABC_OR Einschaltmodus	[0] Meldungen ...
p30001	ABC_OR P-Regler Eingang Signalquelle	0-BICO
r30002	ABC_OR P-Regler Ausgangssignal	0.00
p30003	ABC_OR P-Regler Verstärkungsfaktor	1.00
p00122	IF1 PROFIdrive SIC/SCC telegram selection	[999] Free tele...

Figure 5-16 Parameter list

Commissioning Technology Extension SERVOUP

Precondition

It is a prerequisite for commissioning of the TEC SERVOUP that the hardware has been fully commissioned, see "Commissioning the hardware (Page 88)".

When commissioning the hardware, you create the drive objects on which you wish to operate the Technology Extension.

Commissioning SERVCUP

To commission Technology Extension SERVCUP using SINUMERIK Operate, set the additional parameters accordingly.

For Technology Extension SERVCUP, parameters starting at p31740 are available, see "Parameter (Page 139)".

The commissioning is described in detail in Chapter "Commissioning (Page 85)".

5.3.2.3 Upgrading Technology Extension

Technology Extension "ABC_OA" is upgraded from version V1.1 to version V1.2 in the following. When doing this, the old version of Technology Extension is overwritten.

This description to upgrade a Technology Extension is valid both when using SINUMERIK Operate and when using an SFTP client.

The upgrade is essentially a new installation of the latest version of the Technology Extension. When upgrading, the previously used version of the Technology Extension is overwritten.

Preconditions

- The installation package for Technology Extension ABC_OA "abc_oa_v1_1_oaif04402300.tgz" has been installed and assigned to the required drive objects, see "Installing and activating a Technology Extension (Page 65)".
- The installation package with the new version of the Technology Extension "abc_oa_v1_2_oaif04402300.tgz" is ready.

Procedure

Install the Technology Extension as described in the following chapters:

- "Installing Technology Extension on the drive unit (Page 65)"
- "Activating Technology Extension on the drive object (Page 67)"

During this procedure, the previously used version of the Technology Extension is overwritten.

More information about upgrading

Pay particular attention to the following information about upgrading:

1. The data from the previous version of the Technology Extension saved to folder "/oem/sinamics/oa/abc_oa/" - as well as file "/oem/sinamics/oa/abc_oa.cfs" - are overwritten.
 - Parallel operation of drive objects with active Technology Extension "ABC_OA" Version V1.1 and other drive objects with active version V1.2 is **not** possible.
 - You must reinstall Technology Extension "ABC_OA" Version V1.1 to switch back to version V1.1.
2. The drive objects activated in the previous version of the Technology Extension remain activated.

3. The parameters set in a drive object in the previous version of the Technology Extension and their values are retained.
4. New parameters of the newly installed version of the Technology Extension are preassigned the default settings and may have to be set.

5.3.2.4 Uninstalling Technology Extension

Uninstalling the ABC_OA Technology Extension using an SFTP client for Windows (e.g. WinSCP)

Deactivate the Technology Extension in the drive object using SINUMERIK Operate, see "Activating Technology Extension on the drive object (Page 67)".

Uninstall the Technology Extension using the SFTP client for Windows (e.g. WinSCP) as follows:

1. Start WinSCP and connect to the relevant SINUMERIK IP address.
2. Open the input console from the menu "Commands > Open Terminal".
3. Stop the system:
 - Reestablish the connection using Secure Shell (SSH).
 - Execute command "`sc stop all`" and wait for the completion message "done".
4. Delete the subdirectory and files on the memory card:
 - Select the system data.
 - Select directory `/oem/sinamics/oa` under the system CF card.
 - Select and delete subdirectory `abc_oa`.
 - Select and delete file `abc_oa.cfs`.

Note

Pay attention to the sequence when deleting:

First delete the subdirectory and then the file.

5. Restart SINUMERIK NCU:
 - Switch the device off and then on again (POWER ON) or
 - Press the "Reset" button.
6. If necessary, carry out a RAM-to-ROM or save the drive parameters.

5.4 STARTER or SIMOTION SCOUT

5.4.1 Preconditions for installing using STARTER or SIMOTION SCOUT

This description for installing and commissioning a Technology Extension is applicable to the STARTER commissioning tool and to engineering software with integrated STARTER (e.g. SIMOTION SCOUT).

Generally, the term STARTER is used hereafter.

Devices

This general description applies to:

- SINAMICS S120, S150, G130, G150, MV (CU320-2)
- SINAMICS S120 (CU310-2)
- SIMOTION D4x5-2 with SINAMICS Integrated
- SIMOTION D410-2 with SINAMICS Integrated
- SINAMICS DCM, DCP

Preconditions

1. The current STARTER version is recommended for the installation. If scripting is to be used in STARTER, as a minimum STARTER version V5.1SP1 HF2 should be used.
2. The installation package for Technology Extension ABC_OA (oasp_abc_oa_v1_1_oaif04402300.zip) must be in a known directory.

5.4.2 Installing and activating the Technology Extension

5.4.2.1 Installing the OA Support Package in STARTER

In the following description, the Technology Extension is installed in STARTER as a technology package.

Preconditions

The following preconditions must be met before installation:

1. The STARTER commissioning tool has been opened.
2. No project is open.

Procedure

Proceed as follows for installation:

1. From the "Tools" menu, choose the "Installation of libraries and technology packages" function.

The "Installation of libraries and technology packages" window opens.

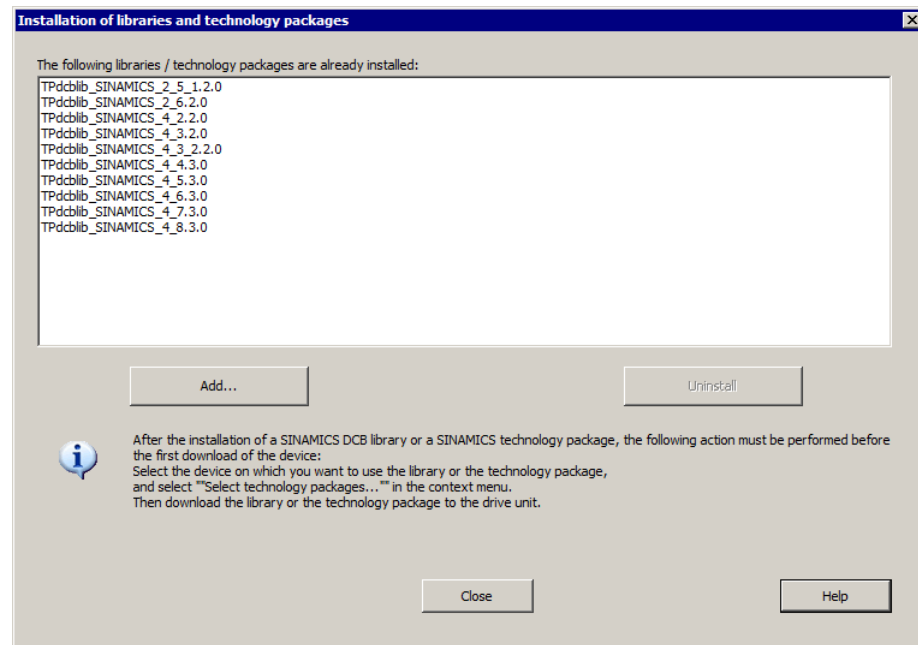


Figure 5-17 Selecting and installing the technology package

2. Click on "Add".
3. Open file "oasp_abc_oa_v1_1_oaif04402300.zip".
The technology package belonging to the Technology Extension ABC_OA is added.
4. Click the "Close" button.

5.4.2.2 Downloading the technology package

In the following, the Technology Extension ABC_OA with version V1.1 is loaded into the device via STARTER.

Requirements

The following requirements must be met before downloading:

1. A project matching the device is open.
2. The STARTER commissioning tool is in ONLINE mode.

Procedure

To download, proceed as follows:

1. Right-click the drive unit in the project navigator.
2. Click "Select technology packages" in the shortcut menu.
The "Select technology packages" window opens.
3. For the technology package "ABC_OA", set the action "Load to target device"

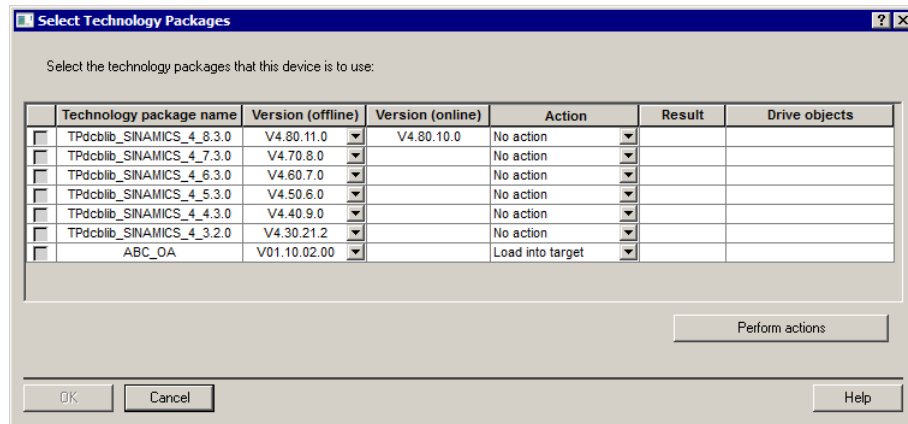


Figure 5-18 Select the technology packages

4. Click the "Perform actions" button.
After successfully performing the action, the information "OK" is displayed for the corresponding "Result" field.
5. If necessary, switch the target device off and on again (POWER ON).

Additional information on the "Select technology package" dialog

For a technology package, the "Version (online)" column is only populated after executing "Load to target device".

The version data between the "Version (offline)" and "Version (online)" columns may differ. When you download the technology package, the version in the target device is always overwritten.

5.4.2.3 Activating the Technology Extension in the drive object

In the following, the Technology Extension is assigned to a drive object.

Preconditions

1. A project matching the device is open.
2. The corresponding drive axes have been created in the project.
3. The STARTER commissioning tool is in the OFFLINE mode.

Procedure

To activate the Technology Extension in the drive object, proceed as follows:

1. In the project navigator, select the drive object for which the functionality is required (e.g. SERVO_03).
2. Select "Properties" in the shortcut menu.
3. To activate the Technology Extension, select check box "ABC_OA" on the "Technology packages" tab.

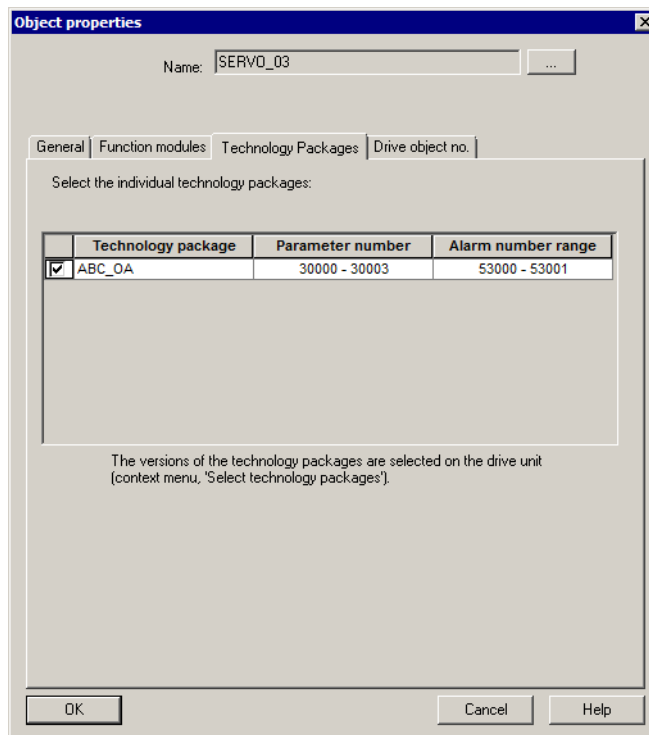


Figure 5-19 Object properties

4. Click on "OK".

Note

If multiple versions of a Technology Extension are installed in STARTER, select the required version, see "Downloading the technology package (Page 74)".

- Open the expert list of the drive object.
The additional parameters of the installed Technology Extension must now be visible in the expert list of the corresponding drive object.

	Parameter	Data set	Parameter text	Offline value	SERVO_03	Unit	Modifiable to	Access level	Minimum	Maximum
	All	All	All	All	All	All	All	All	All	All
1215	p10203		SI Motion SBT control selection	[0] SBT via SCC (p10235)			Commissioni...	3		
1216	p10204		SI Motion SBT motor type	[0] Rotating			Commissioni...	3		
1217	p10208[0]		SI Motion SBT test torque ramp time, Brake 1	1000		ms	Commissioni...	3	20	10000
1218	p10209[0]		SI Motion SBT brake holding torque, Brake 1	10.00		Nm	Commissioni...	3	1	60000
1219	p10210[0]		SI Motion SBT test torque factor sequence 1, Brake 1	1.00			Commissioni...	3	0.3	1
1220	p10211[0]		SI Motion SBT test duration sequence 1, Brake 1	1000		ms	Commissioni...	3	20	10000
1221	p10212[0]		SI Motion SBT position tolerance sequence 1, Brake 1	1.000		mm	Commissioni...	3	0.001	360
1222	p10218		SI Motion SBT test torque sign	[0] Positive			Commissioni...	3		
1223	p10220[0]		SI Motion SBT test torque factor sequence 2, Brake 1	1.00			Commissioni...	3	0.3	1
1224	p10221[0]		SI Motion SBT test duration sequence 2, Brake 1	1000		ms	Commissioni...	3	20	10000
1225	p10222[0]		SI Motion SBT position tolerance sequence 2, Brake 1	1.000		mm	Commissioni...	3	0.001	360
1226	p10230[0]		BI: SI Motion SBT control word, Select brake test	0			Commissioni...	3		
1227	p10231		SI Motion SBT control word diagnostics	0H				3		
1228	r10234		CO/BO: SI Safety Info Channel status word S_ZSW3B	0H				3		
1229	p10235		CI: SI Safety Control Channel control word S_STW3B	0			Ready to run	3		
1230	r10240		SI Motion SBT test torque diagnostics	0.00		Nm		3		
1231	r10241		SI Motion SBT load torque diagnostics	0.00		Nm		3		
1232	p10250		CI: SI Safety Control Channel control word S_STW1B	0			Ready to run	3		
1233	r10251		CO/BO: SI Safety Control Channel control word S_STW1B diagnostics	0H				3		
1234	p30000		ABC_OA switch-on mode	[0] Reset messages			Operation	1		
1235	p30001		CI: ABC_OA P controller input signal source	0			Operation	1		
1236	r30002		CO: ABC_OA P controller output signal	0.00				1		
1237	p30003		ABC_OA P controller gain factor	1.00			Operation	1	0	1000

Figure 5-20 Expert list

- To activate the Technology Extension for the drive object, download the project.
Set the mode to ONLINE and select "Download Project to Target System".

5.4.2.4 Commissioning Technology Extension SERVCUP

Precondition

To commission Technology Extension SERVCUP, it is assumed that the hardware has been fully commissioned "Commissioning sequence (Page 85)".

When commissioning the hardware, you create the drive objects on which you wish to operate the Technology Extension.

Commissioning SERVCUP

To commission Technology Extension SERVCUP, set the additional parameters in the expert list of the STARTER commissioning tool.

For Technology Extension SERVCUP, parameters starting at p31740 are available, see "Parameter (Page 139)".

The commissioning is described in detail in Chapter "Commissioning (Page 85)".

5.4.3 Technology Extension upgrade

5.4.3.1 Installing the OA Support Package in STARTER

Technology Extension "ABC_OA" is upgraded from version V1.1 to version V1.2 in the following.

The new Technology Extension is installed in STARTER as an additional technology package.

Procedure

To install the OA Support Package "oasp_abc_oa_v1_2_oaif04402300.zip", proceed as described in Chapter "Installing the OA Support Package in STARTER (Page 72)".

After this installation, both versions of ABC_OA are visible in the window "Installation of libraries and technology packages".

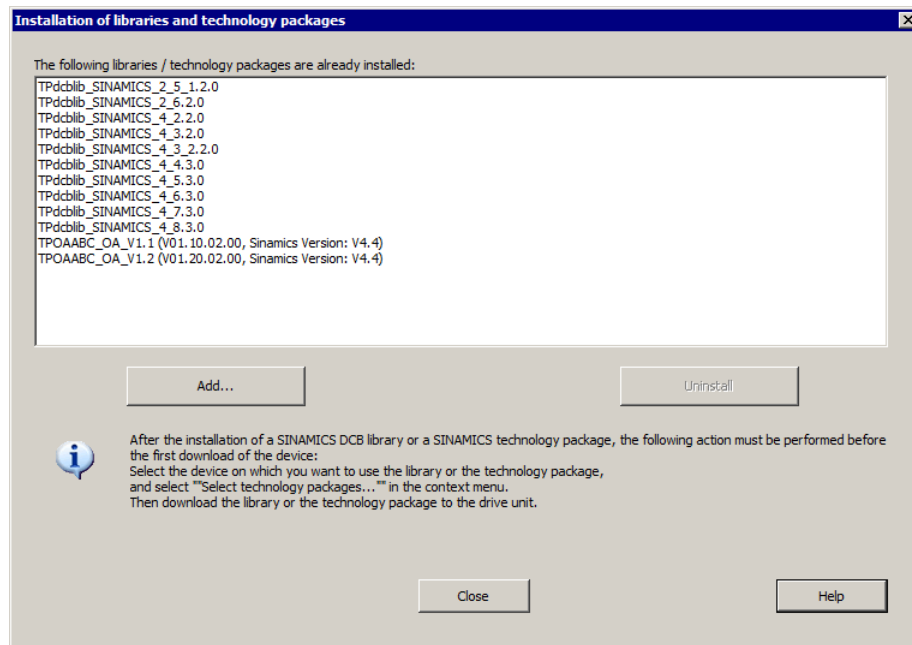


Figure 5-21 Installing the OA Support Package (technology package)

5.4.3.2 Download the technology package for the new version

In the following, the Technology Extension ABC_OA with version V1.2 is loaded into the device via STARTER.

Requirements

The following requirements must be met before downloading:

1. A project matching the device is open.
2. The STARTER commissioning tool is in ONLINE mode.

Procedure

To download, proceed as follows:

1. Right-click the drive unit in the project navigator.
2. Click "Select technology packages" in the shortcut menu.
The "Select technology packages" window opens.
3. For technology package "ABC_OA", select version V01.20.02.00 under the column "Version (offline)".

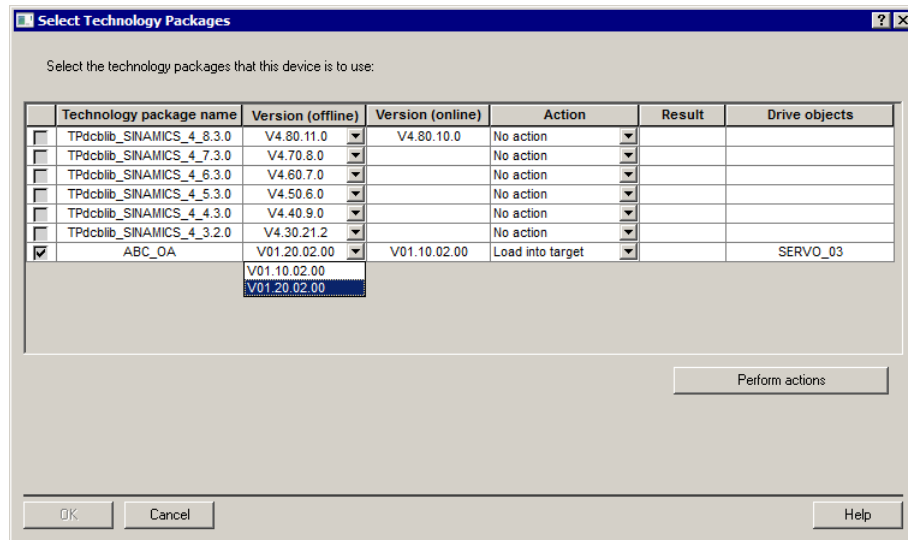


Figure 5-22 Selecting the technology package version

4. For the technology package "ABC_OA", set the action "Load to target device"
5. Click the "Perform actions" button.
6. Confirm the message that the existing technology package should be overwritten.
After successfully performing the action, the information "OK" is displayed for the corresponding "Result" field.
Version V01.20.02.00 is now used on the drive device.
7. To activate the Technology Extension for the drive object, perform the project download.
Set the mode to ONLINE and select "Download Project to Target System".

5.4.3.3 Additional information about upgrading

Pay particular attention to the following information about upgrading:

1. The drive objects activated in the previous version of the Technology Extension remain activated.
Procedure for activating/deactivating the Technology Extension in further drive objects, see "Activating the Technology Extension in the drive object (Page 75)".
2. The parameters set in a drive object in the previous version of the Technology Extension and their values are retained.
3. New parameters of the newly installed version of the Technology Extension are preassigned the factory settings and may have to be set.
4. The OA Support Package of the previous version of the Technology Extension can be deleted from STARTER if it can no longer be used for other projects or drive devices.
For the procedure for deleting/uninstalling, see "Uninstalling Technology Extension (Page 80)".

5.4.4 Uninstalling Technology Extension

Procedure

To uninstall a Technology Extension using STARTER or SIMOTION SCOUT, reverse the installation sequence.

1. Deactivate the Technology Extension in the drive object, see "Activating the Technology Extension in the drive object (Page 75)".
2. Delete the technology package belonging to the Technology Extension in the drive unit, see "Downloading the technology package (Page 74)".
 - Deactivate the technology package in OFFLINE mode.
 - Save and compile the project.
 - Download the project to the target device.
 - For the technology package in ONLINE mode, select the "Delete" action and click the "Perform actions" button.
3. Uninstall the Technology Extension in STARTER.

Uninstalling the Technology Extension in STARTER

To uninstall, proceed as follows:

1. From the "Tools" menu, choose the "Installation of libraries and technology packages" function.
The "Installation of libraries and technology packages" window opens.

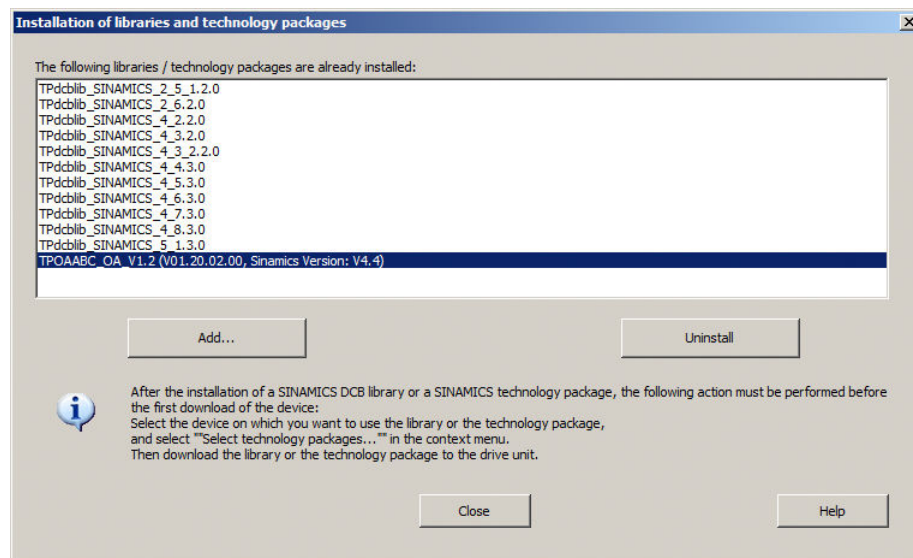


Figure 5-23 Uninstalling technology packages

2. Select the technology package belonging to the Technology Extension ABC_OA.
3. Click the "Uninstall" button.
The technology package is deleted.
4. Click the "Close" button.

5.4.5 Scripting with STARTER or SIMOTION SCOUT

5.4.5.1 Information about scripting

Preconditions

Using the scripting functionality assumes that you are familiar with script programming; therefore, a general introduction will not be provided here.

The implementation is based on VBScript from MICROSOFT, which has been expanded to include special objects and methods for STARTER. The current STARTER version is recommended when using SINAMICS TEC scripting functions with STARTER. As a minimum, STARTER version V5.1 SP1 HF2 must be used when using SINAMICS TEC scripting functions.

Devices

This description applies to:

- SINAMICS S120, S150, G130, G150, MV (CU320-2)
- SINAMICS S120 (CU310-2)
- SIMOTION D4x5-2 with SINAMICS Integrated
- SIMOTION D410-2 with SINAMICS Integrated
- SINAMICS DCM, DCP

Working with scripting functionality

Using the scripting functionality, you can automate the configuration using an easy-to-learn script language. Drive objects (DOs), e.g. SINAMICS drives and SIMOTION technology objects (TOs), for example axes, can be configured.

Standard scripts can be adapted to specific situations during the runtime using interactive queries, which means that the scripts are executed dependent on query results. This simplifies and speeds up commissioning. Other applications include documenting settings that have been made and repeating complex settings without error, for example.

WARNING

Malfunctions as a result of incorrect scripts

Scripting provides extensive automation options that are required to be able to automate manual operator actions in STARTER, therefore optimizing the time required for the recurring configuration of projects and tasks. Incorrect configurations that are not identified in tests can result in property damage, serious injury or death! The script programmer and the script user are responsible for the operator actions implemented in the scripting.

- Run systematic tests on new and modified scripts to verify and validate them.
- Before running a script, carefully ensure it has the correct content! Verify and validate the results when running a script by performing tests on the machine.

Note

Information about scripting, tools and application examples

- Detailed documentation about VBScript is available at the following address (<https://www.microsoft.com>).
 - Detailed notes for SIMOTION scripts are contained in SIMOTION Utilities & Applications. This information is available on DVD or in the Internet at the following address (<https://support.industry.siemens.com/cs/document/26340545>).
In addition to the SIMOTION Scripting Interface Manual and a script styleguide, there is a collection of scripts that provide support when working with SIMOTION SCOUT.
-

Scripting variants

The following scripting variants are available in STARTER:

VBScript Internal

In the STARTER project navigator, script folders can be inserted under the project, each device and each TO/DO. You can then insert the scripts into this script folder. Scripts are edited using an internal editor. Scripts can be imported or exported in text format (ASCII) and XML.

VBScript External

Scripts can also be executed from Windows Explorer. STARTER does not have to be started for this purpose. This allows operators without system knowledge to perform configuration tasks. In this case, the script is available as a VBScript in an ASCII file "TECupdaten.vbs" in the Windows file system, for example.

External scripting

For more complex scripting applications, you can implement your own application – which provides a task-oriented user interface – and internal SIMOTION scripting, which uses the STEP7 command interface and other scripting interfaces (e.g. for databases or XML). This form of scripting is implemented using VisualBasic or Visual C#, for example.

5.4.5.2 Scripting for Technology Extensions

An application example, where several TEC-specific scripting methods are applied, is the automated update of Technology Extensions. The typical workflow when upgrading and the methods used are subsequently described.

Detailed information about general and TEC-specific scripting methods are provided in the STARTER online help.

Upgrading a Technology Extension using scripting methods

To update a Technology extension using scripting, the same steps must be performed as for a manual update, see "Technology Extension upgrade (Page 76)". Additional steps and queries serve especially to guarantee a safe and reliable function.

Table 5-1 Scripting methods and corresponding commissioning steps

Scripting methods	Commissioning step
GetActivatedTECs	Query, on which drive objects are Technology Extensions activated and which version is used.
GetTECParameterRanges	Query, which parameters belong to a specific, activated Technology Extension.
Parameter	Read out and save the settings of these parameters.
DeActivateTEC	Deactivate the old TEC version.
UninstallTEC	Uninstall the old TEC version.
InstallTEC	Install the new TEC version.
SelectTECVersion	Select the new TEC version to be installed.
DownloadTEC	Download the new TEC version.
ActivateTEC	Activate the new TEC version on all drive objects on which the old version was active. To do this, the drive objects read-out using "GetActivatedTECs" must now be used as target.
Parameter	Restore the parameter settings in the new TEC version.

The methods listed can be removed from the complex context and separately applied. For instance, a text file can be created using "GetActivatedTECs" that can be used for documentation purposes or as configuration example.

The steps defined using scripting can also be extended to include additional actions. For example, the results from "GetActivatedTECs" can be compared with the OASP in an installation folder. If more recent versions are saved to the installation folder, then an update can be fully automatically performed in STARTER.

Explanations and programming examples

An overview and help for scripting methods specific to Technology Extensions are provided in the STARTER help:

1. Open Help, by pressing key "F1", for example.
2. Double-click on folder "Scripts to Automated Execution".
3. Double-click on folder "Methods".
4. Double-click on folder "Technology Extensions methods".
A detailed description with syntax, notes and programming examples is provided in this folder for all TEC-specific scripting methods.

Commissioning

6.1 Commissioning sequence

 WARNING
Danger to life due to incorrect parameterization As a result of incorrect parameterization, machines can be damaged or malfunction, which in turn can lead to injuries or death. • Perform the commissioning carefully in accordance with these instructions. • Protect the parameterization (parameter assignments) against unauthorized access. • Respond to possible malfunctions by applying suitable measures (e.g. EMERGENCY STOP or EMERGENCY OFF).

General commissioning sequence

Commissioning Technology Extension SERVCOUPL comprises 3 subprocesses:

1. Commissioning the hardware (Page 88)
You must first commission the hardware before using Technology Extension SERVCOUPL. Certain special issues must be taken into account.
2. Commissioning the Technology Extension SERVCOUPL (Page 117)
After commissioning the hardware, install, activate and configure Technology Extension SERVCOUPL. The SERVO coupling is established in this step.
3. Complete commissioning (Page 127)
After commissioning the Technology Extension, it may be necessary to make adaptations to the higher-level control system. This involves, e.g. the switch-on sequence of the drive objects or ensuring that the data sets are switched over in synchronism.

Controller-specific commissioning sequence

The commissioning sequence varies depending on the control system and commissioning tool. When using the Startdrive commissioning tool, the procedure is analogous to the commissioning described with STARTER/SCOUT.

SIMATIC/SIMOTION	SINUMERIK	
STARTER/SCOUT	CMC-Topo, CMC-Expert	SINUMERIK HMI
"Commissioning the hardware – overview (Page 88)"		
"Commissioning the hardware using STARTER (Page 93)"	"Commissioning the hardware using CMC-Topo/CMC-Expert (Page 99)"	"Commissioning the hardware using SINUMERIK HMI (Page 116)"
"STARTER or SIMOTION SCOUT (Page 72)"	"SINUMERIK Operate (Page 55)"	
"Overview for commissioning TEC SERVCOUP (Page 117)"		

6.1 Commissioning sequence

SIMATIC/SIMOTION	SINUMERIK	
STARTER/SCOUT	CMC-Topo, CMC-Expert	SINUMERIK HMI
"Commissioning the Technology Extension using STARTER (Page 122)"	"Commissioning the Technology Extension using SINUMERIK Operate (Page 124)"	
"Complete commissioning (Page 127)"		

6.2 Sampling times and number of controllable drives

The sampling time of Technology Extension SERVCUP corresponds to the current controller sampling time p0115[0].

Technology Extension SERVCUP requires additional CPU time. This can reduce the maximum number of drive objects that can be controlled.

Note

Information on the system sampling times and the number of drives that can be controlled can be found in the following reference:

- SINAMICS S120 Function Manual Drive Functions
Chapter "System rules, sampling times and DRIVE-CLiQ wiring"

The remaining computation time (see r9976) can be used for SERVCUP and other options (e.g. DCC).

Examples of computation time utilization

The following table lists the values for the additional computation time utilization:

- For 2 SERVO drive objects with activated Technology Extension SERVCUP (1 master and 1 follower drive object).
- For 3 SERVO drive objects with activated Technology Extension SERVCUP (1 master and 2 follower drive objects).
- For 6 SERVO drive objects with activated Technology Extension SERVCUP (1 master and 5 follower drive objects - application example for segment motor).
- For 4 SERVO drive objects with activated Technology Extension SERVCUP (2 master and 2 follower drive objects - application example for 2 connected double-winding motors).

Table 6-1 SERVCUP for SERVO drive object computation time utilization

Current controller sampling time	Additional computation time utilization (r9976[1])			
	1 master with 1 follower	1 master with 2 followers	1 master with 5 followers	2 master with 2 followers
p0115[0]				
62.5 μ s	6.1% *	9.0% *	-	-
125 μ s	3.3% *	4.8% *	9.4% *	6.3% *
250 μ s	2.6%	3.9%	7.7%	5.0%

* The utilization values for SINAMICS firmware versions older than V5.1 are approx. 1.5 times higher.

For 6 drives with servo control (p0115[0, 1] = 125 μ s), SERVCUP can be operated with a sampling time of 125 μ s for all SERVO drive objects.

6.3 Commissioning the hardware

6.3.1 Commissioning the hardware – overview

The following tasks must be performed when commissioning the hardware:

- Setting up and basic commissioning of the drive line-up
- Parameterization of the drive objects
 - Creating an encoder interface on all drive objects and deactivating them on follower drive objects
 - Adapting the motor parameterization
 - Setting identical parameters for master and follower drive objects

Commissioning variants

There are differences in detail with regard to the requirements and sequence of the commissioning variants. The following table provides an overview.

Table 6-2 Differences between the commissioning variants

SIMATIC/SIMOTION	SINUMERIK	
	CMC-Topo, CMC-Expert	SINUMERIK HMI
Commissioning the encoder interface on the follower drive objects (Page 90)		
Commissioning the hardware using STARTER (Page 93)	Commissioning the hardware using CMC-Topo/CMC-Expert (Page 99)	Commissioning the hardware using SINUMERIK HMI (Page 116)
1. Install the drive line-up (wired drive objects: only master drive object) 2. Connect the encoder 3. Create the STARTER project, create the drive unit, configure the infeed 4. Configure the master drive object (this also involves assigning the encoder) 5. Create copies of the master drive object (corresponding to the required follower drive objects) 6. Deactivate the encoder interface on the follower drive objects 7. Wire the follower drive objects	1. Install the drive line-up (wired drive objects: all drive objects) 2. Connect the encoder 3. Create a drive archive in the control system 4. Process/edit the drive archive using CMC-Topo – Also create and deactivate the encoder interface on the follower drive objects – Save as user-specified topology 5. Create a project in CMC-Expert – Import the user-specified topology – Create and integrate a component (this contains the motor data and the values that have been identically set for the master and follower) – Save as Linux package 6. Boot the control system with the created package 7. Configure the drive and perform the first commissioning	1. Set up the drive line-up (wired drive objects: Master and one follower drive object) 2. Connect an encoder for the master and an additional SMx for the wired follower drive object 3. Perform the first commissioning for both drive objects 4. Deactivate the encoder interface on the follower drive object 5. Create an encoder interface on an additional drive object – Switch off SINUMERIK – Reconnect Sensor Module to the next follower drive object – Switch on SINUMERIK – Commission the follower drive object – Create/deactivate encoder interface 6. Repeat step 5 for all the other follower drive objects

6.3.2 Commissioning the encoder interface on the follower drive objects

In order to be able to receive the actual encoder values at the follower drive objects, the encoder interface must be configured on the follower drive objects during commissioning, even if an encoder is not physically connected. In this way, the required variables are created which are used later by Technology Extension SERVCUP.

At the end of the commissioning, the created encoder interface must be deactivated again on all follower drive objects via parameter p0145 because an encoder is not physically connected. The variables remain active and are used by Technology Extension SERVCUP to transfer values and to operate the motor.

Note

It is not permissible that any other components are connected to the DRIVE-CLiQ socket with the parameterized and deactivated encoder interface, even if the DRIVE-CLiQ socket is not physically occupied.

- Check the topology in the commissioning tool.
-

Replacing an encoder

If an encoder is replaced on a motor that has already been commissioned, a full recommissioning should take place.

Especially if there is a change of encoder type, partial commissioning may result in incompatible or incorrect settings such as an incorrect switch-on sequence of drive objects.

6.3.3 Temperature evaluation

Temperature sensors

When operating the Technology Extension SERVCUP, only 1 encoder can be used. This means the temperature monitoring via encoder (p0600 = 1) would only be possible at the master drive object. For Technology Extension SERVCUP, the temperature sensors should therefore always be connected via TM120 Terminal Modules. In this case, p0600 = 20/21 must be set on the drive objects, and the interconnection established via p0608/p0609. The temperature sensors must be evaluated by the associated drive object.

Application example

Two coupled direct motors are each equipped with a PTC and a PT1000 temperature sensor. For motor data set 1 (MDS1), the following parameterization applies:

Motor 1 (master drive object)	Motor 2 (follower drive object)
Temperature sensing/monitoring	
p0600[0] = 20	
p0601[0] = 11	

p0608[0] = TM120_r4105[0] p0608[1] = TM120_r4105[1]	p0608[0] = TM120_r4105[2] p0608[1] = TM120_r4105[3]
p4610[0] = 20 p4611[0] = 10	
Response forwarding	
Master drive object fault in operation (Page 137)	Follower drive object fault in operation (Page 137)

Note

Only TM120 Terminal Modules are permissible when it comes to monitoring the temperature of follower drive objects.

- It is not permissible to use TM150 Terminal Modules, as they do not provide protective separation.
- Temperature monitoring via SME requires an active encoder. As a consequence, SME are unsuitable for monitoring the temperature of follower drive objects.

6.3.4 Using Double Motor Modules

Checking the drive object number

When using Double Motor Modules, after the automatic configuration, 2 SERVO drive objects are already created. The SERVO drive object with the lowest drive object number must be configured as master drive object. Normally, this is the uppermost drive object in the topology view; to be on the safe side, the drive object number should be checked. The STARTER commissioning tool offers several options to do this:

Variant 1

In the online mode, check parameter p0101 in the Control Unit Expert list.

Variant 2

Double-click on a drive object. The drive object number is located under the drive object name:

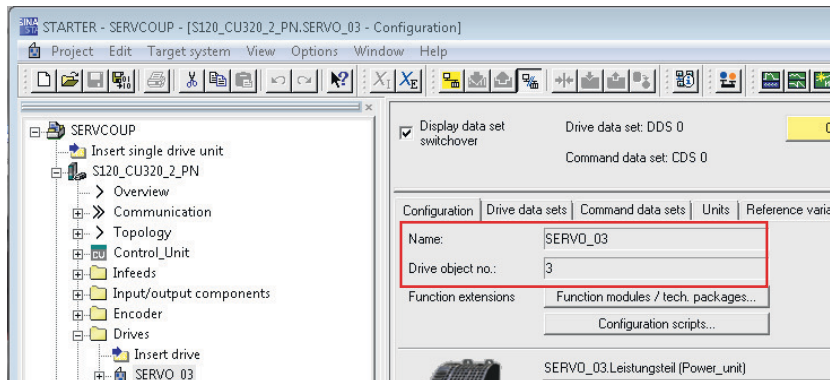


Figure 6-1 Drive object number displayed via the configuration view of the drive object

Variant 3

Open the project overview. The values in brackets correspond to the drive object numbers:

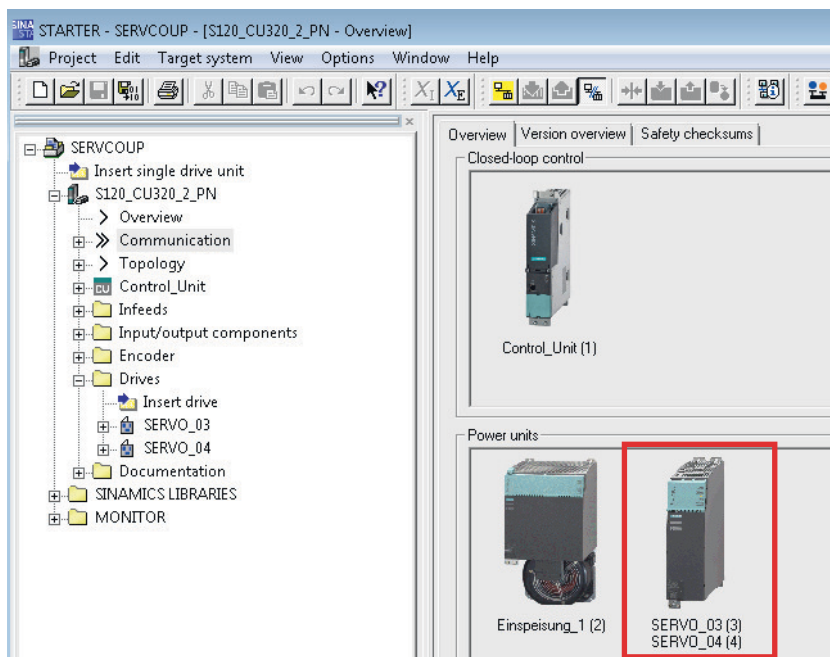


Figure 6-2 Drive object number displayed via the project overview

Further steps

When using Double Motor Modules, as the second drive object is already created, when commissioning the hardware using STARTER, the step "Creating follower drive objects and Terminal Modules (Page 97)" is omitted.

The follower drive object must be commissioned in the same way as the master drive object. When commissioning Double Motor Modules, it must be ensured that the master and follower drive objects are identically parameterized.

6.3.5 Commissioning the hardware using STARTER

6.3.5.1 Overview

This chapter describes commissioning using STARTER based on an example. Using the Startdrive commissioning tool, the procedure is analogous to commissioning described with STARTER.

Single Motor Modules are used in the commissioning example. When using Double Motor Modules, also observe the notes in "Using Double Motor Modules (Page 91)".

In the example, 1 master drive object and 1 follower drive object are commissioned. The procedure would be identical when using 1 master drive object with 5 follower drive objects, only more copies of the master drive object would have to be made.

We recommend following this example for the following reasons:

- The example satisfies all mandatory preconditions, e.g.
 - Within a SERVO coupling, the drive object number of the master drive object must be less than the drive object number of the associated follower drive objects.
 - Many master and follower parameters have already been set identically
See Table A-1 Parameter settings of Technology Extension SERVCOU (Page 161).
 - The number of data sets and their assignment is the same for all drive objects.
- The example includes the following simplifications.
 - The motor data only has to be entered once (instead of separately at each drive object).
 - Clear designation of the drive objects.

Note

You can find information on STARTER and alternative procedures in the following reference:

- SINAMICS S120 Commissioning Manual
-

6.3.5.2 Preconditions

The following preconditions apply when commissioning the hardware using STARTER:

- The drive line-up has been set up completely. The master drive object is connected via DRIVE-CLiQ; the DRIVE-CLiQ connection to the follower drive objects is disconnected.
- The encoder is connected.
- The DRIVE-CLiQ wiring rules have been observed.

- The communication interface between the PG/PC and the drive has been configured.
- A new project has been created in STARTER. In the project, master drive object, infeed and possibly a TM120 (if required) have been created, and the infeed is configured. This corresponds to steps 1-3 in Chapter "Commissioning with STARTER (example)" in the "SINAMICS S120 with STARTER Commissioning Manual":
 - Creating a new project
 - Automatic configuration
 - Configuring the infeed

6.3.5.3 Configuring a master drive object

The master drive object is renamed in this commissioning example. This is not mandatory but it simplifies the commissioning and avoids confusion when using a large number of drive objects.

Renaming the master drive object

To rename the master drive object, proceed as follows:

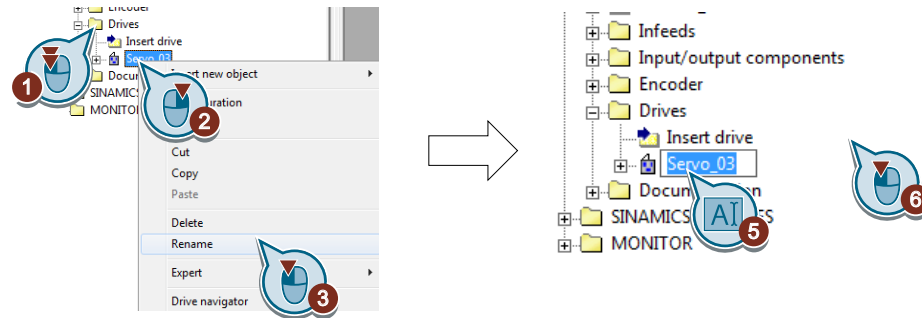


Figure 6-3 Renaming the master drive object

1. Double-click "Drives" in the project navigator.
2. Right-click "Servo_03".
3. In the shortcut menu, select "Rename".
The "Change Name" window opens (unless the "Do not display this message anymore." checkbox has been permanently deactivated).
4. Click "Close" in the "Change Name" window after reading the information.
5. In the selected text field, enter the new name (in this commissioning example: TEC_Master).
6. Complete the input with <Return> or click on any arbitrary position in the project navigator.

Configuring the master drive object "TEC_Master"

To configure the "TEC_Master" master drive object, proceed as follows:

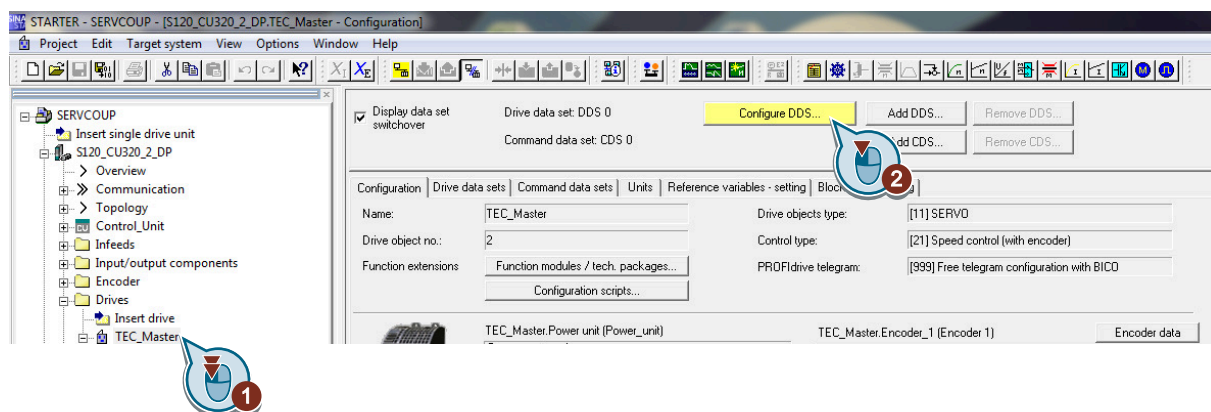


Figure 6-4 Configuring the drive

1. Double-click the "TEC_Master" master drive object.
The drive properties are displayed in the working area.
2. Click on "Configure DDS".
The "Configuration - Drive Unit - Control Structure" dialog box opens.
3. Populate the "Control Structure" and "Power Unit" dialog boxes for the master drive object in accordance with the hardware being used
Click on "Continue >" to switch to the "Motor" dialog.

Configuring the motor

Observe the "Notes for commissioning motors (Page 31)" when configuring the motor.

Configuration as list motor

1. Activate the "Select standard motor from list" checkbox in the "Motor" dialog box.
2. Select the appropriate entry in the "Motor type" drop-down list.
3. Click the used motor in the "Motor selection" list.
4. Complete the motor selection by clicking "Next".

Configuring as third-party motor

1. Activate the "Enter motor data" checkbox in the "Motor" dialog box.
2. In the drop-down list "Motor type", select the appropriate entry and then click "Next".
3. Enter the motor data, taking into account the drive objects being used, see "Notes for commissioning motors (Page 31)".
4. Activate the "Use optional motor data" checkbox and click "Next".
5. Enter the optional motor data taking into account the used drive objects.
6. Complete the motor selection by clicking "Next".

Further steps

1. Populate the other dialog boxes.
2. Close the last "Summary" dialog box by clicking "Finish".

Settings in the Expert list

1. Open the expert list by clicking the  button.
2. Configure the number of used drive data sets.
3. Configure all parameters that are identical for the master and follower drive object. This also applies for the assignment of the indices of the data set parameters.
Table "Table A-1 Parameter settings of Technology Extension SERVOUP (Page 161)" can be used as support.

4. If you have configured a motor that is listed in the catalog, which is described as a complete motor, then remove the write protection for the motor parameters and adapt the motor data:
 - To remove write protection, change p0300 from the actual parameter value to the corresponding general motor type, i.e. to the first digit of the actual value.
For example:
from p0300 = 232 (1FE2 synchronous motor) to p0300 = 2 (synchronous motor) or
from p0300 = 403 (1FN3 linear synchronous motor) to p0300 = 4 (linear synchronous motor).
 - Adapt the motor parameter values taking into account the drive objects used, see "Notes for commissioning motors (Page 31)".
 5. Save the settings by clicking the  button.
- The master drive object has been commissioned.

6.3.5.4 Creating follower drive objects and Terminal Modules

Follower drive objects and Terminal Modules for temperature evaluation can be created as copies of the master drive object or from already created Terminal Modules.

Copying the master drive object

To copy the master drive object, proceed as follows:

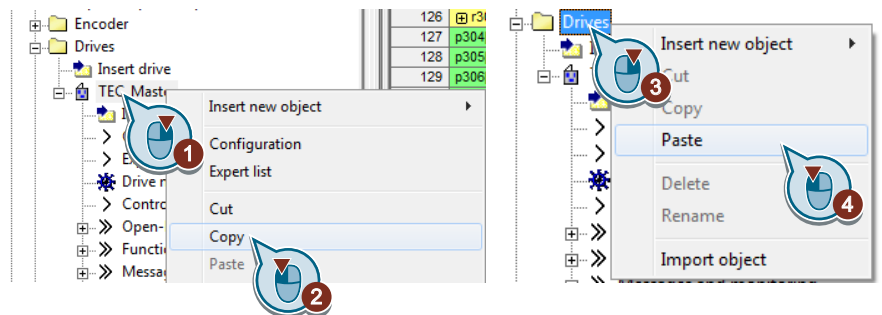


Figure 6-5 Copying the master drive object

1. Right-click the master drive object in the project navigator. Select "Copy" in the shortcut menu.
 2. Right-click the "Drives" folder.
 3. In the shortcut menu, select "Paste".
A progress bar is displayed. A new drive should then appear in the project navigator and a message about the successful import in the detail view.
 4. Right-click the newly created "TEC_Master_1" drive and rename it as "TEC_Follower".
- If required, create additional follower drive objects.

Creating additional Terminal Modules TM120

If you require additional TM120 Terminal Modules, proceed as follows:

1. Copy an existing TM120 in the appropriate folder.
2. Rename it.
3. Adapt the BICO interconnection of the new TM120 at "Inputs/outputs".

6.3.5.5 Completing the hardware commissioning

To complete commissioning the hardware, proceed as follows:

1. Open the expert list of the follower drive object in the offline mode.
2. To deactivate the encoder interface, set p0145 to "2".
3. Open the topology structure tree by double-clicking on the entry "Topology".

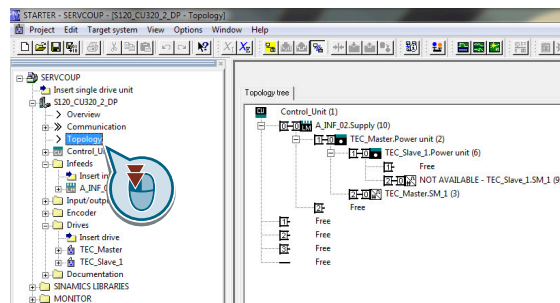


Figure 6-6 Topology structure tree

4. Check the topology structure of the drive units and correct them in case of errors.
5. Insert the DRIVE-CLiQ connection to the follower Motor Module in accordance with the topology structure.
6. Save the project using the button.
7. Go online by clicking the button.
The "Online/Offline Comparison" dialog box opens.
8. Click "Download to target device".
The "Download to target device" dialog opens.
9. Start the load operation by clicking "Yes".
The dialog "Load to target device" is closed - and dialog "Online/offline comparison" is reopened.
10. Click "Load to PG".
The "Load to PG" dialog opens.
11. Start the load operation by clicking "Yes".
12. Save the project by clicking the button.
13. Click the button to switch to the offline mode.
The hardware has now been commissioned.
14. Continue the commissioning in Chapter "Overview for commissioning TEC SERVCOUP (Page 117)".

6.3.6 Commissioning the hardware using CMC-Topo/CMC-Expert

The following chapter describes configuring a SINUMERIK to operate motors, which as a result of their size and/or format, cannot be operated with a single SINAMICS power unit. When commissioning a system using CMC-Topo/CMC-Expert, the encoder interfaces are created without connecting the corresponding hardware. As a consequence, this commissioning differs from the "Commissioning the hardware using SINUMERIK HMI (Page 116)" where a Sensor Module (SMx) must be plugged into each follower drive object.

When configuring, in order to avoid connecting encoders or Sensor Modules, using Create MyConfig (CMC) a package is created, which is executed at the control system. In the CMC package, a user-specified topology is executed and the appropriate drive parameters are specified.

Motor data and parameters that are identical for the master and follower drive objects are also integrated as a component. This approach has the following advantages:

- Master and follower drive objects are parameterized in an identical fashion.
- Data is entered once for all drive objects.
- For motors that are not DRIVE-CLiQ motors, this procedure is mandatory in order that the system can be commissioned for the first time at a later point in time.

The example shows the commissioning of a maximum configured axis grouping (1 master drive object + 5 follower drive objects). The name of the sample drive archive created in the control is "SERVCOUP_Master_5Follower.ARC".

This commissioning was performed with Create MyConfig 4.8 SP1. There may be slight differences with regard to screens, designations and memory formats in other versions. However, the basic procedure is the same.

Note

You can find information on CMC-Topo and CMC-Expert in the following references:

- Operating Manual - SINUMERIK ONE Create MyConfig - Diff, Expert, Topo
 - SINUMERIK Integrate Create MyConfig - Diff, Expert, Topo Operating Manual
-

6.3.6.1 Preconditions

The following preconditions must be satisfied when commissioning the hardware:

- A memory reset has been performed on the SINUMERIK control and the drive reset to the factory setting.
- The drive system has been completely set up and wired, the encoder is connected and the DRIVE-CLiQ wiring rules were complied with.
- A first commissioning including the steps "Automatic device configuration" and "Parameterization of the infeed" have been performed in the SINUMERIK control. A drive archive was subsequently created, saved (in this example: SERVCOUP_Master_5Follower.ARC) and was made available for further processing.
- Create MyConfig 4.6 or higher has been installed on the programming device (PG/PC).

6.3.6.2 Important a drive archive into CMC-Topo

1. Start CMC-Topo.
2. Open the import dialog box via the menu "Project" > "Display/import topology" > "From archive":

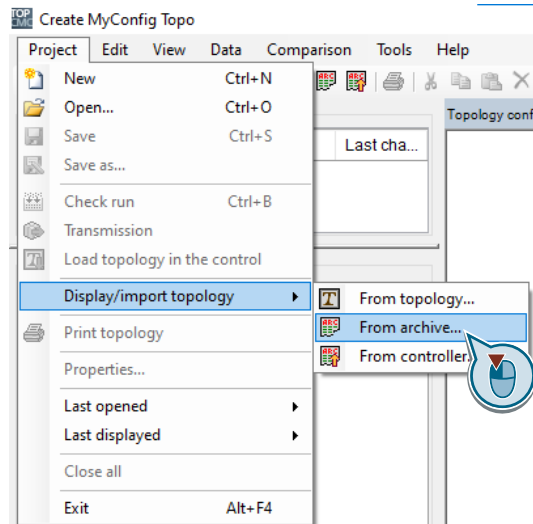


Figure 6-7 Import a series commissioning archive that as a minimum contains the drive archive data

The "Topology from Archive" dialog box opens.

3. Navigate to the appropriate archive file (in this commissioning example: SERVCUP_Master_5Follower.ARC") and open the file.
The "Create MyConfig Topo" prompt opens.
4. To close the dialog and continue, click on "No".

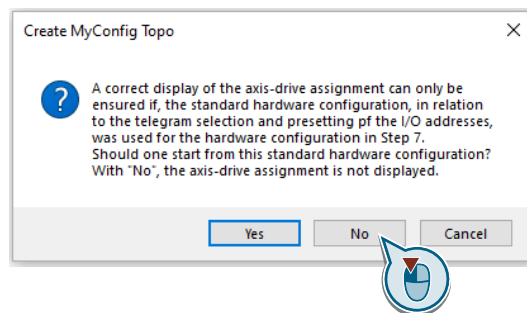


Figure 6-8 "Create MyConfig Topo" prompt

The topology structure is loaded and displayed grayed-out.

5. Click "Import".

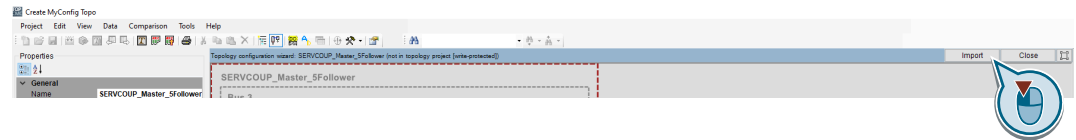


Figure 6-9 Topology import

The previously grayed-out topology now has a white background and can be edited.
A topology project was created automatically with the import of the archive.

6. Save the project by clicking the button.

The "Save As..." dialog box opens.

7. Enter the required name (in this example: "SERVCOUP_Master_5Follower") and confirm by clicking on "Save".

The topology project based on the imported archive is saved.

6.3.6.3 Editing imported data

Adapting the deployment version

Note

The user-specified topology must always be transferred for a defined CNC software release, as the SINAMICS parameters are dependent on the software release.

Adapt the deployment version as follows:

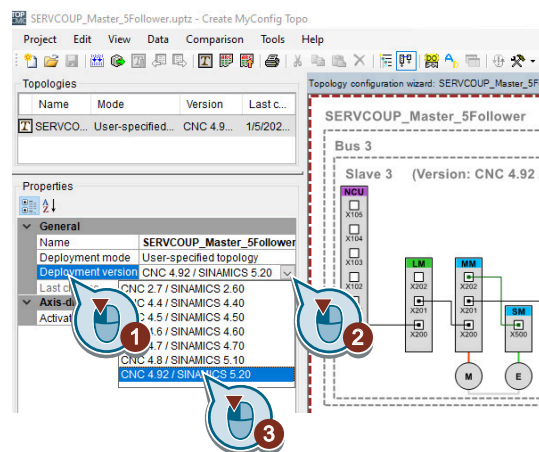


Figure 6-10 Adapting the deployment version

1. Click "Deployment version".

The drop-down list button can be selected.

2. Click the "Deployment version" drop-down list button.

3. Select the appropriate version from the drop-down list.

Editing DO variables

Open DO management using button ; the "DO list" dialog box opens.

Proceed as follows to rename the drive objects:

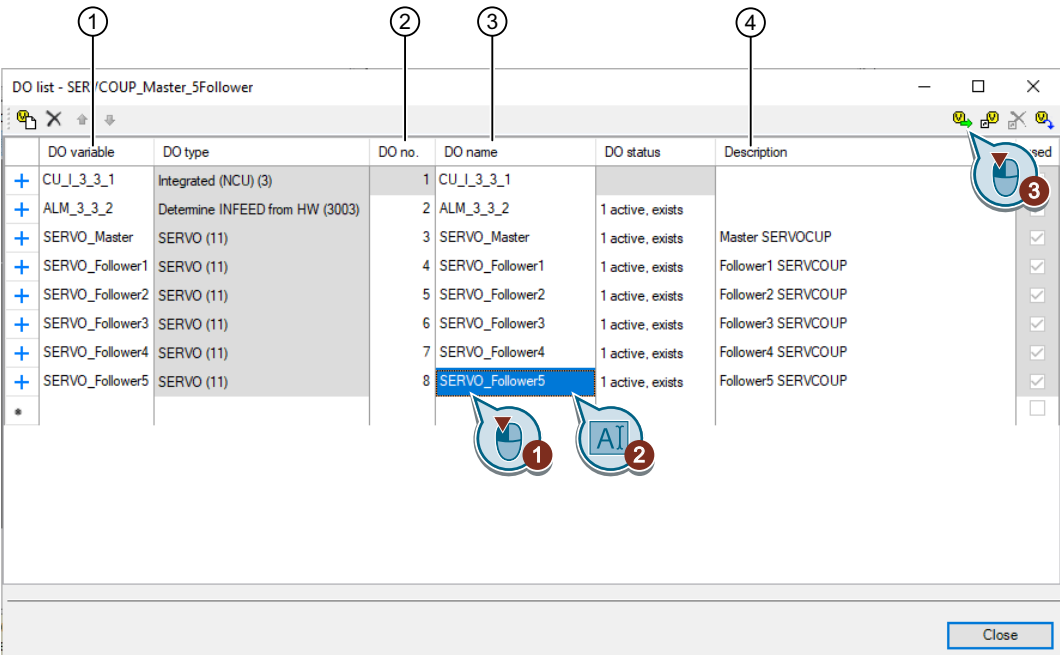


Figure 6-11 Renaming drive objects

- 1. Click on the entry to be changed.
The selected entry is shown with a blue background.
- 2. Overwrite the old entry and acknowledge the entry with <Enter>

①	The drive objects are subsequently assigned their parameter values via the DO variable. Make sure that you do not make any typing errors.
②	The master drive object must have a lower drive object number than the coupled follower drive objects.
③	The DO name is only for display on the HMI and does not have a function.
④	The description is not mandatory and has no effect on the functionality.

- 3. After you have made all the changes, click the "Export DO list" button.
The "Export DO list" dialog box opens.
- 4. Enter the file name and click "Save".
The "Export DO list" dialog box closes.
- 5. In the "DO list" dialog box, click "OK".
The "DO list" dialog closes.

Creating an encoder interface on the follower drive objects

The encoder interface is created by connecting an SMx to the drive object. A distinction must be made as to whether the SMx is connected directly to the follower drive object or to a TM120. Both options are shown in the following.

Connecting the SMx directly to the drive object

To set up the encoder interface on the follower drive object, proceed as follows:

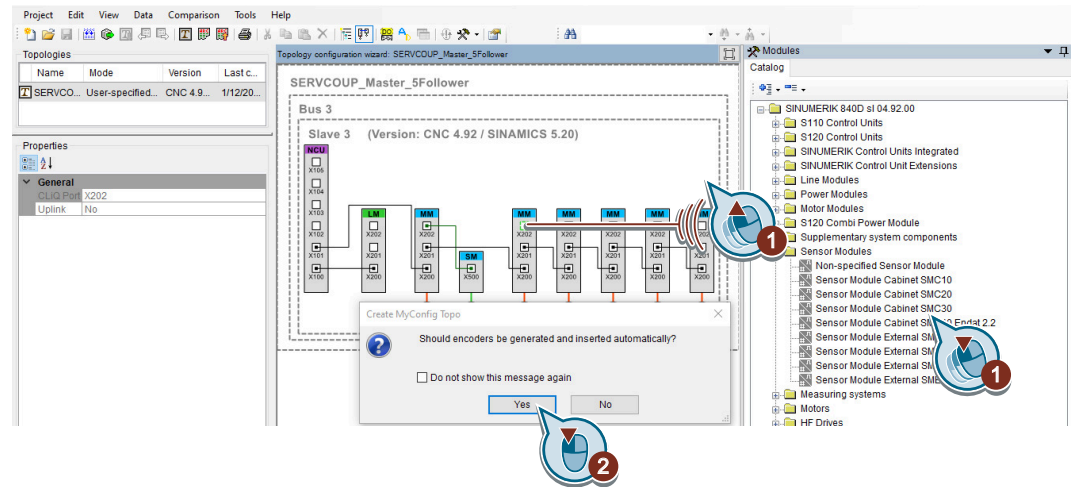


Figure 6-12 Connecting the encoder

1. Drag the relevant Sensor Module to input "X202" of a follower drive object.
2. Confirm the dialog box by clicking "Yes".
A dialog box for the variable assignment opens.
3. Click "Yes".
The dialog box closes and the Motor Module including all components is displayed with a yellow background.

Connecting the SMx via a Terminal Module

To set up the encoder interface on the follower drive object via a TM120, proceed as follows:

1. Drag the relevant Sensor Module to input "X501" of the Terminal Module.
2. Confirm the dialog box by clicking "Yes".

To assign a follower drive object to the SMx, proceed as follows:

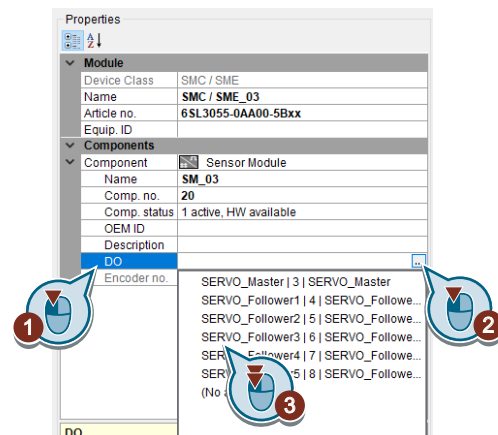


Figure 6-13 Creating the encoder interface via the TM120

1. In the "Properties" > "Components" area, click the "DO" entry.
The drop-down list button can be selected.
2. Click the "DO" drop-down list button.
3. Double-click the appropriate follower drive object.
The selected Motor Module including all components is displayed with a yellow background.

Deactivating the encoder interface

Deactivate the created Sensor Module as follows:

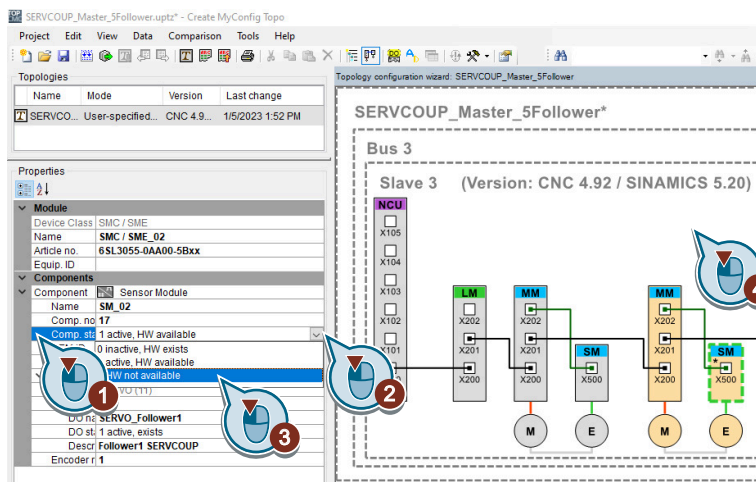


Figure 6-14 Deactivating the Sensor Module

1. Select the Sensor Module and in the "Properties" > "Components" area, click on "Comp. status".
The drop-down list button can be selected.
2. Click the "Comp. status" drop-down list button.
3. Select "2 HW not available".
4. Click anywhere in the topology area.
The module is grayed-out and is now deactivated.

Repeat the creation and deactivation of the encoder interface on all other follower drive objects.

Delete all existing MLFB entries for motors, encoders and SMx.

6.3.6.4 Deploying edited data as user-specified topology

1. Open the axis-drive assignment by clicking the  button.
The "Axis-drive assignment" dialog box opens.
2. Click on the drop-down list button "Activate" (①) and select entry "No" (②).

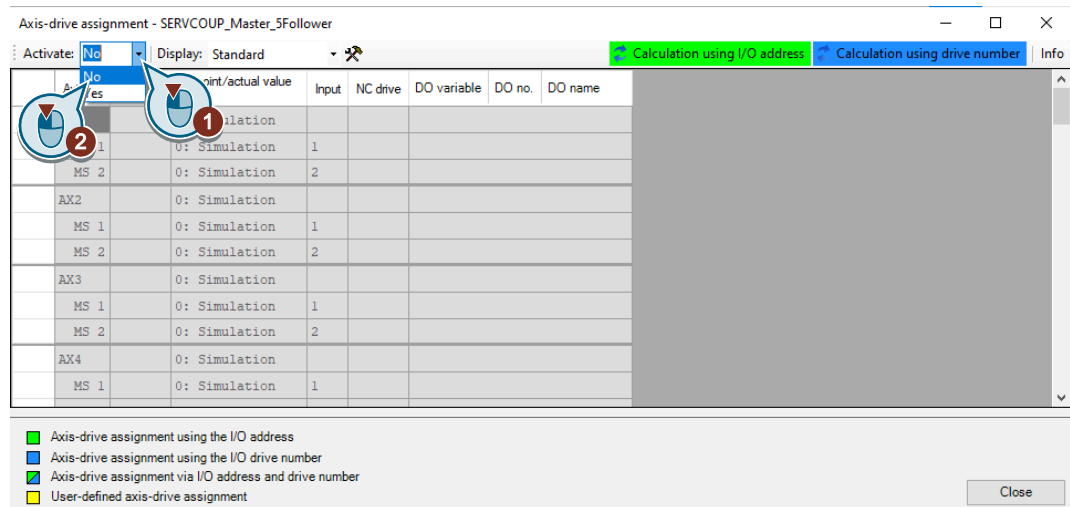


Figure 6-15 "Axis-Drive Assignment" dialog box

Any existing red entries are grayed-out.

3. Click the "Close" button.
4. In the menu, click "Project" > "Deployment" > "SERVCOUP_Master_5Follower" to "User-specified topology".

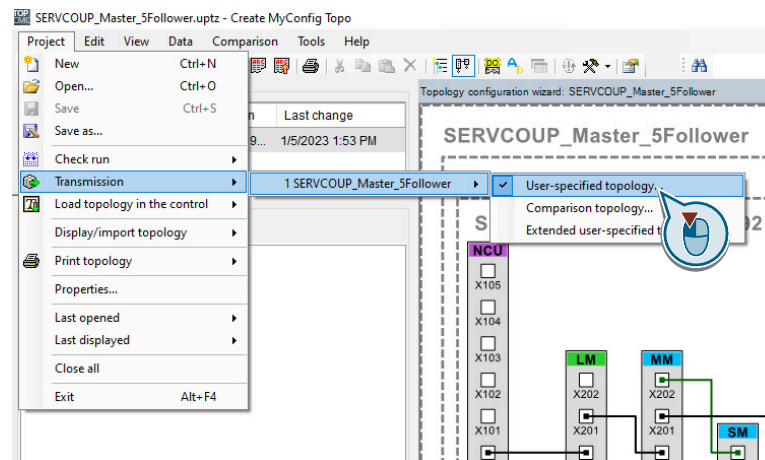


Figure 6-16 "Deploy user-specified topology" dialog box

The "Deploy user-specified topology" dialog box opens.

5. Save the user-specified topology by clicking "Save".
The "Deploy user-specified topology" dialog box closes and a prompt opens.
6. Click "OK" to close the prompt.

7. Check that no errors have occurred in the verification run.

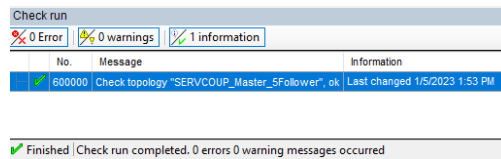


Figure 6-17 Output window

8. Close CMC-Topo.

6.3.6.5 Creating a project in CMC-Expert

Creating a project in CMC-Expert

1. Open CMC-Expert.
2. Create a new project via the menu "Project" > "New".
3. When required, change the folder where data is to be saved, and enter a project name (in this commissioning example: SERVCOUP_Master_5Follower).
4. Confirm your entries by clicking "OK".
The dialog box closes and the project name appears at the top left in the program window.

Configuring a project in CMC-Expert

Set the following configuration in the "Package" tab under "Project folder":

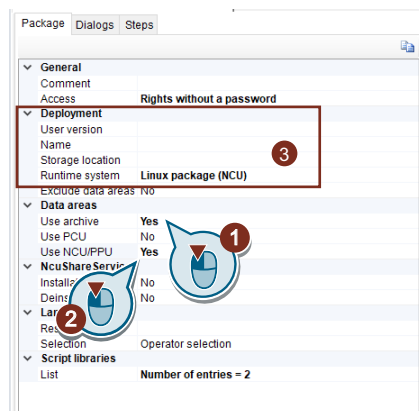


Figure 6-18 Tab "Package"

1. Activate the "Use archive" area.
2. Activate the "Use NCU/PPU" areas.
3. Check that the "Linux package (NCU)" is set.

Under "Project folder", click on tab "Dialogs" and activate the "System configuration" dialog.
Set the system configuration as follows:

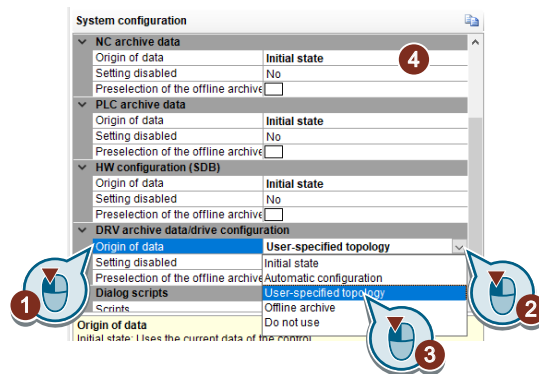


Figure 6-19 "System configuration" dialog

1. In the "DRV archive data / drive configuration" area, click on "Origin of data". The drop-down list button is displayed.
2. Click on the drop-down list button.
3. Select the "User-specified topology" entry.
4. Under "Origin of data", check that "Initial state" is set in the following areas: NC archive data, PLC archive data, HW configuration (SDB)

Importing the user-specified topology into CMC-Expert

To integrate a user-specified topology, proceed as follows:

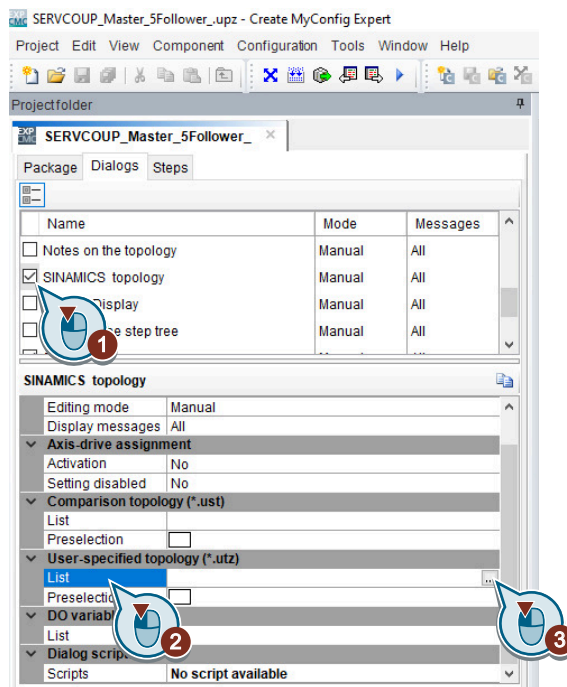


Figure 6-20 Dialog "SINAMICS Topology"

1. Activate the "SINAMICS Topology" dialog.
2. In the "User-specified topology (*.utz)" area, click on "List".
The "..." button is displayed.
3. Click on the "..." button.
The "List of user-specified topologies" dialog box opens.

To integrate the topology created in CMC-Topo, proceed as follows:

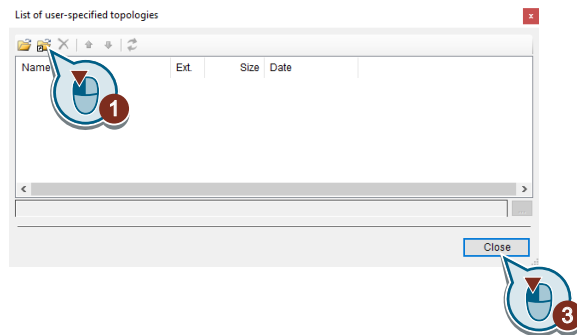


Figure 6-21 "List of user-specified topologies" dialog box

1. In the "List of user-specified topologies" dialog, click on the  button.
An explorer window opens.
2. Navigate to the folder with the file "SERVCOUP_Master_5Follower.utz" and double-click on the file.
The explorer window closes and the file is displayed in the "List of user-specified topologies" dialog box.
3. Close the dialog box by clicking "Close".
The following is located in the "User-specified topology (*.utz)" area, next to the entry "List":
"No. entries = 1"

To preselect the topology, proceed as follows:

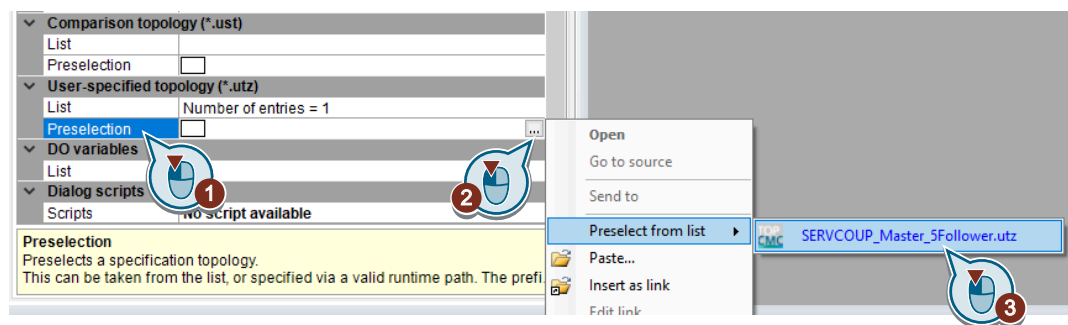


Figure 6-22 Preselecting the topology

1. In the "User-specified topology (*.utz)" area, click the "Preselection" entry. The "..." button is displayed.
2. Click on the "..." button. A selection window opens.
3. Move the mouse over the "Preselect from list" entry and select the "SERVCOUP_Master_5Follower.utz" file. The selected file is now displayed next to the "Preselection" entry.

Importing DO variables

Import the DO variables as follows:

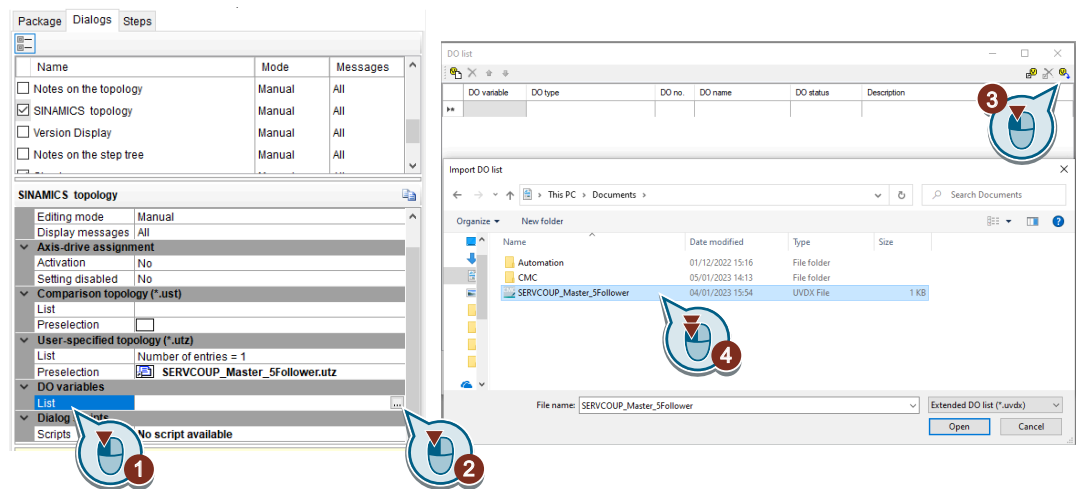


Figure 6-23 Importing DO variables

1. In the "DO variables" area, click the "List" entry. The "..." button is displayed.
2. Click on the "..." button. The "DO list" dialog opens.
3. Click on the  ("Import DO list") button. An explorer window opens.
4. Navigate to the folder in which the DO variables created in CMC-Topo are stored and double-click the UVDX file. The explorer window closes and the imported variables are displayed.
5. Close the "DO list" dialog box by clicking "OK". The number of imported variables is displayed in the "DO variables" area.

Save the project.

Creating a CMC component

In a CMC component, activate the "Manipulate" action and create a task to assign an identical value to the drive parameters of all drive objects. This task is executed when subsequently running the Linux package on the control system.

1. In the toolbar, click the  button ("New component").
2. In the "Component" text field, enter a name (in this example "Common_data") and click "Create".

To be able to manipulate the component, proceed as follows:

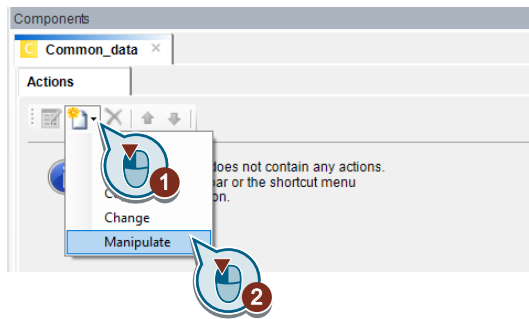


Figure 6-24 Manipulating a component

1. Click on the "Add new action" button.
2. Click the "Manipulate" entry.
A new tab called "Manipulate" is created.

Create a new manipulation job:

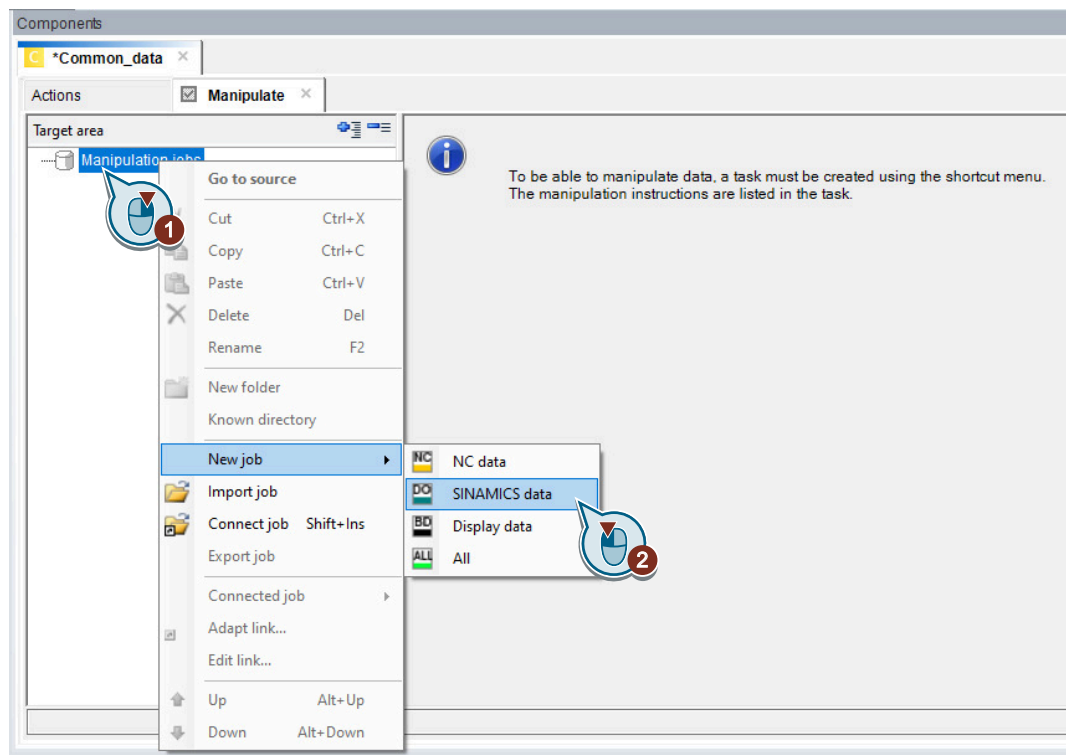


Figure 6-25 Creating a manipulation job

1. In the "Target area" area, right-click on "Manipulation jobs".
2. Select "New job" > "SINAMICS data" and enter a component name (in the example: "Identical_master_follower") and click on any location in CMC-Expert.

Create the manipulation instructions as follows:

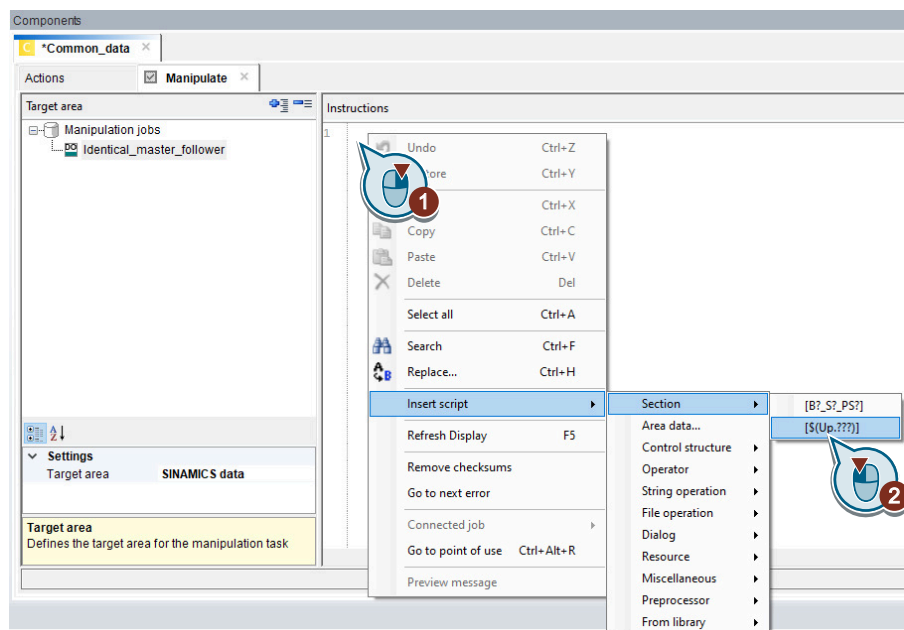


Figure 6-26 Creating manipulation instructions

1. Right-click in the "Instructions" area.
2. Select "Insert script" > "Section" > **[\$(Up.???)].**
3. Replace "???" with the variable name of the master drive object, see "Importing DO variables".
4. Insert below all motor parameters and identical parameters to be set according to the following rule: p3xx[0]=value.
 - Adapt the motor parameter values taking into account the drive objects used, see "Notes for commissioning motors (Page 31)".
 - If you are using several data sets, enter all values for all data sets.
 - Supplement additional parameters, which are identical between master and follower drive objects, e.g. p1980[0]=1 and p1982[0]=1.
See also table "Table A-1 Parameter settings of Technology Extension SERVCUP (Page 161)".
A possible instruction could start as follows:
[\$(Up.Servo_Master)]
p300[0]=2
p304[0]=23
p305[0]=9.5
p306[0]=1
p307[0]=3.71
p310[0]=2
p311[0]=240
p312[0]=180
p314[0]=49
...
5. Select and copy the entire text of the master drive object and insert it below the existing text.
6. In the inserted text, replace the variable name of the master drive object ("SERVO_Master") with that of the first follower drive object ("SERVO_Follower1").
7. Repeat substeps 5. and 6. for all of the remaining follower drive objects.

Save the component with the  button ("Save component").

Link the component as follows with the step tree:

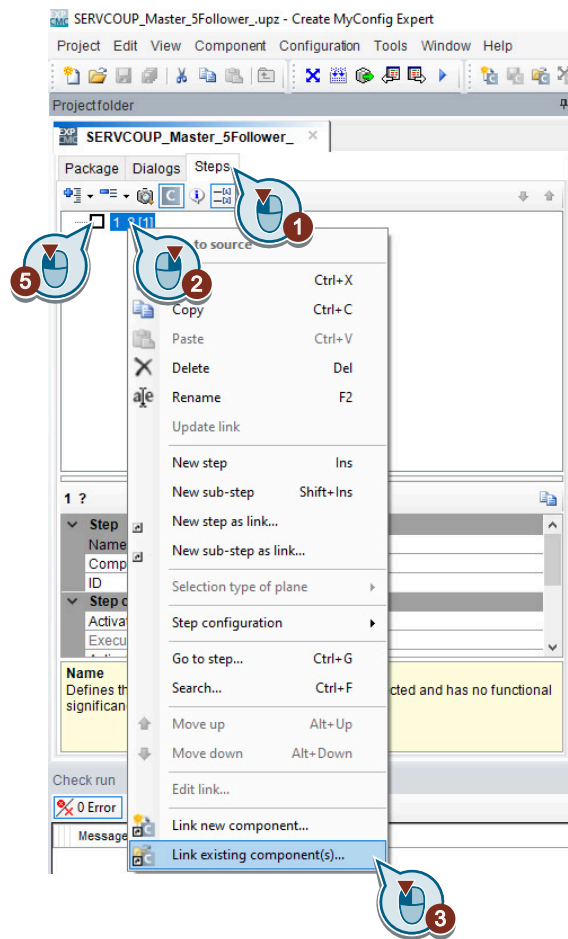


Figure 6-27 Linking the component

1. Click the "Steps" tab in the "Project folder".
 2. Right-click on the first entry.
 3. Click "Link existing component(s)".
 4. Select the "Identical_Master_Follower" component in the component explorer and click "Link".
 5. Activate the checkbox to activate execution of the step and the component.
The checkbox is displayed in green and the "Activation" entry is set to "Yes" in the overview.
- Save the project.

6.3.6.6 Deploying the Linux package with user-specified topology

1. In the "Project" > "Deployment" menu, select the "Deploy Linux package (NCU)" command.
The "Deploy Linux Package (NCU)" dialog box opens.
2. Enter the name and storage location (in this commissioning example: SERVCOUPLMaster_5Follower.usz) and click "OK".
Some feedback dialog boxes open, confirm these by clicking "OK".

3. Check that no errors were identified in the verification run:

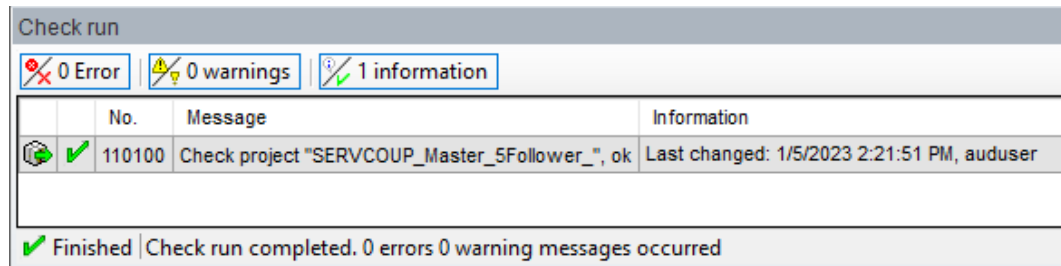


Figure 6-28 Verification run

4. Copy file "SERVCOUP_Master_5Follower.usz" to an empty USB stick.

6.3.6.7 Executing the Linux package in the control system

1. Insert the USB stick into a USB interface (X125 or X135) of the SINUMERIK NCU.
2. Perform a Power Off / Power On or a "Reset".
3. After power-up, press the "Next" softkey in the "Linux Access" window.
 - If the file "SERVCOUP_Master_5Follower.usz" is the only usz file on the USB stick, then it is immediately imported; otherwise, it must be selected in the appropriate window.
 - The "System Configuration" is displayed after loading.

4. Check the system configuration for the following settings:
 - "Drives": "User-defined topology"
 - all other options: "Initial state"

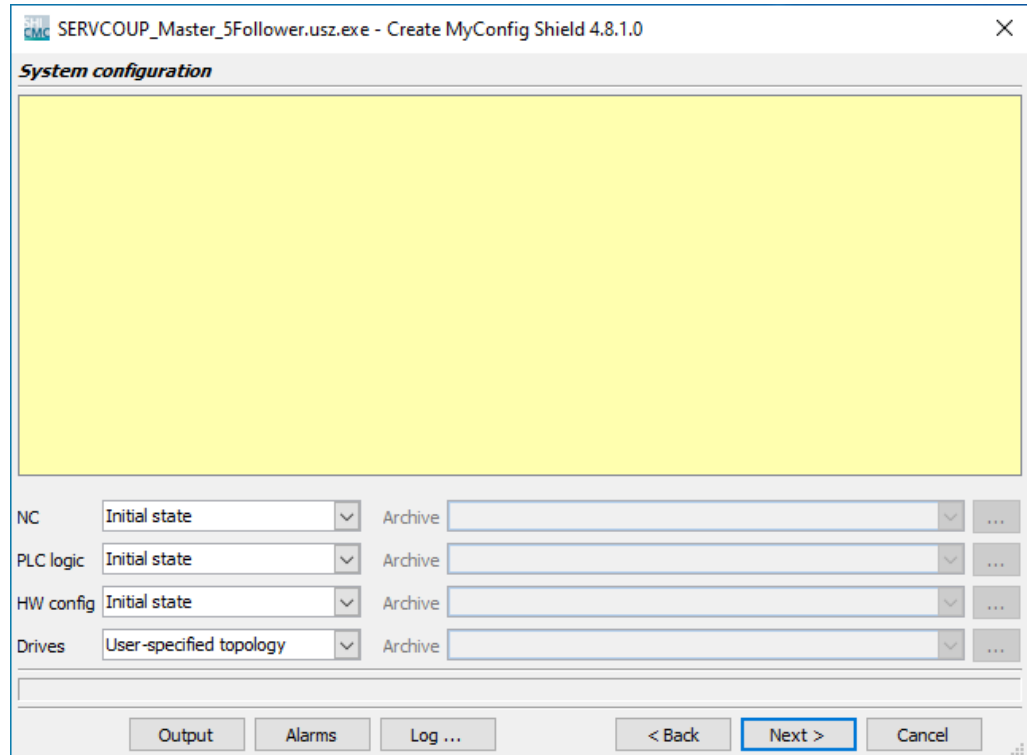


Figure 6-29 System configuration

5. Press the "Next" softkey.
The "SINAMICS Topology" dialog box opens.
6. Press the "Next" softkey.
The "End" dialog box opens.
7. Activate/deactivate the checkbox of the log file according to your requirements.
8. Press the "Close" softkey.
9. If required, save the log file by pressing the "Save" softkey.
10. Switch the control off and remove the USB stick.
11. Switch the control system back on again.

6.3.6.8 Complete the commissioning of the drive line-up

After powering up, the SINUMERIK control system is in the "Perform first commissioning" status.

The following commissioning dialog boxes have already been populated according to the entries in the linked component. The preset values should be checked when commissioning, and missing settings should be completed, e.g. for temperature monitoring or encoder data.

Continue commissioning with Chapter "Commissioning the Technology Extension using SINUMERIK Operate (Page 124)".

6.3.7 Commissioning the hardware using SINUMERIK HMI

This commissioning corresponds generally to the standard SINUMERIK commissioning procedure. The drive objects are created with a Sensor Module, and this is deactivated at the end of the commissioning.

The difference to the standard commissioning procedure is that the drive objects are first separated from the system without a connected Sensor Module, and then subsequently commissioned one-by-one.

Note

Information about commissioning SINUMERIK is provided in the following reference:

- Commissioning Manual SINUMERIK ONE Steps for configuring and commissioning
 - Commissioning Manual SINUMERIK ONE Final steps for commissioning
 - Commissioning Manual SINUMERIK 840D sl, SINAMICS S120 commissioning CNC: NCK, PLC, drive
-

Preconditions

- A memory reset has been performed on the SINUMERIK control and the drive reset to the factory setting.
- The drive line-up has been set up completely; the master drive object and one follower drive object have been wired by means of DRIVE-CLiQ.
- An encoder is connected (for subsequent use at the master drive object).
- An additional Sensor Module (SMx) is only required for commissioning, and is switched over between the follower drive objects.

Procedure

For this commissioning variant, in addition to an encoder assigned to the master drive object, an additional Sensor Module must be switched over from follower drive object to follower drive object. This is created via MD30200 = 1, and is subsequently deactivated via p0145 = 2.

Only the follower drive object with connected Sensor Module may be commissioned.

1. Commission the master drive object and the first follower drive object with connected Sensor Module.
2. After completing the commissioning, set the encoder interface on the follower drive object to "deactivated and not available".
3. Save the configuration and switch the control system off.
4. Disconnect the Sensor Module from the follower drive object and connect it to the next follower drive object.
5. Switch the control system back on again and commission the next follower drive object.
6. After commissioning has been completed, at the follower drive object, set the encoder interface to "deactivated and not available" using p0145=2.

7. Save the configuration and switch the control system off.
8. Repeat Steps 4-7 until all follower drive objects have been created with deactivated encoder interface.

6.4 Commissioning the Technology Extension SERVCOU

6.4.1 Overview for commissioning TEC SERVCOU

Licensing

A license key is required for the Technology Extension SERVCOU:

You can generate the appropriate license key using the WEB License Manager. To do this, you require the Certificate of License (CoL).

The article number for the Certificate of License (CoL) is as follows:

6SL3077-0AA00-8Ax0

Note

Information and the procedure required for licensing can be found in the following reference:

- SINAMICS S120 Drive Functions Function Manual, Chapter "Licensing".
-

You can use the Technology Extension for a limited time by activating the "Trial License" function.

Please see the corresponding product documentation for further information about the Trial License.

Commissioning steps

The following tasks must be performed when commissioning Technology Extension SERVCOU:

1. The drive object with encoder must be parameterized as the master drive object, all dependent drive objects as follower drive objects (p31740). It is mandatory that the master drive object has a lower drive object number than the coupled follower drive objects. How this can be checked is described in "Using Double Motor Modules (Page 91)".
2. After the master and follower assignment, all follower drive objects must be interconnected to the associated master drive object (r31745, p31746).
3. If there is an offset between the electrical angle of the master and follower drive objects for synchronous motors as a result of the system configuration, then this can be corrected using the angle offset p31748. The angle offset to be set can be determined in various ways, see "Determining the commutation angle offset (Page 119)".
4. If a follower drive object is consciously dimensioned for just a fraction of the torque of the master drive object, the torque setpoint of the follower drive object can be reduced corresponding to the scaling factor (p31744).

5. When required, the setting to propagate faults from the follower to the master drive object must be adapted using p31749.
6. The settings of the relevant parameters must be checked based on "Table A-1 Parameter settings of Technology Extension SERVCOU (Page 161)".
The parameters introduced specifically for Technology Extension SERVCOU are listed in detail in Chapter "Parameter (Page 139)".

Different parameterization between master and follower drive objects

Fundamentally, the master and follower drive objects must be parameterized identically, see "Commissioning the encoder interface on the follower drive objects (Page 90)" and "Table A-1 Parameter settings of Technology Extension SERVCOU (Page 161)".

An exception to the fundamental identical parameterization of all drive objects are the parameters listed in the following table. One of their functions is to specify whether the drive object is a master or follower drive object and whether an encoder/SMx is connected. These parameters must be especially taken into account when subsequently commissioning the system.

Table 6-3 Parameters with different values for master and follower drive objects

Parameter	Parameter name	Master value	Follower value
p0145	Activate/deactivate encoder interface	1	2
p1460	Speed controller P gain adaptation speed, lower	*	0
p1462	Speed controller integral time adaptation speed, lower	*	0
p2175	Motor blocked speed threshold	*	Maximum value, and therefore inactive
p31740	SERVCOU operating mode	1	2
p31741	SERVCOU master encoder count	1	0
p31746	SERVCOU follower coupling assignment signal source	0	r31745 (master)

* Arbitrary value

6.4.2 No offset clocking for multi-winding motors

You must ensure that no offset clocking is parameterized for motors with overlapping or adjacent winding systems in a common enclosure.

NOTICE

Winding damage as a result of incorrect parameterization

When incorrectly parameterizing multi-winding motors, potential (voltage) differences can occur between the individual winding systems. This can result in the insulation system breaking down (arcing) in the motor.

Carefully observe the following points to prevent such motor damage:

- For motors with overlapping or adjacent winding systems in a common enclosure ensure that the following parameters are correctly set:
 - p31743 = 0
 - p1815.0 = 1 at all drive objects
 - p1800, p1810, p1816 and p1819 are identical in all data sets for master and follower drive objects
- Protect the parameterization (parameter assignments) against unauthorized access.

6.4.3 Determining the commutation angle offset

6.4.3.1 Overview

If a commutation angle offset is obtained for synchronous motors as a result of the mechanical arrangement, then this must be corrected using angle offset p31748.

When using Technology Extension SERVCUP, users can determine the commutation angle offset in the following ways:

- Method 1: determining p0431 of the follower drive object (Page 119) by automatically determining the commutation angle offset (p1990 = 1).
- Method 2: Optimizing the commutation angle by evaluating the current actual values (Page 120)
- Method 3: Determining the commutation angle offset by measuring the EMF (Page 120) and the standardized electrical pole position angle.

6.4.3.2 Method 1: determining p0431 of the follower drive object

To automatically determine the commutation angle offset of the follower drive object, p1990 = 1, proceed as follows:

1. Check that basic commissioning has been completed, and all drive data have been correctly saved in the commissioning tool.
2. Note down the commutation angle offset (p0431) for the master drive object.

3. Disconnect the link from the master motor/motor segment/section motor and master Motor Module. Connect the follower motor/motor segment/section motor to the master Motor Module instead.
4. Set $p1990 = 1$, and continue with the automatic determination of the commutation angle offset as described in the help texts for $p1990$.
5. Read off the angle offset in $p0431$ for the follower drive object, and re-establish the original connections (those applicable before Point 3).
6. In $p0431$ of the master drive object, set the value noted in Point 2.
7. Using the angle offset of the follower drive object, calculate the value for $p31748$ corresponding to the table "Table 6-4 Calculation of follower angle offset $p31748$ (Page 121)".

6.4.3.3 Method 2: Optimizing the commutation angle by evaluating the current actual values

NOTICE

Material damage as a result of an incorrectly commutated drive

For an incorrectly commutated motor, current is fed into the motor at the incorrect time. As a consequence, it can make unintentional movements, for example it can rotate at a high speed in the wrong direction.

- Set the current limit using parameter $p0640$ to 20% of $p0323$ (motor maximum current).

Proceed as follows to determine the angle offset:

During positioning, change the follower angle offset ($p31748$), and at the same time measure the torque-generating current actual value $r0078[0]$.

The lower the measured current actual value, the better the commutation. The angle offset has been correctly set at the lowest current actual value.

6.4.3.4 Method 3: Determining the commutation angle offset by measuring the EMF

Note

You can find information on how to determine the angle offset using the appropriate measurements in the following reference:

- SINAMICS S120 Commissioning Manual
Chapter "Checking the commutation angle offset with an oscilloscope" for the motor being used, e.g. SIMOTICS T-1FW6

The procedure to determine the commutation angle offset by taking the appropriate measurements is described in the "SINAMICS S120 Commissioning Manual" for linear and rotary drives.

Using the commutation angle offset of the follower drive object determined, calculate the value for p31748 corresponding to table "Table 6-4 Calculation of follower angle offset p31748 (Page 121)".

6.4.3.5 Calculating the follower angle offset (p31748) for methods 1 and 3

The basis for calculating p31748 is the difference between the angle offset for the follower and master drive object:

- $\text{Offset_diff} = \text{p0431 (follower drive object)} - \text{p0431 (master drive object)}$ or
- $\text{Offset_diff} = \text{angle offset of the follower drive object using method 3} - \text{p0431 (master drive object)}$

Table 6-4 Calculation of follower angle offset p31748

	Value of the offset difference between the master and follower drive object	Setting p31748 on the follower drive object
Case 1	$\text{Offset_diff} < -180^\circ$	$\text{p31748 (follower)} = \text{offset_diff} + 360^\circ$
Case 2	$-180^\circ < \text{offset_diff} < 180^\circ$	$\text{p31748 (follower)} = \text{offset_diff}$
Case 3	$\text{Offset_diff} > 180^\circ$	$\text{p31748 (follower)} = \text{offset_diff} - 360^\circ$

6.4.3.6 Checking the values that have been determined

Checking the values determined using method 2

1. Set the value determined for p31748, and measure the torque-generating current actual value r0078[0].
2. During positioning, change the follower angle offset step-by-step (p31748), and at the same time measure the torque-generating current actual value r0078[0].

The lower the measured current actual value, the better the commutation. The angle offset has been correctly set at the lowest current actual value.

When correctly determining the angle offset, this should be the value set under Point 1.

Checking the determined values for vertical axes (swiveling axes)

For this checking method, the torque required to hold the axis at a certain position must be known.

1. Check whether the master drive object, without support of the follower drive object, indicates the expected torque at this position.
2. Check whether the master drive object, when supported by the follower drive object, only indicates half of the torque at the same position.

6.4.4 Slip controller for induction motors

When induction motors are used, the integrated slip controller in SERVCUP prevents different pole position angles r0093 being set between the coupled drive objects during operation. Each SERVCUP follower drive object with motor type ASM (p0300 = 1xx) has its own slip controller, see function diagram 7336 (Page 155).

If integral time p31754 > 0:

the slip controller is active and the angle of slip difference between the master and follower drive object is corrected on the angle offset p31748, see also "Determining the commutation angle offset (Page 119)".

In tests, the factory setting p31754 = 12 ms produced good results for different induction motors. To check the results, the slip controller input and output values are available in parameter r31755[0...1].

6.4.5 Commissioning the Technology Extension using STARTER

This chapter describes commissioning using STARTER.

Using the Startdrive commissioning tool, the procedure is analogous to commissioning described with STARTER.

Precondition

The following preconditions must be satisfied when using STARTER for commissioning:

- The hardware has been commissioned.
- Technology Extension SERVCUP is installed and activated on all of the drive objects involved, see "STARTER or SIMOTION SCOUT (Page 72)".

Parameterizing Technology Extension SERVCUP

All drive objects are parameterized using the appropriate expert list of the STARTER commissioning tool.

1. Open the expert lists of all the drive objects involved.
2. Set p31740 for the master drive object to "1", and for all the follower drive objects, to "2".
3. On the master drive object, check that the encoder interface is active (p0145 = 1) - and then set p31741 to "1".
4. To couple the drive objects, interconnect parameter p31746 on all follower drive objects to parameter r31745 of the master drive object.
5. For motors with overlapping windings/adjacent windings in a common enclosure, p31743 = 0 and p1815.0 = 1 must be set. If speed limiting applies for operation with only one winding, then p31742 must be appropriately set on the follower drive objects.
6. If a follower drive object is consciously dimensioned for just a fraction of the torque of the master drive object, then reduce the torque setpoint of the follower drive object corresponding to the scaling factor (p31744).

7. Set p31748 corresponding to the motor being used.
 Synchronous motor: If there is an offset between the electrical angle of the master and follower drive objects as a result of the system configuration, then set an appropriate angle offset p31748 at the follower drive object. Support on determining the angle offset and for setting p31748 is provided in Chapter "Determining the commutation angle offset (Page 119)".
 Induction motor: If an incorrect polarity is obtained at the winding transitions, then set $p31748 = 0$ or $p31748 = 180$. For further information, see "Double- and multi-winding motors (Page 28)".
 Set p31748 corresponding to your particular application.
 If there is an offset between the electrical angle of the master and follower drive objects for synchronous motors as a result of the system configuration, then set an appropriate angle offset p31748 at the follower drive object. Support on determining the angle offset and setting p31748 is provided in Chapter "Determining the commutation angle offset (Page 119)".
 For induction motors, set $p31748 = 0$ or $p31748 = 180$ if an incorrect polarity is obtained at the winding transitions. For further information, see "Double- and multi-winding motors (Page 28)".
 8. If the factory setting for the fault propagation ($p31749 = 1$) for the planned servo coupling is not suitable, then you must change the setting of p31749.
 For the setting $p31749 = 0$, it must be guaranteed that the drive line-up is in a position to operate the load, even without the failed follower drive object.
 An application-specific fault handling routine must be saved when using a higher-level control system.
 9. Check all parameters listed in Table "Table A-1 Parameter settings of Technology Extension SERVCOU (Page 161)" and adapt them if required.
 Especially ensure that:
 - The encoder interfaces are deactivated on all follower drive objects ($p0145 = 2$).
 - Parameters p1460 / p1462 are set to "0" on all follower drive objects.
 - Parameters p0115[0] and p0115[1] are set to the value of p0115[0] of the master drive object on all drive objects.
 - p0118 has been parameterized identically on all drive objects.
 10. Save the settings using the  button.
 11. Go online using the  button.
 12. Click "Download to target device".
 The "Download to target device" dialog opens.
 13. Click "Yes".
 The "Download to target device" dialog closes.
 14. Click "Load to PG".
 The "Load to PG" dialog opens.
 15. Click "Yes".
 16. Save the project and switch to the offline mode.
- The Technology Extension SERVCOU has been commissioned.

6.4.6 Commissioning the Technology Extension using SINUMERIK Operate

6.4.6.1 Parameterizing/configuring SERVCUP

Precondition

The following preconditions must be satisfied when using SINUMERIK HMI for commissioning:

- The hardware has been commissioned.
- Technology Extension SERVCUP is installed and activated on all of the drive objects involved, see "SINUMERIK Operate (Page 55)".

Parameterizing Technology Extension SERVCUP

1. Press the "Control Unit" softkey.
2. Set parameter p0009 to "3".
3. Set p31740 for the master drive object to "1", and for all the follower drive objects, to "2".
4. On the master drive object, check that the encoder interface is active (p0145 = 1) - and then set p31741 to "1".
5. Interconnect parameter p31746 on all follower drive objects to parameter r31745 of the master drive object.
 - Select parameter p31746.
 - Press the "Select" key.
 - In the BICO editor, interconnect parameter p31746 with parameter r31745 of the master drive object.
6. For motors with overlapping windings/adjacent windings in a common enclosure, p31743 must be set to "0" and p1815.0 to "1".
If speed limiting applies for operation with only one winding, then p31742 must be appropriately set on the follower drive objects.
7. If a follower drive object is consciously dimensioned for just a fraction of the torque of the master drive object, then reduce the torque setpoint of the follower drive object corresponding to the scaling factor (p31744).
8. Set p31748 corresponding to the motor being used.
Synchronous motor: If there is an offset between the electrical angle of the master and follower drive objects as a result of the system configuration, then set an appropriate angle offset p31748 at the follower drive object. Support on determining the angle offset and for setting p31748 is provided in Chapter "Determining the commutation angle offset (Page 119)".
Induction motor: If an incorrect polarity is obtained at the winding transitions, then set p31748 = 0 or p31748 = 180. For further information, see "Double- and multi-winding motors (Page 28)".

9. If the factory setting for the fault propagation ($p31749 = 1$) for the planned servo coupling is not suitable, then you must change the setting of $p31749$.
For the setting $p31749 = 0$, it must be guaranteed that the drive line-up is in a position to operate the load, even without the failed follower drive object.
An application-specific fault handling routine must be saved when using a higher-level control system.
10. Check that all parameters have been set according to the table "Table A-1 Parameter settings of Technology Extension SERVCOU (Page 161)".
Especially ensure that:
 - The encoder interfaces are deactivated on all follower drive objects ($p0145 = 2$).
 - Parameters $p1460$ / $p1462$ are set to "0" on all follower drive objects.
 - Parameters $p0115[0]$ and $p0115[1]$ are set to the value of $p0115[0]$ of the master drive object on all drive objects.
 - $p0118$ has been parameterized identically on all drive objects.
11. Set parameter $p0009$ to "0".

Configuring the higher-level control system

Two options are available for adapting the control system to the drive system:

- Configuration with saved PLC logic without master-slave option
- Configuration with master-slave option

If you establish the configuration in the PLC, then you can flexibly program the switch-on logic and diagnostics, and adapt to the specific application. You can couple up to 6 SERVO drive objects; however, when using the measuring functions, you must make the appropriate adaptations, see Chapter "Measuring functions relating to the complete motor (Page 127)".

Using the SINUMERIK master-slave option has the advantage that the activation logic of the individual drive objects is specified, and error handling and diagnostics is automatically realized in the control system. When using a maximum of 3 coupled SERVO drive objects, the SINUMERIK measuring functions can be used without any restrictions.

Note

Information about commissioning with SINUMERIK - and additional information are provided in the following references:

- Commissioning Manual SINUMERIK ONE Final steps for commissioning
 - Commissioning Manual, SINUMERIK 840D sl Commissioning CNC: NCK, PLC, drive
-

6.4.6.2 Parameterization in the PLC without master-slave option

Depending on the particular application, the parameterization differs; however, the following requirements must be fulfilled as a minimum:

- The correct enable sequence of the drive objects:
Depending on the requirement or the hardware being used, the controllers of the master and follower drive objects must be enabled in a specific sequence. An appropriate switch-on/off logic must be configured in the PLC for this purpose.
See also "Switching drive objects on and off (Page 130)".
- Application-specific fault handling:
If the internal SERVCOU alarm propagation via p31749 = 1/2 cannot be used for the special application, then a specific fault handling procedure must be implemented.
See also "Fault handling (Page 137)" and "SINAMICS Safety Integrated / SINUMERIK Safety Integrated (Page 33)".

6.4.6.3 Parameterization in the NC with master-slave option

Proceed as follows to parameterize the master-slave option:

1. Press the <MENU SELECT> key on the HMI.
2. Press the "Startup" softkey.
3. To open the axis-specific machine data, press the "Axis MD" softkey.
4. Change the machine data to the specified values:

Table 6-5 Settings for the axis-specific machine data

Number and identifier	MASTER value	Value on ALL SLAVES
N30130 \$MA_CTRLOUT_TYPE[n] Activate setpoint transfer from the NC to the drive	[0,MASTER] = 1	[0,SLAVE _x] = 1
N30240 \$MA_ENC_TYPE[n] Activate actual value sensing from the drive to the NC at the master. With the slave setting, no actual values are displayed. However, they correspond to the master axis.	[0,MASTER] ≠ 0	[0,SLAVE _x] = 0
N37250 \$MA_MS_ASSIGN_MASTER_SPEED_CMD[n] The master-slave function is activated at the slave axis - and the axis number of the master axis is entered.		[SLAVE _x] = axis number MASTER
N37252 \$MA_MS_ASSIGN_MASTER_TORQUE[n] Default setting = 0: The same master axis is used for the torque distribution as for the speed setpoint coupling.		[SLAVE _x] = 0
N37254 \$MA_MS_TORQUE_CTRL_MODE[n] Deactivate torque equalization controller	[MASTER] = 3	[SLAVE _x] = 3
N37262 \$MA_MS_COUPLING_ALWAYS_ACTIVE[n] Master-slave coupling is always active		[SLAVE _x] = 1

6.5 Complete commissioning

After the hardware and Technology Extension have been commissioned, the communication between the control system and drive objects must also be configured.

It is especially important to note the following points when completing the commissioning:

- For some measuring functions, there are special issues, which require that adaptations are made.
- Depending on the components being used, it may be necessary to adapt the activation sequence of the drive objects.
- The data set must be switched over in synchronism on all drive objects.

6.5.1 Measuring functions

All measuring functions can be used for Technology Extension SERVCUP. For several measuring functions, extra adaptations must be made. The following overview lists measuring functions for which the measured values can be directly used, and lists where subsequent processing is first required.

6.5.1.1 Measuring functions relating to the complete motor

Correct measurement results

The results of the following measuring functions are correct.

- "Speed controller setpoint step (downstream of the speed setpoint filter)"
- "Speed controller reference frequency response (downstream of the speed setpoint filter)"
- "Speed controller reference frequency response (upstream of the speed setpoint filter)"

Note

Note when performing the measurement

The master drive object must obtain its enable signal via the master control (control authority) and the follower drive objects must be switched on and enabled during the measurement.

On all follower drive objects, the current setpoint filter must be set the same as for the master drive object.

Measurement results with necessary adaptation

The results of the following measuring functions are correct if the disturbing torque is copied with p31757 to the follower drive objects (alternative 1), the measurement results are correctly scaled (alternative 2) or the measurement takes place using SINUMERIK HMI with active master-slave option (alternative 3):

- "Speed controller path (excitation downstream of the current setpoint filter)"
- "Speed controller interference frequency response (fault downstream of the current setpoint filter)"
- "Speed controller disturbance step change (fault downstream of the current setpoint filter)"

Alternative 1 (excitation via entire drive line-up):

If excitation of the measuring functions described above takes place via the entire drive line-up, the measurement results are correct.

For excitation via the entire drive line-up, the signal source p31757 must be set to = 1 signal (copy follower disturbing torque) and the follower drive objects must be enabled. With p31757 = 1 signal, r1651 (function generator torque setpoint) is copied from the master to the follower drive objects, meaning that the follower drive objects too are loaded with the disturbing torque of the master drive object. Here, the disturbing torque of the follower drive object is additionally scaled using p31744.

Note**Note when performing the measurement**

The master drive object must obtain its enable signal via the master control (control authority) and the follower drive objects must be switched on and enabled during the measurement.

Alternative 2 (excitation via section motor):

If excitation of the measuring functions described above only takes place via a section motor, the measurement results are incorrectly scaled. Correct scaling can be achieved with the following factor:

Factor = number of drive objects (number of follower drive objects + 1) (e.g. factor = 2 for a double-winding motor)

The correct scaling is calculated as follows: $\text{Amplitude_total} = \text{Amplitude_measurement_result} * \text{factor}$

Note**Note when performing the measurement**

The master drive object must obtain its enable signal via the master control (control authority). The follower drive objects must be switched on during the measurement.

Alternative 3 (using SINUMERIK master-slave option):

If the SINUMERIK configuration with the master-slave option is used, neither adaptations nor result scaling are required when performing measurements via SINUMERIK HMI.

6.5.1.2 Measuring functions relating to the section motor

The results of the following measuring functions are themselves correct, however they must be transferred to other drive objects after the measurement.

- "Current controller reference frequency response (downstream of the current setpoint filter)"
- "Current controller setpoint change (downstream of the current setpoint filter)"

The measurement can be made on the master as well as on the follower drive object. The results are correct for the respective section motor.

Recommendation:

For identical drive objects, typically, the measurement is made at the master drive object. The measurement results and the resulting parameterization must then be identically carried out for the follower drive objects.

6.5.2 Switching drive objects on and off

Technology Extension SERVCUP does not automatically transfer switch-on and switch-off commands between the master and follower drive objects.

As a consequence, during commissioning it is possible to separately activate and deactivate the coupled drive objects, for example. In normal operation, the enable can be distributed to all drive objects using a sequence program. When operating Technology Extension SERVCUP in a line-up with a higher-level control system, we recommend that separate PROFIdrive telegrams are configured for the master and follower drive objects – and that the axis is enabled using the control word in the telegram.

Use with a higher-level control system

When using a SINUMERIK control, the required switch-on sequence must be specified by the interface signals of the various axes. It is not possible to adapt the switch-on sequence when using the SINUMERIK master-slave option.

To adapt the switch-on sequence for SIMATIC/SIMOTION, PROFIdrive telegrams must be configured for the master and follower drive objects which implement the enable signals using control words. The correct enable sequence must then be defined using a sequence program (see diagram "Programming the switch-on sequence" at the end of the chapter).

Use without a higher-level control system

Drive objects must be switched on and switched off via BICO interconnections as follows:

Master_p1142 = follower_r899.1 (enable master_setpoint = follower_ready)

Follower_p0840 = follower_r31750.11 (follower_ON/OFF (OFF1) = "Follower drive ready to start")

Independent of whether a higher-level control system is being used or not, the correct switch-on sequence depends on the encoder and motor being used; see the following sections.

Factors that influence the switch-on sequence

Encoder

For synchronous motors with incremental encoder, before the drive is switched on for the first time, a pole position identification routine is carried out at the master drive object. The follower drive objects can only be enabled after the pole position identification routine has been successfully carried out. An error signal is issued if the follower drive objects are enabled too early.

A pole position identification routine is not required for absolute encoders and induction motors.

Motors

Some multi-winding motors (e.g. the SIMOTICS T-1FW4) must not be operated with only one section winding, or only up to a certain speed. Therefore, with these motors, you must ensure that setpoints are only specified when all the drive objects have been enabled, otherwise the bearings may be damaged.

Recommendation for the switch-on sequence

The following recommendation can be derived from the above information:

Table 6-6 Switch-on sequence of the drive objects

	Incremental encoder	Absolute encoder
Precondition	Set the same PROFIdrive telegram at all drive objects.	
Switch-on sequence	1. Switch-on the master drive object. 2. The follower drive objects can be switched on after the feedback signal from the master drive object ("operation enabled"). 3. Wait for the feedback signal from the follower drive objects ("operation enabled").	1. Switch on the follower drive objects ("controller enable"). 2. Switch on the master drive objects ("controller enable").
Setpoint input	Setpoint specification is only permitted after a positive feedback from the follower drive objects.	A setpoint can be immediately entered after the controller enable of the master drive object.

Sample code: Switch on sequence for double-winding motor with absolute encoder

As the setpoint is entered at the master drive object, we recommend that this is only enabled after the follower drive objects.

The programming for the switch-on sequence is shown for a SIMOTION in structured text (ST) as example:

6.5 Complete commissioning

```

CASE i16Step OF
  1: // Command to switch on the TEC_Follower drive object
  IF TEC_Follower.actorMonitoring.driveState <> ACTIVE
    OR TEC_Follower.actorMonitoring.power <> ACTIVE THEN

    i32ReturnCode := _enableAxis (
      axis                := TEC_Follower
      ,enableMode         := ALL
      ,servoControlMode   := ACTIVE
      ,servoCommandToActualMode := INACTIVE
      ,nextCommand        := IMMEDIATELY
      // ,commandId       := (0,0)
      // ,forceControlMode := INACTIVE
      // ,STWBitSet       := 0
      // ,movingMode      := DO_NOT_CHANGE
    );

    IF i32ReturnCode <> 0 THEN
      // Error reaction
      ...
    END_IF;
  END_IF;

  i16Step := 2;

  2: // Wait until TEC_Follower is switched on
  IF TEC_Follower.actorMonitoring.driveState = ACTIVE
    AND TEC_Follower.actorMonitoring.power = ACTIVE THEN

    i16Step := 3;
  END_IF;

  3:// Command to switch on the TEC_Master drive object
  IF TEC_Master.actorMonitoring.driveState <> ACTIVE
    OR TEC_Master.actorMonitoring.power <> ACTIVE THEN

    i32ReturnCode := _enableAxis (
      axis                := TEC_Master
      ,enableMode         := ALL
      ,servoControlMode   := ACTIVE
      ,servoCommandToActualMode := INACTIVE
      ,nextCommand        := IMMEDIATELY
      // ,commandId       := (0,0)
      // ,forceControlMode := INACTIVE
      // ,STWBitSet       := 0
      // ,movingMode      := DO_NOT_CHANGE
    );

    IF i32ReturnCode <> 0 THEN
      // Error reaction
      ...
    END_IF;
  END_IF;

  ...
END_CASE;

```

Figure 6-30 Programming the switch-on sequence

6.5.3 Synchronous switchover of the data sets

If the hardware and Technology Extension SERVOUP have been correctly commissioned, then the same number of data sets has been set at all of the coupled drive objects, and in the data sets, the parameters correctly set (also no offset clocking for double-winding motors, same parameterization for the master and follower drive objects).

For SINUMERIK, the drive data sets for all coupled drive objects must be simultaneously switched over using the relevant interface bits.

When using SIMATIC/SIMOTION, the control bits for the data set switchover, reserved in the PROFIBUS protocol (e.g. DDS (SINAMICS): p0820-p0823) of all coupled drive objects must be supplied and wired to the same source.

6.5.4 Using automatic servo tuning (Auto Servo Tuning - AST)

Precondition

To use "Auto Servo Tuning", a SINUMERIK 840D sl or SINUMERIK ONE with SINUMERIK Operate is required; furthermore, the drives must have been commissioned. The tuning routine can be used for servo and direct drives.

It is preferable to use the SINUMERIK master-slave option for "Auto Servo Tuning" or manual measurement of the drive line-up. The master-slave torque controller or force compensation controller must not be activated (see Chapter "Parameterization in the NC with master-slave option (Page 126)").

In addition to the parameterization described there, the following settings must be made:

- Set the SINUMERIK master-slave option permanently or temporarily.
- The programmable logic controller enabling (controller enable and pulse enable) for the slave are taken over directly from the master axis.
- The override bits of the slave-PLC interface must be derived from the master.

Version dependency of "Auto Servo Tuning" (AST)

With SINUMERIK V4.91 / V6.11 and higher, the "Auto Servo Tuning" actively supports the tuning of a SERVOUP drive line-up with up to three coupled axes. A SINUMERIK version of V4.95 / V6.15 or higher is recommended for tuning a SERVOUP drive line-up with more than three axes.

SINUMERIK V4.95 / V6.15 or higher

The tuning of up to three coupled axes (1 master and 2 follower drive objects) can be performed with AST and the SINUMERIK master-slave option.

The tuning of more than three coupled axes is possible with AST, however, can be performed only without the SINUMERIK master-slave option.

SINUMERIK V4.91 - V4.94 / V6.11 - V6.14

It is necessary to use the SINUMERIK master-slave option for tuning a SERVOUP drive line-up in these versions. Since the function generator can be used only for a maximum of three axes

per Control Unit, the use of AST is limited to a maximum of three axes for a SERVCOUPL drive line-up.

The following possibilities exist for tuning a larger drive line-up:

- Use SINUMERIK V4.95 / V6.15 or higher.
- Prior to tuning with AST, remove as many SERVCOUPL follower axes from the SERVCOUPL coupling as necessary until a maximum of 3 coupled axes (1 master and 2 follower drive objects) are left.
- Alternatively, each axis can be individually tuned manually using the measuring functions of the drive. Expert knowledge is required for this purpose.

Special assessment and adaptation of the tuning results from AST

Expert knowledge is required for a correct assessment of the tuning results and a stable controller setting during and after "Auto Servo Tuning". If you need support or have any further questions, please contact your regional SIEMENS sales partner.

A special assessment and possible correction of the tuning results is required in the following cases:

- Use of AST with SINUMERIK V4.5, V4.7, V4.8.
- Use of AST with SINUMERIK V4.91 - V4.94 / V6.11 - V6.14 after removing follower axes from the SERVCOUPL drive line-up.
- Use of AST with SINUMERIK V4.95 or higher without SINUMERIK master-slave option for more than three axes.

Correction of the measurement results may not be necessary if the following is true at all coupled follower drive objects:

- Follower_p31757 = 1 signal
- Follower drive objects are enabled

Example system

The function check was also performed on the following system; a good tuning result was achieved:

- Control: SINUMERIK 840D sl with FW version V04.91
- Motor: 3x 1FW6230
- Control Unit: SINAMICS S120 with FW version 05.20
- Communication: using PROFIdrive telegram 136

The three individual motors were each operated on a Motor Module, and coupled to a motor group using the Technology Extension SERVCOUPL. This drive line-up was used together with the master-slave option, and tuned in the higher-level SINUMERIK control system. By using the master-slave option, the pulse enable is issued in parallel to all 3 drive objects.

Performing the tuning routine

When tuning, the speed as well as position controllers should be tuned and a subsequent measurement performed to check the result.

Note

Copying the master disturbing torque to the follower drive objects

For a simplified evaluation of the measurement of the speed control circuit, excitation including the follower disturbing torque is possible with the following setting:

- Follower_p31757 = 1 signal
- Follower drive objects are enabled

In many cases this also allows a more accurate estimation to be made of the total inertia with AST.

1. Start function "Automatic Servo Tuning" in the operating area of SINUMERIK Operate via "Commissioning" → "Tuning test".
2. Select a suitable strategy via "Select strategy" → "Axis".
Strategy 101 has shown good results in the test and performs a measurement to check the results in addition to the measurement and tuning of the speed and position controllers.

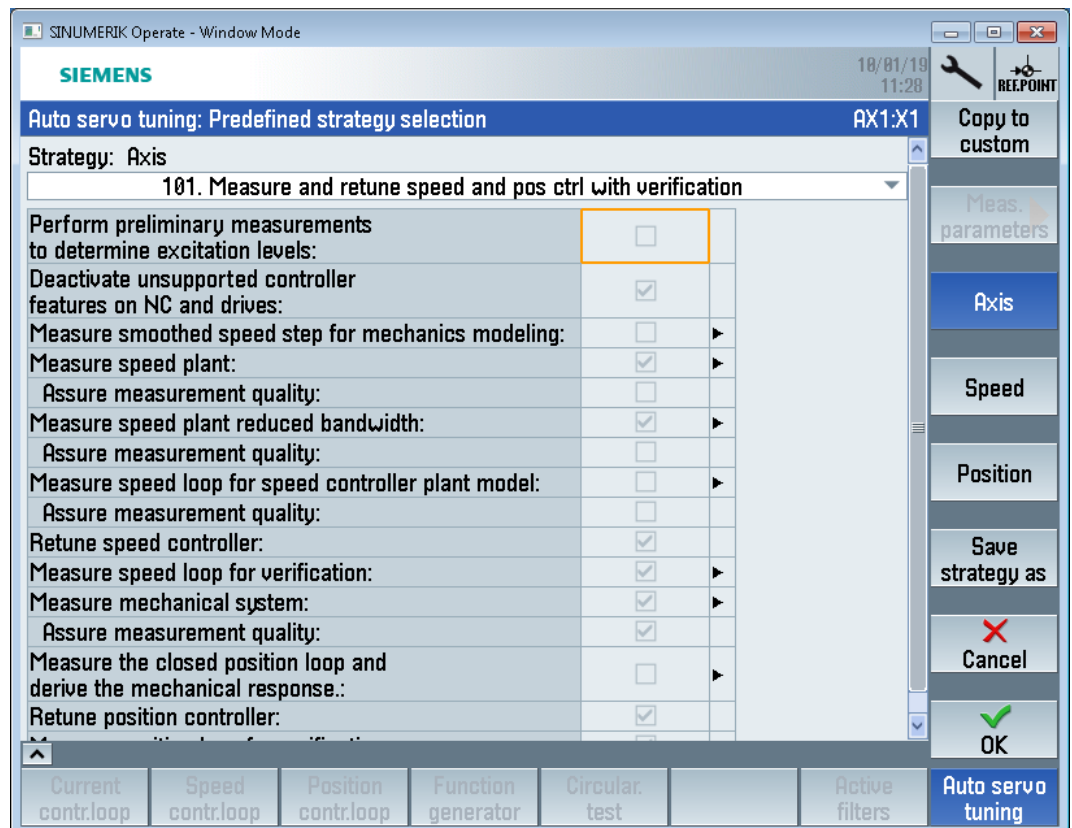


Figure 6-31 Strategy 101 (Measure, tune and check)

3. If necessary, adapt the selected strategy.

4. Confirm the setting with "OK" and perform the tuning.
5. Check the plausibility of the tuning suggestions.
If the tuning suggestions are plausible, accept the changes and exit AST.

6.5.5 Setting the torque tolerance

Determining the torque deviation

Technology Extension SERVCUP cyclically checks the torque actual values r0080 of all coupled drive objects to determine whether there is a relative deviation. To prevent measuring errors, the torque actual values are smoothed over 2 ms. The torque scaling r31744 of the follower drive objects is taken into account, but not any supplementary torque interconnected with p31756.

Setting and evaluating the torque tolerance

The permissible tolerance is set in p31758 (torque coupling tolerance permissible) on the master drive object and refers to the torque actual value r0080 of the master drive object. When interconnecting p31756, the setting must be increased if necessary.

The tolerance is determined according to the size of the torque actual value. For large torque actual values, the tolerance equals the product of r0080 and p31758. Measuring inaccuracies must be taken into account for small torque actual values despite smoothing, so in this case the tolerance is set as follows:

- 1 Nm for motors with reference torque ≤ 100 Nm
- 1% of p2003 for motors with reference torque > 100 Nm

If the absolute deviation between master and follower torque actual values remains smaller than the tolerance, the status bit r31750.10 is set to = 1 signal ("Master torque coupling tolerance OK").

If the absolute deviation between the follower torque actual value and the master torque actual value is greater than the tolerance, however, the status bit r31750.10 is set to = 0 signal.

The status bit can be used to verify correct parameterization and indicates possible errors such as:

- Error in the enable logic
- Incorrectly set angle offset p31748
- Insufficient test torque during a Safe Brake Test (SBT), see also Safe Brake Test (Page 37)
- Damage to one of the coupled section motors
- Tolerance p31758 set too low (factory setting: 10%)

6.6 Fault handling

6.6.1 Fault after commissioning has been completed

If a parameterization error is detected during power-up / warm restart after completing the configuration, alarm "A53470 SERVCUP: Configuration error" is output, and Technology Extension SERVCUP cannot be activated.

Help regarding individual alarm values is provided in Chapter "Faults and alarms (Page 157)".

The incorrectly set parameter that initiated the alarm is also displayed in r31751.

6.6.2 Master drive object fault in operation

If a fault occurs on the master drive object with fault response OFF2, fault F53471 with the same fault response OFF2 is initiated on all follower drive objects.

If a fault occurs on the master drive object with fault response OFF1 or OFF3, the entire drive line-up is braked along the specified braking ramp. After standstill, the pulses are disabled on the master drive object and fault F53471 with fault response OFF2 triggered on the follower drive objects.

6.6.3 Follower drive object fault in operation

If a fault is initiated at a follower drive object, then for settings p31749 = 1 and 2 the fault response is automatically transferred to the master drive object. The drive line-up is then stopped corresponding to the selected setting. The propagation set using p31749 has priority over that configured with the stored PLC logic or master-slave option.

Propagation via parameter p31749 is activated in the factory, and should also be preferentially used.

For existing projects, a compatibility mode can be selected using p31749 = 0. The internal SERVCUP loop through (transfer) is then deactivated, and it is imperative that one of the following options is configured:

- Configuration of the SINUMERIK master-slave option in the higher-level control.
- Programming of a fault monitoring of the follower drive objects with the appropriate shutdown logic in the PLC.
- Parameterization of the corresponding drive-internal BICO interconnections in order to initiate an external fault at the master drive object or to cancel the enable signals, see "Use without higher-level control system" in Chapter "Switching drive objects on and off (Page 130)".

Note

If SERVCUP version 1.1 is used, the fault handling should be configured in the same manner as p31749 = 0.

6.6.4 Violation of the maximum speed monitoring

The response is only realized at the master drive object when the following preconditions are satisfied:

- P31742 setting (SERVCOUP follower maximum speed monitoring) > 0
- The actual speed of the master drive object is higher than the value set in p31742
- The follower drive object is not enabled, e.g. due to missing enable signal or due to an active fault with fault response OFF2.

When all of the preconditions are satisfied, fault F53473 with the fault response parameterized in p31749 is output at the master drive object. F53471 is then initiated on all follower drive objects.

Note

Deactivating maximum speed monitoring

To deactivate maximum speed monitoring, set p31742 to the maximum value.

Parameter

Overview

This chapter only includes the parameters for the Technology Extension SERVCOU.

Note

For example, you can find the product-dependent parameters available for SINAMICS in:

- the online help of the respective control system
- the commissioning tool
- the product-specific List Manual, e.g. SINAMICS S120/S150 List Manual, Chapter "List of parameters".

Additional information about the list of parameters is provided in the product-specific List Manuals in Chapter "Overview of parameters".

Use of "Master DO" and "Follower DO" instead of "Master drive object" and "Follower drive object"

The terms "Master DO" and "Follower DO" are identical to "Master drive object" and "Follower drive object". Use of the short form is intended to make the text clearer and easier to read, but there is no difference in terms of content.

List of parameters

The following is a list of parameters of Technology Extension SERVCOU.

Product: drvoa_servcoup, Version: 1201100, Language: eng

Objects: SERVO

p31740	SERVCOU operating mode / Operating mode		
SERVO	Can be changed: C1(3)	Calculated: -	Access level: 3
	Data type: Integer16	Dyn. index: -	Function diagram: 7335
	P group: -	Unit group: -	Unit selection: -
	Not for motor type: -	Scaling: -	Expert list: 1
	Min:	Max:	Factory setting:
	0	2	0
Description:	Setting the operating mode for the SERVCOU Technology Extension Master and follower drive objects of the SERVO type are coupled using SERVCOU (SERVO coupling). The torque setpoint, speed actual value and electrical pole position angle for the follower drive objects are specified by the master drive object.		
Value:	0: Inactive 1: Master drive object 2: Follower drive object		
	Note SERVCOU: SERVO COUPLING (SERVO coupling) A SERVO coupling must contain precisely 1 master drive object (master DO) and 1 to 5 follower drive objects (follower DO).		

p31740	SERVOCOUP operating mode / Operating mode		
SERVO (Lin)	Can be changed: C1(3)	Calculated: -	Access level: 3
	Data type: Integer16	Dyn. index: -	Function diagram: 7335
	P group: -	Unit group: -	Unit selection: -
	Not for motor type: -	Scaling: -	Expert list: 1
	Min: 0	Max: 2	Factory setting: 0
Description:	Setting the operating mode for the SERVOCOUP Technology Extension Master and follower drive objects of the SERVO type are coupled using SERVOCOUP (SERVO coupling). The force setpoint, velocity actual value and electrical pole position angle for the follower drive objects are specified by the master drive object.		
Value:	0: Inactive 1: Master drive object 2: Follower drive object		
	Note SERVOCOUP: SERVO COUPLING (SERVO coupling) A SERVO coupling must contain precisely 1 master drive object (master DO) and 1 to 5 follower drive objects (follower DO).		
p31741	SERVOCOUP number of encoders / No. of encoders		
SERVO	Can be changed: C1(3)	Calculated: -	Access level: 3
	Data type: Integer16	Dyn. index: -	Function diagram: -
	P group: -	Unit group: -	Unit selection: -
	Not for motor type: -	Scaling: -	Expert list: 1
	Min: 0	Max: 1	Factory setting: 0
Description:	Sets the number of encoders that are used for the closed-loop motor control. For the master drive object, p31741 must be set = 1. For the follower drive object, p31741 must be kept = 0.		
Value:	0: No encoder 1: One encoder (encoder 1)		
Dependency:	See also: A53470		
p31742	SERVOCOUP follower maximum speed monitoring / F n_max mon		
SERVO	Can be changed: C1(3)	Calculated: -	Access level: 3
	Data type: FloatingPoint32	Dyn. index: -	Function diagram: -
	P group: -	Unit group: -	Unit selection: -
	Not for motor type: -	Scaling: -	Expert list: 1
	Min: 0.000 [rpm]	Max: 340.28235E36 [rpm]	Factory setting: 0.000 [rpm]

Description:	Sets the maximum speed for operation of a multi-winding motor with missing enables at the follower motor module. On multi-winding motors operation with missing enables at the follower drive object is only permissible up to a certain speed because not all the windings are energized. Monitoring is only realized at the assigned master drive object when the following preconditions are satisfied: 1. Setting p31742 > 0. 2. Setting p31743 = 0 (multiple separate winding systems in one enclosure). 3: The actual speed of the master drive object is greater than that of the value set in p31742. 4. The follower drive object is not enabled, e.g. due to missing enable signal or due to an active fault with fault response OFF2. If all these conditions are met, fault F53473 is output at the master drive object with fault response OFF2. Fault F53471 is then initiated on all follower drive objects.
Dependency:	The monitoring time in p1227 is active for the follower drive object. If the fault should be immediately output after the speed is exceeded, then p1227 must be set = 0. See also: F53473

Note

This parameter is only relevant for follower drive objects (p31740 = 2). This parameter is ignored for a master drive object (p31740 = 1).

This monitoring is deactivated for the setting p31742 = 0.

p31742	SERVOUP follower maximum velocity monitoring / F v_max mon		
SERVO (Lin)	Can be changed: C1(3)	Calculated: -	Access level: 3
	Data type: FloatingPoint32	Dyn. index: -	Function diagram: -
	P group: -	Unit group: -	Unit selection: -
	Not for motor type: -	Scaling: -	Expert list: 1
	Min: 0.000 [m/min]	Max: 340.28235E36 [m/min]	Factory setting: 0.000 [m/min]
Description:	Sets the maximum velocity for operation of a multi-winding motor with missing enables at the follower motor module. On multi-winding motors operation with missing enables at the follower drive object is only permissible up to a certain velocity because not all the windings are energized. Monitoring is only realized at the assigned master drive object when the following preconditions are satisfied: 1. Setting p31742 > 0. 2. Setting p31743 = 0 (multiple separate winding systems in one enclosure). 3: The actual velocity of the master drive object is greater than the value set in p31742. 4. The follower drive object is not enabled, e.g. due to missing enable signal or due to an active fault with fault response OFF2. If all these conditions are met, fault F53473 is output at the master drive object with fault response OFF2. Fault F53471 is then initiated on all follower drive objects.		
Dependency:	The monitoring time in p1227 is active for the follower drive object. If the fault should be immediately output after the velocity is exceeded, then p1227 must be set = 0. See also: F53473		
	Note This parameter is only relevant for follower drive objects (p31740 = 2). This parameter is ignored for a master drive object (p31740 = 1). This monitoring is deactivated for the setting p31742 = 0.		

p31743	SERVOUP motor type / Motor type		
SERVO	Can be changed: C1(3)	Calculated: -	Access level: 3
	Data type: Integer16	Dyn. index: -	Function diagram: -
	P group: -	Unit group: -	Unit selection: -
	Not for motor type: -	Scaling: -	Expert list: 1
	Min: 0	Max: 1	Factory setting: 0

Description:	Sets the motor type. Depending on the motor type, offset clocking is either permitted or inhibited. If value = 0: For motors with windings in a common enclosure (e.g. 1FW4, 1FE2), the following applies: - Offset clocking is not permitted. - The parameters for the offset clocking should be appropriately set (p1815, p1816, p1819). - The plausibility of the parameter setting for offset clocking is checked. If value = 1: For motors with windings in a separate enclosure (e.g. 1FW6, 1FN3, segment motors), the following applies: - Offset clocking is permitted (p1815, p1816, p1819). - the parameter setting for offset clocking is not checked.
Value:	0: Multiple separate winding systems in one enclosure 1: Multiple separate winding systems in separate enclosures
Dependency:	See also: p31748 See also: A53470

p31744	SERVOUP follower torque scaling / F M_scaling		
SERVO	Can be changed: T	Calculated: -	Access level: 3
	Data type: FloatingPoint32	Dyn. index: -	Function diagram: 7335
	P group: -	Unit group: -	Unit selection: -
	Not for motor type: -	Scaling: -	Expert list: 1
	Min: 0.10 [%]	Max: 100.00 [%]	Factory setting: 100.00 [%]
Description:	Sets the scaling factor for the torque setpoint specified by the master drive object for the follower drive object.		
	Note This parameter is only effective for a follower drive object; it is always 100 % for master drive objects. The torque obtained at the follower drive object depends on the setpoint from the higher-level speed controller of the master drive object and the torque limits set there.		

p31744	SERVOUP follower force setpoint scaling / F F_scaling		
SERVO (Lin)	Can be changed: T	Calculated: -	Access level: 3
	Data type: FloatingPoint32	Dyn. index: -	Function diagram: 7335
	P group: -	Unit group: -	Unit selection: -
	Not for motor type: -	Scaling: -	Expert list: 1
	Min: 0.10 [%]	Max: 100.00 [%]	Factory setting: 100.00 [%]
Description:	Sets the scaling factor for the force setpoint specified by the master drive object for the follower drive object.		
	Note This parameter is only effective for a follower drive object; it is always 100 % for master drive objects. The force obtained at the follower drive object depends on the setpoint from the higher-level speed controller of the master drive object and the force limits set there.		

r31745	CO: SERVOUP master coupling assignment / M coupl assign		
SERVO	Can be changed: -	Calculated: -	Access level: 3
	Data type: Integer16	Dyn. index: -	Function diagram: 7335
	P group: -	Unit group: -	Unit selection: -
	Not for motor type: -	Scaling: -	Expert list: 1
	Min: -	Max: -	Factory setting: -
Description:	Display and connector output for the coupling between the master and follower drive object.		

Dependency: See also: p31746
See also: A53470

Note

This parameter is only relevant for a master drive object.
No signals are transferred via the BICO interconnection CI: p31746 (follower drive object) = r31745 (master drive object).
The interconnection is only used for the master-follower drive object assignment.

p31746	CI: SERVCOUPL follower coupling assignment signal source / F coupl ass s_s		
SERVO	Can be changed: C1(3)	Calculated: -	Access level: 3
	Data type: Unsigned32 / Integer16	Dyn. index: -	Function diagram: 7335
	P group: -	Unit group: -	Unit selection: -
	Not for motor type: -	Scaling: -	Expert list: 1
	Min:	Max:	Factory setting:
	-	-	0

Description: Sets the signal source for the coupling between the master and follower drive object.

Example:

The following BICO interconnections are required for one master and two follower drive objects:

CI: p31746 (follower drive object 1) = r31745 (master drive object)

CI: p31746 (follower drive object 2) = r31745 (master drive object)

Dependency: See also: r31745
See also: A53470

Note

This parameter is only relevant for a follower drive object.
No signals are transferred via the BICO interconnection CI: p31746 (follower drive object) = r31745 (master drive object).
The interconnection is only used for the master-follower drive object assignment.

r31747	SERVCOUPL follower assignment to master drive object display / F assign disp		
SERVO	Can be changed: -	Calculated: -	Access level: 3
	Data type: Unsigned16	Dyn. index: -	Function diagram: -
	P group: -	Unit group: -	Unit selection: -
	Not for motor type: -	Scaling: -	Expert list: 1
	Min:	Max:	Factory setting:
	-	-	-

Description: Displays the drive object number of the assigned master drive object.

Dependency: See also: r31745, p31746

Note

This parameter is only relevant for follower drive objects; it is always 0 for a master drive object.

p31748	SERVCOUPL follower angular offset / F angle offset		
SERVO	Can be changed: T	Calculated: -	Access level: 3
	Data type: FloatingPoint32	Dyn. index: -	Function diagram: 7335
	P group: -	Unit group: -	Unit selection: -
	Not for motor type: -	Scaling: -	Expert list: 1
	Min:	Max:	Factory setting:
	-180.00 [°]	180.00 [°]	0.00 [°]

Description: Sets an angular offset between the master and follower drive objects.

For motors with multiple separate winding systems in separate enclosures (p31743 = 1), using this parameter, a possible mechanical offset can be compensated therefore ensuring correct commutation.

Dependency: See also: p31743

⚠ WARNING

For an incorrectly set angular offset, the motor component is incorrectly oriented, which can result in injury and/or material damage.

Note

This parameter is only active for the particular follower drive object.

For a master drive object, correct alignment to the encoder system is achieved via the angular commutation offset (p0431).

p31749**SERVO master alarm propagation / M alarm propag**

SERVO

Can be changed: C1(3)**Calculated:** -**Access level:** 3**Data type:** Integer16**Dyn. index:** -**Function diagram:** -**P group:** -**Unit group:** -**Unit selection:** -**Not for motor type:** -**Scaling:** -**Expert list:** 1**Min:****Max:****Factory setting:**

0

2

1

Description:

Setting to activate the propagation of faults from the follower to the master drive object.

If a fault response occurs for a follower drive object, then it can be set so that it is propagated to the master drive object.

If value = 0:

In the case of a fault, the drive group continues to operate with reduced torque. The magnitude of the total torque is reduced by the torque of the follower drive object that failed.

If value = 1:

A fault with OFF2 fault response is sent to the master and to the associated follower drive objects. The drive group coasts down.

If value = 2:

A fault with OFF3 fault response is sent to the master drive object. The master drive object brakes the drive group along the OFF3 ramp. A fault with OFF2 fault response is then output on the associated follower drive objects.

Value:

0: Follower to master DO: propagation deactivated

1: Follower to master DO: propagation activated with OFF2

2: Follower to master DO: propagation activated with OFF3

Dependency:

See also: F53471, F53475

NOTICE

If value = 0:

It must be guaranteed that the drive group is able to operate the load, even without the follower drive object that has failed (for a certain length of time).

If value = 2:

It must be guaranteed that the drive group is able to brake the load along the OFF3 ramp, even without the follower drive object that has failed.

Note

The parameter is only relevant for master drive objects.

p31749**SERVO master alarm propagation / M alarm propag**

SERVO (Lin)

Can be changed: C1(3)**Calculated:** -**Access level:** 3**Data type:** Integer16**Dyn. index:** -**Function diagram:** -**P group:** -**Unit group:** -**Unit selection:** -**Not for motor type:** -**Scaling:** -**Expert list:** 1**Min:****Max:****Factory setting:**

0

2

1

Description:	Setting to activate the propagation of faults from the follower to the master drive object. If a fault response occurs for a follower drive object, then it can be set so that it is propagated to the master drive object. If value = 0: In the case of a fault, the drive group continues to operate with reduced force. The magnitude of the total force is reduced by the force of the follower drive object that failed. If value = 1: A fault with OFF2 fault response is sent to the master and to the associated follower drive objects. If value = 2: A fault with OFF3 fault response is sent to the master drive object. The master drive object brakes the drive group along the OFF3 ramp. A fault with OFF2 fault response is then output on the associated follower drive objects.
Value:	0: Follower to master DO: propagation deactivated 1: Follower to master DO: propagation activated with OFF2 2: Follower to master DO: propagation activated with OFF3
Dependency:	See also: F53471, F53475

NOTICE
If value = 0: It must be guaranteed that the drive group is able to operate the load, even without the follower drive object that has failed (for a certain length of time). If value = 2: It must be guaranteed that the drive group is able to brake the load along the OFF3 ramp, even without the follower drive object that has failed.

Note

The parameter is only relevant for master drive objects.

r31750.0...15**CO/BO: SERVCOUPL status word / Status word**

SERVO

Can be changed: -

Calculated: -

Access level: 3

Data type: Unsigned16

Dyn. index: -

Function diagram: -

P group: -

Unit group: -

Unit selection: -

Not for motor type: -

Scaling: -

Expert list: 1

Min:

Max:

Factory setting:

-

-

-

Description:

Display and BICO output for the status word.

Bit array:

Bit	Signal name	1 signal	0 signal	FD
00	Inactive	Yes	No	-
01	Master drive object	Yes	No	-
02	Follower drive object	Yes	No	-
03	Master incremental encoder available	Yes	No	-
04	Master absolute encoder available	Yes	No	-
05	Induction motor	Yes	No	-
06	Master incremental encoder with C/D track available	Yes	No	-
07	Copy follower torque setpoint function generator / SBT	Yes	No	-
08	Follower coarse synchronization acceptance running	Yes	No	-
09	Follower coarse synchronization accepted	Yes	No	-
10	Master torque coupling tolerance OK	Yes	No	-
11	Follower drive ready to start	Yes	No	-
12	Master status OK	Yes	No	-
13	Master status rundown	Yes	No	-
14	Master status inhibit pulses	Yes	No	-
15	Master status acknowledge message	Yes	No	-

Note

Bits 00 and 05 are of significance for master and follower drive objects.

Bits 01, 03, 04, 06, 10, 12...15 are only of significance for a master drive object. They have a 0 signal for a follower drive object.

Bits 02, 07, 08, 09, 11 are only of significance for a follower drive object; otherwise they have a 0 signal.

For bit 07:

The bit is set if one of the following conditions is satisfied:

- a monitoring cycle (p9500) was detected on the assigned master drive object before the start of the brake test (r10231.1 = 1 signal).

- the parameter p31757 = 1 signal was set on the follower drive object.

If the bit is set r1651 of the master drive object is scaled using p31744 and acts on the follower drive object as function generator torque setpoint r1651.

For bit 10:

The bit is set if the absolute deviation between master and follower torque actual values is smaller than the tolerance set in p31758.

An overshoot or undershoot of the follower torque actual value to the master torque actual value by the tolerance set in p31758 sets the bit equal to 0.

The bit can also be used for the SBT for automatic evaluation.

SBT: Safe Brake Test (Safety Integrated Extended Function)

r31750.0...15

SERVO (Lin)

CO/BO: SERVCoup status word / Status word

Can be changed: -

Data type: Unsigned16

P group: -

Not for motor type: -

Min:

-

Calculated: -

Dyn. index: -

Unit group: -

Scaling: -

Max:

-

Access level: 3

Function diagram: -

Unit selection: -

Expert list: 1

Factory setting:

-

Description:

Display and BICO output for the status word.

Bit array:

Bit	Signal name	1 signal	0 signal	FD
00	Inactive	Yes	No	-
01	Master drive object	Yes	No	-
02	Follower drive object	Yes	No	-
03	Master incremental encoder available	Yes	No	-
04	Master absolute encoder available	Yes	No	-
05	Induction motor	Yes	No	-
06	Master incremental encoder with C/D track available	Yes	No	-
07	Copy follower force setpoint function generator / SBT	Yes	No	-
08	Follower coarse synchronization acceptance running	Yes	No	-
09	Follower coarse synchronization accepted	Yes	No	-
10	Master force coupling tolerance OK	Yes	No	-
11	Follower drive ready to start	Yes	No	-
12	Master status OK	Yes	No	-
13	Master status rundown	Yes	No	-
14	Master status inhibit pulses	Yes	No	-
15	Master status acknowledge message	Yes	No	-

Note

Bits 00 and 05 are of significance for master and follower drive objects.

Bits 01, 03, 04, 06, 10, 12...15 are only of significance for a master drive object. They have a 0 signal for a follower drive object.

Bits 02, 07, 08, 09, 11 are only of significance for a follower drive object; otherwise they have a 0 signal.

For bit 07:

The bit is set if one of the following conditions is satisfied:

- a monitoring cycle (p9500) was detected on the assigned master drive object before the start of the brake test (r10231.1 = 1 signal).

- the parameter p31757 = 1 signal was set on the follower drive object.

If the bit is set r1651 of the master drive object is scaled using p31744 and acts on the follower drive object as function generator force setpoint r1651.

For bit 10:

The bit is set if the absolute deviation between master and follower force actual values is smaller than the tolerance set in p31758.

An overshoot or undershoot of the follower force actual value to the master force actual value by the tolerance set in p31758 sets the bit equal to 0.

The bit can also be used for the SBT for automatic evaluation.

SBT: Safe Brake Test (Safety Integrated Extended Function)

r31751[0...9]			
SERVO	SERVOUP configuration error / Config error		
	Can be changed: -	Calculated: -	Access level: 3
	Data type: Unsigned16	Dyn. index: -	Function diagram: -
	P group: -	Unit group: -	Unit selection: -
	Not for motor type: -	Scaling: -	Expert list: 1
	Min:	Max:	Factory setting:
	-	-	-
Description:	Displays the number of incorrectly set parameters in the basic system.		
	The entered parameter numbers are deleted when the system powers up next time.		
Index:	[0] = 1st parameter number [1] = 2nd parameter number [2] = 3rd parameter number [3] = 4th parameter number [4] = 5th parameter number [5] = 6th parameter number [6] = 7th parameter number [7] = 8th parameter number [8] = 9th parameter number [9] = 10th parameter number		
Dependency:	The parameter numbers are entered after alarm A53470 occurs. See also: A53470		

r31752			
SERVO	CO: SERVOUP master torque actual value total display / M M_act tot disp		
	Can be changed: -	Calculated: -	Access level: 3
	Data type: FloatingPoint32	Dyn. index: -	Function diagram: -
	P group: -	Unit group: -	Unit selection: -
	Not for motor type: -	Scaling: p2003	Expert list: 1
	Min:	Max:	Factory setting:
	- [Nm]	- [Nm]	- [Nm]

Description: Display and connector output for current torque actual value.
The value is the sum of the torques r0080 of all connected power units.

Dependency: See also: p31744, p31756

Note

This parameter is only relevant for master drive objects. It is always 0 for a follower drive object.
The display is delayed by one speed controller clock cycle p0115[1].

r31752**CO: SERVCOUPL master force actual value total display / M F_act tot disp**

SERVO (Lin)

Can be changed: -**Calculated:** -**Access level:** 3**Data type:** FloatingPoint32**Dyn. index:** -**Function diagram:** -**P group:** -**Unit group:** -**Unit selection:** -**Not for motor type:** -**Scaling:** p2003**Expert list:** 1**Min:****Max:****Factory setting:**

- [N]

- [N]

- [N]

Description: Display and connector output for actual force value.
The value is the sum of the forces r0080 of all connected power units.

Dependency: See also: p31744, p31756

Note

This parameter is only relevant for master drive objects. It is always 0 for a follower drive object.
The display is delayed by one velocity controller clock cycle p0115[1].

r31753**SERVCOUPL master scaling factor total display / M scal tot disp**

SERVO

Can be changed: -**Calculated:** -**Access level:** 3**Data type:** FloatingPoint32**Dyn. index:** -**Function diagram:** -**P group:** -**Unit group:** -**Unit selection:** -**Not for motor type:** -**Scaling:** -**Expert list:** 1**Min:****Max:****Factory setting:**

- [%]

- [%]

- [%]

Description: Displays the scaling factor for the total torque of the drive group.
Using this factor, the total torque of the drive group can be calculated from the master drive object torque. The scaling factor is valid for setpoint and actual value (r0079, r0080).
The factor is calculated from the set scaling factors of the follower drive objects (p31744) plus 100 % from the master drive object.

Example:

Master drive object: p31744 = 100 % (reference value)

Follower drive object 1: p31744 = 100 %

Follower drive object 2: p31744 = 100 %

Follower drive object 3: p31744 = 100 %

Follower drive object 4: p31744 = 50 %

--> Master drive object: r31753 = 450 %

Dependency: See also: p31744

Note

This parameter is only relevant for master drive objects. It is always 0 for a follower drive object.

r31753	SERVO master scaling factor total display / M scal tot disp		
SERVO (Lin)	Can be changed: - Data type: FloatingPoint32 P group: - Not for motor type: - Min: - [%]	Calculated: - Dyn. index: - Unit group: - Scaling: - Max: - [%]	Access level: 3 Function diagram: - Unit selection: - Expert list: 1 Factory setting: - [%]
Description:	Displays the scaling factor for the total force of the drive group. Using this factor, the total force of the drive group can be calculated from the master drive object force. The scaling factor is valid for setpoint and actual value (r0079, r0080). The factor is calculated from the set scaling factors of the follower drive objects (p31744) plus 100 % from the master drive object. Example: Master drive object: p31744 = 100 % (reference value) Follower drive object 1: p31744 = 100 % Follower drive object 2: p31744 = 100 % Follower drive object 3: p31744 = 100 % Follower drive object 4: p31744 = 50 % --> Master drive object: r31753 = 450 %		
Dependency:	See also: p31744		
	Note This parameter is only relevant for master drive objects. It is always 0 for a follower drive object.		
p31754	SERVO follower ASM slip controller integral time / F ASM slipct Tn		
SERVO	Can be changed: T Data type: FloatingPoint32 P group: - Not for motor type: - Min: 0.00 [ms]	Calculated: - Dyn. index: - Unit group: - Scaling: - Max: 250.00 [ms]	Access level: 4 Function diagram: - Unit selection: - Expert list: 1 Factory setting: 12.00 [ms]
Description:	Sets the integral time for the slip controller of the master and follower drive object. The angle of slip difference between master and follower drive object is corrected on the angle offset p31748. The values of the slip controller are displayed in parameter r31755.		
Recommendation:	Recommended initial value: p31754 = 12 ms.		
Dependency:	See also: p31748, r31755		
	NOTICE Possible effects if parameter assignments are inappropriate: - If the integral time is too long, the slip controller is too slow and the angle of slip difference can increase. This can produce different torques at the master and follower drive object. - If the integral time is too short, the angle of slip difference can oscillate and the control can become unstable.		
	Note The parameter is only relevant for follower drive objects and should only be used for induction motors of identical design.		
r31755[0...1]	SERVO follower ASM slip controller display / Fw ASM slipct disp		
SERVO	Can be changed: - Data type: FloatingPoint32 P group: - Not for motor type: - Min: - [°]	Calculated: - Dyn. index: - Unit group: - Scaling: - Max: - [°]	Access level: 4 Function diagram: - Unit selection: - Expert list: 1 Factory setting: - [°]

Description: Display of the input and output of the slip controller.

Index: [0] = Slip controller input
[1] = Slip controller output

Dependency: See also: p31748, p31754

Note

For index 0:

Displays the angle difference between master and follower drive object minus the angle offset r31748.

For index 1:

Displays the integrator value at the output of the slip controller. This is added to the commutation angle r0093 of the follower drive object.

This parameter is only displayed on the particular follower drive object and only for induction motors.

Otherwise it is always 0.

p31756

SERVO

CI: SERVCoup follower supplementary torque signal source / F M_suppl s_s

Can be changed: C1(3)

Calculated: -

Access level: 3

Data type: Unsigned32 / FloatingPoint32

Dyn. index: -

Function diagram: -

P group: -

Unit group: -

Unit selection: -

Not for motor type: -

Scaling: p2003

Expert list: 1

Min:

Max:

Factory setting:

-

-

0

Description: Sets the signal source for a supplementary torque at the follower drive object.

The value of the signal source is multiplied by the scaling factor p31744 and then added to the torque setpoint.

Recommendation: The set supplementary torque r31756 only acts on this drive object, but influences the behavior of the complete group. p1511 of the master drive object should be used for identical supplementary torques at all coupled drive objects.

Dependency: See also: p31744

Note

This parameter is only active for the particular follower drive object.

p31756

SERVO (Lin)

CI: SERVCoup follower supplementary force signal source / F F_suppl s_s

Can be changed: C1(3)

Calculated: -

Access level: 3

Data type: Unsigned32 / FloatingPoint32

Dyn. index: -

Function diagram: -

P group: -

Unit group: -

Unit selection: -

Not for motor type: -

Scaling: p2003

Expert list: 1

Min:

Max:

Factory setting:

-

-

0

Description: Sets the signal source for a supplementary force at the follower drive object.

The value of the signal source is multiplied by the scaling factor p31744 and then added to the force setpoint.

Recommendation: The set supplementary force r31756 only acts on this drive object, but influences the behavior of the complete group. p1511 of the master drive object should be used for identical supplementary forces at all coupled drive objects.

Dependency: See also: p31744

Note

This parameter is only active for the particular follower drive object.

p31757	BI: SERVCOUF follower disturbing torque copying signal source / F M_dsb cop s_s		
SERVO	Can be changed: T Data type: Unsigned32 / Binary P group: - Not for motor type: - Min: -	Calculated: - Dyn. index: - Unit group: - Scaling: - Max: -	Access level: 3 Function diagram: - Unit selection: - Expert list: 1 Factory setting: 0
Description:	Sets the signal source to copy the disturbing torque. When function generator/metering functions are used, the follower drive object may be loaded with the disturbing torque of the master drive object (r1651). The disturbing torque of the follower drive object is additionally scaled using p31744. For p31757 = 0 signal, the following applies: - Master drive object disturbing torque is not copied. For p31757 = 1 signal, the following applies: - r1651 of master drive object is scaled using p31744 and acts on the follower drive object as function generator torque setpoint r1651. - Status bit r31750.7 = 1		
Dependency:	See also: p31744		
	Note This parameter is only relevant for follower drive objects.		
p31757	BI: SERVCOUF follower disturbing force copying signal source / F F_dsb cop s_s		
SERVO (Lin)	Can be changed: T Data type: Unsigned32 / Binary P group: - Not for motor type: - Min: -	Calculated: - Dyn. index: - Unit group: - Scaling: - Max: -	Access level: 3 Function diagram: - Unit selection: - Expert list: 1 Factory setting: 0
Description:	Sets the signal source to copy the disturbing force. When function generator/metering functions are used, the follower drive object may be loaded with the disturbing force of the master drive object (r1651). The disturbing force of the follower drive object is additionally scaled using p31744. For p31757 = 0 signal, the following applies: - No disturbing force of the master drive object is copied. For p31757 = 1 signal, the following applies: - r1651 of master drive object is scaled using p31744 and acts on the follower drive object as function generator force setpoint r1651. - Status bit r31750.7 = 1		
Dependency:	See also: p31744		
	Note This parameter is only relevant for follower drive objects.		
p31758	SERVCOUF master torque coupling tolerance permissible / M M_coupl tol		
SERVO	Can be changed: T Data type: FloatingPoint32 P group: - Not for motor type: - Min: 0.00 [%]	Calculated: - Dyn. index: - Unit group: - Scaling: - Max: 50.00 [%]	Access level: 4 Function diagram: - Unit selection: - Expert list: 1 Factory setting: 10.00 [%]

Description: Sets the tolerance of the torque actual values of all coupled follower drive objects.
The percentage value refers to the current torque actual value r0080 of the master drive object.

If the absolute deviation between master and follower torque actual values is smaller than the set tolerance, r31750.10 = 1 is set.
An overshoot or undershoot of the follower torque actual value to the master torque actual value by the set tolerance sets bit r31750.10 = 0.

The torque scaling r31744 of the follower drive objects is taken into account.
The follower supplementary torque p31756 is not monitored. When interconnecting p31756, the percentage value p31758 must be increased if necessary.

Dependency: See also: p31744, r31750, r31752, p31756

Note

This parameter is only relevant for a master drive object.

p31758

SERVO (Lin)

SERVCoup master force coupling tolerance permissible / M F_coupl tol

Can be changed: T	Calculated: -	Access level: 4
Data type: FloatingPoint32	Dyn. index: -	Function diagram: -
P group: -	Unit group: -	Unit selection: -
Not for motor type: -	Scaling: -	Expert list: 1
Min: 0.00 [%]	Max: 50.00 [%]	Factory setting: 10.00 [%]

Description: Sets the tolerance of the force actual values of all coupled follower drive objects.
The percentage value refers to the current force actual value r0080 of the master drive object.

If the absolute deviation between master and follower force actual values is smaller than the set tolerance, r31750.10 = 1 is set.
An overshoot or undershoot of the follower force actual value to the master force actual value by the set tolerance sets bit r31750.10 = 0.

The force setpoint scaling r31744 of the follower drive objects is taken into account.
The follower supplementary force p31756 is not monitored. When interconnecting p31756, the percentage value p31758 must be increased if necessary.

Dependency: See also: p31744, r31750, r31752, p31756

Note

This parameter is only relevant for a master drive object.

Function diagrams

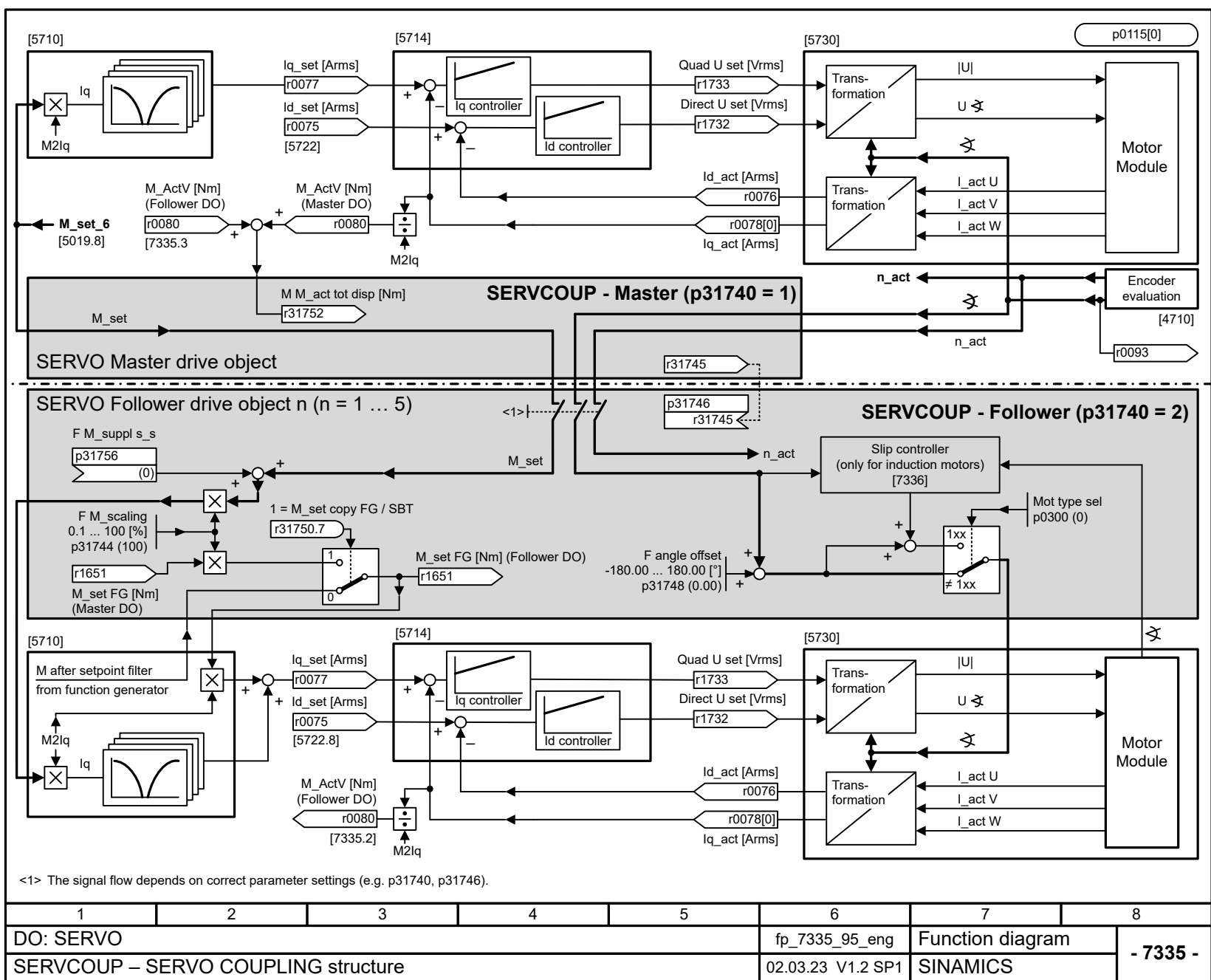
Note

This chapter only includes the function diagrams for Technology Extension SERVCUP.

You can find the product-dependent function diagrams available for SINAMICS in the following reference:

- SINAMICS S120/S150 List Manual, Chapter "Function diagrams".
-

SERVICUP
Function Manual, 12/2023 V1.2 SP1, A5E38012711B AG



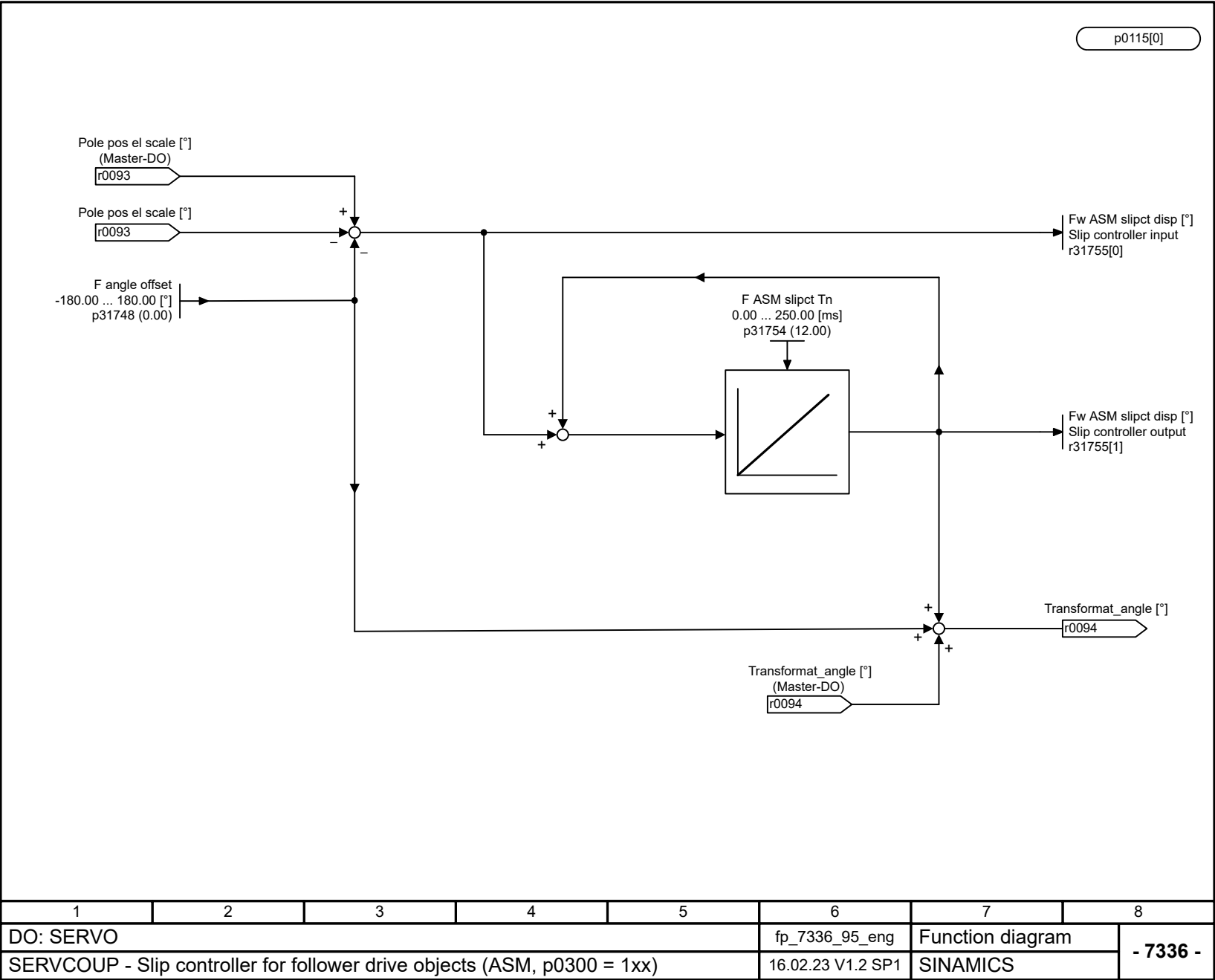


Figure 8-2 7336 - slip controller for follower drive objects (ASM, p0300 = 1xx)

Faults and alarms

Overview

This chapter only includes the faults and alarms for Technology Extension SERVCOU.

Note

You can find information on additional messages that are output (faults, alarms), for example, in:

- the online help of the respective control system
- the commissioning tool
- the product-specific List Manual, e.g. SINAMICS S120/S150 List Manual, Chapter "List of faults and alarms".

Additional explanations of the faults and alarms list can be found in the product-specific List Manuals in the Chapter "Overview of faults and alarms".

List of faults and alarms

The following is a list of faults and alarms of the SERVCOU Technology Extension.

Product: drvoa_servcoup, Version: 1201100, Language: eng

Objects: SERVO

A53470	SERVCOU configuration error
Drive object:	SERVO
Message value:	%1
Reaction:	NONE
Acknowledge:	NONE

Cause:

The configuration of the SERVCUP Technology Extension is incorrect.

In this state, the servo coupling is not ready for operation, and can only be activated once the cause has been resolved.

Alarm value (r2124, interpret decimal):

- 1: No master drive object set, or drive object is not interconnected with another master drive object via p31746.
- 2: No follower drive object set.
- 3: The drive object number of the master drive object is larger than that of the follower drive object.
- 4: No encoder is set on the master drive object.
- 6: The master drive object is interconnected with another master drive object via p31746.
- 7: The rule p0115[0] = p0115[1] has been violated on at least one of the drive objects involved.
- 8: On the master drive object, p1460[D] is set to > 0.0 or p1462[D] is set to > 0.0.
- 9: Parameter p0115[0] or p0115[1] is different on the master drive object and follower drive object.
- 10: Number of data sets (p0180) is different on the master drive object and follower drive object.
- 11: Motor type p31743 is different between the master drive object and follower drive object.
- 12: Parameter p1815.0 is different on the follower drive object and master drive object.
- 13: Parameter p1816 is different on the follower drive object and master drive object.
- 14: Parameter p1819 is different on the follower drive object and master drive object.
- 15: A speed or velocity to monitor the enable signal is set in parameter p31742. However, no propagation of faults was set in parameter p31749.
- 16: Parameter p0300 of the master drive object is not identical for all MDS. The configured motor type (SM / ASM) differs between the MDS of the same motor module.
- 17: Parameter p0300 differs between master and follower drive objects. The configured motor type (SM / ASM) differs between the MDS on at least one follower drive object.
- 18: Parameter p0290 value 2, 3, 12, 13 not permissible.
- 19: Parameter p0290 is different on the master drive object and follower drive object.

Note:

This alarm can also initiate the display of incorrectly set parameters in r31751.

MDS: Motor Data Set

Remedy:	For alarm value = 1: For a drive object, set the operating mode – master drive object (p31740 = 1). For alarm value = 2: For one or several drive objects, set the operating mode – follower drive object (p31740 = 2). For alarm value = 3: Use the drive object with the lowest drive object number as master drive object (p31740). For alarm value = 4: For the master drive object, correctly set the number of encoders (p31741). For alarm value = 6: For the master drive object, deactivate the coupling to an additional drive object (p31746 = 0). For alarm value = 7: Set p0115[0] = p0115[1] on all of the drive objects involved. For alarm value = 8: On the follower drive objects, set p1460[D] = p1462[D] = 0.0 in all drive data sets (DDS). For alarm value = 9: On all of the follower drive objects involved, set p0115[0] and p0115[1] the same as the master drive object. For alarm value = 10: Set the number of drive data sets (p0180) the same on all drive objects involved. For alarm value = 11: On all follower drive objects, set p31743 the same as the master drive object. For alarm value = 12: Set parameter p1815.0 the same on all of the drive objects involved. For alarm value = 13: Set parameter p1816 the same on all of the drive objects involved. For alarm value = 14: Set parameter p1819 the same on all of the drive objects involved. For alarm value = 15: Set an appropriate propagation in parameter p31749, or with p31742 = 0, deactivate monitoring the enable signal. For alarm value = 16: In parameter p300 of the master drive object, configure the same motor type for all MDS. For alarm value = 17: In parameter p0300 of all follower drive objects, configure the same motor type as that of the master drive object for all MDS. For alarm value = 18: In parameter p0290 of all master and follower drive objects, configure another power unit overload response with the value 0, 1 or 10. For alarm value = 19: Set parameter p0290 the same on all of the drive objects involved. Note: SERVCUP: SERVO COUPLING (SERVO coupling) MDS: Motor Data Set See also: p31740, p31741, p31743, r31745, p31746, r31751
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F53471 SERVCUP fault detected at the drive object

Drive object:	SERVO
Message value:	%1
Reaction:	OFF2
Acknowledge:	IMMEDIATELY

Cause:	A fault with pulse cancellation was detected on a drive object. As a consequence, a fault was output at all coupled drive objects. Fault value (r0949, interpret decimal): Drive object number. Note: This fault can only be acknowledged at all of the other drive objects if, at the specified drive object, the cause of the fault was removed. This fault can occur as response to F53475. See also: p31749 (SERVCOUP master alarm propagation)
Remedy:	Resolve the fault at the specified drive object and acknowledge. Note: SERVCOUP: SERVO COUPLING (SERVO coupling)

F53473 SERVCOUP follower maximum velocity exceeded

Drive object:	SERVO
Message value:	-
Reaction:	NONE
Acknowledge:	IMMEDIATELY
Cause:	The maximum speed or maximum velocity set in p31742 on a follower drive object that has not been enabled has been exceeded. As a consequence, this fault is output at the master drive object. See also: p31742
Remedy:	- Check enable signals for the follower drive object and activate if necessary. - Resolve the cause of the fault on the follower drive object. - Check the setting of the maximum speed or maximum velocity in p31742 and change it if necessary. Note: SERVCOUP: SERVO COUPLING (SERVO coupling)

F53475 SERVCOUP fault detected on the follower drive object

Drive object:	SERVO
Message value:	%1
Reaction:	OFF3
Acknowledge:	IMMEDIATELY
Cause:	A fault with pulse cancellation was detected on a follower drive object. As a consequence, a fault was output by the master drive object. Fault value (r0949, interpret decimal): Drive object number. Note: This fault can only be acknowledged at the master drive object if, at the specified drive object, the cause of the fault was removed. This fault sets fault F53471 at all associated follower drive objects. See also: p31749 (SERVCOUP master alarm propagation)
Remedy:	Resolve the fault at the specified follower drive object and acknowledge. Note: SERVCOUP: SERVO COUPLING (SERVO coupling)

Appendix

A.1 Parameters relevant for operation of Technology Extension SERVCUP

"*" in the following table represents an arbitrary value.

Table A-1 Parameter settings of Technology Extension SERVCUP

Parameter number	Parameter name	Master value	Follower value
p0112	Sampling times default setting p0115	*	= master
p0115[0]	Sampling time current controller	*	= master
p0115[1]	Sampling time speed controller	= p0115[0]	= master
p0118	Current controller computing dead time	*	= master
p0145	Activate/deactivate encoder interface	1	2
p0180	Number of Drive Data Sets (DDS)	*	= master
p0188[x]	Encoder 2 encoder data set number When using a direct measuring system and operation with an NC, otherwise, both values = 99	1	99
p0210	Device supply voltage	*	= master
p0290	Power unit overload response	0 / 1 / 10	= master
p0300	Motor type selection	*	= master
p0301	Motor code number selection	*	= master
p0304	Rated motor voltage	*	= master
p0305	Rated motor current	*	= master
p0307	Rated motor power	*	= master
p0310	Rated motor frequency	*	= master
p0311	Rated motor speed	*	= master
p0312	Rated motor torque	*	= master
p0314	Motor pole pair number	*	= master
p0316	Motor torque constant	*	= master
p0317	Motor voltage constant	*	= master
p0318	Motor stall current	*	= master
p0319	Motor static torque	*	= master
p0320	Motor rated magnetizing current / short-circuit current	*	= master
p0322	Maximum motor speed	*	= master
p0323	Maximum motor current	*	= master
p0324	Winding maximum speed	*	= master
p0325	Motor pole position identification current 1st phase	*	= master
p0326	Motor stall torque correction factor	*	= master
p0327	Optimum motor load angle	*	= master
p0328	Motor reluctance force constant	*	= master

A.1 Parameters relevant for operation of Technology Extension SERVOUP

p0329	Motor pole position identification current	*	= master
p0338	Motor limit current	*	= master
p0341	Motor moment of inertia	*	= master
p0344	Motor weight (for the thermal motor model)	*	= master
p0348	Speed at the start of field weakening V _{dc} = 600 V	*	= master
p0350	Motor stator resistance, cold	*	= master
p0354	Motor rotor resistance, cold	*	= master
p0356	Motor stator leakage inductance	*	= master
p0358	Motor rotor leakage inductance	*	= master
p0360	Motor magnetizing inductance	*	= master
p0391	Current controller adaptation, starting point KP	*	= master
p0392	Current controller adaptation, starting point KP adapted	*	= master
p0393	Current controller adaptation, P gain adaptation	*	= master
p0400	Encoder type selection	*	= master
p0404	Encoder configuration active	*	= master
p0408	Rotary encoder pulse number	*	= master
p0410	Encoder inversion actual value	*	= master
p0425	Encoder rotary zero mark distance	*	= master
p0431	Angular commutation offset To correct the angle difference between the master and follower drive objects, p31748 must be set on the follower drive objects.	*	0
p0491	Motor encoder fault response ENCODER	0	= master
p0500	Technology application	*	= master
p0604	Mot_temp_mod 2/KTY alarm threshold	*	= master
p0605	Mot_temp_mod 1/2 threshold	*	= master
p0640	Current limit	*	= master
p0840	ON/OFF (OFF1)	*	*
p0845	No coast down / coast down (OFF2) signal source 2	*	*
p0864	Infeed operation	*	* / = master
p1082	Maximum speed	*	= master
p1300	Open-loop/closed-loop control operating mode	<> 20:	= master
p1402	Current control and motor model configuration	*	= master
p1441	Actual speed value smoothing time	*	= master
p1460	Speed controller P gain adaptation speed, lower	*	0
p1461	Speed controller K _p adaptation speed, upper scaling	*	* (Rec.: 100%)
p1462	Speed controller integral time adaptation speed, lower	*	0
p1463	Speed controller T _n adaptation speed, upper scaling	*	* (Rec.: 100%)
p1464	Speed controller adaptation speed, lower	*	* (Rec.: 0.0)
p1465	Speed controller adaptation speed, upper	*	* (Rec.: 0.0)
p1498	Load moment of inertia	*	= master
p1520	Force limit upper/motoring	*	= master
p1521	Force limit lower/regenerative	*	= master
p1530	Power limit, motoring	*	= master
p1531	Power limit, regenerative	*	= master

A.1 Parameters relevant for operation of Technology Extension SERVOUP

p1612	Current setpoint, open-loop control, encoderless	*	= master
p1656	Current setpoint filter activation	*	= master
p1657	Current setpoint filter 1 type	*	= master
p1658	Current setpoint filter 1 denominator natural frequency	*	= master
p1659	Current setpoint filter 1 denominator damping	*	= master
p1660	Current setpoint filter 1 numerator natural frequency	*	= master
p1661	Current setpoint filter 1 numerator damping	*	= master
p1662	Current setpoint filter 2 type	*	= master
p1663	Current setpoint filter 2 denominator natural frequency	*	= master
p1664	Current setpoint filter 2 denominator damping	*	= master
p1665	Current setpoint filter 2 numerator natural frequency	*	= master
p1666	Current setpoint filter 2 numerator damping	*	= master
p1667	Current setpoint filter 3 type	*	= master
p1668	Current setpoint filter 3 denominator natural frequency	*	= master
p1669	Current setpoint filter 3 denominator damping	*	= master
p1670	Current setpoint filter 3 numerator natural frequency	*	= master
p1671	Current setpoint filter 3 numerator damping	*	= master
p1672	Current setpoint filter 4 type	*	= master
p1673	Current setpoint filter 4 denominator natural frequency	*	= master
p1674	Current setpoint filter 4 denominator damping	*	= master
p1675	Current setpoint filter 4 numerator natural frequency	*	= master
p1676	Current setpoint filter 4 numerator damping	*	= master
p1715	Current controller P gain	*	= master
p1717	Current controller integral time	*	= master
p1752	Motor model, changeover speed operation with encoder	*	= master
p1755	Motor model changeover speed encoderless operation	*	= master
p1800	Pulse frequency setpoint	*	= master
p1810	Modulator configuration	*	= master
p1815.0	Phase for PWM generation, subgroup	1	1
p1816	Set phase for PWM generation manually	* But $\neq -1$	= master
p1819	Phase for PWM generation	*	= master
p1821	Direction of rotation For direct motors arranged so that they oppose one another, the following applies: For direct motors rotating in opposite directions, the direction of rotation of a motor must be adapted so that the setpoints act in the same direction. There are two options: - Set the direction of rotation p1821 differently for the master and follower drive objects. This version is recommended. - When commissioning the hardware, appropriately change the phase sequence at a drive object, and leave p1821 identical for the master and follower drive object.	*	= master
p1952	Voltage emulation error, final value	*	= master
p1953	Voltage emulation error, current offset	*	= master
p1980	PolID technique	*	= master

A.1 Parameters relevant for operation of Technology Extension SERVCOU

p1981	PolID distance max	*	= master
p1982	PolID selection	*	= master
p1993	PolID motion-based current	*	= master
p1995	PolID motion-based gain	*	= master
p1996	PolID motion-based integral time	*	= master
p1997	PolID motion-based smoothing time	*	= master
p2000	Reference speed reference frequency	*	= master
p2001	Reference voltage	*	= master
p2002	Reference current	*	= master
p2003	Reference torque	*	= master
p2004	Reference power	*	= master
p2005	Reference angle	*	= master
p2006	Reference temperature	*	= master
p2007	Reference acceleration	*	= master
p2162	Hysteresis speed $n_{act} > n_{max}$ (due to the field weakening mode, also relevant for follower drive object)	*	= master
p2175	Motor blocked speed threshold	*	Maximum value, and therefore inactive
p31740	SERVCOU operating mode	1	2
p31741	SERVCOU master encoder count	1	0
p31743	SERVCOU motor type	* (0 for double/ multi-winding motors)	= master
p31746	SERVCOU follower coupling assignment	0	r31745 (master)
p31744	SERVCOU follower torque scaling	No function	*
p31748	SERVCOU follower angular offset		
	ASM: For motors with windings in separate enclosures (p31743 = 1)	No function	* (Rec.: 0)
	ASM: For motors with windings in a common enclosure (p31743 = 0)	No function	0, or 180 for incorrect polarity
	Synchronous motor	No function	*, determined value
p31749	SERVCOU master alarm propagation A value of 0 is only permissible if the drive line-up is in a position to also operate the load without the failed follower (for a specific time).	0-2	No function
p31754	SERVCOU follower ASM slip controller integral time	No function	* (Rec.: 12)
p31756	SERVCOU follower supplementary torque signal source	No function	*
p31757	SERVCOU follower disturbing torque copying signal source	No function	1 signal for enhanced measuring function (e.g. AST), otherwise 0 signal
p31758	SERVCOU master torque coupling tolerance permissible	* (Rec.: 10%)	No function

A.2 Function designations of Safety Integrated for SINAMICS and SINUMERIK

Table A-2 Overview of Safety Integrated for SINAMICS and SINUMERIK

Function designation of SINAMICS Safety Integrated			Function designation of SINUMERIK Safety Integrated		
Abbr.	German	English	Abbr.	German	English
STO ^{*)}	Sicher abgeschaltetes Moment	Safe Torque Off	SH	Sicherer Halt (STOP A)	Safe standstill (STOP A)
SS1 ^{*)}	Sicherer Stop 1	Safe Stop 1	-	STOP B	STOP B
SS1E	Sicherer Stop 1 ¹⁾	Safe Stop 1	-	-	-
SS2	Sicherer Stop 2	Safe Stop 2	-	STOP C	STOP C
SS2E	Sicherer Stop 2 ²⁾	Safe Stop 2	-	STOP D	STOP D
SS2ESR	Sicherer Stop 2 ³⁾	Safe Stop 2	-	STOP E	STOP E
SOS	Sicherer Betriebshalt	Safe Operating Stop	SBH	Sicherer Betriebshalt	Safe Operating Stop
SBC ^{*)}	Sichere Bremsenansteuerung	Safe Brake Control	SBC	Sichere Bremsenansteuerung	Safe Brake Control
SAM	Sichere Überwachung auf Beschleunigung	Safe Acceleration Monitor	SBR	Sichere Überwachung auf Beschleunigung (ehemalige Bezeichnung: Sichere Bremsrampe)	Safe Acceleration Monitor (former name: Safe Brake Ramp)
SBT	Sicherer Bremsentest	Safe Brake Test	SBT	Sicherer Bremsentest	Safe Brake Test
SLS	Sicher begrenzte Geschwindigkeit	Safely-Limited Speed	SG	Sicher reduzierte Geschwindigkeit	Safely reduced speed
SSM	Sichere Drehzahlüberwachung	Safe Speed Monitor	-	n < nx	n < nx
SDI	Sichere Bewegungsrichtung	Safe Direction	-	-	-
SLA	Sicher begrenzte Beschleunigung	Safely-Limited Acceleration	-	-	-
SLP	Sicher begrenzte Lage	Safely-Limited Position	SE	Sichere Software-Endschalter	Safe software limit switch
SP	Sichere Position	Safe Position	-	-	-
SCA	Sichere Nocken	Safe Cam	SN	Sichere Software-Nocken bzw. Nockenspur	Safe software cam, Safe cam track
F-DI F-DO	Fehlersicherer Digital-ein-/ausgang	Failsafe Digital Input Failsafe Digital Output	SGE/SG A	Sicherheitsgerichtete Ein-/Ausgabesignale	Safety-related I/O
SBM	Sicheres Bremsenmanagement	Safe Brake Management	SBM	Sicheres Bremsenmanagement	Safe Brake Management
SBR	Sichere Überwachung der Bremsrampe	Safe Brake Ramp	-	-	-
-	-	-	SPL	Sichere programmierbare Logik	Safe Programmable Logic
-	-	-	-	Sicheres Software Relais	Safe software relay

^{*)} SINAMICS Safety Integrated Basic Functions

¹⁾ Drive switches off after expiration of a delay time (OFF2)

²⁾ For drive-based safety functions of SINAMICS, this involves a delayed SOS

- ³⁾ For drive-based safety functions of SINAMICS, this involves a delayed SOS with previous triggering of ESR

More information

Siemens:
www.siemens.com

Industry Online Support (Service and Support):
www.siemens.com/online-support

IndustryMall:
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