PROFIdrive – PMC SC6, PMC SI6

Pilz

Table of contents

1 Foreword

The DriveControlSuite commissioning software for 6th generation drive controllers offers convenient functions for efficient project configuration and commissioning of drive controllers in multi-axis and single-axis applications.

The PROFIdrive application included in the software contains various application classes for controller and drive-based motion profiles. Jog mode is available in all application classes for commissioning, emergency operation,and maintenance or repair work.

This documentation describes the general functions of the PROFIdrive application and guides you step by step through the setup and project configuration of your drive project in the individual application classes.

2   User information

This documentation supports you during the setup and project configuration of your drive system with the PROFIdrive application, which is based on the internationally standardized PROFIdrive drive profile for electric drives in accordance with IEC 61800-7-303 (version 4.2).

Commissioning is described using examples of a PROFINET network with Pilz 6th generation drive controllers in combination with a Siemens AG controller.

Technical knowledge

To be able to commission one or more drive controllers in combination with a controller using the PROFIdrive application, you should have basic knowledge of handling 6th generation Pilz drive controllers and of the DriveControlSuite commissioning software. Operating your PROFINET network requires being familiar with PROFINET network technology and the basics of the associated Siemens SIMATIC automation systems.

Technical requirements

Before you begin operating your PROFINET network, you need to wire the drive controllers and initially check that they are functioning correctly. To do this, follow the instructions in the manual for the relevant drive controller.

2.1   Storage and transfer

As this documentation contains important information for handling the product safely and efficiently, it must be stored in the immediate vicinity of the product until product disposal and be accessible to qualified personnel at all times.

Also pass on this documentation if the product is transferred or sold to a third party.

2.2   Described product

This documentation is binding for:

PMC SC6 or PMC SI6 series drive controllers in conjunction with the DriveControlSuite software (DS6) in V 6.6-B or later and associated firmware in 6.6-B-PN or later.

2.3   Directives and standards

Refer to the drive controller documentation for the European directives and standards relevant to the drive controller and accessories.

2.4   Timeliness

Check whether this document is the most up-to-date version of the documentation. We make the latest document versions for our products available for download on our website: https://www.pilz.com/en-INT.

2.5 Original language

The original language of this documentation is German; all other language versions are derived from the original language.

2.6 Limitation of liability

This documentation was created taking into account the applicable standards and regulations as well as the current state of technology.

No warranty or liability claims for damage shall result from failure to comply with the documentation or from use that deviates from the intended use of the product. This is especially true for damage caused by individual technical modifications to the product or the project configuration and operation of the product by unqualified personnel.

2.7   Formatting conventions

Orientation guides in the form of signal words, symbols and special text markups are used to emphasize specific information so that you are able identify it in this documentation quickly.

2.7.1   Display of warning messages and information

Warning messages are identified with symbols. They indicate special risks when handling the product and are accompanied by relevant signal words that express the extent of the risk. Furthermore, useful tips and recommendations for efficient, error-free operation are specially highlighted.

ATTENTION!

Attention

This indicates that damage to property may occur

- ▪ if the stated precautionary measures are not taken.

CAUTION!

Caution

This word with a warning triangle indicates that minor personal injury may occur

- ▪ if the stated precautionary measures are not taken.

WARNING!

Warning

This word with a warning triangle means there may be a considerable risk of fatal injury

- ▪ if the stated precautionary measures are not taken.

DANGER!

Danger

This word with a warning triangle indicates that there is a considerable risk of fatal injury

- ▪ if the stated precautionary measures are not taken.

Information

Information indicates important information about the product or serves to emphasize a section in the documentation that deserves special attention from the reader.

2.7.2 Markup of text elements

Certain elements of the continuous text are distinguished as follows.

Important information	Words or expressions with a special meaning
Interpolated position mode	Optional: File or product name or other name
Detailed information	Internal cross-reference
http://www.samplelink.com	External cross-reference

Software and other displays

The following formatting is used to identify the various information content of elements referenced by the software interface or a drive controller display, as well as any user entries.

Main menu Settings	Window names, dialog box names, page names or buttons, combined proper nouns, functions referenced by the interface
Select `Referencing method A`	Predefined entry
Save your `<own IP address>`	User-defined entry
EVENT 52: COMMUNICATION	Displays (status, messages, warnings, faults)

Keyboard shortcuts and command sequences or paths are represented as follows.

[CTRL], [CTRL] + [S]	Key, key combination
Table > Insert table	Navigation to menus/submenus (path specification)

2.7.3 Mathematics and formulas

The following signs are used to represent mathematical relationships and formulas.

–	Subtraction
+	Addition
×	Multiplication
÷	Division
| |	Absolute value

2.8 Trademarks

The following names used in connection with the device, its optional equipment and its accessories are trademarks or registered trademarks of other companies:

EnDat®	EnDat® and the EnDat® logo are registered trademarks of Dr. Johannes Heidenhain GmbH, Germany.
PLCopen®	PLCopen® is a registered trademark of the PLCopen Organisation, Netherlands.
PROFIBUS®, PROFINET®	PROFIBUS® and PROFINET® are registered trademarks of PROFIBUS Nutzerorganisation e.V., Germany.
PROFIdrive®, PROFIsafe®	PROFIdrive® and PROFIsafe® are registered trademarks of Siemens AG, Germany.
SIMATIC®, TIA Portal®	SIMATIC® and TIA Portal® are registered trademarks of Siemens AG, Germany.

All other trademarks not listed here are the property of their respective owners.

Products that are registered as trademarks are not specially indicated in this documentation. Existing property rights (patents, trademarks, protection of utility models) are to be observed.

2.9   Explanation of terms

As relevant standards and products of other manufacturers are referenced, different manufacturer- or standard-specific names are used for the same term in this documentation.

For improved understandability, the names in this documentation are standardized to the terminology of Pilz to the greatest extent possible. The correlation of Pilz names to other sources can be found in the following table.

Pilz	PROFINET
Controller	IO controller
Drive controller	IO device

Tab. 1: Correlation of Pilz terminology to PROFINET

Pilz	PROFIdrive
Motion block operating mode	Program mode
Command operating mode	MDI mode
Referencing	Homing
Jog	Jogging

Tab. 2: Correlation of Pilz terminology to PROFIdrive

3 Safety notes

> **WARNING!**
>
> **Risk of fatal injury if safety notes and residual risks are not observed!**
>
> Failure to observe the safety notes and residual risks in the drive controller documentation may result in accidents causing serious injury or death.
>
> - Observe the safety notes in the drive controller documentation.
> - Consider the residual risks in the risk assessment for the machine or system.

> **WARNING!**
>
> **Malfunction of the machine due to incorrect or modified parameterization!**
>
> In the event of incorrect or modified parameterization, malfunctions can occur on machines or systems which can lead to serious injuries or death.
>
> - Observe the security notes in the drive controller documentation.
> - Protect the parameterization, e.g. from unauthorized access.
> - Take appropriate measures for possible malfunctions (e.g. emergency off or emergency stop).

4 What you should know before commissioning

The following chapters provide a quick introduction to the structure of the program interface and accompanying window designations as well as relevant information about parameters and generally saving your project configuration.

4.1 Program interfaces

The following chapters include an overview of the program interfaces for the described software components.

4.1.1 DS6 program interface

Using the graphical interface of the DriveControlSuite commissioning software (DS6), you can project, parameterize and commission your drive project quickly and efficiently. In case of service, you can evaluate diagnostic information such as operating states, fault memories and fault counters of your drive project using DriveControlSuite.

> **Information**
>
> The program interface of DriveControlSuite is available in German, English and French. To change the language of the program interface, select Settings > Language.

> **Information**
>
> The DriveControlSuite help in the menu bar can be reached via Help > Help for DS6 or via the [F1] key on your keyboard. When you press [F1] in an area of the program, the corresponding help topic opens.
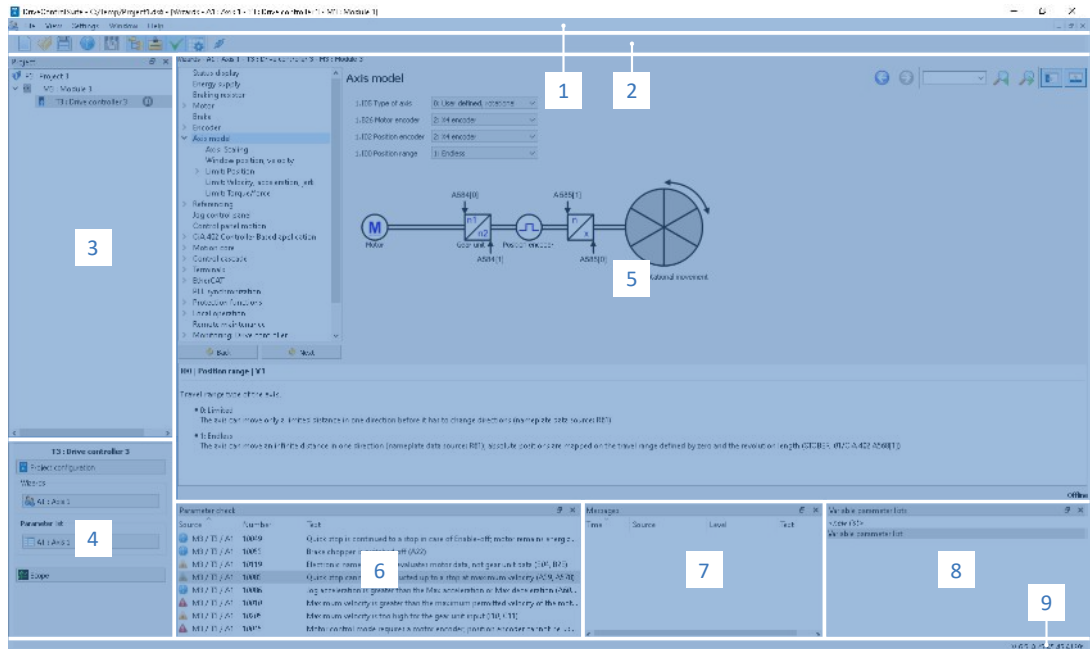
Fig. 1: DS6: Program interface

No.	Area	Description
1	Menu bar	Using the File, View, Settings and Window menus, you can open and save projects, display and hide program windows, select the interface language and access level and change between different windows in the workspace.
2	Toolbar	The toolbar enables quick access to frequently needed functions, like opening and saving projects and hiding and displaying windows in the program interface.
3	Project tree	The project tree forms the structure of your drive project in the form of modules and drive controllers. Select an element using the project tree first in order to edit it using the project menu.
4	Project menu	The project menu offers you various functions for editing the project, module and drive controller. The project menu adapts to the element that you selected in the project tree.
5	Workspace	The different windows which can be used to edit your drive project, such as the configuration dialog, wizards, the parameter list or the scope analysis tool, open in the workspace.
6	Parameter check	The parameter check points out irregularities and inconsistencies that were detected in the plausibility check of calculable parameters.
7	Messages	The entries in the messages log the connection and communication status of the drive controllers, incorrect inputs caught by the system, errors when opening a project or rule violations in the graphical programming.
8	Variable parameter lists	You can use variable parameter lists to compile any parameters in individual parameter lists for a quick overview.
9	Status bar	In the status bar, you can find the specifications of the software version and get additional information about the project file, the devices and the progress of the process during processes such as loading projects.

4.1.1.1   **Configuring the view**

In DriveControlSuite, you can change the visibility and arrangement of areas and windows, such as to optimize the available space in the workspace when working with smaller screens.

Showing/hiding areas

Use the icons in the toolbar or the items in the View menu to show or hide specific areas in DriveControlSuite as needed.

Icon	Item	Description
–	Reset	Resets the view to factory settings.
	Project	Shows/hides the Project window (project tree, project menu).
	Messages	Shows/hides the Messages window.
	Parameter check	Shows/hides the Parameter check window.
	Variable parameter lists	Shows/hides the Variable parameter lists window.

Arrange and group areas

You can undock and rearrange the individual areas via drag and drop. If you drag an undocked window to the edge of DriveControlSuite, you can release it there in a color-highlighted area either next to or on top of another window to redock it.

When you release the window onto another window, the two areas are merged into one window where you can use tabs to switch between the areas.

4.1.1.2   Navigation using sensitive circuit diagrams
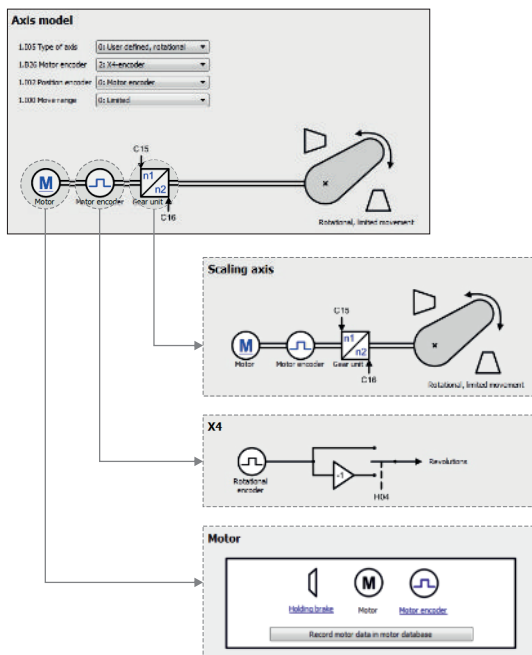
Fig. 2: DriveControlSuite: Navigation using text links and symbols

In order to graphically illustrate the processing sequence of actual and set values, the use of signals or the arrangement of drive components and to make configuring the accompanying parameters easier, they are displayed on the respective wizard pages of the workspace in the form of circuit diagrams.

Blue text links or clickable icons indicate links within the program. These refer to the corresponding wizard pages and, as a result, allow you to reach additional helpful detail pages with a click.

4.1.2 TIA Portal program interface

The Siemens Totally Integrated Automation Portal (TIA Portal) offers a platform you can use to commission your PROFINET system. The TIA Portal is broken down into the portal view and the project view.

TIA portal view

The TIA overall functionality is broken down into different task areas that you can reach using portals. The following graphic shows the interface elements of the TIA portal view relevant to this documentation.
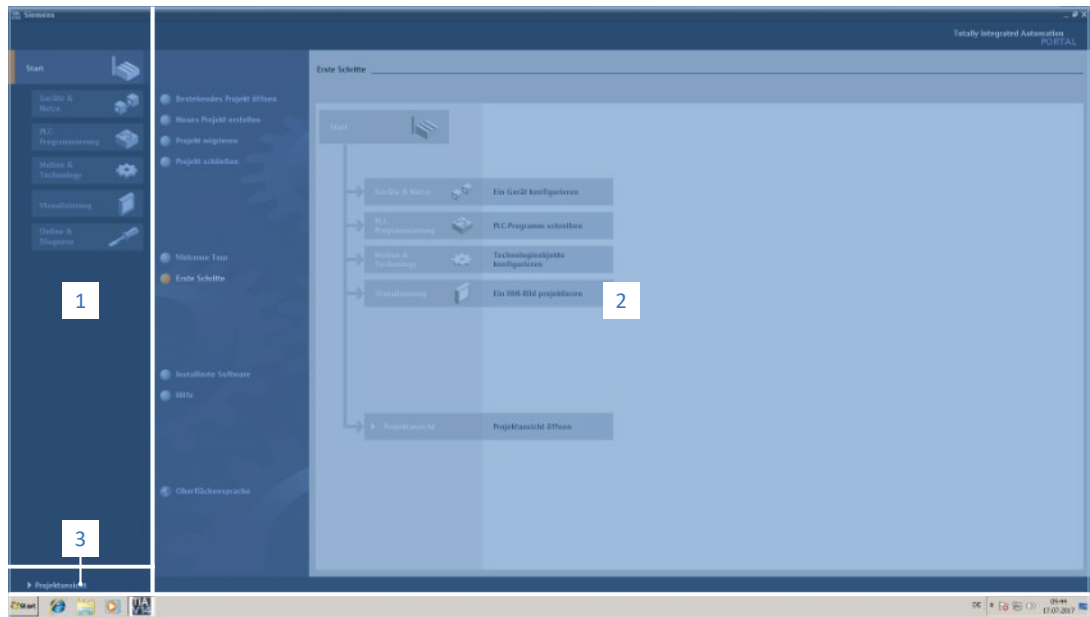
Fig. 3: TIA Portal: Program interface of the portal view

No.	Area	Description
1	Portal selection	The portal selection offers you access to various portals for different tasks and functions.
2	Portal functions	Depending on the selected portal, the portal functions are available here.
3	Project view	The button lets you change to the project view.

TIA project view

The TIA project view offers you access to all components of a project. The following graphic shows the TIA project view interface elements relevant to this documentation.
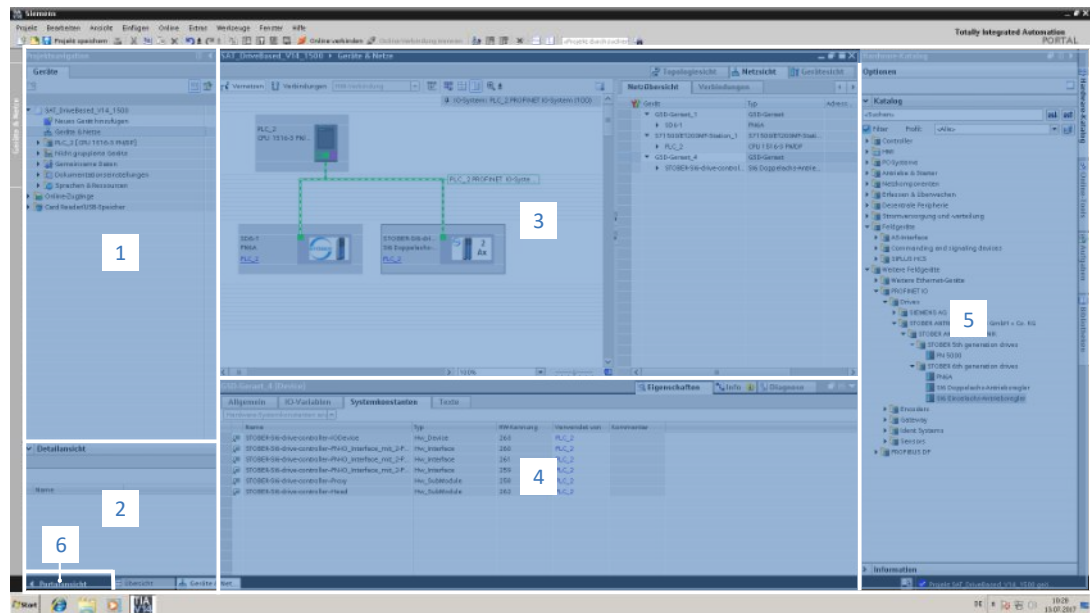
Fig. 4: TIA Portal: Program interface of the project view

No.	Area	Description
1	Project navigation	Project navigation offers you access to all components of your TIA project.
2	Details view	The details view shows you additional information about a selected object.
3	Workspace	In the workspace, you can edit objects in the topology view, network view or device view, for example.
4	Inspector window	The inspector window shows you additional information about a selected object.
5	Task cards	Task cards are available depending on the selected object and grant you access to the hardware catalog, online tools, tasks or libraries, for example.
6	Portal view	The button lets you change to the portal view.

4.2 Meaning of parameters

You can use parameters to adapt the function of the drive controller to your individual application. In addition, parameters visualize the current actual values (actual velocity, actual torque, etc.) and trigger actions such as Save values, Test phase, etc.

Interpretation of parameter identification

Parameter identification consists of the following elements, where short forms are also possible, i.e. only specifying a coordinate or the combination of coordinate and name.

E50 | Drive controller | G6 | V0

Coordinate   Name   Version

Drive controller
generation/series
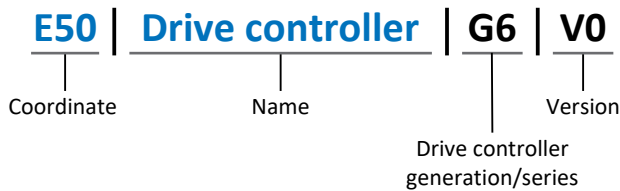
4.2.1 Parameter groups

Parameters are assigned to individual groups by topic. The drive controllers differentiate between the following parameter groups.

Group	Topic
A	Drive controllers, communication, cycle times
B	Motor
C	Machine, velocity, torque/force, comparators
D	Set value
E	Display
F	Terminals, analog and digital inputs and outputs, brake
G	Technology – Part 1 (application-dependent)
H	Encoder
I	Motion (all motion settings)
J	Motion blocks
K	Control panel
L	Technology – Part 2 (application-dependent)
M	Profiles (application-dependent)
N	Additional functions (application-dependent; e.g. extended cam control unit)
P	Customer-specific parameters (programming)
Q	Customer-specific parameters, instance-dependent (programming)
R	Production data for the drive controller, motor, brakes, motor adapter, gearbox and geared motor
S	Safety (safety technology)
T	Scope
U	Protection functions
Z	Fault counter

Tab. 3: Parameter groups

4.2.2 Parameter types and data types

In addition to topic-based sorting in individual groups, all parameters belong to a certain data type and parameter type. The data type of a parameter is displayed in the parameter list, properties table. The connections between parameter types, data types and their value range can be found in the following table.

Data type	Parameter type	Length	Value range (decimal)
INT8	Integer or selection	1 byte (signed)	-128 – 127
INT16	Integer	2 bytes (1 word, signed)	-32768 – 32767
INT32	Integer or position	4 bytes (1 double word, signed)	-2 147 483 648 – 2 147 483 647
BOOL	Binary number	1 bit (internal: LSB in 1 byte)	0, 1
BYTE	Binary number	1 byte (unsigned)	0 – 255
WORD	Binary number	2 bytes (1 word, unsigned)	0 – 65535
DWORD	Binary number or parameter address	4 bytes (1 double word, unsigned)	0 – 4 294 967 295
REAL32 (single type according to IEE754)	Floating-point number	4 bytes (1 double word, signed)	-3.40282×10^{38} – 3.40282×10^{38}
STR8	Text	8 characters	—
STR16	Text	16 characters	—
STR80	Text	80 characters	—

Tab. 4: Parameters: Data types, parameter types, possible values

Parameter types: Use

▸ Integer, floating-point number
   For general computing processes
   Example: Set and actual values

▸ Selection
   Numeric value to which a direct meaning is assigned
   Example: Sources for signals or set values

▸ Binary number
   Bit-oriented parameter information that is collected in binary
   Example: Control and status words

▸ Position
   Integer combined with associated units and decimal places
   Example: Actual and set values of positions

▸ Velocity, acceleration, deceleration, jerk
   Floating-point number combined with associated units
   Example: Actual and set values for velocity, acceleration, deceleration, jerk

▸ Parameter address
   Referencing of a parameter
   Example: In F40 AO1 source, for example, E08 n-motor filtered can be parameterized

▸ Text
   Outputs or messages

4.2.3 Parameter types

The following types of parameters are differentiated.

Parameter type	Description	Example
Simple parameters	Consist of one group and one line with a defined value.	A21 Brake resistor R: Value = 100 ohms
Array parameters	Consist of a group, a line and multiple sequential (listed) elements, which have the same properties but different values.	A10 Access level ▸ A10[0] access level: Value = Access level via operating unit ▸ A10[2] access level: Value = Access level via CANopen and EtherCAT ▸ A10[4] access level: Value = Access level via PROFINET
Record parameters	Consist of a group, a line and multiple sequential (listed) elements, which can have different properties and different values.	A00 Save values ▸ A00[0] Start: Value = Start action ▸ A00[1] Progress: Value = Display action progress ▸ A00[2] Result: Value = Display action result

Tab. 5: Parameter types

4.2.4 Parameter structure

Every parameter has specific coordinates with the following structure.
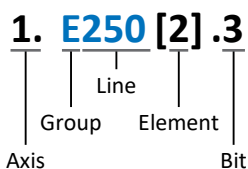
▸ Axis (optional)
In case of multiple axes, the one to which a parameter is assigned; not applicable for global parameters (value range: 1 – 4).

▸ Group
The thematic group to which a parameter belongs (value range: A – Z).

▸ Line
Distinguishes the parameters within a parameter group (value range: 0 – 999).

▸ Element (optional)
Elements of an array or record parameter (value range: 0 – 16000).

▸ Bit (optional)
Selection of a single bit for complete data addressing; depends on the data type (value range: 0 – 31).

4.2.5 Parameter visibility

The visibility of a parameter is controlled by the access level you set in DriveControlSuite and by the properties you project for the respective drive controller (e.g. hardware, firmware and application). A parameter can also be shown or hidden depending on other parameters or settings. For example, the parameters of an additional function are only shown as soon as you activate the relevant additional function.

Access level

The access options for the individual software parameters are ranked hierarchically and divided into individual levels. This means that parameters can be hidden for a specific purpose and, relatedly, their configuration options can be locked starting from a specific level.

Each parameter has one access level for read access (visibility) and one access level for write access (editability). The following levels are present:

▶ Level 0

  Elementary parameters

▶ Level 1

  Important parameters of an application

▶ Level 2

  Important parameters for service with extensive diagnostic options

▶ Level 3

  All parameters needed for commissioning and optimizing an application

The parameter A10 Access level controls general access to parameters:

▶ Over CANopen or EtherCAT (A10[2])

▶ Over PROFINET (A10[3])

> **Information**
>
> It is not possible to write to or read the parameter hidden in DriveControlSuite during communication via fieldbus.

Hardware

Which parameters are available to you in DriveControlSuite is determined by which series you select in the configuration dialog for the drive controller, for example, or whether you project an option module. Basically, the only parameters that are displayed are the ones you need to parameterize the configured hardware.

Firmware

Due to the further development and updating of functions for the drive controllers, new parameters and also new versions of existing parameters are continuously being implemented in DriveControlSuite and in the firmware. The parameters are displayed in the software according to the DriveControlSuite version used and the configured firmware version of the respective drive controller.

Applications

Applications generally differ in terms of functions and their control. For this reason, different parameters are available with each application.

4.3 Signal sources and process data mapping

The transmission of control signals and set values in DriveControlSuite meets the following principles.

Signal sources

Drive controllers are controlled either over a fieldbus, using mixed operation consisting of a fieldbus system and terminals or exclusively using terminals.
You can use the corresponding selection parameters, referred to as signal sources, to configure whether the control signals and set values of the application are obtained over a fieldbus or using terminals.

In case of activation over a fieldbus, parameters that are selected as data sources for control signals or set values must be part of the subsequent process data mapping. In the case of activation using terminals, the respective analog or digital inputs are specified directly.

Process data mapping

In the PROFIdrive application, the process data mapping is specified by the controller as soon as you establish an online connection between the controller and the drive controller. It is not necessary to manually assign the process data channels for transmission of the receive and transmit process data in DriveControlSuite.

4.4 Non-volatile memory

All project configurations, parameterizations and related changes to parameter values are in effect after transmission to the drive controller, but are only stored in volatile memory.

Saving to a drive controller

To save the configuration in non-volatile memory on a drive controller, you have the following options:

▸ Saving the configuration using the Save values wizard:
Project menu > Wizards area > Projected axis > Save values wizard: Select the Save values action

▸ Saving the configuration using the parameter list:
Project menu > Parameter list area > Projected axis > Group A: Drive controller > A00 Save values: Set the parameter A00[0] to the value 1: Active

▸ Saving the configuration using the S1 operating button:
Drive controller with S1 operating button: Press and hold the operating button for 3 s

Saving to all drive controllers within a project

To save the configuration in non-volatile memory on several drive controllers, you have the following options:

▸ Saving the configuration using the toolbar:
Toolbar > Save values icon: Click the Save values icon

▸ Saving the configuration using the Online functions window:
Project menu > Online connection button > Online functions window: Click on Save values (A00)

> **Information**
>
> Do not shut off the drive controller while saving. If the supply voltage to the control unit is interrupted while saving, the drive controller will start with the last correct configuration that was saved and with fault 40: Invalid data the next time it is switched on. In order to acknowledge the fault and successfully complete the saving process, the configuration must be stored again in non-volatile memory and the action must be completed.

5   Commissioning

The following chapters describe the commissioning of a PROFINET network, consisting of a Siemens controller and multiple Pilz drive controllers, with the help of DriveControlSuite and the Siemens TIA Portal.

We assume the following system environment **as an example** so that you can follow the individual commissioning steps better:

- Drive controllers from the PMC SC6 or PMC SI6 series with firmware V 6.5-K-PN or later
- DriveControlSuite commissioning software in V 6.5-K or later

in combination with

- Siemens SIMATIC S7-1500 controller
- Siemens Totally Integrated Automation Portal (TIA Portal) automation software in V16 or later

Commissioning is divided into the following steps:

1. First, define the control for the drive controllers.

2. DriveControlSuite:
    Then project all drive controllers of your PROFINET network (device control, application and process data), parameterize all general PROFINET settings and the motor, as well as the axis model or reference speed if necessary, and transmit your configuration to the drive controllers of your PROFINET network.

3. TIA Portal:
    Next, map your real PROFINET network in TIA Portal, configure the individual nodes and parameterize the control of the drive controllers. Transfer the configuration to the controller and start up your PROFINET network.

> **Information**
>
> Before you start commissioning your PROFINET network using DriveControlSuite and TIA Portal, you must network all nodes of your PROFINET network with each other.

5.1   Setting the control

The options described below are available for controlling Pilz drive controllers via TIA Portal.

Siemens technology objects (TO)

Technology object	Description	Application
TO_SpeedAxis	Control of a velocity-controlled axis	Controller-based application
TO_PositioningAxis, TO_SynchronousAxis	Control of a position-controlled axis	Controller-based application
TO_BasicPos	Control of a position-controlled axis	Drive-based application

Tab. 6: Siemens technology objects

You can access the technology objects directly in TIA Portal and add them to your controller.

Siemens function blocks (FB) from the DriveLib

Function block	Description	Application
FB SINA_SPEED	Control of a velocity-controlled axis	Drive-based application
FB SINA_POS	Control of a position-controlled axis	Drive-based application

Tab. 7: Siemens function blocks DriveLib

The function blocks can be downloaded free of charge from the Siemens website after registration and imported into TIA Portal (https://support.industry.siemens.com). If you are already using the function blocks in TIA Portal, make sure that you are working with the latest version.

Possible combinations

The following table shows **examples** of possible combinations of technology objects or function blocks with the available application classes and telegrams.

During commissioning in TIA Portal, you will learn how to configure your control system based on these examples.

Control	Application class	Telegrams
TO_SpeedAxis	AC1	Standard telegrams 1, 2, 3
TO_PositioningAxis, TO_SynchronousAxis	AC4	Standard telegrams 3, 5 or Siemens telegrams 102, 105 (optionally in combination with Siemens additional telegram 750)
TO_BasicPos	AC3	Siemens telegram 111
FB SINA_SPEED	AC1	Standard telegram 1
FB SINA_POS	AC3	Siemens telegram 111

Tab. 8: Combinations: function block or technology object with telegram

For more information on application classes and telegrams, see Application classes and telegrams in detail [📖 76].

> **ℹ️ Information**
>
> This documentation focuses on the device-specific settings that must be considered for drive controllers from Pilz for parameterizing technology objects from Siemens or controlling function blocks. For settings that are not described in detail, refer to the Siemens documentation.

5.2 DS6: Configuring the drive controller

Project and configure all drive controllers for your drive system in DriveControlSuite (see also DS6 program interface [🕮 14]).

> ### ℹ️ Information
>
> Always perform the steps described below in the specified order!
>
> Some parameters are interdependent and do not become accessible to you until you have first configured certain settings. Follow the steps in the specified sequence so that you can finish the parameterization completely.

5.2.1 Initiating the project

In order to be able to configure all drive controllers and axes of your drive system using DriveControlSuite, you must record them as part of a project.

5.2.1.1 Projecting the drive controller and axis

Create a new project and project the first drive controller along with the accompanying axis.

> ### ℹ️ Information
>
> Make sure that you project the correct series in the Drive controller tab. The projected series cannot be changed afterwards.

Creating a new project

1. Start DriveControlSuite.

2. On the start screen, click Create new project.
   - ⇨ The new project is created and the configuration dialog for the first drive controller opens.
   - ⇨ The Drive controller button is active.

Projecting the drive controller

1. Properties tab:
   Establish the relationship between your circuit diagram and the drive controller to be projected in DriveControlSuite.

   1.1. Reference:
   Define the reference code (equipment code) of the drive controller.

   1.2. Designation:
   Give the drive controller a unique name.

   1.3. Version:
   Version your project configuration.

   1.4. Description:
   If necessary, save additional supporting information (e.g., the change history).

2. Drive controller tab:
   Select the series, device type and firmware version of the drive controller.

   2.1. Firmware:
        Select the PROFINET version 6.x -**PN**.

3. Option modules tab, Safety module:
   If the drive controller is part of a safety circuit, select the corresponding safety module.

4. Device control tab:
   Project the basic control of the drive controller.

   4.1. Device control:
        Select PROFIdrive device control.

   4.2. Rx process data, Tx process data:
        Select PROFINET Rx and PROFINET Tx for transmitting PROFINET process data.

Projecting the axis

1. Click Axis A.

2. Properties tab:
   Establish the relationship between your circuit diagram and the axis to be projected in DriveControlSuite.

   2.1. Reference:
        Define the reference code (equipment code) of the axis.

   2.2. Designation:
        Give the axis a unique name.

   2.3. Version:
        Version your project configuration.

   2.4. Description:
        If necessary, save additional supporting information (e.g., the change history).

3. Application tab:
   Select the PROFIdrive application.

4. Motor tab:
   Select the type of motor you operate with this axis. If you are working with motors from third-party suppliers, enter the accompanying motor data later.

5. Repeat the steps for axis B (only for double-axis controllers).

6. Confirm with OK.

5.2.1.2   **Configuring safety technology**

If the drive controller is part of a safety circuit, you must configure the safety technology in accordance with the commissioning steps outlined in the corresponding manual in the next step (see Further information [📖 161]).

5.2.1.3 Creating other drive controllers and modules

In DriveControlSuite, all drive controllers within a project are grouped using modules. If you add a new drive controller to your project, be sure to always assign it to an existing module. Group drive controllers in a module if, for example, they are located in the same control cabinet or work together to operate the same machine part.

Creating a drive controller

1. In the project tree, select your project P1 > module M1 > context menu Create new drive controller.

    ⇨ The drive controller is created in the project tree and the configuration dialog opens.

2. Project the drive controller as described in Projecting the drive controller and axis.

3. Repeat the steps for all other drive controllers that you want to project.

Creating a module

1. In the project tree, select your project P1 > context menu Create new module.

    ⇨ The module is created in the project tree.

2. Project the module as described in Projecting the module [30].

3. Repeat the steps for all other modules that you want to project.

5.2.1.4 Projecting the module

Give your module a unique name, enter the reference code and, as an option, store additional information like the version and change history of the module.

1. Select the module in the project tree and click on Project configuration in the project menu.

    ⇨ The configuration dialog for the module opens.

2. Establish the relationship between your circuit diagram and the module in DriveControlSuite.

    2.1. Reference:
    Define the reference code (equipment code) of the module.

    2.2. Designation:
    Give the module a unique name.

    2.3. Version:
    Version the module.

    2.4. Description:
    If necessary, save additional supporting information (e.g., the change history).

3. Confirm with OK.

5.2.1.5 **Projecting the project**

Give your project a unique name, enter the reference code and, as an option, store additional information like the version and change history of the project.

1. Select the project in the project tree and click on Project configuration in the project menu.
   ⇨ The configuration dialog for the project opens.

2. Establish the relationship between your circuit diagram and the project in DriveControlSuite.

   2.1. Reference:
   Define the reference code (equipment code) of the project.

   2.2. Designation:
   Give the project a unique name.

   2.3. Version:
   Version the project.

   2.4. Description:
   If necessary, save additional supporting information (e.g., the change history).

3. Confirm with OK.

5.2.2 Parameterizing general PROFINET settings

✓ You have projected the PROFINET Rx and PROFINET Tx process data for the drive controller.

1. Select the relevant drive controller in the project tree and click on the desired projected axis in the Project menu > Wizard area.

2. Select the PROFINET wizard.

3. A100 Fieldbus scaling:
   Leave the default value at 1: Native (values are passed unchanged).

4. A273 PN device name:
   Elements [0] to [2] show the PROFINET device name that was assigned in TIA Portal if there is an online connection between the drive controller and controller.
   In elements [3] to [5], you have the option to enter the device name. This eliminates the need to assign the device name in TIA Portal.

5. A109 PZD-Timeout:
   Define the time that results from the tolerated failure time for monitoring the PZD communication plus the watchdog time of the controller (TIA Portal: watchdog time) in the PROFINET network (default value: 20 ms).

5.2.3 Configuring PZD transmission

The PZD channel (process data transmission channel) serves to transfer control and status information as well as actual and set values between a controller (IO controller) and drive controller (IO device) cyclically in real time. The direction of data flow is important in this data exchange. From the perspective of the drive controller, PROFINET distinguishes between receive PZD (RxPZD) and transmit PZD (TxPZD). Pilz drive controllers support a flexible assignment of the parameter values to be transmitted.

In the PROFIdrive application, all parameters for mapping the process data are configured automatically during start-up of PROFINET depending on the telegram specified by the controller. You do not need to set these parameters manually.

5.2.4 Parameterizing the motor

You have projected one of the following motors:

Synchronous servo motor with EnDat 2.2 digital encoder or EnDat 3 (with optional brake)

By projecting the corresponding motor, limiting values for currents and torques as well as associated temperature data are automatically transferred to the respective parameters of the individual wizards. All additional data on the brake and encoder is transferred at the same time.

Lean motor without encoder (with optional brake)

By projecting the corresponding motor, limiting values for currents and torques as well as associated temperature data are automatically transferred to the respective parameters of the individual wizards. You only have to parameterize the cable length in use. Even the brake purging and engaging times are already stored. You just have to activate the brake.

1. Select the relevant drive controller in the project tree and click on the desired projected axis in the Project menu > Wizard area.

2. Select the Motor wizard.

3. B101 Cable length:
   Select the cable length of the power cable in use.

4. Repeat the steps for the 2nd axis (only for double-axis controllers).

Then activate the brake.

1. Select the relevant drive controller in the project tree and click on the first projected axis in the Project menu > Wizard area.

2. Select the Brake wizard.

3. F00 Brake:
   Select 1: Active.

4. Repeat the steps for the 2nd axis (only for double-axis controllers).

Motor protection

The drive controller has an i²t model of the motor, a computational model for thermal monitoring of the motor. To activate it and set up the protective function, configure the following settings (deviating from the presets): U10 = 2: Warning and U11 = 1.00 s. This model can be used instead of or in addition to motor temperature monitoring.

5.2.5 Mapping the mechanical axis model

For a control in combination with telegram 111, you must map your complete mechanical environment in DriveControlSuite to be able to commission your real drive train with one or more drive controllers.

For all other telegrams, do not make any changes to the axis model. Instead, parameterize the required limits directly in the next step (see Parameterizing the reference speed [38]).

5.2.5.1 Parameterizing the axis model

Parameterize the setup of your drive in this order:

▸ Define the axis model

▸ Scale the axis

▸ Parameterize the position and velocity window

▸ Limit the axis (optional)

- Limit the position

- Limit the velocity, acceleration and jerk

- Limit the torque and force

> **Information**
>
> If you are using a double-axis controller with two projected axes, you must parameterize the axis model for each axis individually.

5.2.5.1.1   Define the axis model

1. Select the relevant drive controller in the project tree and click on the desired projected axis in the Project menu > Wizard area.

2. Select the Axis model wizard.

3. I05 Type of axis:
   Define whether the axis type is rotational or translational.

   3.1. If you would like to configure the units of measure and the number of decimal places individually for specifying and displaying positions, velocities, accelerations and jerk, select 0: User defined, rotational or 1: User defined, translational.

   3.2. If the units of measure and the number of decimal places for specifying and displaying positions, velocities, accelerations and jerk are to be fixed, select 2: Rotational or 3: Translational.

4. B26 Motor encoder:
   Define the interface to which the motor encoder is connected.

5. I02 Position encoder (optional):
   Define the interface to which the position encoder is connected.

6. I00 Position range:
   Define whether the travel range of the axis is limited or endless (modulo).

7. If you select I00 = 1: Endless, parameterize a revolution length when you scale the axis.

> **Information**
>
> When you parameterize I05 Type of axis, you can either use selection 0: User defined, rotational or 1: User defined, translational to configure units of measure and the number of decimal places for the axis model individually or use selections 2: Rotational and 3: Translational to revert to preset values.
>
> Selection 0: User defined, rotational and selection 1: User defined, translational let you configure the unit of measure (I09) and the decimal places (I06) individually. Velocity, acceleration and jerk are represented as the derivative of the unit of measure with respect to time.
>
> Selection 2: Rotational sets the following units of measure for the axis model: position in °, velocity in rpm, acceleration in rad/s^2, jerk in rad/s^3.
>
> Selection 3: Translational sets the following units of measure for the axis model: position in mm, velocity in m/s, acceleration in m/s^2, jerk in m/s^3.

> **Information**
>
> If you do not parameterize it differently for I02 Position encoder, B26 Motor encoder is used for position control as standard.

5.2.5.1.2 **Scale the axis**

1. Select the relevant drive controller in the project tree and click on the desired projected axis in the Project menu > Wizard area.

2. Select the Axis model wizard > Axis: Scaling.

3. Scale the axis by configuring the overall gear ratio between the motor and output.
To simplify this scaling for you, you are provided with the scaling calculator Conversion of positions, velocities, accelerations, torque/force, which calculates the effects of changed motion variables on the entire system.

4. I01 Circular length:
If you have selected 1: Endless for I00 Position range, enter the revolution length.

5. I06 Decimal places position (optional):
If you have selected 0: User defined, rotational or 1: User defined, translational for I05 Type of axis, define the desired number of decimal places.

6. I09 Measure unit (optional):
If you have selected 0: User defined, rotational or 1: User defined, translational for I05 Type of axis, define the desired unit of measure.

7. I03 Axis polarity:
Use the polarity to specify the direction of interpretation between the axis movement and motor movement.

> **Information**
>
> A change to parameter I06 moves the decimal separator for all axis-specific position values! Ideally, define I06 before parameterizing other position values and then check them.
>
> If the axis receives set value specifications from a controller or follows the master values of a master, the resolution of position values directly impacts the smooth operation of the axis. Therefore, you should define a sufficient number of decimal places appropriate for your application.

> **Information**
>
> Parameter I297 Maximum speed position encoder must be parameterized according to your application case. If I297 is set too low, the permitted maximum speed is exceeded even at normal operating speeds. On the other hand, if I297 is set too high, measuring errors of the encoder can be overlooked.
>
> I297 depends on the following parameters: I05 Type of axis, I06 Decimal places position, I09 Measure unit as well as I07 Distance factor numerator position and I08 Distance factor denominator position or A585 Feed constant for CiA 402. If you have made changes to one of the parameters listed, select I297 accordingly as well.

5.2.5.1.3 **Parameterizing the position and velocity window**

Enter position limits and velocity zones for set values. To do so, parameterize boundary values for reaching a position or velocity.

1. Select the Axis model wizard > Window position, velocity.

2. C40 Velocity window:
   Parameterize a tolerance window for velocity tests.

3. I22 Target window:
   Parameterize a tolerance window for position tests.

4. I87 Actual position in window time:
   Parameterize how long a drive must stay in the specified position window before a corresponding status message is output.

5. I21 Maximal following error:
   Parameterize a tolerance window for lag tests.

For more information on monitoring the lag, see Lag monitoring [📖 158].

5.2.5.1.4 **Limiting the axis**

As an option, you can limit the maximum permitted motion variables of position, velocity, acceleration, jerk and torque/force according to your application.

> **ℹ Information**
>
> To simplify the scaling and limiting of the axis, the Axis model wizard > Axis: Scaling provides you with the **Conversion of position, velocities, accelerations, torque/ force** scaling calculator, which calculates the effects of changed motion variables on the entire system. You can use the scaling calculator to enter values for motion variables of the motor, gearbox output and axis in order to convert the values to all other locations in the axis model.

Limiting the position

To secure the travel range of the axis, you have the option to limit the permitted positions using a software or hardware limit switch.

1. Select the relevant drive controller in the project tree and click on the desired projected axis in the Project menu > Wizard area.

2. Select the Axis model wizard > Limit: Position.

3. I101 Source positive /limit switch, I102 Source negative /limit switch:
   To limit the travel range of the axis via hardware limit switches, select the source of the digital signal that is used to evaluate a limit switch at the positive or negative end of the travel range.

   3.1. If a fieldbus is the source, select 2: Parameter.

   3.2. If a digital input (direct or inverted) acts as the source, select the corresponding input.

4. I50 Software stop positive, I51 Software stop negative:
   To limit the travel range of the axis via software limit switches, define the largest or smallest permitted position for software position limiting.

Limiting velocity, acceleration, jerk

As an option, you can limit the motion variables of velocity, acceleration and jerk and define the quick stop deceleration according to your application. The default values are designed for slow velocities without gearboxes.

1. Select the Motor wizard.

2. B83 v-max motor:
   Determine the maximum permitted velocity of the motor.

3. Select the Axis model wizard > Axis: Scaling.

4. Conversion of positions, velocities, accelerations, torque/force area:
   Use the scaling calculator to determine the maximum permitted velocity of the output using the maximum permitted velocity of the motor.

5. Select the Axis model wizard > Limit: Velocity, acceleration, jerk.

6. I10 Maximal speed:
   Define the maximum permitted velocity for the output.

7. I11 Maximal acceleration:
   Define the maximum permitted acceleration for the output.

8. I16 Maximal jerk:
   Define the maximum permitted jerk for the output.

9. I17 Quickstop deceleration:
   Define the desired quick stop deceleration for the output.

10. Repeat the steps for axis B (only for double-axis controllers).

Limiting torque/force

As an option, you can limit the torque/force according to your application. The default values take into account the rated operation together with the overload reserves.

1. Select the Axis model wizard > Limit: Torque/force.

2. C03 Maximum positive torque/force, C05 Maximum negative torque/force:
   Define the maximum permitted set torque/maximum permitted set force.

3. C08 Maximum torque/force for quick stop:
   Define the maximum permitted set torque/maximum permitted set force in case of a quick stop and in case of drive-controlled emergency stop SS1, SS1 and SS2.

5.2.6　Parameterizing the reference speed

Parameterize the reference value for the set and actual velocities as described below in order to ensure the function of the application. For control in combination with telegram 111, the reference value is not evaluated and parameterization is therefore not required.

1. Select the relevant drive controller in the project tree and click on the desired projected axis in the Project menu > Wizard area.

2. Select the Application PROFIdrive wizard > Additional functions > Drive data.

3. Reference speed in user unit:
   Define the reference value for the target and actual velocities.

4. Repeat the steps for axis B (only for double-axis controllers).

Limiting velocity, acceleration, jerk

As an option, you can limit the motion variables of velocity, acceleration and jerk and define the quick stop deceleration according to your application. The default values are designed for slow velocities without gearboxes.

1. Select the Motor wizard.

2. B83 v-max motor:
   Determine the maximum permitted velocity of the motor.

3. Select the Axis model wizard > Axis: Scaling.

4. Conversion of positions, velocities, accelerations, torque/force area:
   Use the scaling calculator to determine the maximum permitted velocity of the output using the maximum permitted velocity of the motor.

5. Select the Axis model wizard > Limit: Velocity, acceleration, jerk.

6. I10 Maximal speed:
   Define the maximum permitted velocity for the output.

7. I11 Maximal acceleration:
   Define the maximum permitted acceleration for the output.

8. I16 Maximal jerk:
   Define the maximum permitted jerk for the output.

9. I17 Quickstop deceleration:
   Define the desired quick stop deceleration for the output.

10. Repeat the steps for axis B (only for double-axis controllers).

ℹ Information

When you set the corresponding parameters on the controller side during commissioning in TIA Portal, note that some units on the drive controller and controller side may be different.

Parameter DriveControlSuite	Condition	TIA Portal parameter
M571 Velocity reference value (reference speed in user unit)	=	Reference speed
Reference torque (C09 × 2.5)	=	Reference torque
I10 Maximal speed	≥	Maximum permitted velocity
I11 Maximal acceleration	≥	Maximum permitted acceleration/ deceleration
I16 Maximal jerk	≥	Maximum permitted jerk
I17 Quickstop deceleration	≥	Emergency deceleration

Tab. 9: Limits: Required parameters on drive controller and controller sides

5.2.7 Referencing the absolute position

When commissioning a system with position measurement systems, the relation of a measured to an actual axis position must be determined to be able to work with absolute positions.

For a control in combination with telegram 111, you must reference your drive if you are working with absolute positions. For all other controls, this step is not necessary. In this case, transfer and save the configuration (see Transmitting and saving the configuration [📖 42]).

> **ℹ Information**
>
> If you are using a double-axis controller with two projected axes, you must reference the absolute position for each axis individually.

5.2.7.1 Defining the referencing method

1. Select the relevant drive controller in the project tree and click on the desired projected axis in the Project menu > Wizard area.

2. Select the Referencing wizard.

3. I30 Referencing type, I31 Referencing direction, I35 Referencing with zero pulse:
   Define the characteristics for referencing.
   For information on possible combinations of the named characteristics as well as detailed descriptions of the individual referencing methods, see Referencing methods [📖 117].

4. I43 Move to reference position:
   If the axis is to automatically move to the referenced position after referencing, set this parameter to 1: Active.

5.2.7.2 Parameterizing the reference switch

If you are working with absolute positions and would like to determine a reference position while referencing using the reference switch, proceed as follows.

1. Select the PROFIdrive application wizard > Data sources > Application digital signals: Data source.

2. I103 Source reference switch:

   2.1. If a digital input (direct or inverted) acts as the source, select the corresponding input.

   2.2. If bit 3 of the control word I210 of the application is the source, select 2: Parameter.

5.2.7.3 Setting the reference

If you are working with absolute positions and would like to reference without using a referencing run, the value of the current actual position is applied directly as a parameter value from I34 using the Set reference signal.

1. Select the PROFIdrive application wizard > Data sources > Application digital signals: Data source.

2. I111 Source set reference:

   2.1. If a digital input (direct or inverted) acts as the source, select the corresponding input.

   2.2. If bit 11 of the control word I210 of the PROFIdrive application is the signal source, select 2: Parameter.

5.2.7.4   **Parameterizing the limit switch**

Using the limit switch, you can limit the travel range in the positive and negative direction using sensor signals, regardless of the operating mode. Both signals are protected against wire breaks (= low active, i.e. a low level leads to a limit switch fault).

Parameterizing a positive limit switch

1. Select the PROFIdrive application wizard > Data sources > Application digital signals: Data source.

2. I101 Source positive /limit switch:
   To limit the travel range in the positive direction of motion, select the source for the positive limit switch.

   2.1. If a digital input (direct or inverted) acts as the source, select the corresponding input.

   2.2. If bit 1 of the control word I210 of the application is the source, select 2: Parameter.

Parameterizing a negative limit switch

1. Select the PROFIdrive application wizard > Data sources > Application digital signals: Data source.

2. I102 Source negative /limit switch:
   To limit the travel range in the positive direction of motion, select the source for the negative limit switch.

   2.1. If a digital input (direct or inverted) acts as the source, select the corresponding input.

   2.2. If bit 2 of the control word I210 of the application is the source, select 2: Parameter.

5.2.8 Transmitting and saving the configuration

In order to transmit and save the configuration to one or more drive controllers, you must connect your PC and the drive controllers over the network.

> ⚠️ **WARNING!**
>
> **Injury to persons and material damage due to axis movement!**
>
> If there is an online connection between DriveControlSuite and the drive controller, changes to the configuration can lead to unexpected axis movements.
>
> - Only change the configuration if you have visual contact with the axis.
> - Make sure that no people or objects are within the travel range.
> - For access via remote maintenance, there must be a communication link between you and a person on site with eye contact to the axis.

> ℹ️ **Information**
>
> During the search, all drive controllers within the broadcast domain are found via IPv4 limited broadcast.
>
> Requirements for finding a drive controller in the network:
>
> - Network supports IPv4 limited broadcast
> - All drive controllers and the PC are in the same subnet (broadcast domain)

✓ The drive controllers are switched on and can be found in the network.

1. In the project tree, select the module under which you have recorded your drive controller and click Online connection in the project menu.
   ⇨ The Add connection dialog box opens. All drive controllers found via IPv4 limited broadcast are displayed.

2. Direct connection tab, IP address column:
   Activate the IP addresses in question and confirm your selection with OK.
   ⇨ The Online functions window opens. All drive controllers connected through the selected IP addresses are displayed.

3. Select the module and the drive controller to which you would like to transfer the configuration. Change the selection of transmission type from Read to Send.

4. Change the selection Create new drive controller:
   Select the configuration that you would like to transfer to the drive controller.

5. Repeat steps 3 and 4 for all other drive controllers to which you would like to transfer your configuration.

6. Online tab:
   Click Establish online connections.

⇨ The configurations are transferred to the drive controllers.

Saving a configuration

✓ You have successfully transferred the configuration.

1. Online functions window, Online tab, Actions for drive controller in online operation area:
Click Save values (A00).

   ⇨ The Save values (A00) window opens.

2. Select on which drive controllers you want to save the configuration.

3. Click Start action.

   ⇨ The configuration is stored on the drive controllers in non-volatile memory.

4. Close the Save values (A00) window.

> ℹ️ **Information**
>
> For the configuration to take effect on the drive controller, a restart is required: for example, after the configuration is saved on the drive controller for the first time or when changes are made to the firmware or process data mapping.

Restarting a drive controller

✓ You have stored the configuration on the drive controller in non-volatile memory.

1. Online functions window, Online tab:
Click Restart (A09).

   ⇨ The Restart (A09) window opens.

2. Select which of the connected drive controllers you want to restart.

3. Click Start action.

4. Confirm the safety note with OK.

   ⇨ The Restart (A09) window closes.

⇨ The fieldbus communication and connection between DriveControlSuite and drive controllers are interrupted.

⇨ The selected drive controllers restart.

5.2.9 Testing the configuration

After you have transferred the configuration to the drive controller, first check your projected axis model and the parameterized electrical and mechanical data for plausibility before continuing with the parameterization.

Test the configuration for control in combination with telegram 111. For all other telegrams, this step is optional.

> **Information**
>
> Make sure that the values of the control panel are compatible with your projected axis model in order to obtain useful test results that you can use to optimize your configuration for the respective axis.
>
> The scaling calculator is available under the Axis model wizard > Axis: Scaling to recalculate the values for the control panel according to your projected axis model.

> **WARNING!**
>
> **Injury to persons and material damage due to axis movement!**
>
> When you activate the control panel, DriveControlSuite gives you sole control of the motions of the axis. If you are using a controller, it no longer monitors the axis movements after the control panel is activated. The controller cannot intervene to prevent collisions. The controller takes over control again when the control panel is deactivated, which can cause unexpected axis movements.
>
> - Do not switch to other windows when the control panel is active.
> - Only use the control panel if you have visual contact with the axis.
> - Make sure that no people or objects are within the travel range.
> - For access via remote maintenance, there must be a communication link between you and a person on site with eye contact to the axis.

Testing the configuration using the jog control panel

✓ There is an online connection between DriveControlSuite and the drive controller.

✓ You have successfully stored the configuration on the drive controller.

✓ No safety function is active.

1. Select the relevant drive controller in the project tree and click on the desired projected axis in the Project menu > Wizard area.

2. Select the Jog control panel wizard.

3. Click Control panel on and then Enable.

   ⇨ The axis is monitored via the active control panel.

4. Check the default values of the control panel and adjust them to your projected axis model if necessary.

5. To test the configuration of your projected axis for direction of motion, velocity, etc., move the axis gradually using the Jog+, Jog-, Jog step+ and Jog step- buttons.

6. Use your test results to optimize your configuration as necessary.

7. To deactivate the control panel, click on Control panel off.

> **Information**
>
> Jog+ and Jog− cause a continual manual movement in the positive or negative direction. Jog step+ and Jog step- move the axis relative to the current actual position by the increment specified in I14.
>
> Jog+ and Jog− have a higher priority than Jog step+ and Jog step−.

5.3 TIA Portal: Setting up a PROFINET network

A PROFINET networks generally consists of a controller (IO controller) and multiple drive controllers (IO devices). Using TIA Portal, map your real PROFINET network in a TIA project, configure all PROFINET nodes and link them logically with each other. Then, transfer the configuration to the controller and check the cyclical communication.

> **Information**
>
> Always perform the steps described below in the specified order!
>
> Some parameters are interdependent and do not become accessible to you until you have first configured certain settings. Follow the steps in the specified sequence so that you can finish the parameterization completely.

5.3.1 Installing the GSD file

To be able to map the Pilz drive controllers of your PROFINET network in your TIA project, you must import and install a GSD file (general station description file) from Pilz in your TIA project. Pilz drive controllers are available in the hardware catalog of your TIA project as STOBER field devices as soon as the GSD file has been installed.

> **Information**
>
> If you have already downloaded a GSD file from the Pilz download area at an earlier point, make sure that you are using the current version of the GSD file required.

✓ You have downloaded the current version of the GSD file from the Pilz download area and saved it locally.

✓ You have created a TIA project and are in the TIA project view.

1. In the menu bar, select Options > Manage general station description files (GSD).

   ⇨ The Manage general station description files window opens.

2. Installed GSDs tab > Source path area:
   Select the directory in which you have stored the GSD file from Pilz and confirm with OK.

   ⇨ The GSD file is displayed in the Content of the imported path area.

3. Content of the imported path area:
   Select the desired GSD file and click on Install.

⇨ The GSD file is installed; the Pilz drive controllers are available in the hardware catalog.

5.3.2 Projecting the PROFINET network

Map the controller and all drive controllers of your PROFINET network in a TIA project by selecting the corresponding modules from the hardware catalog and incorporating them into the project.

5.3.2.1 Projecting the controller

Project the controller of your PROFINET network.

✓ You have created a TIA project and installed the GSD file from Pilz.

✓ You are in the TIA network view; the hardware catalog is open.

1. Hardware catalog:
Select Controller > SIMATIC S7-1500 > CPU and open the folder of the CPU type that belongs to your controller.

2. Drag and drop the desired controller into the network view.

⇨ The controller is incorporated into your TIA project.

5.3.2.2 Projecting the drive controller

Project all drive controllers of your PROFINET network.

✓ You have created a TIA project and installed the GSD file from Pilz.

✓ You are in the TIA network view; the hardware catalog is open.

1. Hardware catalog:
Select Other field devices > PROFINET IO > Drives > STOBER ANTRIEBSTECHNIK GmbH & Co. KG > STOBER ANTRIEBSTECHNIK > STOBER 6th generation drive controllers > SI6, SC6 double-axis controllers+ PD3 or SI6, SC6 single-axis controllers + PD3.

2. Drag and drop the desired drive controller into the network view.

⇨ The drive controller is incorporated into your TIA project.

3. Repeat steps 1 and 2 for all drive controllers of your PROFINET network.

5.3.2.3 Linking the controller and drive controller logically

Establish a logical gate link between the controller and drive controllers in order to enable the communication between the devices.

✓ You have projected the controller and drive controllers.

✓ You are in the TIA network view.

1. Click on the interface of the controller and drag a connection to the interface of the first drive controller while holding the mouse button.

2. Repeat the process for all drive controllers of your PROFINET network.

⇨ The controller and drive controllers of your PROFINET network are linked logically with each other.

> **ℹ Information**
>
> To be able to link the controller and drive controllers with each other logically, you must be in the TIA network view.

5.3.2.4 Connecting ports

If you want to implement a control in application class 4, you have to connect the ports of all nodes. For other application classes, this step is optional.

In order for PROFIdrive to operate in application class 4, PROFINET must be in synchronous operation mode. For synchronous operation via PROFINET IRT, you must define how all PROFINET nodes are connected to each other in the connection topology. To do this, in the topology view, specify the connection of each individual cable from device to device and the exact port.

- ✓ You have logically linked the controller and drive controllers.

- ✓ You are in the TIA topology view.

1. Click on the port you want to connect and drag it to the destination port while holding down the mouse button.

2. Repeat the process for all ports to be connected in your PROFINET network.

⇨ You have created the port connections.

> **ℹ Information**
>
> With an existing online connection, you can compare the connections you have created with your real cable connections. For more information on the topology comparison, see the documentation from Siemens or the online help in TIA Portal.

5.3.3 Configuring network addresses

As needed, you can change the IP address and subnet mask of the controller.

- ✓ You are in the TIA network view.

1. Double-click on the controller of your PROFINET network.

    ⇨ This switches you to the respective device view; the Inspector window shows the device properties.

2. Inspector window > General tab:
   Select PROFINET interface > Ethernet addresses in the area navigation.

3. IP protocol area > Set IP address in the project:
   If not set by default, activate this option and change the IP address and subnet mask of the controller.

⇨ The IP address and subnet mask of the controller are configured.

5.3.4 Configuring the drive controller

Assign a device name for the drive controllers of your TIA project to be able to identify them in the PROFINET network. Project a telegram for each axis and configure the settings for synchronization afterwards if necessary.

5.3.4.1 Assigning device names

Assign a device name for your drive controllers to be able to identify them in the PROFINET network.

✓ You are in the TIA network view.

1. Double-click on a drive controller of your PROFINET network.

   ⇒ This switches you to the respective device view; the Inspector window shows the device properties.

2. Inspector window > General tab:
   Select General in the area navigation.

3. Name:
   Assign a device name for the drive controller that corresponds to the PROFINET naming conventions.

4. Device view:
   Select the relevant drive controller and select Assign device name using its context menu.

   ⇒ The Assign PROFINET device name window opens.

5. Click on Update list.

   ⇒ All drive controllers are listed that were found in the subnet.

   ⇒ Depending on the drive controller, the device type, IP address and MAC address are displayed.

6. Mark the drive controller that you would like to name and click on Assign name.

⇒ The device name is assigned to the selected drive controller.

ℹ Information

Alternatively, you can enter the device name in DriveControlSuite in parameter A273[3] to [5]. This eliminates steps 4 to 6 in TIA Portal for assigning the device name.

ℹ Information

Using Flash LED, you can identify which drive controller you have currently selected if multiple drive controllers are found in the same subnet.

As an alternative, you can identify the drive controller by its MAC address. The MAC address of the drive controller can be read off in parameter A279 PN MAC addresses in DriveControlSuite (PROFINET wizard > Diagnostics).

5.3.4.2 Projecting a standard telegram

Project one standard telegram per axis.

> **Information**
>
> For double-axis controllers, note that mixed operation of the PROFINET RT and PROFINET IRT transmission methods is not possible. For example, if you project standard telegram 1 in AC1 for axis A and standard telegram 5 in AC4 for axis B, standard telegram 1 is ignored.

✓ You are in the TIA network view; the hardware catalog is open.

1. Double-click on a drive controller of your PROFINET network.

    ⇨ This switches you to the respective device view.

2. Hardware catalog:
   Select Module > PROFIdrive modules.

3. Drag and drop the PROFIdrive modules module into the device overview of the drive controller at slot 1.

4. Hardware catalog:
   Select Module > Submodules.

5. Select a telegram.

6. Drag and drop the selected standard telegram into the device overview of the drive controller at slot 1 2.

7. If you want to use an additional telegram, select it in the hardware catalog.

8. Drag and drop the selected additional telegram into the device overview of the drive controller at slot 1 3.

9. If you are using a double-axis controller, repeat steps 2 through 8 for the second axis and for slots 2, 2 2 and 2 3. Project a telegram for the second axis even if you are not using it.

⇨ You have configured the telegrams.

> **Information**
>
> If you project additional telegram 900, define the additional process data that is to be transferred to the controller in DriveControlSuite via the parameters A92 (RxPZD) and A96 (TxPZD). Elements [0] to [11] are used for axis A parameters and elements [12] to [23] for axis B parameters. A data length of 12 bytes each is available for the receive and transmit process data.

5.3.4.3   **Setting a drive controller synchronously**

Configure the following settings for clock synchronization via PROFINET IRT if you want to implement control in application class 4. For other application classes, this step is omitted.

  ✓ You are in the TIA network view.

1. Double-click on a drive controller of your PROFINET network.

   ⇨ This switches you to the respective device view; the Inspector window shows the device properties.

2. Inspector window > General tab:
   Select PROFINET interface > Advanced options > Isochronous mode in the area navigation.

3. Isochronous mode for local modules area > Isochronous mode:
   Activate the option.

4. Detail overview area:
   Activate the submodule with the inserted telegram in the Isochronous mode column to assign the synchronized operation to the telegram.

5. If it is a double-axis controller, activate the second submodule with the inserted telegram.

   ⇨ The times are recalculated and entered in the Isochronous mode for local modules area. The transmission cycle is taken from the GSD file.

⇨ You have configured the drive controller for synchronized operation.

5.3.5   Control via technology objects

The following chapters describe how to configure the control using technology objects. Add a technology object for an axis to your controller. Then follow the instructions for the technology object with which you want to operate the corresponding axis. For information on alternative configuration via a function block, see Control via function blocks [📖 69].

> **ℹ Information**
>
> If you are using a double-axis controller, you must configure the technology objects for each axis individually.

5.3.5.1   **Adding a technology object**

Add a technology object for an axis in the project navigation of your controller.

1. Project tree > Devices tab:
   Open the Technology objects folder of the relevant controller in question.

2. Double-click Add new object.

   ⇨ The Add new object window opens.

3. Select the desired technology object.

4. Confirm with OK.

⇨ The new technology object is created and placed in the Technology objects folder.

⇨ If organization blocks MC-Servo and MC-Interpolator do not yet exist, they are created.

5.3.5.2   TO_SpeedAxis and telegram 1, 2 or 3

With the TO_SpeedAxis technology object, you can implement the control of a velocity-controlled axis. You can use this technology object with the standard telegrams 1, 2 or 3.

5.3.5.2.1   Configuring a technology object

Define the hardware interface of the drive and set other parameters required for your application.

Parameterizing the hardware interface

> **Information**
>
> **Reference speed**, **maximum speed** and **reference torque**:
> Apply the values from the DriveControlSuite, Application PROFIdrive wizard > Additional functions > Drive data.

✓ You have added the TO_SpeedAxis technology object to your controller.

1. Project tree > Devices tab:
   Open the folder of the technology object.

2. Double-click to open the configuration of the technology object.

   ⇨ This switches you to the corresponding function view.

3. In the area navigation, select Hardware interface > Drive.

4. Drive type:
   Select PROFIdrive.

5. Data connection:
   Select Drive.

6. Drive:
   Select the drive with the telegram submodule already inserted.

7. In the area navigation, select Hardware interface > Data exchange with the drive.

8. Drive data area > Drive telegram:
   Select the telegram that corresponds to the telegram of the inserted submodule.

9. Drive data area > Reference speed:
   Enter the reference speed for the set velocity.
   This must match the value on the drive controller side.

10. Drive data area > Maximum speed:
    Enter the maximum permitted speed.
    This must match or be smaller than the value on the drive controller side.

Parameterizing extended parameters

Implement the settings necessary for your application.

✓ You are in the TIA function view of the technology object.

1. In the area navigation, select Extended Parameters > Limits > Dynamic limits.

2. Implement the settings necessary for your application.

3. Maximum velocity:
   Enter the maximum permitted velocity.
   This must match or be smaller than parameter I10 on the drive controller side.

4. Maximum acceleration:
   Enter the maximum permitted acceleration.
   This must match or be smaller than parameter I11 on the drive controller side.

5. Maximum deceleration:
   Enter the maximum permitted delay.
   This must match or be smaller than parameter I11 on the drive controller side.

5.3.5.2.2 Programming the control

The TO_SpeedAxis technology object is controlled via the PLCopen blocks MC_POWER, MC_HALT, MC_RESET and MC_MOVEVELOCITY:
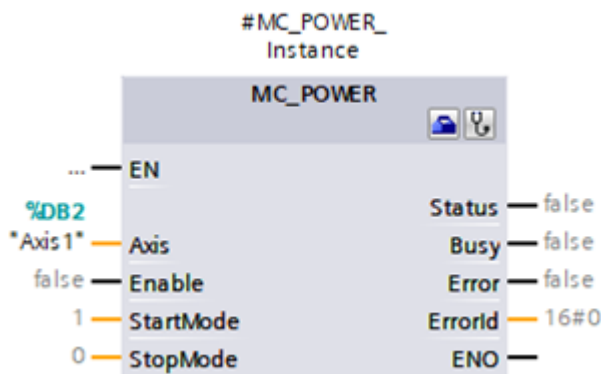
Fig. 5: PLCopen block MC_POWER
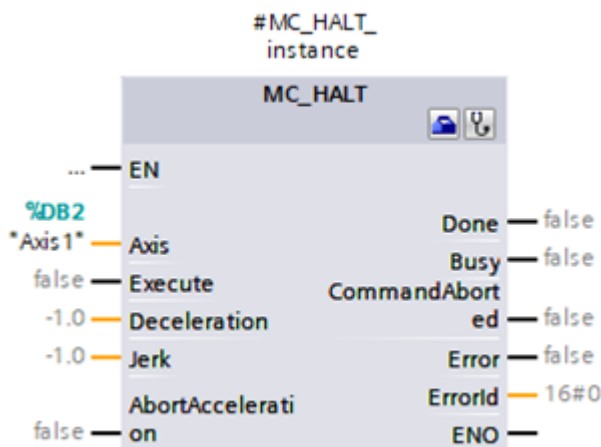
Fig. 6: PLCopen block MC_HALT
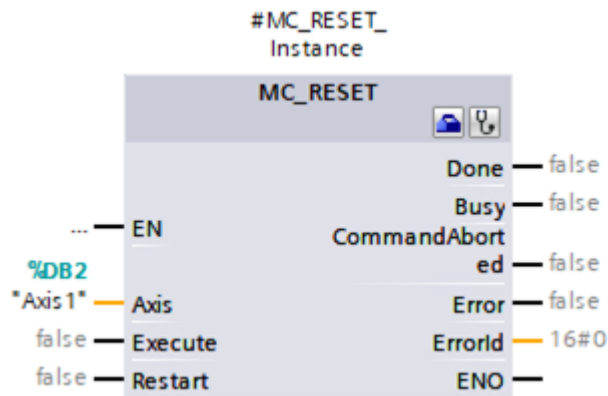
Fig. 7: PLCopen block MC_RESET
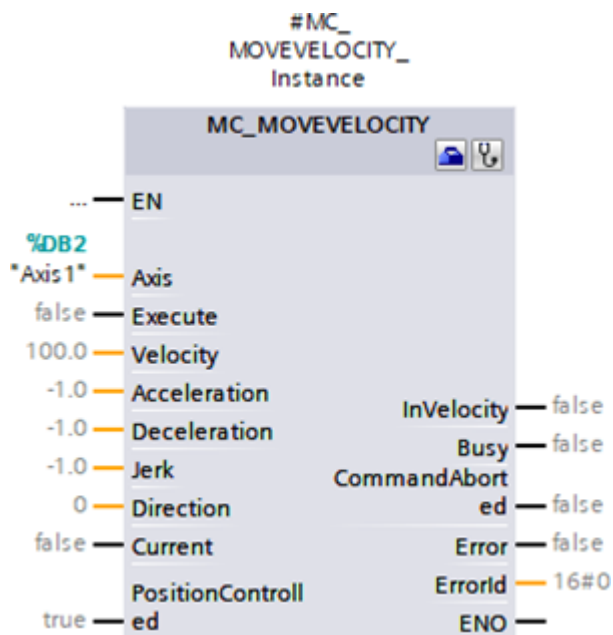
Fig. 8: PLCopen block MC_MOVEVELOCITY

For more information about the control of the PLCopen blocks, see the documentation from Siemens or the online help in the TIA Portal.

5.3.5.2.3 Testing the application

Test the correct function of the application in TIA Portal via a user program using PLCopen programming for technology objects.

For commissioning, you can check the axis functionality via the axis control panel of the technology object (Project tree > Devices tab > Technology object of the relevant controller > Commissioning).

For diagnostics, you can check status and error bits, the status of the movement as well as the PROFIdrive telegram (Project tree > Devices tab > Technology object of the relevant controller > Diagnostics).

After testing the application, transfer the configuration (see Transmitting the configuration [72]).

5.3.5.3 TO_PositioningAxis, TO_SynchronousAxis and telegram 3, 5, 102 or 105

With technology objects TO_PositioningAxis and TO_SynchronousAxis, you can implement the control of a position-controlled axis. TO_SynchonousAxis includes all functions of TO_PositioningAxis, but slave axes can follow the movements of a master axis. From the perspective of the drive, the parameterization of the technology objects is identical. You can use both technology objects with standard telegram 3 or 5 or with Siemens telegram 102 or 105.

5.3.5.3.1 Assigning an organization block

For control in application class 4 (synchronous operation), in the next step, assign the MC-Servo organization block to the telegram submodule for calculating the position controller.

- ✓ You have configured the drive controllers and projected one telegram submodule per axis.

- ✓ You are in the TIA network view.

1. Double-click on a drive controller of your PROFINET network.

    ⇨ This switches you to the device view of the drive controller.

2. Select the telegram submodule in the device overview of the drive controller.

    ⇨ The inspector window shows the device properties of the submodule.

3. General tab:
   Select I/O addresses in the area navigation.

4. Input addresses area > Organization block:
   Select MC-Servo.

5. Output addresses area > Organization block:
   Select MC-Servo.

⇨ You have assigned the organization module to the submodule.

5.3.5.3.2 Adding and configuring measuring inputs

If you want to use the measuring input function to acquire the current actual position of the axis, add the TO_MeasuringInput technology object to the TO_PositioningAxis or TO_SynchronousAxis technology object.

Adding a measuring input

- ✓ You have added the TO_PositioningAxis or TO_SynchronousAxis technology object to your controller.

1. Project tree > Devices tab:
   Open the Measuring input folder of the relevant technology object.

2. Double-click Add new measuring input.

    ⇨ The new measuring input is created and placed in the Measuring input folder.

3. Repeat the steps if you want to add a second measuring input.

Configuring a measuring input

✓ You have added a measuring input.

1. Project tree > Devices tab:
   Open the folder of the measuring input.

2. Open the configuration of the measuring input.

   ⇨ This switches you to the corresponding function view.

3. Select Hardware interface in the area navigation.

4. Input measuring input area > Measuring using PROFIdrive telegram (drive or external encoder):
   Activate this option.

5. Input measuring input area > Number of the measuring input:
   Select the measuring input number.

6. If you have added a further measuring input, repeat the steps for the second measuring input.

> **ℹ Information**
>
> In DriveControlSuite, define the sources of the measuring inputs (hardware interface) in parameter M539. M539[0] corresponds to measuring input 1 of the technology object and M539[1] corresponds to measuring input 2 of the technology object. For the setting in the DriveControlSuite wizard, select Application PROFIdrive > Additional functions > Measuring input.

5.3.5.3.3 Configuring a technology object

Configure the basic settings for your technology object, define the hardware interface of the drive and set other parameters required for your application. Depending on the telegram used, further settings may then be required:

▸ For telegram 102 or 105, the behavior of the monitoring at torque reduction

▸ For telegram 5 or 105, the settings for position control in the drive (DSC)

Parameterizing basic parameters

✓ You have added the TO_PositioningAxis or TO_SynchronousAxis technology object to your controller.

1. Project tree > Devices tab:
   Open the folder of the technology object.

2. Double-click to open the configuration of the technology object.

   ⇨ This switches you to the corresponding function view.

3. In the area navigation, select Basic parameters.

4. Set the basic parameters in accordance with your requirements. These basic parameters are independent of the parameterization in the drive controller.

5. Name:
   Enter the name to be used for the axis assignment at the PLCopen blocks.

Parameterizing the hardware interface

> **ℹ Information**
>
> **Reference speed**, **maximum speed** and **reference torque**:
> Apply the values from the DriveControlSuite, Application PROFIdrive wizard >
> Additional functions > Drive data.

✓ You are in the TIA function view of the technology object.

1. In the area navigation, select Hardware interface > Drive.

2. Drive type:
   Select PROFIdrive.

3. Data connection:
   Select Drive.

4. Drive:
   Select the drive with the telegram submodule already inserted.

5. In the area navigation, select Hardware interface > Encoder.

6. Data connection:
   Select Encoder.

7. Encoder:
   Select the drive with the telegram submodule already inserted, as this contains the required
   encoder data.

8. Encoder type:
   Select the type of encoder connected to the drive controller:

   8.1. Select Incremental for incremental encoders.

   8.2. Select Absolute for single-turn absolute encoders.

   8.3. Select Cyclic absolute for multi-turn absolute encoders.

9. In the area navigation, select Hardware interface > Data exchange with the drive > Drive data
   area.

10. Drive telegram:
    Select the telegram that corresponds to the telegram of the inserted submodule.

11. Reference speed:
    Enter the reference speed for the set velocity.
    This must match the value on the drive controller side.

12. Maximum speed:
    Enter the maximum permitted speed.
    This must match or be smaller than the value on the drive controller side.

13. Reference torque:
    Enter the reference torque.
    This must match the value on the drive controller side.

14. Additional data area > Additional telegram:
    If you have projected an additional telegram, select the PROFIdrive module with the additional
    telegram submodule inserted.

15. In the area navigation, select Hardware interface > Data exchange with encoder.

16. Encoder telegram:
Select the additional telegram that corresponds to the additional telegram of the inserted submodule.

17. Automatically apply values during run time (online):
Activate this option so that the technology object reads the required values from the drive controller.
If automatic readout is not supported by the controller, you must enter the required encoder values manually (see Required encoder values).

18. In the area navigation, select Extended Parameters > Mechanics.
Encoder mounting type:
Select On motor shaft.
Other options are not supported.

Parameterizing extended parameters

✓ You are in the TIA function view of the technology object.

1. In the area navigation, select Extended Parameters > Mechanics.

2. Encoder mounting type:
Select On motor shaft. Other options are not supported.

3. In the area navigation, select Extended Parameters > Dynamic default values.

4. Implement the settings necessary for your application.

5. Velocity:
Enter the velocity.
This must match or be smaller than parameter I10 on the drive controller side.

6. Acceleration:
Enter the acceleration.
This must match or be smaller than parameter I11 on the drive controller side.

7. Deceleration:
Enter the deceleration.
This must match or be smaller than parameter I11 on the drive controller side.

8. In the area navigation, select Extended Parameters > Emergency stop.

9. Implement the settings necessary for your application.

10. Maximum velocity:
Enter the maximum permitted velocity.
This must match or be smaller than parameter I10 on the drive controller side.

11. Emergency deceleration:
Enter the quick stop deceleration.
This must match or be smaller than parameter I17 on the drive controller side.

12. In the area navigation, select Extended Parameters > Limits > Dynamic limits.

13. Implement the settings necessary for your application.

14. Maximum velocity:
Enter the maximum permitted velocity.
This must match or be smaller than parameter I10 on the drive controller side.

15. Maximum acceleration:
Enter the maximum permitted acceleration.
This must match or be smaller than parameter I11 on the drive controller side.

16. Maximum deceleration:
Enter the maximum permitted delay.
This must match or be smaller than parameter I11 on the drive controller side.

Parameterizing the behavior of monitoring during torque reduction (telegram 102 or 105)

For telegram 102 or 105, define the behavior for position-related monitoring (positioning monitoring/following error monitoring) and effective torque/force limiting.

✓ You are in the TIA function view of the technology object.

1. In the area navigation, select Extended Parameters > Limits > Torque limits.

2. Position-related monitoring area:

   2.1. To deactivate following error monitoring and positioning monitoring during torque/force limiting, select Disable position-related monitoring.

   2.2. To enable position-related monitoring, select Leave position-related monitoring enabled.

> **ℹ Information**
>
> Limits can cause a larger difference to develop between the set position and actual position for position-controlled axes. This can lead to an unintentional response of the positioning monitoring and following error monitoring.

For the torque reduction, you need PLCopen block MC_TORQUELIMITING, with which you define the limiting value during programming (see Programming torque reduction [📖 62]).

Parameterizing position control (telegram 5 or 105)

Set the position control in the drive (DSC) for telegram 5 or 105.

✓ You are in the TIA function view of the technology object.

1. In the area navigation, select Positioning monitoring > Control loop.

2. Position control area > Gain (Kv factor):
   Define the value for the gain.

3. Dynamic Servo Control (DSC) area:
   Activate the Position control in the drive (DSC enabled) option (preset for telegram 5 or 105).

> ⚠ **ATTENTION!**
>
> **Material damage due to vibrations!**
>
> With DSC, the position control in the drive is executed synchronously with the velocity control. This makes it possible to set a much larger value for the gain (proportional coefficient).
>
> - Define the gain value for your application accordingly.
> - Start with a smaller value and increase it gradually to avoid vibrations.
> - Decrease the gain before deactivating DSC.

> ℹ **Information**
>
> When torque/force limiting is active, a larger difference can develop between the set and actual positions. The axis continuously attempts to reduce the lag while the set value remains constant.
>
> - Increase the limiting values or deactivate the limit while position control is active. This allows the axis to accelerate briefly to reduce the lag.
> - Switch the axis to non-position-controlled operation. As a result, the following error is no longer in effect.

To switch the axis to non-position controlled operation, set PLCopen block MC_MOVEVELOCITY at the PositionControlled input to `FALSE` (see Programming the control [📖 64]).

5.3.5.3.4 Programming measuring inputs

The TO_MeasuringInput technology object is controlled using PLCopen blocks MC_MEASURINGINPUT and MC_ABORTMEASURINGINPUT.
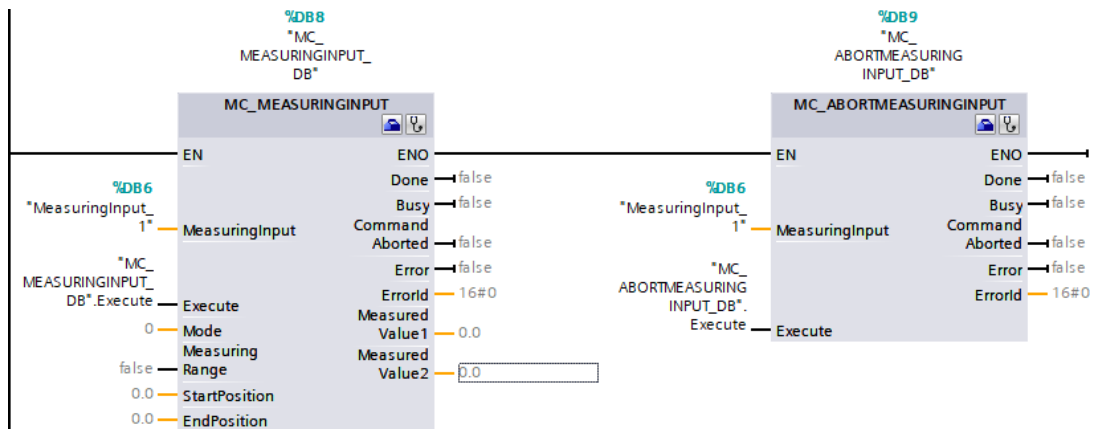
Fig. 9: PLCopen blocks MC_MEASURINGINPUT and MC_ABORTMEASURINGINPUT

The following measuring methods are supported at the Mode input:

Mode	Description
0	Measurement of the next rising edge
1	Measurement of the next falling edge
2	Measurement of the next two edges and saving of the measurement results: ▸ Rising edge = MeasuredValue 1 ▸ Falling edge = MeasuredValue 2

Tab. 10: Measuring inputs: supported measuring methods

For more information about the control of the PLCopen blocks, see the documentation from Siemens or the online help in the TIA Portal.

5.3.5.3.5 **Programming torque reduction**

With telegram 102 or 105, you can use PLCopen block MC_TORQUELIMITING to limit the torque at the Limit input in both directions.
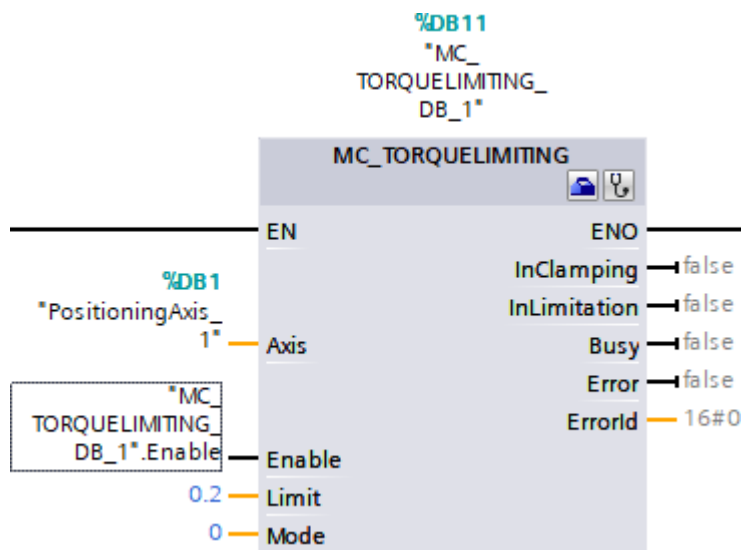
Fig. 10: PLCopen block MC_TORQUELIMITING

The following methods are supported at the Mode input:

Mode	Description
0	Torque/force limiting
1	Detecting the fixed stop

Tab. 11: Torque reduction: supported methods

> **Information**
>
> When torque/force limiting is active, a larger difference can develop between the set and actual positions. The axis continuously attempts to reduce the lag while the set value remains constant.
>
> ▪ Increase the limiting values or deactivate the limit while position control is active. This allows the axis to accelerate briefly to reduce the lag.
>
> ▪ Switch the axis to non-position-controlled operation. As a result, the following error is no longer in effect.

To switch the axis to non-position controlled operation, set PLCopen block MC_MOVEVELOCITY at the PositionControlled input to FALSE (see Programming the control [64]).

For more information about the control of the PLCopen blocks, see the documentation from Siemens or the online help in the TIA Portal.

5.3.5.3.6   **Programming Siemens additional telegram 750**

With Siemens additional telegram 750, you can implement the following functions using the PLCopen blocks listed:

▸ MC_TORQUERANGE for specifying a torque limit with definition of a maximum permissible positive torque (UpperLimit input) and a maximum permissible negative torque (LowerLimit input)

▸ MC_TORQUEADDITIVE for specifying an additive torque (Value input) in order to add an additional torque in the drive

Fig. 11: PLCopen block MC_TORQUERANGE

Fig. 12: PLCopen block MC_TORQUEADDITIVE

For more information about the control of the PLCopen blocks, see the documentation from Siemens or the online help in the TIA Portal.

5.3.5.3.7 Programming the control

The TO_PositioningAxis and TO_SynchronousAxis technology objects are controlled using PLCopen blocks MC_MOVECELOCITY, MC_POWER, MC_HALT, MC_RESET, MC_HOME, MC_MOVERELATIVE, MC_MOVEABSOLUTE and MC_MOVEJOG:
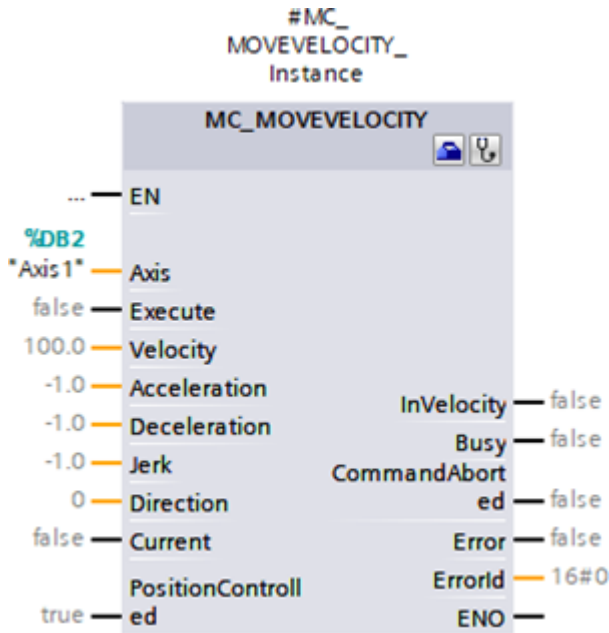
Fig. 13: PLCopen block MC_MOVEVELOCITY

Information

To switch the axis to non-position-controlled operation when torque/force limiting is active, set PLCopen block MC_MOVEVELOCITY at the PositionControlled input to `FALSE`.
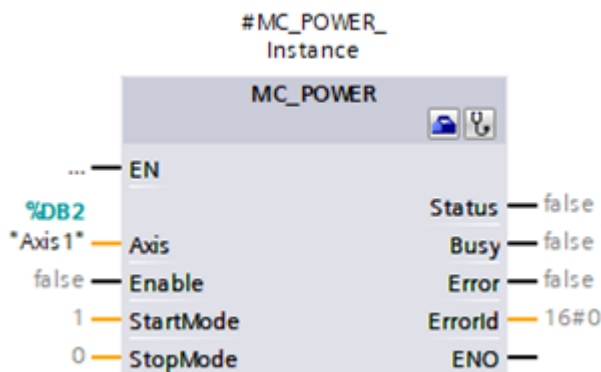
Fig. 14: PLCopen block MC_POWER

#MC_HALT_
instance

MC_HALT

— EN

%DB2
"Axis 1" — Axis

Done — false
Busy — false

false — Execute

CommandAbort
ed — false

-1.0 — Deceleration
-1.0 — Jerk

Error — false

AbortAccelerati

ErrorId — 16#0

false — on

ENO —

Fig. 15: PLCopen block MC_HALT

#MC_RESET_
Instance

MC_RESET

Done — false
Busy — false

CommandAbort

— EN

ed — false

%DB2
"Axis 1" — Axis

Error — false

false — Execute

ErrorId — 16#0

false — Restart

ENO —

Fig. 16: PLCopen block MC_RESET

#MC_HOME_
Instance

MC_HOME

ReferenceMarkP
osition — 0.0

— EN

Done — false
Busy — false

%DB2

CommandAbort

"Axis 2" — Axis

ed — false

false — Execute

Error — false

0.0 — Position

ErrorId — 16#0

0 — Mode

ENO —

Fig. 17: PLCopen block MC_HOME

Fig. 18: PLCopen block MC_MOVERELATIVE
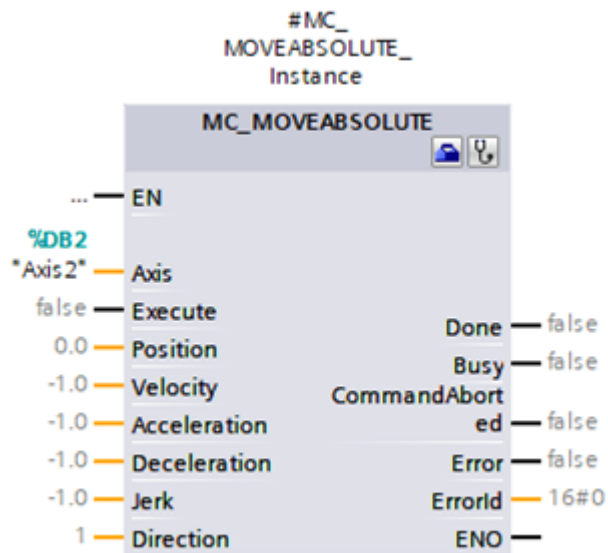
Fig. 19: PLCopen block MC_MOVEABSOLUTE
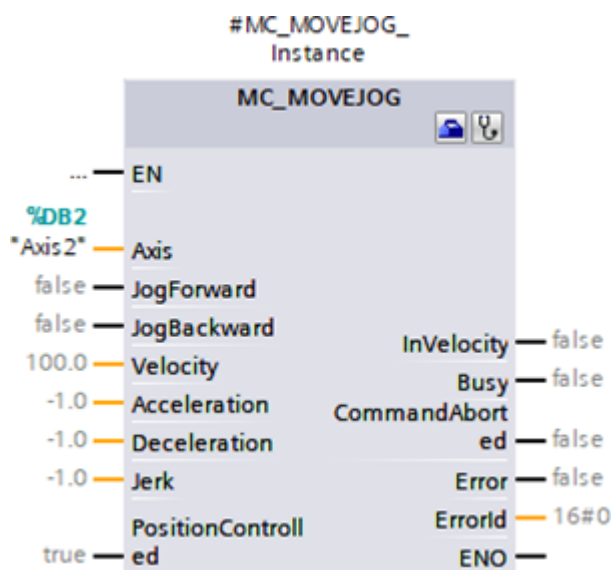
Fig. 20: PLCopen block MC_MOVEJOG

For the TO_SynchronousAxis technology object, PLCopen blocks MC_GEARIN and MC_MOVESUPERIMPOSED are also available:
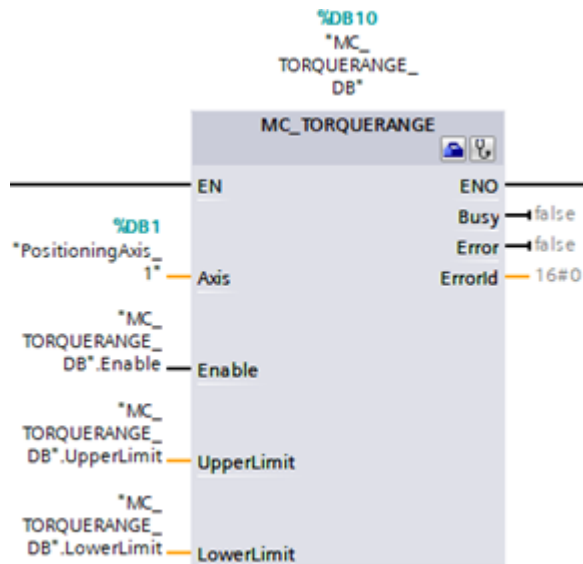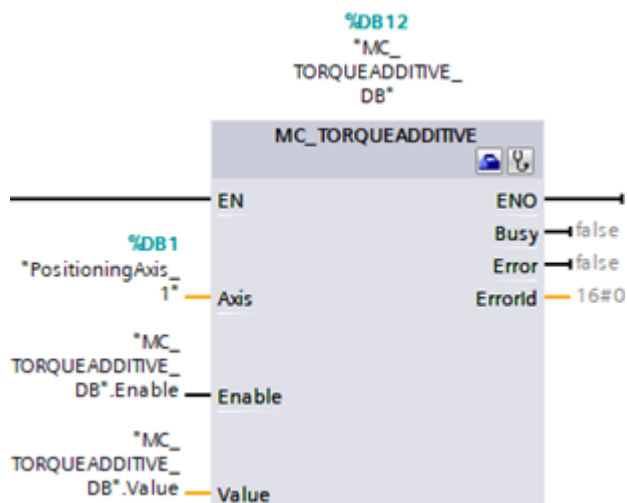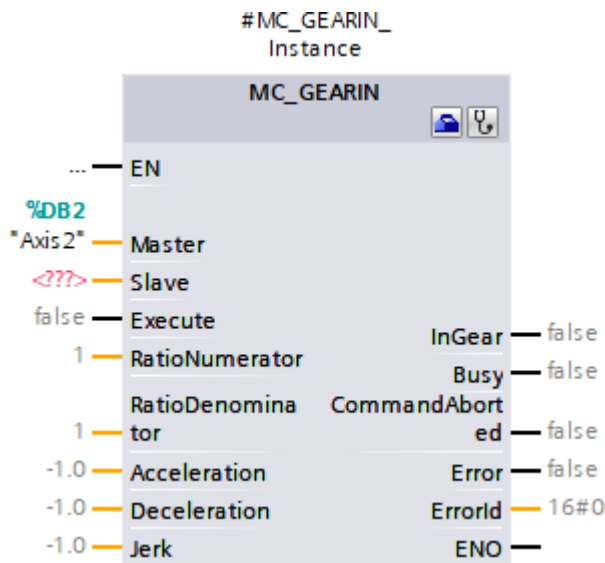

Fig. 21: PLCopen block MC_GEARIN
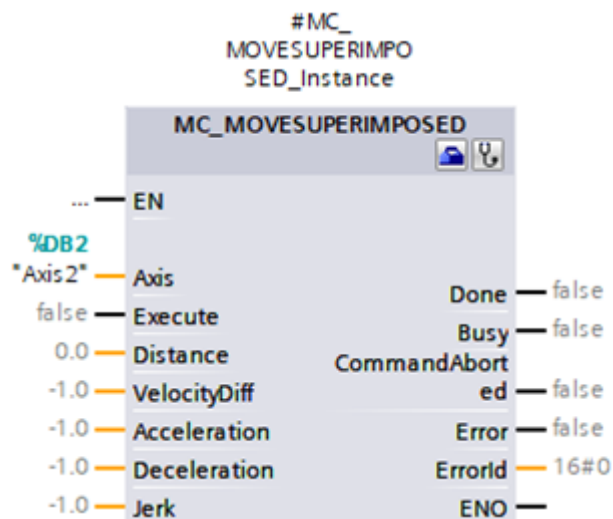
Fig. 22: PLCopen block MC_MOVESUPERIMPOSED

For more information about the control of the PLCopen blocks, see the documentation from Siemens or the online help in the TIA Portal.

5.3.5.3.8 Testing the application

Test the correct function of the application in TIA Portal via a user program using PLCopen programming for technology objects.

For commissioning, you can check the axis functionality via the axis control panel of the technology object (Project tree > Devices tab > Technology object of the relevant controller > Commissioning).

For diagnostics, you can check status and error bits, the status of the movement as well as the PROFIdrive telegram (Project tree > Devices tab > Technology object of the relevant controller > Diagnostics).

After testing the application, transfer the configuration (see Transmitting the configuration [📖72]).

5.3.5.4 TO_BasicPos and Siemens telegram 111

With the technology object TO_BasicPos, you can implement the control of a position-controlled axis. You can use this technology object with Siemens telegram 111.

5.3.5.4.1 Configuring a technology object

Define the hardware interface of the drive.

✓ You have added the TO_BasicPos technology object to your controller.

1. Project tree > Devices tab:
   Open the folder of the technology object.

2. Double-click to open the configuration of the technology object.
   ⇨ This switches you to the corresponding function view.

3. HIn the area navigation, select Hardware interface > Drive.

4. Drive:
   Select the drive with the telegram submodule already inserted.

5.3.5.4.2 Programming the control

The TO_BasicPos technology object is controlled via its function block:
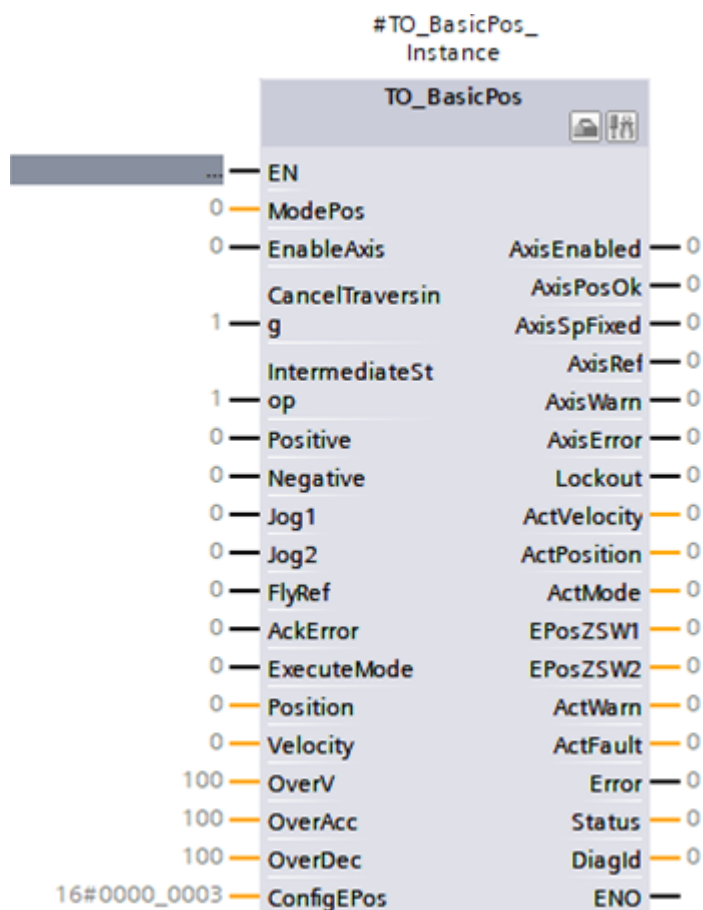
Fig. 23: TO_BasicPos block

For more information about the control of the block, see the documentation from Siemens or the online help in TIA Portal.

5.3.5.4.3 Testing the application

Test the correct function of the application in TIA Portal via a corresponding user program or via the interface of the block TO_BasicPos.

After testing the application, transfer the configuration (see).

5.3.6 Control via function blocks

The following chapters describe how to configure the control using function blocks. Follow the instructions for the function block with which you want to operate the corresponding axis.

5.3.6.1 FB SINA_SPEED and standard telegram 1

With the function block SINA_SPEED, you can implement the control of a velocity-controlled axis. You can use this function block with standard telegram 1.

Programming the control

Fig. 24: Function block SINA_SPEED

For communication with the drive controller, you need the hardware identifier of the telegram submodule on the controller side. The hardware identifier, 267 in this example, is displayed in the Inspector window > System constants tab if you select the telegram in the device overview of the workspace.

Store the address for the inputs HWIDSTW (transmitting side from controller view) and HWIDZSW (receiving side from controller view).

Input	Data type	Required value
HWIDSTW	HW_IO	Hardware identifier of the telegram submodule
HWIDZSW	HW_IO	Hardware identifier of the telegram submodule

Tab. 12: Function block SINA_SPEED: Required values

For further information about the control of the function block, see the DriveLib documentation from Siemens.

Testing the application

Test the correct function of the application in the TIA Portal via a corresponding user program.

After testing the application, transfer the configuration (see Transmitting the configuration [📖72]).

| 5.3.6.2 | **FB SINA_POS and telegram 111** |

With the function block SINA_POS, you can implement the control of a position-controlled axis. You can use this function block with Siemens telegram 111.

Programming the control
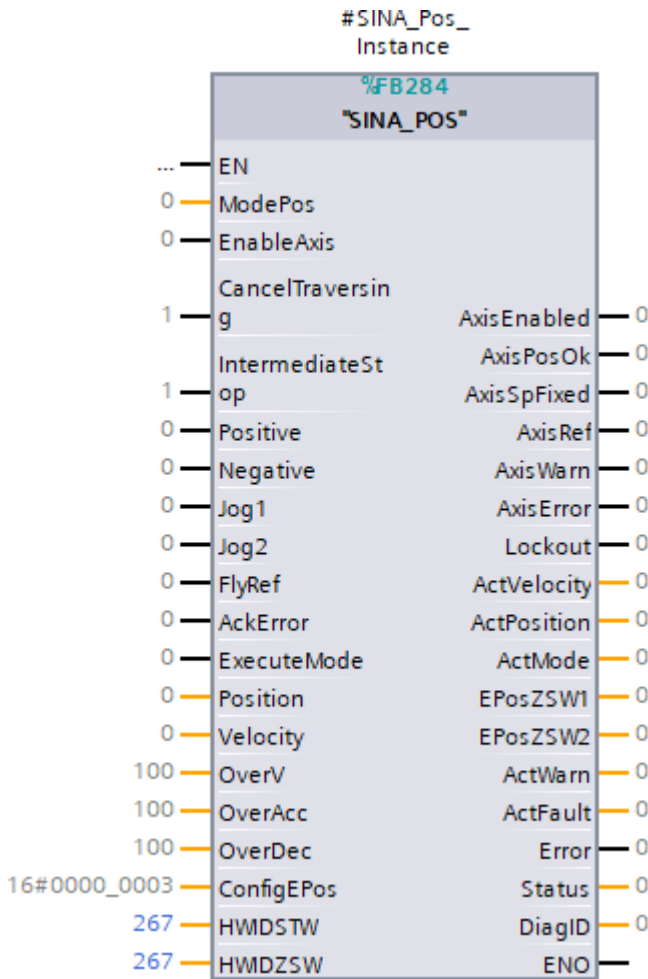
Fig. 25: Function block SINA_POS

For communication with the drive controller, you need the hardware identifier of the telegram submodule on the controller side. The hardware identifier, 267 in this example, is displayed in the Inspector window > System constants tab if you select the telegram in the device overview of the workspace.

Store the address for the inputs HWIDSTW (transmitting side from controller view) and HWIDZSW (receiving side from controller view).

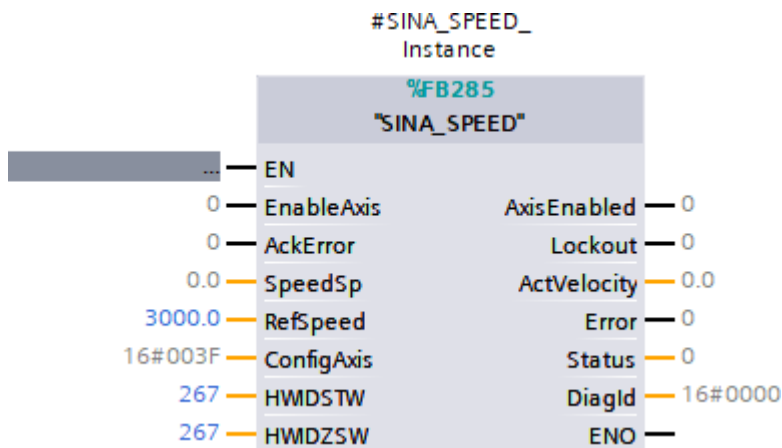| Input	Data type	Required value
HWIDSTW	HW_IO	Hardware identifier of the telegram submodule
HWIDZSW	HW_IO	Hardware identifier of the telegram submodule

Tab. 13: Function block SINA_POS: Required values

For further information about the control of the function block, see the DriveLib documentation from Siemens.

Testing the application

Test the correct function of the application in TIA Portal via a corresponding user program or via the interface of the function block SINA_POS.

After testing the application, transfer the configuration (see Transmitting the configuration [72]).

5.3.7 Transmitting the configuration

Transmit the configuration of your TIA project from your PC to your controller.

✓ You have fully mapped and parameterized your PROFINET network in the TIA project.

1. Project navigation > Devices tab:
   Select the folder of the controller in question.

2. Select Online > Advanced download to device in the menu bar.

   ⇨ The Advanced download window opens.

3. Select target device area:
   Select Show all compatible nodes and click on Start search.

   ⇨ All controllers are listed that were found in the subnet.

4. Select the controller where you would like to transfer the configuration and click on Download.

   ⇨ The Software synchronization before downloading to a device window opens.

5. Click on Continue without synchronizing.

   ⇨ The Preview download window opens.

6. Click on Download.

   ⇨ The configuration is transmitted to the selected controller and the Results of the download process window opens.

7. Click on Finish.

⇨ The download process is complete; the configuration was transmitted successfully to the controller.

ℹ Information

If there is an online connection, you can identify which controller you have currently selected using Flash LED if multiple controllers are located in the same subnet.

ℹ Information

In DriveControlSuite, parameter A271 provides information about the state of the drive controller in the PROFINET network. If the application selected in DriveControlSuite does not match the inserted module in TIA Portal, the status 6: Configuration Application / PROFINE does not fit is output there.

▪ In this case, make sure that the device control and the PROFIdrive application are projected in DriveControlSuite and that a PROFIdrive module has been inserted in TIA Portal.

ℹ Information

Parameter A272 in DriveControlSuite provides information about the submodules projected in TIA Portal (display format: XXX YYY ZZZ; XXX = submodule ID (telegram no.), YYY = TxPZD data length in bytes, ZZZ = RxPZD data length in bytes).

5.3.8 Testing communication

Check the communication between the controller and drive controllers of your PROFINET network using the diagnostics buffer of the controller.

✓ You have transferred the configuration to the controller.

1. Project tree > Devices tab:
   Open the folder of the relevant controller.

2. Double-click Online & diagnostics.

   ⇨ This switches you to the respective device view.

3. Select Online access in the area navigation.

4. Online access area:
   Click on Go online.

   ⇨ An online connection to the selected controller is being established.

5. In the area navigation, select Diagnostics > Diagnostics buffer.

6. Results area:
   Check the events in the diagnostics buffer for possible errors and correct their causes if necessary.

⇨ The connection between the controller and drive controller is projected and a data exchange between the nodes in the PROFINET network is possible.

Information

If there is an online connection, you can identify which controller you have currently selected using Flash LED if multiple controllers are located in the same subnet.

---

6 More on PROFIdrive?

The following chapters summarize the important terms and relationships concerning the application PROFIdrive.

6.1 PROFIdrive – Concept

Depending on the selected control, you can implement drive- or controller-based applications using the PROFIdrive application. The drive-based applications provide full motion calculation and execution in the drive. Here, the set values for position and velocity are converted into movements accurately and precisely. Referencing and jogging are performed, like all movements, with jerk limitation during commissioning. In controller-based applications with cyclic set value specification by the controller, the drive controllers can also perform motion tasks independently, for example referencing and the jog function during commissioning. The drive controllers are either networked via PROFINET or receive signals and set values via digital hardware inputs.

6.1.1 Control

The application is based on the internationally standardized drive profile PROFIdrive for electric drives (version 4.2) according to IEC 61800-7-303. Accordingly, the drive controller is controlled using the PROFIdrive-compliant control and status words.

6.1.2 Application classes and telegrams

Depending on the type and scope of the application processes, there are different application classes for the PROFIdrive application. These can be reached via various telegrams. In production mode, these 3 application classes are available with the respective telegrams:

Application class 1 (AC1)

‣ Set velocity specification by a controller

‣ Standard telegram 1, 2 or 3

‣ Siemens telegram 102 with torque reduction

Application class 3 (AC3)

‣ Set position specification by a controller

‣ Siemens telegram 111

Application class 4 (AC4)

‣ Synchronized, cyclic set velocity specification by a controller

‣ Telegram-dependent with torque reduction and/or Dynamic Servo Control (DSC)

‣ Standard telegram 3 or 5

‣ Siemens telegram 102 or 105

Additional telegrams

Siemens additional telegram 750 provides additional process data for torque feedforward control via additive torque and for different torque limits in the positive and negative direction. The combination of standard telegram 3 or 5 and additional telegram 750, for example, offers a greater range of functions compared to Siemens telegram 102 or 105. The additional telegram can be combined with all telegrams and used in all application classes.

The additional telegram 900 is a freely assignable telegram. You can combine it with all telegrams and use it in all application classes.

Further functions

You can use the measuring input function for recording the actual position of the axis with standard telegram 3 or 5 or with Siemens telegram 102 or 105.

For commissioning, emergency operation and maintenance or repair work, you can also use jog mode (manual operation) to move the drive independently of the controller.

For more information on application classes and telegrams, see Application classes and telegrams in detail [📖 76].

6.1.3 Source for digital signals

Certain signals can be controlled by digital hardware inputs.

In DriveControlSuite, you can flexibly select the source for control signals such as limit switches and reference switches.

6.1.4 Control panels

The control panels are special wizards in DriveControlSuite, which you can use to take control of the axis. With the help of the control panels, you can manually release and move an axis even if the drive controller has no operating unit or is difficult to access.

Using control panels, you can check the connection wiring, the project configuration of your physical axis model or the parameterization of your application before you start commissioning the controller or switch to normal operation.

The following control panels are available:

▸ Jog control panel is used to check the projected axis model in jog mode.

▸ Control panel motion provides you with a standard set of motion commands based on PLCopen. Via the control panel, independent of the application and fieldbus interface, you can parameterize a motion profile directly for the motion core of the axis in order to check the basic functions of the drive controller.

Because control panels override normal operation, they can be activated only with a deactivated enable signal and should be operated by experienced users only.

6.2 Application classes and telegrams in detail

Depending on the type and scope of the application processes, there are different application classes for the PROFIdrive application, which can be reached via different telegrams.

Selecting a telegram determines the process data on the drive controller side that is to be transmitted. From the drive controller's point of view, the received process data represents the receive process data (RxPZD) and the process data to be transmitted represents the transmit process data (TxPZD). This data consists of the following elements:

▸ Receive PZD: Control words (STW) or set values

▸ Transmit PZD: Status words (ZSW) or actual values

The time-critical process data is exchanged cyclically.

The mapping of the process data via the telegram is specified by the controller to the drive controller in parameter M513 and displayed in parameter M512.

Standard telegrams

The standard telegrams correspond to the standardized PROFIdrive profile.

The following standard telegrams can be selected:

Standard telegram	Application class	Description
1	AC1	Set velocity 16 bit
2	AC1	Set velocity 32 bit
3	AC1, AC4	Set velocity 32 bit with 1 position encoder
5	AC4	Set velocity 32 bit with 1 position encoder and Dynamic Servo Control

Tab. 14: Standard telegrams of the PROFIdrive application

Manufacturer-specific telegrams

There are the following manufacturer-specific telegrams:

Siemens telegram	Application class	Description
102	AC1, AC4	Set velocity 32 bit with 1 position encoder and torque reduction
105	AC4	Set velocity 32 bit with 1 position encoder, torque reduction and Dynamic Servo Control
111	AC3	Positioning (single positioner)

Tab. 15: Manufacturer-specific telegrams of the application PROFIdrive

Manufacturer-specific additional telegrams

The following manufacturer-specific additional telegrams are available:

Additional telegram	Application class	Description
750	All	Siemens additional telegram; additional process data for torque feedforward control via additive torque and for different torque limits in positive and negative direction
900	All	Additional telegram for free assignment with further process data

Tab. 16: Manufacturer-specific additional telegrams of the PROFIdrive application

6.2.1 Standard mapping of PROFINET and PROFIdrive

The following table shows the standard mapping for the receive and transmit process data in the PROFIdrive application.

> **Information**
>
> Parameter A272 in DriveControlSuite provides information about the submodules projected in TIA Portal (display format: XXX YYY ZZZ; XXX = submodule ID (telegram no.), YYY = TxPZD data length in bytes, ZZZ = RxPZD data length in bytes).

Telegram	AC	Receive PZD	Length (byte)	Transmit PZD	Length (byte)	Display in A272
1	1	M515 Control word 1 (STW1), M520 Speed setpoint A (NSOLL_A)	2, 2	M516 Status word 1 (ZSW1), M522Speed actual value A (NIST_A)	2, 2	1004004
2	1	M515 Control word 1 (STW1), M521 Speed setpoint B (NSOLL_B), M517 Control word 2 (STW2)	2, 4, 2	M516 Status word 1 (ZSW1), M523 Speed actual value B (NIST_B), M518 Status word 2 (ZSW2)	2, 4, 2	2008008
3	1, 4	M515 Control word 1 (STW1), M521 Speed setpoint B (NSOLL_B), M517 Control word 2 (STW2), M526 Sensor 1 control word (G1_STW)	2, 4, 2, 2	M516 Status word 1 (ZSW1), M523 Speed actual value B (NIST_B), M518 Status word 2 (ZSW2), M527 Sensor 1 status word (G1_ZSW), M528 Sensor 1 position actual value 1 (G1_XIST1), M529 Sensor 1 position actual value 2 (G1_XIST2)	2, 4, 2, 2, 4, 4	3018010
5	4	M515 Control word 1 (STW1), M521 Speed setpoint B (NSOLL_B), M517 Control word 2 (STW2), M526 Sensor 1 control word (G1_STW), M559 Position deviation (XERR), M560 Position controller proportional coefficient (KPC)	2, 4, 2, 2, 4, 4	M516 Status word 1 (ZSW1), M523 Speed actual value B (NIST_B), M518 Status word 2 (ZSW2), M527 Sensor 1 status word (G1_ZSW), M528 Sensor 1 position actual value 1 (G1_XIST1), M529 Sensor 1 position actual value 2 (G1_XIST2)	2, 4, 2, 2, 4, 4	5018018

Telegram	AC	Receive PZD	Length (byte)	Transmit PZD	Length (byte)	Display in A272
102	1, 4	M515 Control word 1 (STW1), M521 Speed setpoint B (NSOLL_B), M517 Control word 2 (STW2), M558 Torque reduction (MOMRED) M526 Sensor 1 control word (G1_STW)	2, 4, 2, 2, 2	M516 Status word 1 (ZSW1), M523 Speed actual value B (NIST_B), M518 Status word 2 (ZSW2), M557 Notification word (MELDW), M527 Sensor 1 status word (G1_ZSW), M528 Sensor 1 position actual value 1 (G1_XIST1), M529 Sensor 1 position actual value 2 (G1_XIST2)	2, 4, 2, 2, 2, 4, 4	102020012
105	4	M515 Control word 1 (STW1), M521 Speed setpoint B (NSOLL_B), M517 Control word 2 (STW2), M558 Torque reduction (MOMRED) M526 Sensor 1 control word (G1_STW), M559 Position deviation (XERR), M560 Position controller proportional coefficient (KPC)	2, 4, 2, 2, 2, 4, 4	M516 Status word 1 (ZSW1), M523 Speed actual value B (NIST_B), M518 Status word 2 (ZSW2), M557 Notification word (MELDW), M527 Sensor 1 status word (G1_ZSW), M528 Sensor 1 position actual value 1 (G1_XIST1), M529 Sensor 1 position actual value 2 (G1_XIST2)	2, 4, 2, 2, 2, 4, 4	105020020
111	3	M515 Control word 1 (STW1), M550 Positioning control word 1 (POS_STW1), M551 Positioning control word 2 (POS_STW2), M517 Control word 2 (STW2), M554 Speed override (Override), M530 MDI target position (MDI_TARPOS), M531 MDI velocity (MDI_VELOCITY), M532 MDI acceleration (MDI_ACC), M533 MDI deceleration (MDI_DEC)	2, 2, 2, 2, 2, 4, 4, 2, 2	M516 Status word 1 (ZSW1), M552 Positioning status word 1 (POS_ZSW1), M553 Positioning status word 2 (POS_ZSW2), M518 Status word 2 (ZSW2), M557 Notification word (MELDW), M535 Position actual value A (XIST_A), M523 Speed actual value B (NIST_B), M555 Fault number (FAULT_Code), M556 Alarm number (WARN_Code)	2, 2, 2, 2, 2, 4, 4, 2, 2	111022022
750	All	M562 Couple supplémentaire (M_ADD1), M563 Maximum positive torque (M_LIMIT_POS), M564 Maximum negative torque (M_LIMIT_NEG)	2, 2, 2	M561 Actual torque (M_ACT)	2	750002006
900	All	Free assignment	12 (total)	Free assignment	12 (total)	900012012

Tab. 17: Receive and transmit process data (standard mapping)

6.2.2   Application class 1 (standard drive)

Application class 1 (AC1) is intended for velocity-controlled axes and includes velocity control with an integrated profile generator. The set values for the velocity are specified by the controller and read in the drive controller according to the cycle time. The complete velocity control takes place in the drive controller.

Application Class 1
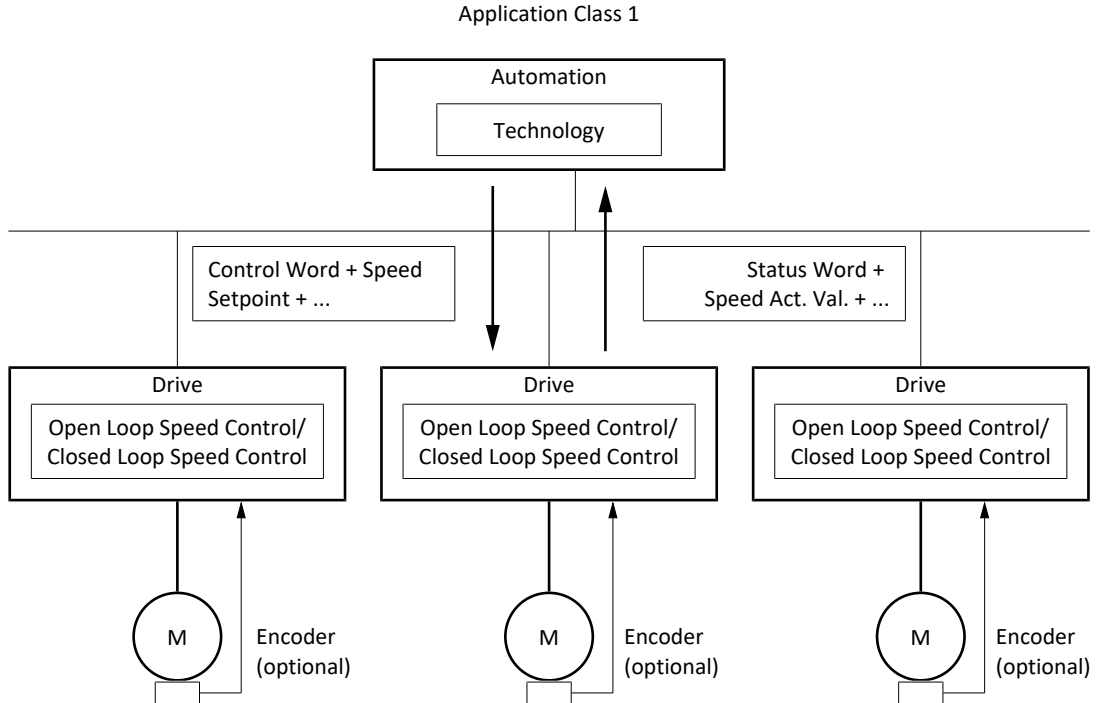
Fig. 26: PROFIdrive: Application class 1 (source: PROFIdrive profile)

To control application class 1, the three standard telegrams 1, 2 and 3 as well as Siemens telegram 102 are defined for PROFIdrive and implemented in the application.

6.2.2.1   Standard telegram 1 in AC1

The standard telegram 1 (set velocity 16 bit) can be used in application class 1.

Structure

The mapping of the process data is specified by the controller (M512, M513).

The following tables show the structure of the telegram.

PZD no.	Data type	Name	Parameter
1	WORD	Control word 1 (STW1)	M515
2	INT16	Speed setpoint A (NSOLL_A)	M520

Tab. 18: Standard telegram 1: RxPZD

PZD no.	Data type	Name	Parameter
1	WORD	Status word 1 (ZSW1)	M516
2	INT16	Speed actual value A (NIST_A)	M522

Tab. 19: Standard telegram 1: TxPZD

Input and output signals

Fig. 27: Standard telegram 1 in AC1: Input and output signals

Control and status information

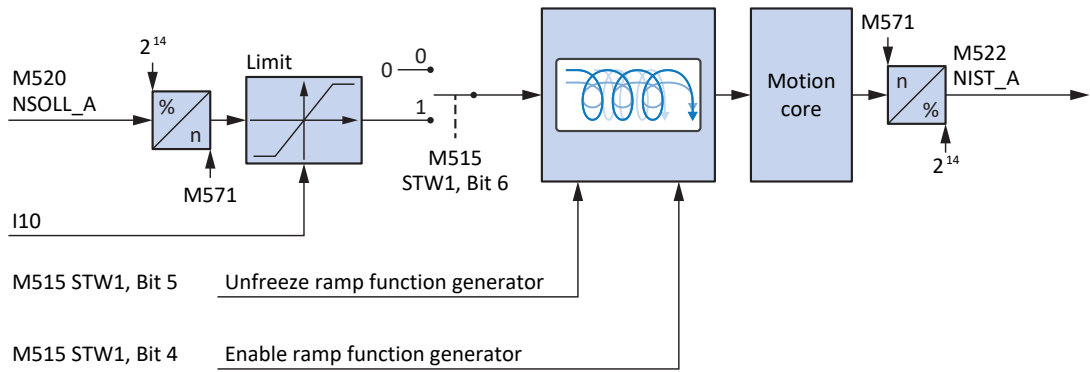The telegram is specified by the controller in parameter M513. The active telegram is output in parameter M512. If standard telegram 1 is active, the information 1: Standard telegram 1 is displayed there.

The following application-specific bits are assigned in control word 1 M515:

Bit	Designation	Comment
4	Enable ramp generator	Activate calculation of the motion profile: 0 = velocity specification = 0; 1 = velocity specification by Speed setpoint (M520)
5	Unfreeze ramp generator	Unfreeze motion profile calculation: 0 = velocity specification = last velocity specification before freeze; 1 = velocity specification by Speed setpoint (M520)
6	Enable setpoint	Deactivate set velocity: 0 = velocity specification = 0; 1 = velocity specification by Speed setpoint (M520)
12	Open brake	Release brakes (prerequisite: F06 = 2: Parameter): ▸ F92[0] = 0: Internal (automatic): Release override 0 = brake control is automatic depending on device state and motion core; 1 = brakes release ▸ F92[0] = 1: External (plc): Brakes are controlled externally by a controller 0 = brakes engage; 1 = brakes release

Tab. 20: Standard telegram 1: Application-specific bit in control word 1

The following application-specific bits are assigned in status word 1 M516:

Bit	Designation	Comment
8	Error within tolerance range	Actual velocity within the permitted tolerance around the set velocity (source: M598): 0 = inactive; 1 = active
10	Target velocity reached	Target velocity reached (source: M596): 0 = inactive; 1 = active
12		Brake control status
13	Standstill	StndStill, standstill (source: I199): 0 = inactive; 1 = active
14	Accelerate	Accel, accelerated (source: I184): 0 = inactive; 1 = active
15	Decelerate	Decel, delayed (source: I185): 0 = inactive; 1 = active

Tab. 21: Standard telegram 1: Application-specific bit in status word 1

Information

Parameter M571 Velocity reference value provides the reference value for the set velocity and actual velocity and ensures the function of the application.

6.2.2.2   Standard telegram 2 in AC1

The standard telegram 2 (set velocity 32 bit) can be used in application class 1.

Structure

The mapping of the process data is specified by the controller (M512, M513).

The following tables show the structure of the telegram.

PZD no.	Data type	Name	Parameter
1	WORD	Control word 1 (STW1)	M515
2 + 3	INT32	Speed setpoint B (NSOLL_B)	M521
4	WORD	Control word 2 (STW2)	M517

Tab. 22: Standard telegram 2: RxPZD

PZD no.	Data type	Name	Parameter
1	WORD	Status word 1 (ZSW1)	M516
2 + 3	INT32	Speed actual value B (NIST_B)	M523
4	WORD	Status word 2 (ZSW2)	M518

Tab. 23: Standard telegram 2: TxPZD
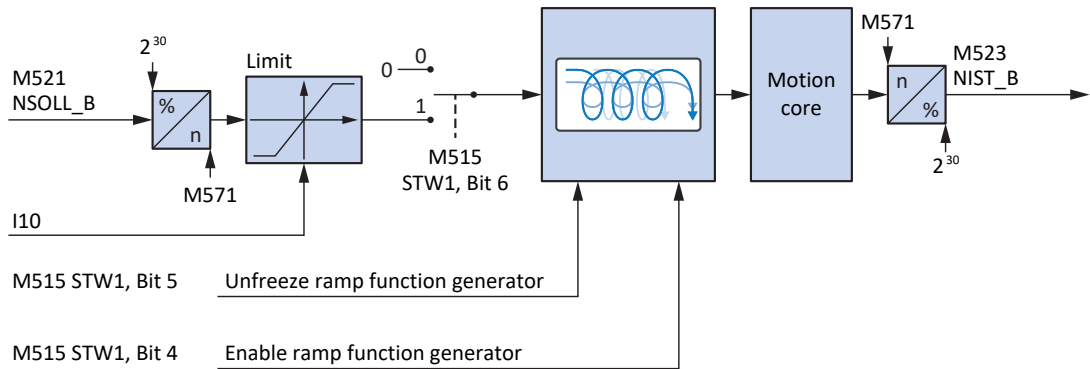
Input and output signals

Fig. 28: Standard telegram 2 in AC1: Input and output signals

Control and status information

The telegram is specified by the controller in parameter M513. The active telegram is output in parameter M512. If standard telegram 2 is active, the information 2: Standard telegram 2 is displayed there.

The following application-specific bits are assigned in control word 1 M515:

Bit	Designation	Comment
4	Enable ramp generator	Activate calculation of the motion profile: 0 = velocity specification = 0; 1 = velocity specification by Speed setpoint (M521)
5	Unfreeze ramp generator	Unfreeze motion profile calculation: 0 = velocity specification = last velocity specification before freeze; 1 = velocity specification by Speed setpoint (M521)
6	Enable setpoint	Deactivate set velocity: 0 = velocity specification = 0; 1 = velocity specification by Speed setpoint (M521)
12	Open brake	Release brakes (prerequisite: F06 = 2: Parameter): ▶ F92[0] = 0: Internal (automatic): Release override 0 = brake control is automatic depending on device state and motion core; 1 = brakes release ▶ F92[0] = 1: External (plc): Brakes are controlled externally by a controller 0 = brakes engage; 1 = brakes release

Tab. 24: Standard telegram 2: Application-specific bit in control word 1

The following application-specific bits are assigned in status word 1 M516:

Bit	Designation	Comment
8	Error within tolerance range	Actual velocity within the permitted tolerance around the set velocity (source: M598): 0 = inactive; 1 = active
10	Target velocity reached	Target velocity reached (source: M596): 0 = inactive; 1 = active
12		Brake control status
13	Standstill	StndStill, standstill (source: I199): 0 = inactive; 1 = active
14	Accelerate	Accel, accelerated (source: I184): 0 = inactive; 1 = active
15	Decelerate	Decel, delayed (source: I185): 0 = inactive; 1 = active

Tab. 25: Standard telegram 2: Application-specific bit in status word 1

> **Information**
>
> Parameter M571 Velocity reference value provides the reference value for the set velocity and actual velocity and ensures the function of the application.

6.2.2.3   **Standard telegram 3 in AC1**

The standard telegram 3 (set velocity 32 bit with 1 position encoder) can be used in application class 1 or 4.

Structure

The mapping of the process data is specified by the controller (M512, M513).

The following tables show the structure of the telegram.

PZD no.	Data type	Name	Parameter
1	WORD	Control word 1 (STW1)	M515
2 + 3	INT32	Speed setpoint B (NSOLL_B)	M521
4	WORD	Control word 2 (STW2)	M517
5	WORD	Sensor 1 control word (G1_STW)	M526

Tab. 26: Standard telegram 3: RxPZD

PZD no.	Data type	Name	Parameter
1	WORD	Status word 1 (ZSW1)	M516
2 + 3	INT32	Speed actual value B (NIST_B)	M523
4	WORD	Status word 2 (ZSW2)	M518
5	WORD	Sensor 1 status word (G1_ZSW)	M527
6 +7	INT32	Sensor 1 position actual value 1 (G1_XIST1)	M528
8 + 9	INT32	Sensor 1 position actual value 2 (G1_XIST2)	M529

Tab. 27: Standard telegram 3: TxPZD
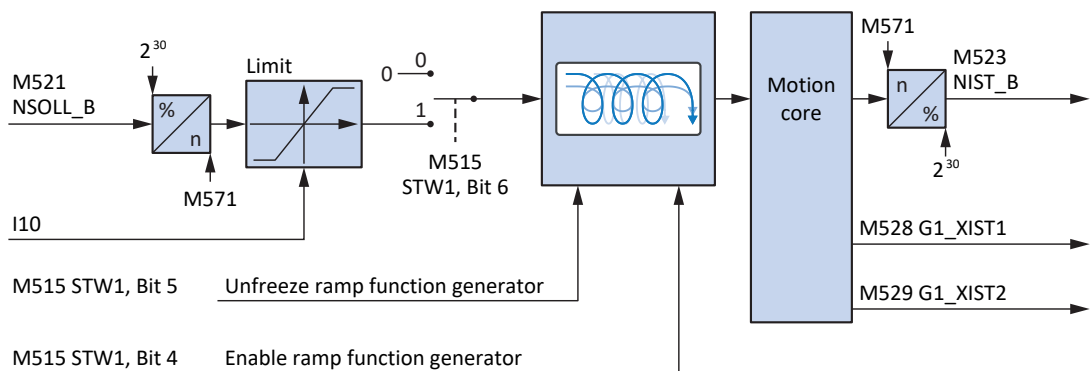
Input and output signals

Fig. 29: Standard telegram 3 in AC1: Input and output signals

Control and status information

The telegram is specified by the controller in parameter M513. The active telegram is output in parameter M512. If standard telegram 3 is active, the information 3: Standard telegram 3 is displayed there.

The following application-specific bits are assigned in control word 1 M515:

Bit	Designation	Comment
4	Enable ramp generator	Activate calculation of the motion profile: 0 = velocity specification = 0; 1 = velocity specification by Speed setpoint (M521)
5	Unfreeze ramp generator	Unfreeze motion profile calculation: 0 = velocity specification = last velocity specification before freeze; 1 = velocity specification by Speed setpoint (M521)
6	Enable setpoint	Deactivate set velocity: 0 = velocity specification = 0; 1 = velocity specification by Speed setpoint (M521)
12	Open brake	Release brakes (prerequisite: F06 = 2: Parameter): ▸ F92[0] = 0: Internal (automatic): Release override 0 = brake control is automatic depending on device state and motion core; 1 = brakes release ▸ F92[0] = 1: External (plc): Brakes are controlled externally by a controller 0 = brakes engage; 1 = brakes release

Tab. 28: Standard telegram 3: Application-specific bit in control word 1

The following application-specific bits are assigned in status word 1 M516:

Bit	Designation	Comment
8	Error within tolerance range	Actual velocity within the permitted tolerance around the set velocity (source: M598): 0 = inactive; 1 = active
10	Target velocity reached	Target velocity reached (source: M596): 0 = inactive; 1 = active
12		Brake control status
13	Standstill	StndStill, standstill (source: I199): 0 = inactive; 1 = active
14	Accelerate	Accel, accelerated (source: I184): 0 = inactive; 1 = active
15	Decelerate	Decel, delayed (source: I185): 0 = inactive; 1 = active

Tab. 29: Standard telegram 3: Application-specific bit in status word 1

Information

Parameter M571 Velocity reference value provides the reference value for the set velocity and actual velocity and ensures the function of the application.

6.2.2.4   **Siemens telegram 102 in AC1**

The Siemens telegram 102 (set velocity 32 bit with 1 position encoder and torque reduction) can be used in application class 1 or 4.

Structure

The mapping of the process data is specified by the controller (M512, M513).

The following tables show the structure of the telegram.

PZD no.	Data type	Name	Parameter
1	WORD	Control word 1 (STW1)	M515
2 + 3	INT32	Speed setpoint B (NSOLL_B)	M521
4	WORD	Control word 2 (STW2)	M517
5	WORD	Torque reduction (MOMRED)	M558
6	WORD	Sensor 1 control word (G1_STW)	M526

Tab. 30: Siemens telegram 102: RxPZD

PZD no.	Data type	Name	Parameter
1	WORD	Status word 1 (ZSW1)	M516
2 + 3	INT32	Speed actual value B (NIST_B)	M523
4	WORD	Status word 2 (ZSW2)	M518
5	INT16	Notification word (MELDW)	M557
6	WORD	Sensor 1 status word (G1_ZSW)	M527
7 + 8	INT32	Sensor 1 position actual value 1 (G1_XIST1)	M528
9 + 10	INT32	Sensor 1 position actual value 2 (G1_XIST2)	M529

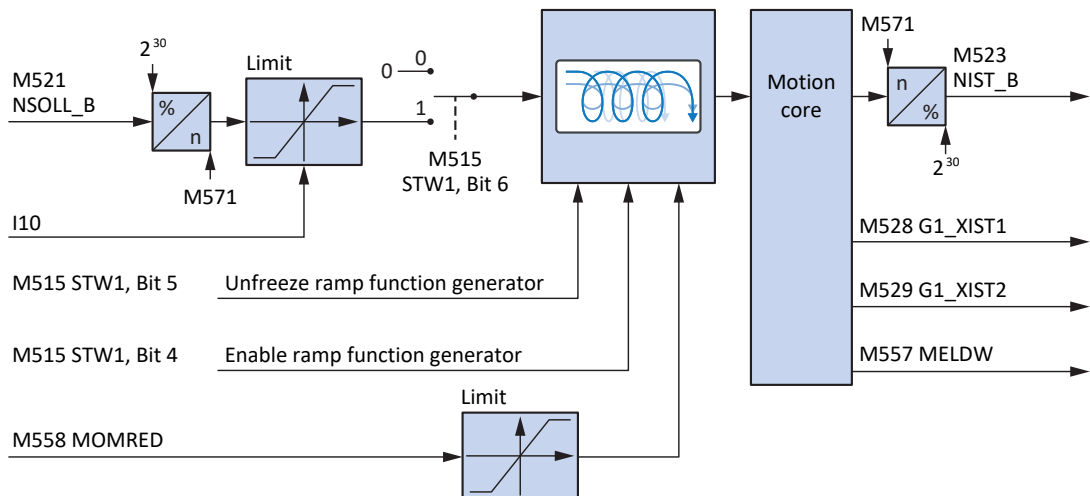Tab. 31: Siemens telegram 102: TxPZD

Input and output signals

Fig. 30: Siemens telegram 102 in AC1: Input and output signals

Control and status information

The telegram is specified by the controller in parameter M513. The active telegram is output in parameter M512. If Siemens telegram 102 is active, there is the information 102: Telegram 102.

The following application-specific bits are assigned in control word 1 M515:

Bit	Designation	Comment
4	Enable ramp generator	Activate calculation of the motion profile: 0 = velocity specification = 0; 1 = velocity specification by Speed setpoint (M521)
5	Unfreeze ramp generator	Unfreeze motion profile calculation: 0 = velocity specification = last velocity specification before freeze; 1 = velocity specification by Speed setpoint (M521)
6	Enable setpoint	Deactivate set velocity: 0 = velocity specification = 0; 1 = velocity specification by Speed setpoint (M521)
12	Open brake	Release brakes (prerequisite: F06 = 2: Parameter): ▸ F92[0] = 0: Internal (automatic): Release override 0 = brake control is automatic depending on device state and motion core; 1 = brakes release ▸ F92[0] = 1: External (plc): Brakes are controlled externally by a controller 0 = brakes engage; 1 = brakes release

Tab. 32: Standard telegram 102: Application-specific bit in control word 1

The following application-specific bits are assigned in status word 1 M516:

Bit	Designation	Comment
8	Error within tolerance range	Actual velocity within the permitted tolerance around the set velocity (source: M598): 0 = inactive; 1 = active
10	Target velocity reached	Target velocity reached (source: M596): 0 = inactive; 1 = active
13	Standstill	StndStill, standstill (source: I199): 0 = inactive; 1 = active
14	Accelerate	Accel, accelerated (source: I184): 0 = inactive; 1 = active
15	Decelerate	Decel, delayed (source: I185): 0 = inactive; 1 = active

Tab. 33: Standard telegram 102: Application-specific bit in status word 1

The following application-specific bits are assigned in status word 2 M518:

Bit	Designation	Comment
5		CmdActRelBrk, release brake active

Tab. 34: Standard telegram 102: Application-specific bit in status word 2

> **ℹ Information**
>
> Parameter M571 Velocity reference value provides the reference value for the set velocity and actual velocity and ensures the function of the application.

6.2.2.5 Presets in AC1

For application class 1 with standard telegram 1, 2 or 3, the following presets are implemented in DriveControlSuite:

Parameter	Default value
K08 Selected operating mode	2: Velocity, torque/force
D01 Command	1: MC_MoveSpeed
D30 Source main reference value	1: Parameter G462
G461 Source external velocity	4: Parameter G460
D15 Control byte fixed acceleration value	15: Fixed acceleration value 15
D17 Control byte fixed deceleration value	15: Fixed deceleration value 15
D19 Control byte fixed jerk value	15: Fixed deceleration value 15

Tab. 35: Presets in AC1: Source digital signals (application)

The presets of the parameters D15, D17 and D19 cause the maximum values from the axis model (I11, I16) to be used for the profile definition for acceleration, deceleration and jerk.

6.2.3   Application class 3 (positioning mode)

Application class 3 (AC3) is intended for position-controlled axes. In application class 3, only the higher-level technological processes run on the controller. Interpolation, position control and velocity control are implemented directly in the drive. The set value can be specified either in MDI mode (Command operating mode) or in Program mode (Motion block operating mode).
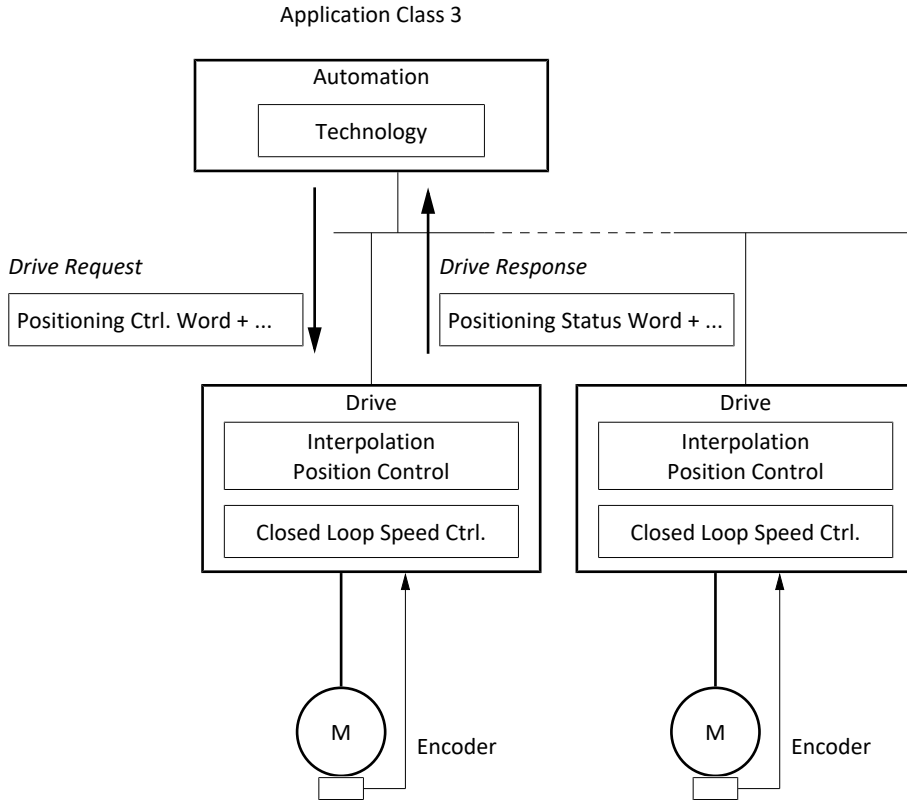
Application Class 3

Fig. 31: PROFIdrive: Application class 3 (source: PROFIdrive profile)

To control application class 3, Siemens telegram 111 is defined for PROFIdrive and implemented in the application.

6.2.3.1 Siemens telegram 111 in AC3

Siemens telegram 111 (single positioner) can be used in application class 3.

Structure

With the exception of the user-defined user area, the mapping of the process data is specified by the controller (M512, M513).

The following tables show the structure of the telegram.

PZD no.	Data type	Name	Parameter
1	WORD	Control word 1 (STW1)	M515
2	WORD	Positioning control word 1 (POS_STW1)	M550
3	WORD	Positioning control word 2 (POS_STW2)	M551
4	WORD	Control word 2 (STW2)	M517
5	INT16	Speed override (Override)	M554
6 + 7	INT32	MDI target position (MDI_TARPOS)	M530
8 + 9	INT32	MDI velocity (MDI_VELOCITY)	M531
10	INT16	MDI acceleration (MDI_ACC)	M532
11	INT16	MDI deceleration (MDI_DEC)	M533
12	WORD/ INT16	User	—

Tab. 36: Siemens telegram 111: RxPZD

PZD no.	Data type	Name	Parameter
1	WORD	Status word 1 (ZSW1)	M516
2	WORD	Positioning status word 1 (POS_ZSW1)	M552
3	WORD	Positioning status word 2 (POS_ZSW2)	M553
4	WORD	Status word 2 (ZSW2)	M518
5	INT16	Notification word (MELDW)	M557
6 + 7	INT32	Position actual value A (XIST_A)	M535
8 + 9	INT32	Speed actual value B (NIST_B)	M523
10	INT16	Fault number (FAULT_Code)	M555
11	INT16	Alarm number (WARN_Code)	M556
12	WORD/ INT16	User	Constant value 0

Tab. 37: Siemens telegram 111: TxPZD
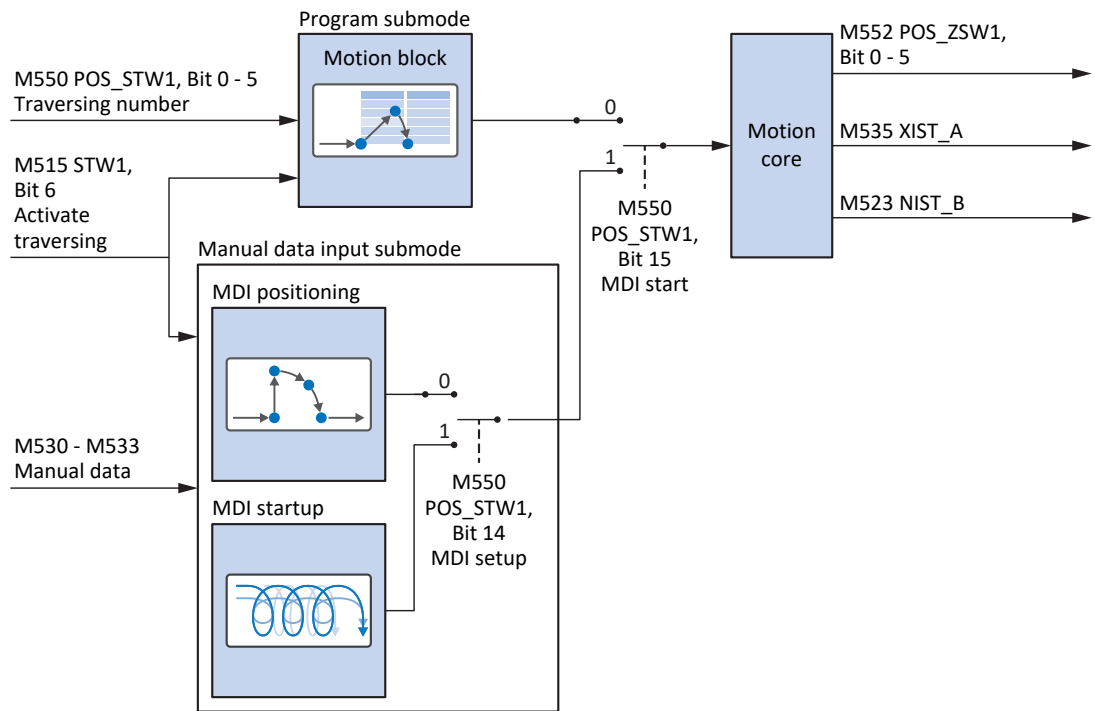
Input and output signals

Fig. 32: Siemens telegram 111 in AC3: Input and output signals

Control and status information

The telegram is specified by the controller in parameter M513. The active telegram is output in parameter M512. If Siemens telegram 111 is active, there is the information 111: Telegram 111.

The following application-specific bits are assigned in control word 1 M515:

Bit	Designation	Comment
4	Do not reject traversing task	Program submode, Do not reject motion block: 0 = cancel active motion block with quick stop; 1 = active motion block is not canceled or a new motion block can be started
5	No intermediate stop	Program submode, No intermediate stop of motion block: 0 = inactive; 1 = active; 0 → 1 = interrupt active motion block by stop; 1 → 0 = continue interrupted motion block (MC_Halt; set deceleration: I11; set jerk: I16; prerequisite: J06 = J06); 0 → 1 = continue canceled motion block (Continue; prerequisite: J917 = 2: Parameter)
6	Activate traversing	Start movement (prerequisite: M515, bit 4 = 1, I100 = 2: Parameter): 0, 1 = inactive; 0 → 1 = active
11	Start homing procedure	Start referencing, referencing type I30

Tab. 38: Standard telegram 111: Application-specific bit in control word 1

The following application-specific bits are assigned in status word 1 M516:

Bit	Designation	Comment
8	No follow error	NoFlwErr, lag within tolerance (source: M598): 0 = inactive; 1 = active
10	Target position reached	TargPos, target position reached (source: M596): 0 = inactive; 1 = active
11	Home position set	RefPSet, in reference (source: M595): 0 = inactive; 1 = active
12	Traversing task acknowledge	TrvTskAck, Execute signal is active and motion command is not finished (source: M594): 0 = inactive; 1 = active
13	Standstill	StndStill, standstill (source: I199): 0 = inactive; 1 = active
14	Accelerate	Accel, accelerated (source: I184): 0 = inactive; 1 = active
15	Decelerate	Decel, delayed (source: I185): 0 = inactive; 1 = active

Tab. 39: Standard telegram 111: Application-specific bit in status word 1

The following application-specific bits are assigned in status word 2 M518:

Bit	Designation	Comment
5		CmdActRelBrk, release brake active

Tab. 40: Standard telegram 111: Application-specific bit in status word 2

6.2.3.2 Operating modes in AC3

The set value in application class 3 with Siemens telegram 111 can be specified either in Program mode or in MDI mode.

The mode is specified by the controller in positioning control word 1 (POS_STW1) in parameter M550. If bit 15 is set to the value 0, the motion block operating mode is activated at the application level. Bit 15 must be set to the value 1 for command operating mode.

Bit	Designation	Comment
15	MDI start	MdiStart, Specification operating mode: 0 = Program mode (motion block operating mode); 1 = MDI mode (command operating mode)

Tab. 41: Specification operating mode: Bit 15 in positioning control word 1

The active operating mode is output in the parameter K09.

For more information on parameterizing the motion block and command operating modes in drive-based applications using DriveControlSuite, refer to the documentation for the Drive Based application (see Further information).

6.2.3.3 Presets in AC3

For application class 3 with Siemens telegram 111, the following presets for the Program mode are implemented in DriveControlSuite:

Parameter	Default value
J03 Source motion block selection	1: Parameter J02

Tab. 42: Presets in AC3: Source selection motion block

6.2.3.4 **Application class AC3 according to PROFIdrive – Commands**

In application class 3 with Siemens telegram 111, special motion commands are used that are based on the PLCopen standard and supplemented by two manufacturer-specific motion commands (MC_DoNothing and MC_MoveSpeed). Any motion command – except MC_Stop – can be overwritten during execution.

In order to execute a command, the drive controller must not be in the Switch on disabled device state.

Settings (Program mode)	Command	Feature	Control type	Necessary motion variables
M550, bit 15 = 0 + J11 (selection of the command)	0: MC_DoNothing	—	—	—
	1: MC_MoveAbsolute	Axis moves to an absolute set position (referencing necessary)	Position	▸ Position ▸ Velocity, override ▸ Acceleration ▸ Deceleration ▸ Jerk
	2: MC_MoveRelative	Axis moves a relative distance; set position is relative to the actual position at the start of the command	Position	▸ Position ▸ Velocity, override ▸ Acceleration ▸ Deceleration ▸ Jerk
	3: MC_MoveAdditive	Axis moves a relative distance; set position is relative to the set position of the previous motion command	Position	▸ Position ▸ Velocity, override ▸ Acceleration ▸ Deceleration ▸ Jerk
	4: MC_MoveVelocity	Axis moves without end with set velocity (with position control)	Position	▸ Velocity, override ▸ Acceleration ▸ Deceleration ▸ Jerk
	5: MC_Stop	Axis is brought to a standstill; next command can be executed after standstill	Velocity	▸ Deceleration ▸ Jerk
	6: MC_Home	Axis is referenced	Depending on the selected referencing type	▸ Velocity, override ▸ Acceleration ▸ Deceleration ▸ Jerk ▸ Torque/force

Settings (Program mode)	Command	Feature	Control type	Necessary motion variables
	8: MC_MoveSpeed	Axis moves without end with set velocity (without position control)	Velocity	▸ Velocity, override ▸ Acceleration ▸ Deceleration ▸ Jerk
	9: MC_TorqueControl	Axis moves without end with set torque/force	Torque/force	Torque/force
	11: MC_Halt	Axis is stopped; next command can be executed before standstill	Velocity	▸ Deceleration ▸ Jerk

Tab. 43: Comparison of AC3 with Siemens telegram 111 (Program mode) with the PLCopen-based commands

Settings (MDI mode)	Command	Feature	Control type	Necessary motion variables
M550, bit 8 = 1 + bit 15 = 1	1: MC_MoveAbsolute	Axis moves to an absolute set position (referencing necessary)	Position	▸ Position ▸ Velocity, override ▸ Acceleration ▸ Deceleration ▸ Jerk
M550, bit 8 = 0 + bit 15 = 1	2: MC_MoveRelative	Axis moves a relative distance; set position is relative to the actual position at the start of the command	Position	▸ Position ▸ Velocity, override ▸ Acceleration ▸ Deceleration ▸ Jerk
M550, bit 14 = 1 + bit 15 = 1	4: MC_MoveVelocity	Axis moves without end with set velocity (with position control)	Position	▸ Velocity, override ▸ Acceleration ▸ Deceleration ▸ Jerk
M550, bit 15 = 1 + bit 11 = 1 (Start homing procedure)	6: MC_Home	Axis is referenced	Depending on the selected referencing type	▸ Velocity, override ▸ Acceleration ▸ Deceleration ▸ Jerk ▸ Torque/force

Tab. 44: Comparison of AC3 with Siemens telegram 111 (MDI mode) with the PLCopen-based commands

For detailed information on the motion commands, refer to the associated manual (see Further information [📖 161]).

6.2.4 Application class 4 (central motion control)

Application class 4 (AC4) is intended for velocity-controlled axes. This application class defines a set velocity interface with a process of velocity control on the drive and position control in the controller. The position control loop is closed via the bus. For optimal interaction, the controller and drives are synchronized via PROFINET IRT. This enables robotics and machine tool applications with coordinated motion sequences of multiple drives.
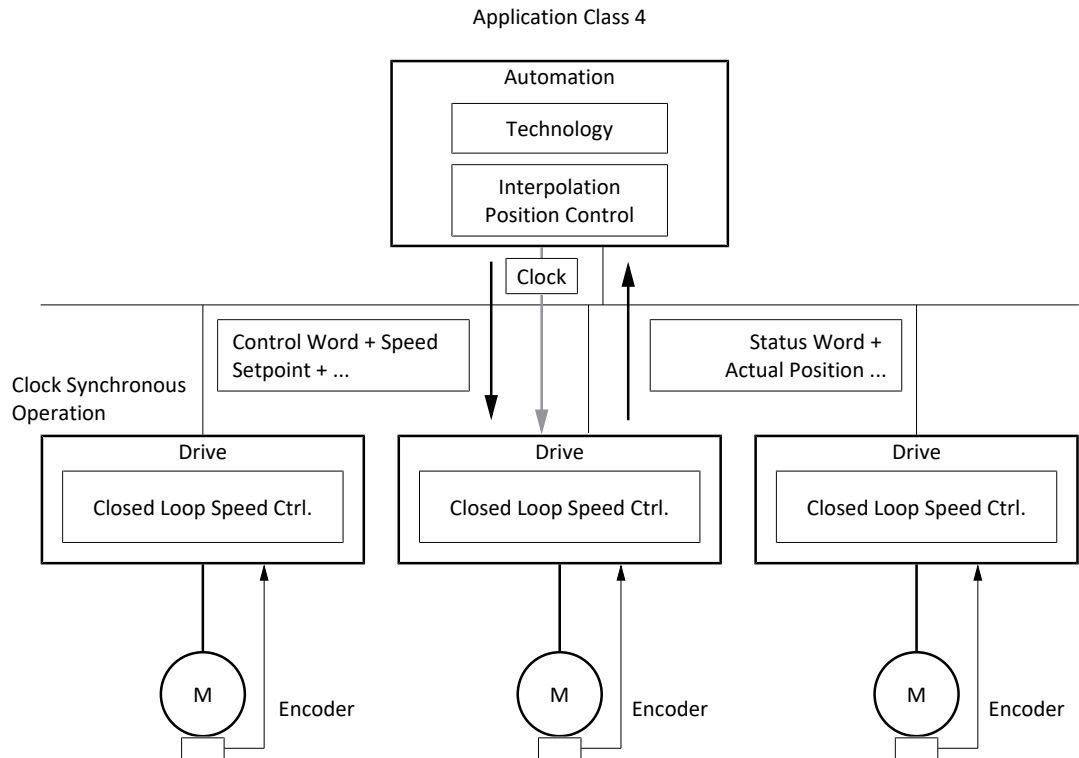
Fig. 33: PROFIdrive: Application class 4 (source: PROFIdrive profile)

To control application class 4, the standard telegrams 3 and 5 as well as Siemens telegrams 102 and 105 are defined for PROFIdrive and implemented in the application.

6.2.4.1 Standard telegram 3 in AC4

The standard telegram 3 (set velocity 32 bit with 1 position encoder) can be used in application class 1 or 4.

Structure

The mapping of the process data is specified by the controller (M512, M513).

The following tables show the structure of the telegram.

PZD no.	Data type	Name	Parameter
1	WORD	Control word 1 (STW1)	M515
2 + 3	INT32	Speed setpoint B (NSOLL_B)	M521
4	WORD	Control word 2 (STW2)	M517
5	WORD	Sensor 1 control word (G1_STW)	M526

Tab. 45: Standard telegram 3: RxPZD

PZD no.	Data type	Name	Parameter
1	WORD	Status word 1 (ZSW1)	M516
2 + 3	INT32	Speed actual value B (NIST_B)	M523
4	WORD	Status word 2 (ZSW2)	M518
5	WORD	Sensor 1 status word (G1_ZSW)	M527
6 +7	INT32	Sensor 1 position actual value 1 (G1_XIST1)	M528
8 + 9	INT32	Sensor 1 position actual value 2 (G1_XIST2)	M529

Tab. 46: Standard telegram 3: TxPZD
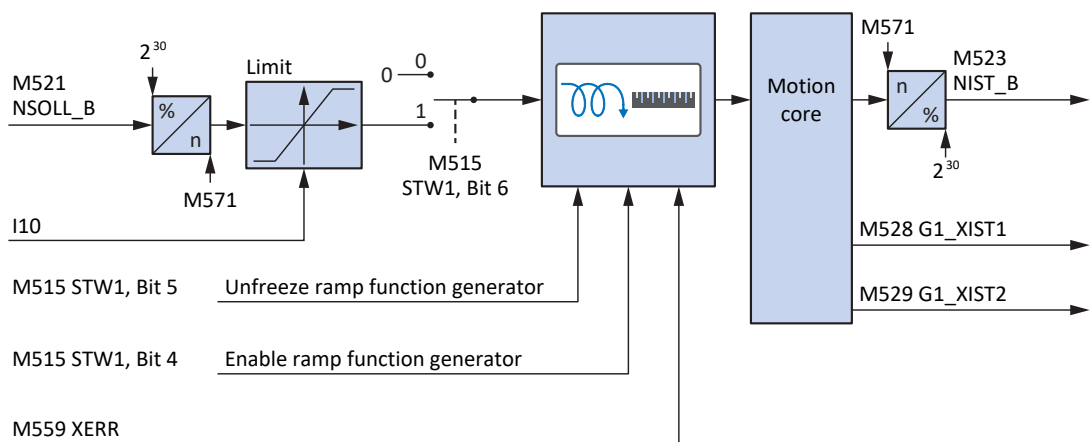
Input and output signals
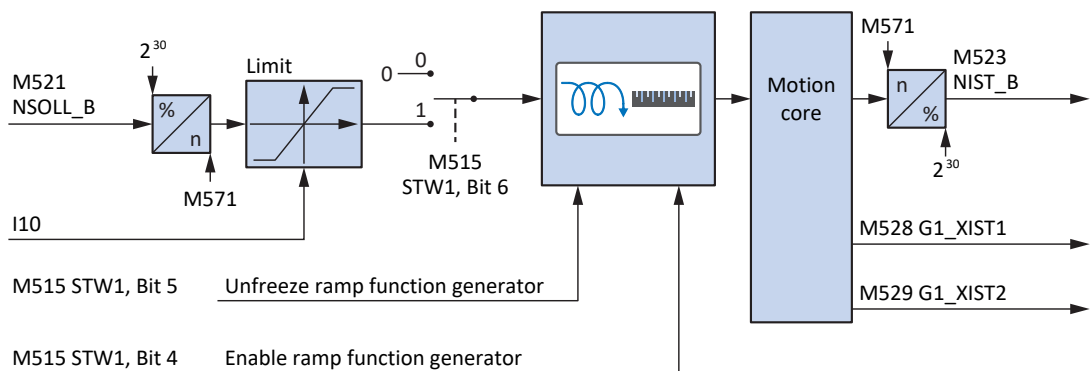
Fig. 34: Standard telegram 3 in AC4: Input and output signals

Control and status information

The telegram is specified by the controller in parameter M513. The active telegram is output in parameter M512. If standard telegram 3 is active, the information 3: Standard telegram 3 is displayed there.

The following application-specific bits are assigned in control word 1 M515:

Bit	Designation	Comment
4	Enable ramp generator	Activate calculation of the motion profile: 0 = velocity specification = 0; 1 = velocity specification by Speed setpoint (M521)
5	Unfreeze ramp generator	Unfreeze motion profile calculation: 0 = velocity specification = last velocity specification before freeze; 1 = velocity specification by Speed setpoint (M521)
6	Enable setpoint	Deactivate set velocity: 0 = velocity specification = 0; 1 = velocity specification by Speed setpoint (M521)
12	Open brake	Release brakes (prerequisite: F06 = 2: Parameter): ▸ F92[0] = 0: Internal (automatic): Release override 0 = brake control is automatic depending on device state and motion core; 1 = brakes release ▸ F92[0] = 1: External (plc): Brakes are controlled externally by a controller 0 = brakes engage; 1 = brakes release

Tab. 47: Standard telegram 3: Application-specific bit in control word 1

The following application-specific bits are assigned in status word 1 M516:

Bit	Designation	Comment
8	Error within tolerance range	Actual velocity within the permitted tolerance around the set velocity (source: M598): 0 = inactive; 1 = active
10	Target velocity reached	Target velocity reached (source: M596): 0 = inactive; 1 = active
12		Brake control status
13	Standstill	StndStill, standstill (source: I199): 0 = inactive; 1 = active
14	Accelerate	Accel, accelerated (source: I184): 0 = inactive; 1 = active
15	Decelerate	Decel, delayed (source: I185): 0 = inactive; 1 = active

Tab. 48: Standard telegram 3: Application-specific bit in status word 1

> **Information**
>
> Parameter M571 Velocity reference value provides the reference value for the set velocity and actual velocity and ensures the function of the application.

6.2.4.2   **Standard telegram 5 in AC4**

The standard telegram 5 (set velocity 32 bit with 1 position encoder and Dynamic Servo Control) requires application class 4.

Structure

The mapping of the process data is specified by the controller (M512, M513).

The following tables show the structure of the telegram.

PZD no.	Data type	Name	Parameter
1	WORD	Control word 1 (STW1)	M515
2 + 3	INT32	Speed setpoint B (NSOLL_B)	M521
4	WORD	Control word 2 (STW2)	M517
5	WORD	Sensor 1 control word (G1_STW)	M526
6 +7	INT32	Position deviation (XERR)	M559
8 + 9	INT32	Position controller proportional coefficient (KPC)	M560

Tab. 49: Standard telegram 5: RxPZD

PZD no.	Data type	Name	Parameter
1	WORD	Status word 1 (ZSW1)	M516
2 + 3	INT32	Speed actual value B (NIST_B)	M523
4	WORD	Status word 2 (ZSW2)	M518
5	WORD	Sensor 1 status word (G1_ZSW)	M527
6 +7	INT32	Sensor 1 position actual value 1 (G1_XIST1)	M528
8 + 9	INT32	Sensor 1 position actual value 2 (G1_XIST2)	M529

Tab. 50: Standard telegram 5: TxPZD
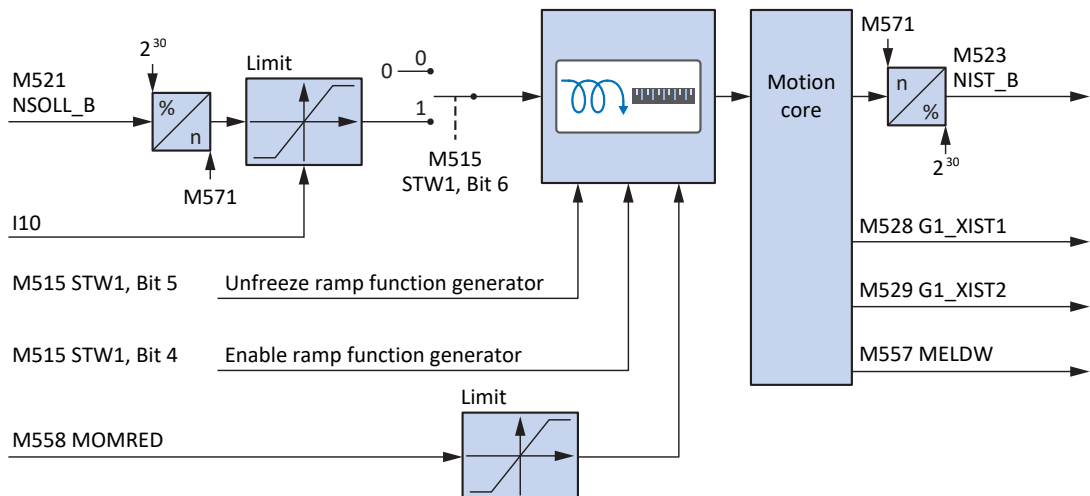
Input and output signals

Fig. 35: Standard telegram 5 in AC4: Input and output signals

Control and status information

The telegram is specified by the controller in parameter M513. The active telegram is output in parameter M512. If standard telegram 5 is active, the information 5: Standard telegram 5 is displayed there.

The following application-specific bits are assigned in control word 1 M515:

Bit	Designation	Comment
4	Enable ramp generator	Activate calculation of the motion profile: 0 = velocity specification = 0; 1 = velocity specification by Speed setpoint (M521)
5	Unfreeze ramp generator	Unfreeze motion profile calculation: 0 = velocity specification = last velocity specification before freeze; 1 = velocity specification by Speed setpoint (M521)
6	Enable setpoint	Deactivate set velocity: 0 = velocity specification = 0; 1 = velocity specification by Speed setpoint (M521)
12	Open brake	Release brakes (prerequisite: F06 = 2: Parameter): ▸ F92[0] = 0: Internal (automatic): Release override 0 = brake control is automatic depending on device state and motion core; 1 = brakes release ▸ F92[0] = 1: External (plc): Brakes are controlled externally by a controller 0 = brakes engage; 1 = brakes release

Tab. 51: Standard telegram 5: Application-specific bit in control word 1

The following application-specific bits are assigned in status word 1 M516:

Bit	Designation	Comment
8	Error within tolerance range	Actual velocity within the permitted tolerance around the set velocity (source: M598): 0 = inactive; 1 = active
10	Target velocity reached	Target velocity reached (source: M596): 0 = inactive; 1 = active
12		Brake control status
13	Standstill	StndStill, standstill (source: I199): 0 = inactive; 1 = active
14	Accelerate	Accel, accelerated (source: I184): 0 = inactive; 1 = active
15	Decelerate	Decel, delayed (source: I185): 0 = inactive; 1 = active

Tab. 52: Standard telegram 5: Application-specific bit in status word 1

> **Information**
>
> Parameter M571 Velocity reference value provides the reference value for the set velocity and actual velocity and ensures the function of the application.

6.2.4.3 **Siemens telegram 102 in AC4**

The Siemens telegram 102 (set velocity 32 bit with 1 position encoder and torque reduction) can be used in application class 1 or 4.

Structure

The mapping of the process data is specified by the controller (M512, M513).

The following tables show the structure of the telegram.

PZD no.	Data type	Name	Parameter
1	WORD	Control word 1 (STW1)	M515
2 + 3	INT32	Speed setpoint B (NSOLL_B)	M521
4	WORD	Control word 2 (STW2)	M517
5	WORD	Torque reduction (MOMRED)	M558
6	WORD	Sensor 1 control word (G1_STW)	M526

Tab. 53: Siemens telegram 102: RxPZD

PZD no.	Data type	Name	Parameter
1	WORD	Status word 1 (ZSW1)	M516
2 + 3	INT32	Speed actual value B (NIST_B)	M523
4	WORD	Status word 2 (ZSW2)	M518
5	INT16	Notification word (MELDW)	M557
6	WORD	Sensor 1 status word (G1_ZSW)	M527
7 + 8	INT32	Sensor 1 position actual value 1 (G1_XIST1)	M528
9 + 10	INT32	Sensor 1 position actual value 2 (G1_XIST2)	M529

Tab. 54: Siemens telegram 102: TxPZD
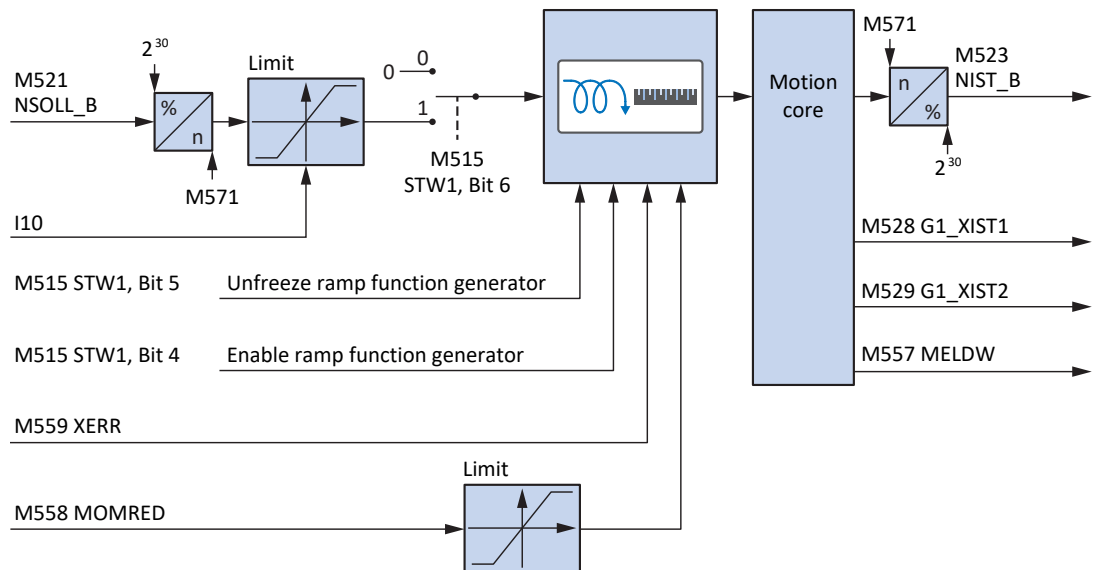
Input and output signals

Fig. 36: Siemens telegram 102 in AC4: Input and output signals

Control and status information

The telegram is specified by the controller in parameter M513. The active telegram is output in parameter M512. If Siemens telegram 102 is active, there is the information 102: Telegram 102.

The following application-specific bits are assigned in control word 1 M515:

Bit	Designation	Comment
4	Enable ramp generator	Activate calculation of the motion profile: 0 = velocity specification = 0; 1 = velocity specification by Speed setpoint (M521)
5	Unfreeze ramp generator	Unfreeze motion profile calculation: 0 = velocity specification = last velocity specification before freeze; 1 = velocity specification by Speed setpoint (M521)
6	Enable setpoint	Deactivate set velocity: 0 = velocity specification = 0; 1 = velocity specification by Speed setpoint (M521)
12	Open brake	Release brakes (prerequisite: F06 = 2: Parameter): ▸ F92[0] = 0: Internal (automatic): Release override 0 = brake control is automatic depending on device state and motion core; 1 = brakes release ▸ F92[0] = 1: External (plc): Brakes are controlled externally by a controller 0 = brakes engage; 1 = brakes release

Tab. 55: Standard telegram 102: Application-specific bit in control word 1

The following application-specific bits are assigned in status word 1 M516:

Bit	Designation	Comment
8	Error within tolerance range	Actual velocity within the permitted tolerance around the set velocity (source: M598): 0 = inactive; 1 = active
10	Target velocity reached	Target velocity reached (source: M596): 0 = inactive; 1 = active
13	Standstill	StndStill, standstill (source: I199): 0 = inactive; 1 = active
14	Accelerate	Accel, accelerated (source: I184): 0 = inactive; 1 = active
15	Decelerate	Decel, delayed (source: I185): 0 = inactive; 1 = active

Tab. 56: Standard telegram 102: Application-specific bit in status word 1

The following application-specific bits are assigned in status word 2 M518:

Bit	Designation	Comment
5		CmdActRelBrk, release brake active

Tab. 57: Standard telegram 102: Application-specific bit in status word 2

> **ℹ Information**
>
> Parameter M571 Velocity reference value provides the reference value for the set velocity and actual velocity and ensures the function of the application.

6.2.4.4   Siemens telegram 105 in AC4

Siemens telegram 105 (set velocity 32 bit with 1 position encoder, torque reduction and Dynamic Servo Control) requires application class 4.

Structure

The mapping of the process data is specified by the controller (M512, M513).

The following tables show the structure of the telegram.

PZD no.	Data type	Name	Parameter
1	WORD	Control word 1 (STW1)	M515
2 + 3	INT32	Speed setpoint B (NSOLL_B)	M521
4	WORD	Control word 2 (STW2)	M517
5	WORD	Torque reduction (MOMRED)	M558
6	WORD	Sensor 1 control word (G1_STW)	M526
7 + 8	INT32	Position deviation (XERR)	M559
9 + 10	INT32	Position controller proportional coefficient (KPC)	M560

Tab. 58: Siemens telegram 105: RxPZD

PZD no.	Data type	Name	Parameter
1	WORD	Status word 1 (ZSW1)	M516
2 + 3	INT32	Speed actual value B (NIST_B)	M523
4	WORD	Status word 2 (ZSW2)	M518
5	INT16	Notification word (MELDW)	M557
6	WORD	Sensor 1 status word (G1_ZSW)	M527
7 + 8	INT32	Sensor 1 position actual value 1 (G1_XIST1)	M528
9 + 10	INT32	Sensor 1 position actual value 2 (G1_XIST2)	M529

Tab. 59: Siemens telegram 105: TxPZD

Input and output signals

Fig. 37: Siemens telegram 105 in AC4: Input and output signals

Control and status information

The telegram is specified by the controller in parameter M513. The active telegram is output in parameter M512. If Siemens telegram 105 is active, there is the information 105: Telegram 105.

The following application-specific bits are assigned in control word 1 M515:

Bit	Designation	Comment
4	Enable ramp generator	Activate calculation of the motion profile: 0 = velocity specification = 0; 1 = velocity specification by Speed setpoint (M521)
5	Unfreeze ramp generator	Unfreeze motion profile calculation: 0 = velocity specification = last velocity specification before freeze; 1 = velocity specification by Speed setpoint (M521)
6	Enable setpoint	Deactivate set velocity: 0 = velocity specification = 0; 1 = velocity specification by Speed setpoint (M521)
12	Open brake	Release brakes (prerequisite: F06 = 2: Parameter): ▸ F92[0] = 0: Internal (automatic): Release override 0 = brake control is automatic depending on device state and motion core; 1 = brakes release ▸ F92[0] = 1: External (plc): Brakes are controlled externally by a controller 0 = brakes engage; 1 = brakes release

Tab. 60: Standard telegram 105: Application-specific bit in control word 1

The following application-specific bits are assigned in status word 1 M516:

Bit	Designation	Comment
8	Error within tolerance range	Actual velocity within the permitted tolerance around the set velocity (source: M598): 0 = inactive; 1 = active
10	Target velocity reached	Target velocity reached (source: M596): 0 = inactive; 1 = active
13	Standstill	StndStill, standstill (source: I199): 0 = inactive; 1 = active
14	Accelerate	Accel, accelerated (source: I184): 0 = inactive; 1 = active
15	Decelerate	Decel, delayed (source: I185): 0 = inactive; 1 = active

Tab. 61: Standard telegram 105: Application-specific bit in status word 1

The following application-specific bits are assigned in status word 2 M518:

Bit	Designation	Comment
5		CmdActRelBrk, release brake active

Tab. 62: Standard telegram 105: Application-specific bit in status word 2

> **Information**
>
> Parameter M571 Velocity reference value provides the reference value for the set velocity and actual velocity and ensures the function of the application.

6.2.4.5 Dynamic Servo Control in AC4

The Dynamic Servo Control (DSC) concept for increasing dynamic control performance is part of the PROFIdrive profile. It requires application class 4 and transmits the proportional coefficient of the position controller (KPC) and the position deviation (XERR) in addition to the velocity feedforward control. This data is used to calculate the position control in the drive. The interpolation of the set position is still done in the controller. The function improves the dynamic behavior of the position control loop by minimizing the delays that normally occur with a set velocity interface.

6.2.5 Additional telegrams

Siemens additional telegram 750

Siemens additional telegram 750 can be projected in addition to a standard telegram or Siemens telegram. It provides additional process data for torque feedforward control via additive torque and for different torque limits in the positive and negative direction. The combination of standard telegram 3 or 5 with additional telegram 750, for example, offers a greater range of functions compared to Siemens telegram 102 or 105.

The mapping of the process data is specified by the controller (M512, M513).

The following tables show the structure of the telegram.

PZD no.	Data type	Name	Parameters
1 + 2	WORD	Couple supplémentaire (M_ADD1)	M562
3 + 4	WORD	Maximum positive torque (M_LIMIT_POS)	M563
5 + 6	WORD	Maximum negative torque (M_LIMIT_NEG)	M564

Tab. 63: Siemens additional telegram 750: RxPZD

PZD no.	Data type	Name	Parameters
1 + 2	WORD	Actual torque (M_ACT)	M561

Tab. 64: Siemens additional telegram 750: TxPZD

Additional telegram 900

You can use additional telegram 900 for free assignment of further process data in all application classes.

> **Information**
>
> If you project additional telegram 900, define the additional process data that is to be transferred to the controller in DriveControlSuite via the parameters A92 (RxPZD) and A96 (TxPZD). Elements [0] to [11] are used for axis A parameters and elements [12] to [23] for axis B parameters. A data length of 12 bytes each is available for the receive and transmit process data.

6.3 Axis model

With the help of the axis model, you map the real mechanical environment of your drive project in DriveControlSuite by parameterizing the axis type and the arrangement of existing encoders. The parameterization of the axis model is required for the smooth operation and easy diagnosis of your drive train.

With I05 Type of axis, you select a rotational or a translational axis model and define whether the scaling of the axis is done using either predefined or individually configured units of measure. With I00 Position range, you parameterize either an endless or a limited travel range. You parameterize the encoder arrangement by using B26 Motor encoder and I02 Position encoder.

The 6th generation of Pilz drive controllers are specially developed for communication between the drive controller and controller on the basis of the actual variables at the output (° or mm of real axis movement). The scaling of the axis model is calculated by the drive controller's firmware independently of the encoder model, without any rounding errors or drift.

If your axis model is not followed by any other gear ratios, you can operate the axis with output-side motion variables where all nominal and actual values correspond to the real axis movement.

> **Information**
>
> The firmware processes values for the motion variables velocity, acceleration and jerk in the data type REAL32 (floating-point number, 32 bits). Position values are processed in the INT32 data type (integer, 32 bits) to eliminate rounding errors and enable precise movements.

Abbreviation	Meaning
M	Motor
MEnc	Motor Encoder
PEnc	Position Encoder

Rotational axis models

The following figures each show a rotational axis model consisting of a motor, a gearbox and a rotary table (endless rotational) or a pointer (limited rotational). Rotational axis models support rotational motor encoders as well as rotational position encoders.
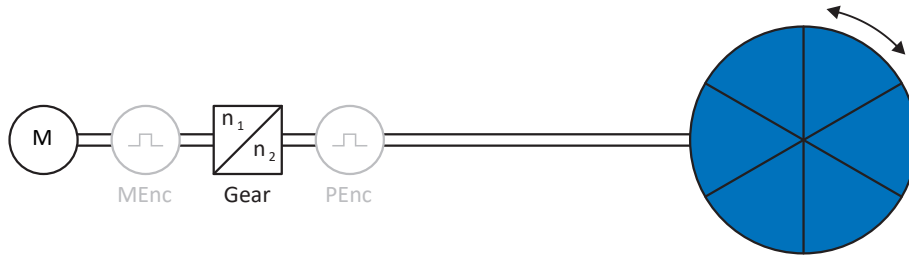
Fig. 38: Endless-rotational motion: Rotary table
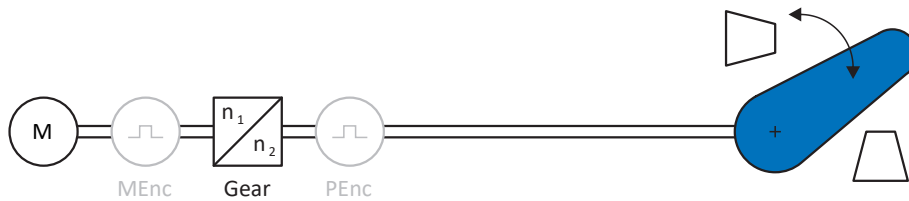
Fig. 39: Limited-rotational motion: Pointer

Translational axis models

The following figures each show a translational axis model consisting of a motor, gearbox, feed and conveyor belt (endless translational) or tool slide (limited translational). Translational axis models support rotational motor encoders as well as rotational or translational position encoders.
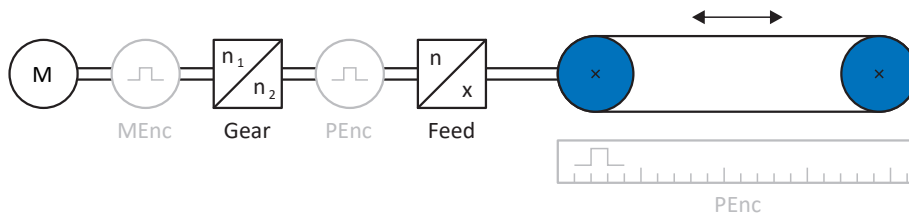
Fig. 40: Endless translational motion: Conveyor belt
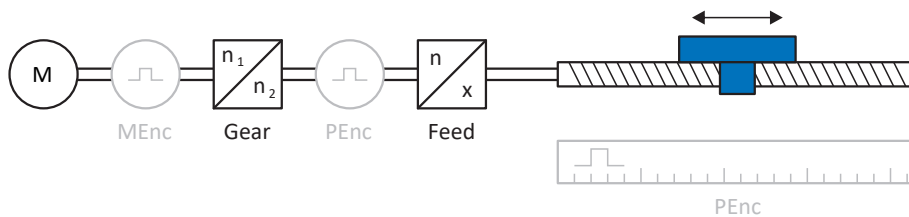
Fig. 41: Limited translational motion: Tool slide

Translational axis model: Linear motor

The following figure shows a limited translation axis model using the example of a linear motor. Linear motors only support translational motor encoders and translational position encoders.

LinM

MEnc/PEnc
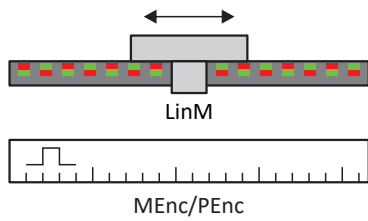
Fig. 42: Limited translational motion: Linear motor

Encoder arrangement

You parameterize the encoder arrangement by using B26 Motor encoder and I02 Position encoder. The motor encoder for velocity control is located on the motor shaft. The position encoder for position control is located on the gearbox output. If you use only one of the two encoders, it will be used for both velocity and position control.

Encoder	Parameterization	Encoder arrangement
Motor encoder	B26 ≠ 0: Inactive I02 = 0: Motor encoder	
Position encoder	B26 ≠ 0: Inactive I02 = B26	
Motor encoder & position encoder	B26 ≠ 0: Inactive I02 ≠ B26	

6.4 Limit switches

Limit switches are sensors that detect when a certain position has been reached.

A distinction is made here between hardware limit switches and software limit switches. While a hardware limit switch is a real switch (hardware), a software limit switch refers to the position limiting or position monitoring implemented in the software.

There are hardware and software limit switches on real axes, while virtual masters only have software limit switches.

Behavior in jog mode, reaching the +/- 31 bit computing limit and simultaneous triggering of positive and negative limit switches are special cases.

6.4.1 Real axes

There are hardware and software limit switches on real axes.

6.4.1.1 Faults

If a hardware limit switch is overshot, a fault is triggered immediately.

If a software limit switch is overshot, a fault is triggered if the following applies:

▶ For a positive software limit switch: actual position > limit switch position + I22

▶ For a negative software limit switch: actual position < limit switch position + I22

Faults

53: Limit switch

Causes

▶ 1: Hardware-Limit-Switch positive

▶ 2: Hardware-Limit-Switch negative

▶ 3: SW-limit switch positive

▶ 4: SW-limit switch negative

▶ 5: +/- 31 bit computing limit reached

▶ 6: Linear motor moving range

▶ 7: Both limit switches not connected

The fault can be acknowledged. Note that movement is only possible in the opposite direction of the limit switch, since the direction of the triggered hardware or software limit switch is locked. A direction lock is displayed in parameter I196.

A fault can be triggered again when the direction lock is no longer active.

6.4.1.2   **Denial**

If the axis is at a hardware limit switch (I441 or I442 = High) or if it is beyond of the software limit switch, movement is denied in the locked direction.

A direction lock is displayed in parameter I196. The direction lock is deactivated if the following applies:

▸ For a positive software limit switch: actual position < limit switch position − I22

▸ For a negative software limit switch: actual position > limit switch position + I22

When the direction lock is active, parameter I91 Error = 1: Active.

The cause is output in parameter I90.

Possible causes are:

▸ 1: Illegal direction

▸ 2: SW-limit switch positive

▸ 3: SW-limit switch negative

▸ 10: Denied because position is not in circular length

▸ 11: HW-limit switch positive

▸ 12: HW-limit switch negative

> **ℹ Information**
>
> There are no software limit switches for an infinite axis, since this would contradict the nature of an infinite axis.

A movement limitation is also displayed in parameter E80:

▸ If E80 = 20: Limit switch, check the parameterization and the connection of the limit switches.

▸ If E80 = 15: Illegal direction, check the set values and a possible direction lock in parameter I196.

Also check I196 if the permitted direction was limited with I04.

> **ℹ Information**
>
> Parameter I04 is only available for infinite axes.

6.4.1.3 Hardware limit switches

Hardware limit switches apply if your sources are defined in parameters I101 and I102.

Relevant parameters

- ▸ I101 Source positive /limit switch
- ▸ I102 Source negative /limit switch
- ▸ I441 Signal /HW limit switch positive
- ▸ I442 Signal /HW limit switch negative
- ▸ I805 Actual value HW-Limit switch positive
- ▸ I806 Actual value HW-Limit switch negative
- ▸ I52 Delete limit switch memory
- ▸ I196 Direction blocking

If I441 and I442 = 0: Inactive, fault 53 is triggered with cause 7: Both limit switches not connected. Therefore, after parameterizing I101 and I102, check whether the hardware limit switches are also connected physically.

If I101 and I102 = 2: Parameter, the fault is triggered by the control word of the application (I210). In this case, check the controller connection.

Passable hardware limit switches

The hardware limit switches can be passed over. It is therefore possible to use an infinite cam as a hardware limit switch. The limit switch is detected if the signal goes to 0: Inactive (parameters I441 and I442).

If the hardware limit switch is overshot, the position at which the limit switch was detected is saved. When resetting limit switches, the axis must have reached or passed back over this saved position before the signal is valid again.
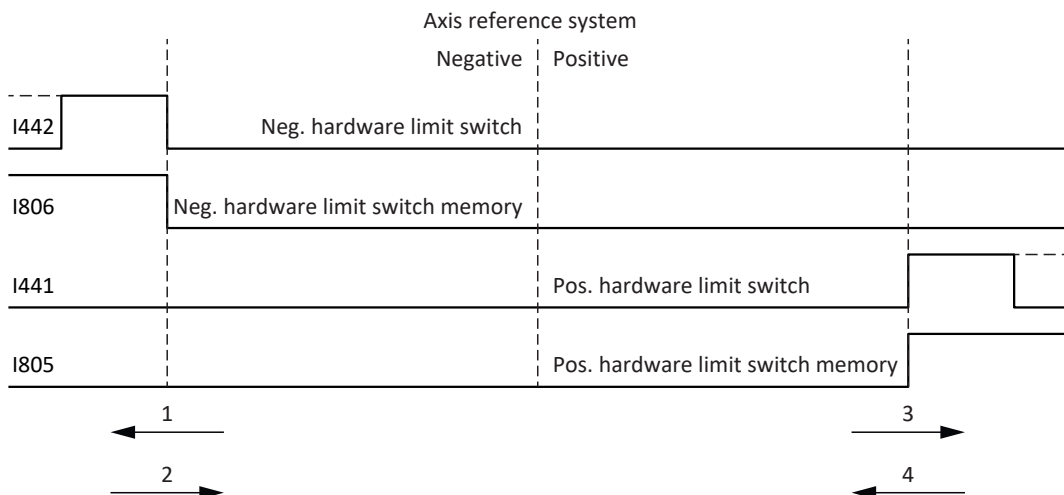
Fig. 43: Hardware limit switch memory

1	Setting the memory (negative hardware limit switch) with rising edge
2	Resetting the memory (negative hardware limit switch) with falling edge
3	Setting the memory (positive hardware limit switch) with rising edge
4	Resetting the memory (positive hardware limit switch) with falling edge

> **ℹ Information**
>
> The passable hardware limit switch is no longer effective once the position at which the edge of the limit switch was detected has been passed over again.

Note that the positions are not saved in non-volatile memory. This means that if the axis is beyond a passable limit switch after activation, it must first be reset to the regular travel range.

The entire system is simpler if you do not use any passable limit switches.

During commissioning or in case of defective hardware limit switch connections, problems can arise with the saved positions. These can be deleted with parameter I52. However, deletion only takes place if the corresponding limit switch signal is inactive. Stored positions can also be deleted by referencing, setting a reference can be deleted using I452 or by restarting the drive controller.

During referencing, the hardware limit switches are not evaluated as limit switches. There are referencing methods in which the hardware limit switches are used for referencing.

Example

A positive limit switch ranges from position 100 to 120.
When moving in the positive direction, it is detected at 100.
On the return journey, due to tolerances, it can be the case that the limit switch has already been left at 101.
Despite this, position 100 must be undershot in order to leave the effective limit switch.

6.4.1.4 Hardware limit switches when referencing

Hardware limit switches assume a special position when referencing.

Limit switch as reference switch

The hardware limit switches can be used in place of a reference switch (I30 = 2: Limit switch).

Change of direction

In other referencing types, a hardware limit switch signal leads to a change of direction. However, the signal only causes a change if it matches the direction of travel.

If the detected hardware limit switch does not match the direction of travel (e.g. negative limit switch with positive direction of travel), a fault is then triggered.

Example

At the start of referencing, the axis is between the reference switch and positive limit switch. The referencing direction is positive. The axis moves in the positive direction and first encounters the positive limit switch, not the reference switch. The axis reverses and searches for the reference switch in the other direction.

6.4.1.5 Software limit switches

Software limit switches only apply if the axis has been referenced.

Only limited axes have software limit switches (I00 = 0: Limited).

Relevant parameters

▸ I50 Software stop positive

▸ I51 Software stop negative

▸ I196 Direction blocking

If the values defined in parameter I50 and parameter I51 are the same, the software limit switches are deactivated.

6.4.1.6 Software limit switches when referencing

Software limit switches are not evaluated when referencing.

6.4.1.7 Shutting down by the limit switch

If a hardware limit switch is approached from the permitted travel range, a fault is immediately triggered after detecting the limit switch edge.

If a software limit switch is approached from the permissible travel range, a fault is triggered if the following applies:

▸ For a positive software limit switch: actual position > limit switch position + I22

▸ For a negative software limit switch: actual position < limit switch position + I22

If the current position is on or beyond the limit switch, a fault can be triggered again when the direction lock is no longer active (I196).

6.4.2 Special cases

A few special cases are described below.

6.4.2.1 Behavior in jog mode

> ⚠️ **DANGER!**
>
> **Risk of fatal injury due to gravity-loaded vertical axis!**
>
> If you select 0: Velocity control as the control type for jog mode, a gravity-loaded vertical axis descends as soon as jog mode is activated via the control panel or application (parameter I26).
>
> - Only use the 0: Velocity control control type with axes that do not have a gravity load.

The jog behavior depends on the control type selected for jog mode (I26).

I26 = 0: Velocity control:
As soon as the axis moves to a software limit switch, a quick stop is triggered instead of a fault. As a result, the axis does not stop precisely on the software limit switch, but shortly thereafter depending on the quick stop ramp. It can immediately be shut down again by the software limit switch. The "incorrect" direction is locked.

I26 = 1: Position control:
The axis is braked during jog mode (with jog deceleration and jog jerk) in such a way that the axis comes to a stop shortly before the software limit switch and does not overrun it.

6.4.2.2 Reaching the +/- 31 bit computing limit

Fault:
53: Limit switch

Cause:
5: +/- 31 bit computing limit reached

The computing limit can be reached if, for example, so many commands follow after each other for the moving axis that the total distance to be traveled (including decimal places) adds up to over 2^{31}.

6.4.2.3 Linear motor travel range

Fault:
53: Limit switch

Cause:
6: Linear motor moving range

This fault is triggered if the axis is more than 200 m away from the commutation reference point, which means that the actual position of the motor has left the permissible range (parameter: E09). Check the axis model and correct the parameterization if necessary.

6.4.2.4 **Simultaneous detection of positive and negative hardware limit switches**

Fault:

53: Limit switch

Cause:

7: Both limit switches not connected

This fault is triggered if I441 and I442 are both 0: Inactive. Check whether the hardware limit switches are also connected physically.

If I101 and I102 = 2: Parameter, the fault is triggered by the control word of the application (I210). In this case, check the controller connection.

The fault can be acknowledged with I52.

6.4.2.5 **Behavior upon controller start-up**

Fault:

53: Limit switch

Cause:

7: Both limit switches not connected

If a controller is used as the source for the digital signals for evaluating the hardware limit switches and this is still in device start-up while the drive controller and fieldbus communication are already active, fault 53: Limit switch is triggered and the limit switch memory is set (I805, I806 = 1: Active).

If the power unit has not yet been enabled since the supply voltage was switched on, the limit switch memory is automatically reset as soon as the controller correctly transmits the signals for evaluating the hardware limit switches.

6.5 Referencing

To be able to work with a system with absolute positions, the relation of a measured to an actual axis position must be determined.

During initial commissioning or after changes to the axis model, the actual position of the axis is unknown. A defined initial position is necessary. As a rule, this is either identified through a reference search or referencing setting. The associated process is referred to as referencing.

Absolute movements can be performed only in a referenced state.

For relative movements, referencing is only required if the software limit switch function is used at the same time.

When replacing a drive controller, the reference can be transferred to the replacement drive controller via an SD card. The information is also saved on the SD card if the action A00 Save values is executed for the referenced axis. For more information on replacing a drive controller, refer to the manual for the respective drive controller.

6.5.1 Referencing in AC1 and AC4

In application classes 1 and 4, the controller is responsible for the position of the axes and is thus responsible for referencing the axes.

Position-capable technology objects are controlled for referencing via the PLCopen block MC_HOME.

Referencing	Positioning axis/ Synchronous axis with incremental encoder	Positioning axis/ Synchronous axis with absolute encoder	External incremental encoder	External absolute encoder
Active referencing (Mode = 3 or 5)	X	—	—	—
Passive referencing (Mode = 2, 8 or 10)	—	—	—	—
Setting the actual position (Mode = 0)	X	X	—	—
Relative displacement of the actual position (Mode = 1)	X	X	—	—
Absolute encoder adjustment (Mode = 6 or 7)	—	X	—	—

Tab. 65: Referencing in AC1 and AC4

For more information about the control of the PLCopen blocks, see the documentation from Siemens or the online help in the TIA Portal.

6.5.2 Referencing in AC3

In application class 3, the drive controller is responsible for the position of the axes, and therefore for referencing the axes.

Various referencing methods are available for referencing

6.5.2.1 Referencing methods

The following table shows an overview of the possible referencing methods.

Abbreviation	Meaning
S	Switch
M/F	Torque or force

	Method	Initial movement	Zero pulse	Feature
	A	Negative	Yes	Negative limit switch
	B	Negative	Yes	Negatively positioned reference switch
	C	Negative	–	Negative limit switch
	D	Negative	–	Negatively positioned reference switch
	E	Positive	Yes	Positive limit switch
	F	Positive	Yes	Positively positioned reference switch
	G	Positive	–	Positive limit switch
	H	Positive	–	Positively positioned reference switch
	I	Positive	Yes	Centrally positioned reference switch
	J	Positive	–	Centrally positioned reference switch
	K	Negative	Yes	Centrally positioned reference switch
	L	Negative	–	Centrally positioned reference switch
	M	Negative	Yes	Zero pulse
	N	Positive	Yes	Zero pulse
	O	–	–	Setting the reference
	P	Positive	–	Torque/force stop
	Q	Positive	Yes	Torque/force stop
	R	Negative	–	Torque/force stop
	S	Negative	Yes	Torque/force stop

Tab. 66: Referencing methods

6.5.2.1.1   **Referencing methods in detail**

The following chapters show the individual referencing methods in detail.

The following abbreviations are used in the graphs on the referencing methods:

Abbreviation	Meaning
ALT	Alternative
LS	Limit Switch
RS	Reference Switch
ZP	Zero Pulse

> **Information**
>
> For graphically representing axes, the left is the smallest and the right is the largest position value. This means a positive movement goes to the right and a negative to the left.

The following parameters are used in the descriptions of the referencing methods:

Coordinate	Name
I28	Homing torque/force limit
I29	Time homing torque/force limit
I30	Referencing type
I31	Referencing direction
I32	Referencing speed fast
I33	Referencing speed slow
I34	Reference position
I35	Referencing with zero pulse
I39	Referencing acceleration
I43	Move to reference position
I44	Referencing jerk
I53	Index search offset
I101	Source positive /limit switch
I102	Source negative /limit switch
I103	Source reference switch

6.5.2.1.1.1 Referencing method A

Referencing method A determines a reference using a run to the negative limit switch and zero pulse.
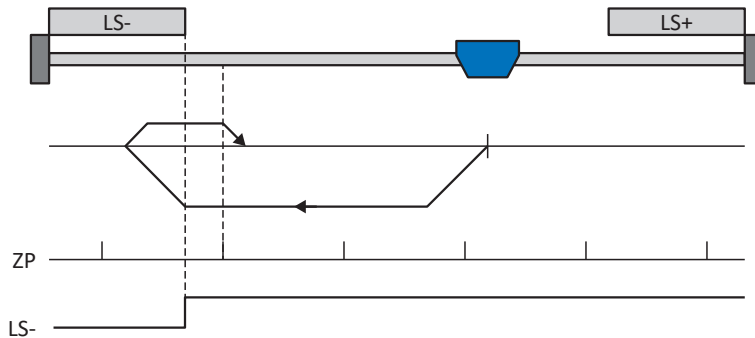
Preparation

1. Activate referencing method A by setting the following parameters to the specified values:
   I30 to 2: Limit switch,
   I31 to 1: Negative,
   I35 to 1: Active.

2. I102:
   Enter the data source for the negative limit switch.

3. I32, I33, I39, I44, I34:
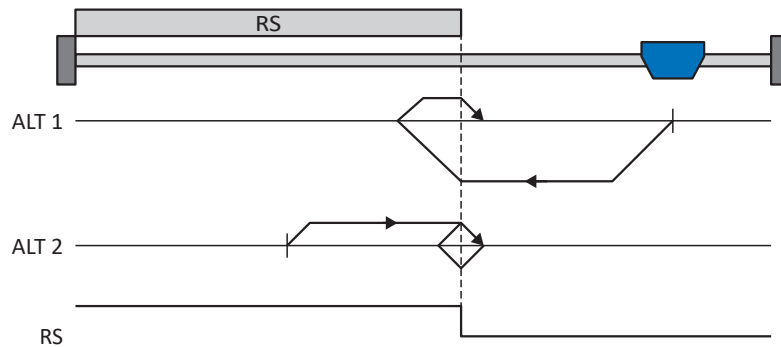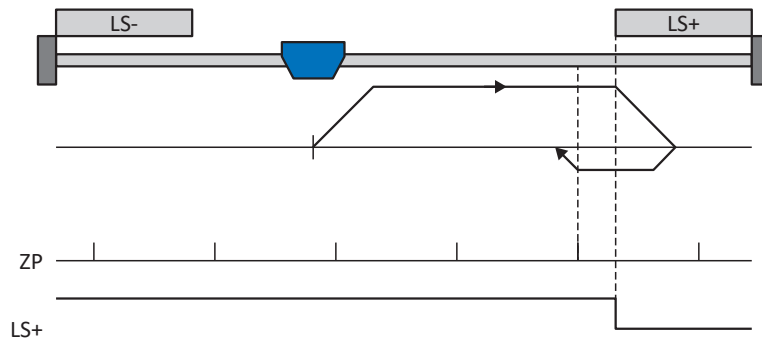   Define the set values necessary for referencing.

4. I53:
   Define the start of the search for the zero pulse search

Referencing

If the PLCopen command MC_Home is active, referencing takes places as follows:

1. The drive starts in the negative direction with acceleration I39 and velocity I32.

2. It changes its direction upon reaching the negative limit switch and continues its run with velocity I33 until it reaches the next zero pulse after leaving the limit switch.

3. The current actual position is set to the value of reference position I34 upon reaching the zero pulse.

4. The drive comes to a standstill with deceleration I39.

5. If I43 is set to 1: Active, the drive is positioned at reference position I34.

6.5.2.1.1.2   Referencing method B

Referencing method B determines the reference using a run to the negatively positioned reference switch and zero pulse.
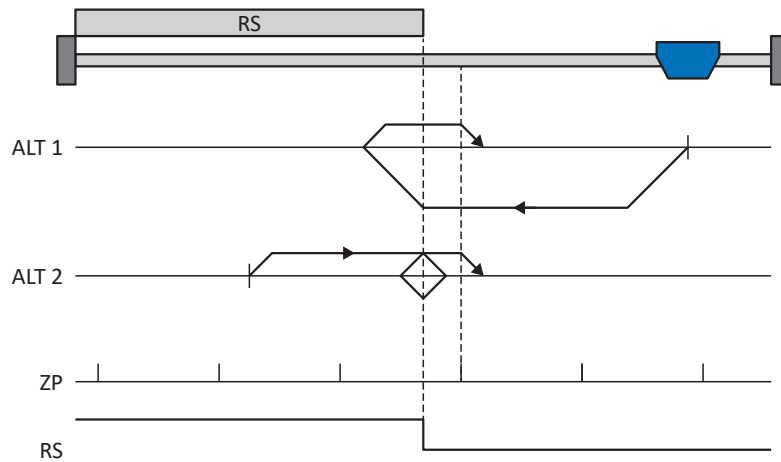
Preparation

1. Activate referencing method B by setting the following parameters to the specified values:
    I30 to 1: Reference input,
    I31 to 1: Negative,
    I35 to 1: Active.

2. I103:
    Enter the data source for the reference switch.

3. I32, I33, I39, I44, I34:
    Define the set values necessary for referencing.

4. I53:
    Define the start of the search for the zero pulse search

Referencing

If the PLCopen command MC_Home is active, a distinction is made between two referencing variants.

✓ Alternative 1: Drive is positioned in front of the reference switch

1. The drive starts in the negative direction with acceleration I39 and velocity I32.

2. It changes its direction upon reaching the reference switch and continues its run with velocity I33 until it reaches the next zero pulse after leaving the reference switch.

3. The current actual position is set to the value of reference position I34 upon reaching the zero pulse.

4. The drive comes to a standstill with deceleration I39.

5. If I43 is set to 1: Active, the drive is positioned at reference position I34.

    ✓ Alternative 2: Drive stopped at reference switch

1. The drive starts in the positive direction with acceleration I39 and velocity I33.

2. It changes its direction upon reaching the reference switch and continues its run with velocity I32.

3. When the drive comes to a stop after the reference switch, it changes direction again and continues at velocity I33 until it reaches the zero pulse.

4. The current actual position is set to the value of reference position I34 upon reaching the zero pulse.

5. The drive comes to a standstill with deceleration I39.

6. If I43 is set to 1: Active, the drive is positioned at reference position I34.

6.5.2.1.1.3   Referencing method C

Referencing method C determines the reference using a run to the negative limit switch.
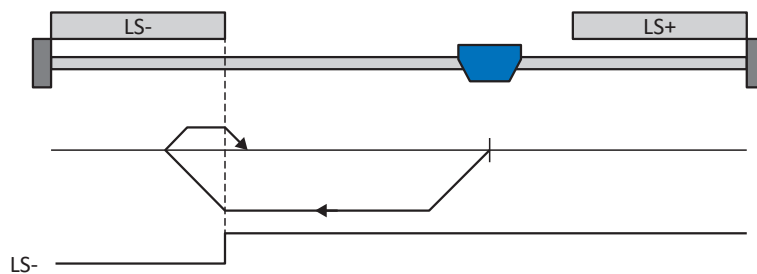
Preparation

1. Activate referencing method C by setting the following parameters to the specified values:
   I30 to 2: Limit switch,
   I31 to 1: Negative,
   I35 to 0: Inactive.

2. I102:
   Enter the data source for the negative limit switch.

3. I32, I33, I39, I44, I34:
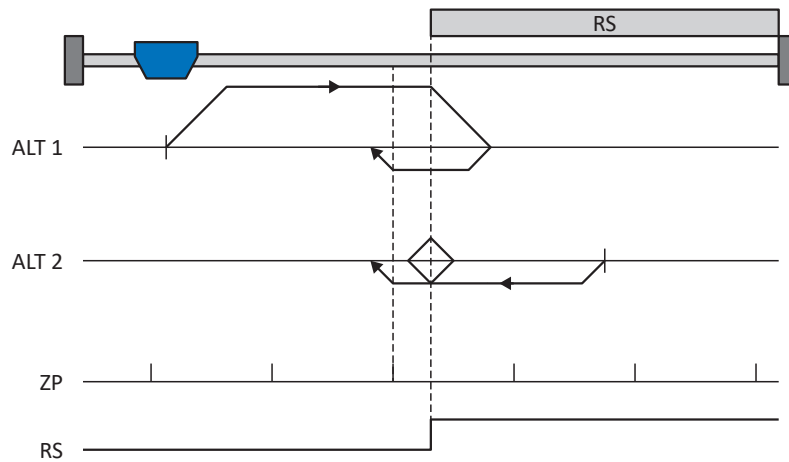   Define the set values necessary for referencing.

Referencing

If the PLCopen command MC_Home is active, referencing takes places as follows:

1. The drive starts in the negative direction with acceleration I39 and velocity I32.

2. It changes its direction upon reaching the negative limit switch and continues its run with velocity I33 until it leaves the limit switch again.

3. The current actual position is set to the value of the reference position I34 upon leaving the limit switch.

4. The drive comes to a standstill with deceleration I39.

5. If I43 is set to 1: Active, the drive is positioned at reference position I34.

6.5.2.1.1.4 **Referencing method D**

Referencing method D determines the reference using a run to the negatively positioned reference switch.

Preparation

1. Activate referencing method D by setting the following parameters to the specified values:
   I30 to 1: Reference input,
   I31 to 1: Negative,
   I35 to 0: Inactive.

2. I103:
   Enter the data source for the reference switch.

3. I32, I33, I39, I44, I34:
   Define the set values necessary for referencing.
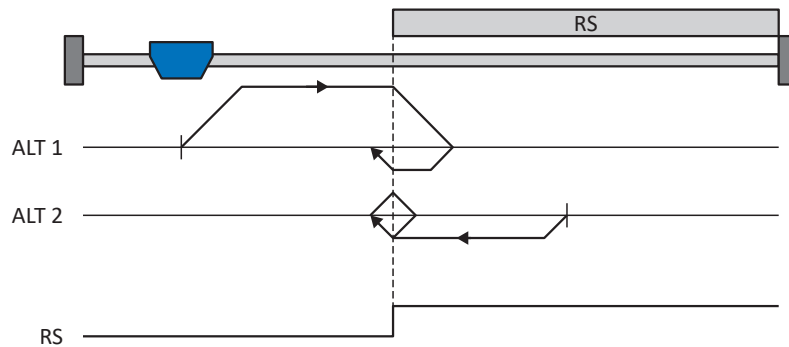
Referencing

If the PLCopen command MC_Home is active, a distinction is made between two referencing variants.

✓ Alternative 1: Drive is positioned in front of the reference switch

1. The drive starts in the negative direction with acceleration I39 and velocity I32.

2. It changes its direction upon reaching the reference switch and continues its run with velocity I33 until it leaves the reference switch again.

3. The current actual position is set to the value of the reference position I34 upon leaving the reference switch.

4. The drive comes to a standstill with deceleration I39.

5. If I43 is set to 1: Active, the drive is positioned at reference position I34.

✓ Alternative 2: Drive stopped at reference switch

1. The drive starts with acceleration I39 and velocity I33 in the positive direction until it leaves the reference switch.

2. It changes its direction upon leaving the reference switch and continues its run with velocity I32.

3. When the drive comes to a stop after the reference switch, it changes direction and continues its run at velocity I33 until it reaches the reference switch again.

4. The current actual position is set to the value of the reference position I34 upon reaching the reference switch.

5. The drive comes to a standstill with deceleration I39.

6. If I43 is set to 1: Active, the drive is positioned at reference position I34.

6.5.2.1.1.5   Referencing method E

Referencing method E determines the reference using a run to the positive limit switch and zero pulse.

Preparation

1. Activate referencing method E by setting the following parameters to the specified values:
   I30 to 2: Limit switch,
   I31 to 0: Positive,
   I35 to 1: Active.

2. I101:
   Enter the data source for the positive limit switch.

3. I32, I33, I39, I44, I34:
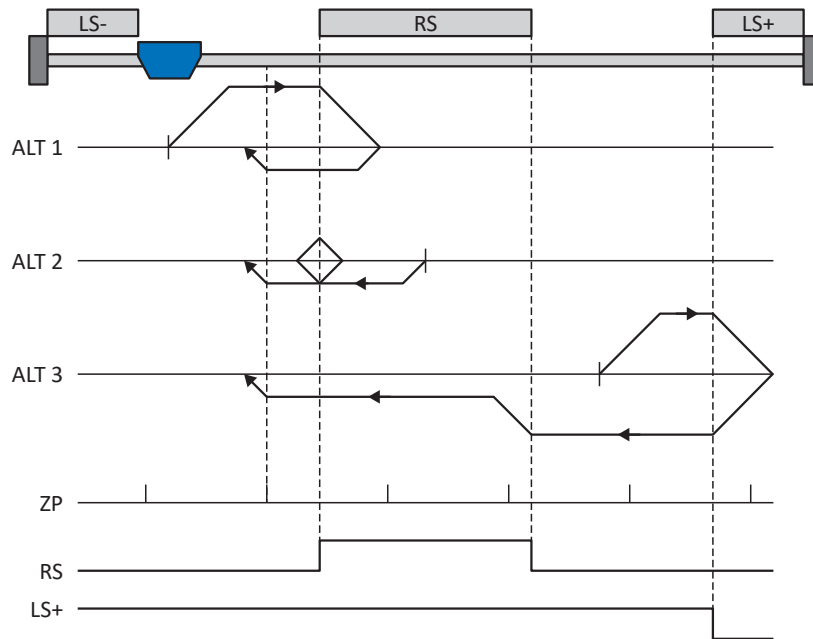   Define the set values necessary for referencing.

4. I53:
   Define the start of the search for the zero pulse search

Referencing

If the PLCopen command MC_Home is active, referencing takes places as follows:

1. The drive starts in the positive direction with acceleration I39 and velocity I32.

2. It changes its direction upon reaching the positive limit switch and continues its run with velocity I33 until it reaches the next zero pulse after leaving the limit switch.

3. The current actual position is set to the value of reference position I34 upon reaching the zero pulse.

4. The drive comes to a standstill with deceleration I39.

5. If I43 is set to 1: Active, the drive is positioned at reference position I34.

6.5.2.1.1.6   Referencing method F

Referencing method F determines the reference using a run to the positively positioned reference switch and zero pulse.

Preparation

1. Activate referencing method F by setting the following parameters to the specified values:
   I30 to 1: Reference input,
   I31 to 0: Positive,
   I35 to 1: Active.

2. I103:
   Enter the data source for the reference switch.

3. I32, I33, I39, I44, I34:
   Define the set values necessary for referencing.

4. I53:
   Define the start of the search for the zero pulse search

Referencing

If the PLCopen command MC_Home is active, a distinction is made between two referencing variants.

✓ Alternative 1: Drive is positioned in front of the reference switch

1. The drive starts in the positive direction with acceleration I39 and velocity I32.

2. It changes its direction upon reaching the reference switch and continues its run with velocity I33 until it reaches the next zero pulse after leaving the reference switch.

3. The current actual position is set to the value of reference position I34 upon reaching the zero pulse.

4. The drive comes to a standstill with deceleration I39.

5. If I43 is set to 1: Active, the drive is positioned at reference position I34.

✓ Alternative 2: Drive stopped at reference switch

1. The drive starts in the negative direction with acceleration I39 and velocity I33.

2. It changes its direction upon reaching the reference switch and continues its run with velocity I32.

3. When the drive comes to a stop after the reference switch, it changes direction again and continues at velocity I33 until it reaches the zero pulse.

4. The current actual position is set to the value of reference position I34 upon reaching the zero pulse.

5. The drive comes to a standstill with deceleration I39.

6. If I43 is set to 1: Active, the drive is positioned at reference position I34.

6.5.2.1.1.7   Referencing method G

Referencing method G determines the reference using a run to the positive limit switch.
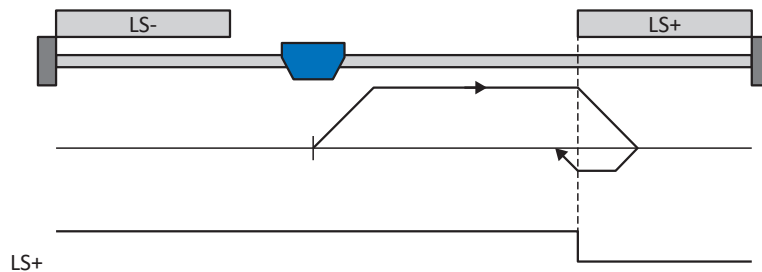
Preparation

1. Activate referencing method G by setting the following parameters to the specified values:
   I30 to 2: Limit switch,
   I31 to 0: Positive,
   I35 to 0: Inactive.

2. I101:
   Enter the data source for the positive limit switch.

3. I32, I33, I39, I44, I34:
   Define the set values necessary for referencing.

Referencing

If the PLCopen command MC_Home is active, referencing takes places as follows:

1. The drive starts in the positive direction with acceleration I39 and velocity I32.

2. It changes its direction upon reaching the positive limit switch and continues its run with velocity I33 until it leaves the limit switch again.

3. The current actual position is set to the value of the reference position I34 upon leaving the limit switch.

4. The drive comes to a standstill with deceleration I39.

5. If I43 is set to 1: Active, the drive is positioned at reference position I34.

6.5.2.1.1.8   Referencing method H

Referencing method H determines the reference using a run to the positively positioned reference switch.

Preparation

1. Activate referencing method H by setting the following parameters to the specified values:
   I30 to 1: Reference input,
   I31 to 0: Positive,
   I35 to 0: Inactive.

2. I103:
   Enter the data source for the reference switch.

3. I32, I33, I39, I44, I34:
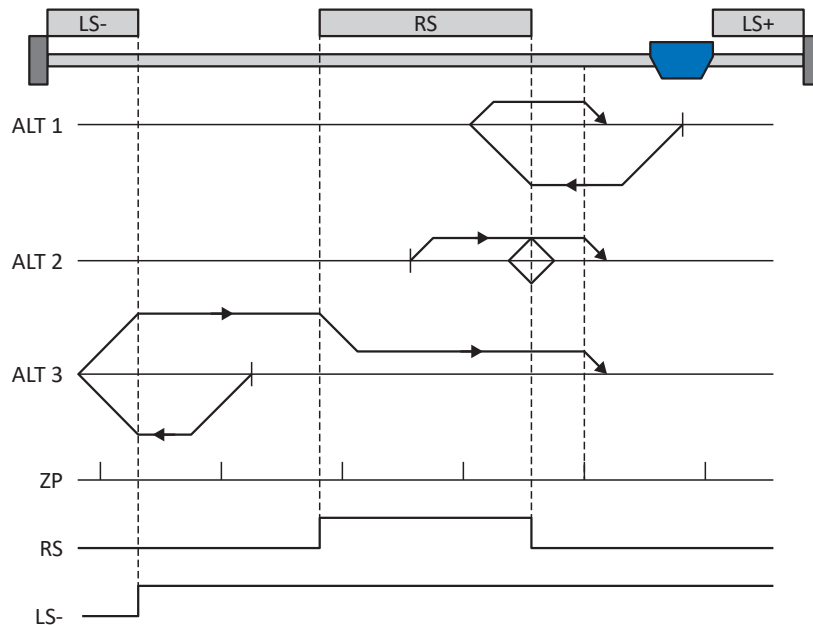   Define the set values necessary for referencing.

Referencing

If the PLCopen command MC_Home is active, a distinction is made between two referencing variants.

✓ Alternative 1: Drive is positioned in front of the reference switch

1. The drive starts in the positive direction with acceleration I39 and velocity I32.

2. It changes its direction upon reaching the reference switch and continues its run with velocity I33 until it leaves the reference switch again.

3. The current actual position is set to the value of the reference position I34 upon leaving the reference switch.

4. The drive comes to a standstill with deceleration I39.

5. If I43 is set to 1: Active, the drive is positioned at reference position I34.

✓ Alternative 2: Drive stopped at reference switch

1. The drive starts with acceleration I39 and velocity I33 in the negative direction until it leaves the reference switch.

2. It changes its direction upon leaving the reference switch and continues its run with velocity I32.

3. When the drive comes to a stop after the reference switch, it changes direction and continues its run at velocity I33 until it reaches the reference switch again.

4. The current actual position is set to the value of the reference position I34 upon reaching the reference switch.

5. The drive comes to a standstill with deceleration I39.

6. If I43 is set to 1: Active, the drive is positioned at reference position I34.

6.5.2.1.1.9 **Referencing method I**

Referencing method I determines the reference using a run to the centered reference switch and zero pulse.

Preparation

1. Activate referencing method I by setting the following parameters to the specified values:
   I30 to 1: Reference input,
   I31 to 0: Positive,
   I35 to 1: Active.

2. I103:
   Enter the data source for the reference switch.

3. I32, I33, I39, I44, I34:
   Define the set values necessary for referencing.

4. I53:
   Define the start of the search for the zero pulse search

Referencing

If the PLCopen command MC_Home is active, a distinction is made between three referencing sequences.

✓ Alternative 1: Drive is positioned between the negative limit and reference switches

1. The drive starts in the positive direction with acceleration I39 and velocity I32.

2. It changes its direction upon reaching the reference switch and continues its run with velocity I33 until it reaches the next zero pulse after leaving the reference switch.

3. The current actual position is set to the value of reference position I34 upon reaching the zero pulse.

4. The drive comes to a standstill with deceleration I39.

5. If I43 is set to 1: Active, the drive is positioned at reference position I34.

✓ Alternative 2: Drive stopped at reference switch

1. The drive starts in the negative direction with acceleration I39 and velocity I33.

2. It changes its direction upon reaching the reference switch and continues its run with velocity I32.

3. When the drive comes to a stop after the reference switch, it changes direction again and continues at velocity I33 until it reaches the zero pulse.

4. The current actual position is set to the value of reference position I34 upon reaching the zero pulse.

5. The drive comes to a standstill with deceleration I39.

6. If I43 is set to 1: Active, the drive is positioned at reference position I34.

✓ Alternative 3: Drive is positioned between the reference and positive limit switches

1. The drive starts in the positive direction with acceleration I39 and velocity I32.

2. It changes its direction upon reaching the positive limit switch until the reference switch is reached.

3. Upon reaching the reference switch, the drive changes its velocity to I33 until it leaves the reference switch again.

4. The current actual position is set to the value of the reference position I34 after leaving the reference switch and upon reaching the next zero pulse.

5. The drive comes to a standstill with deceleration I39.

6. If I43 is set to 1: Active, the drive is positioned at reference position I34.

6.5.2.1.1.10   Referencing method J

Referencing method J determines the reference using a run to the centered reference switch.
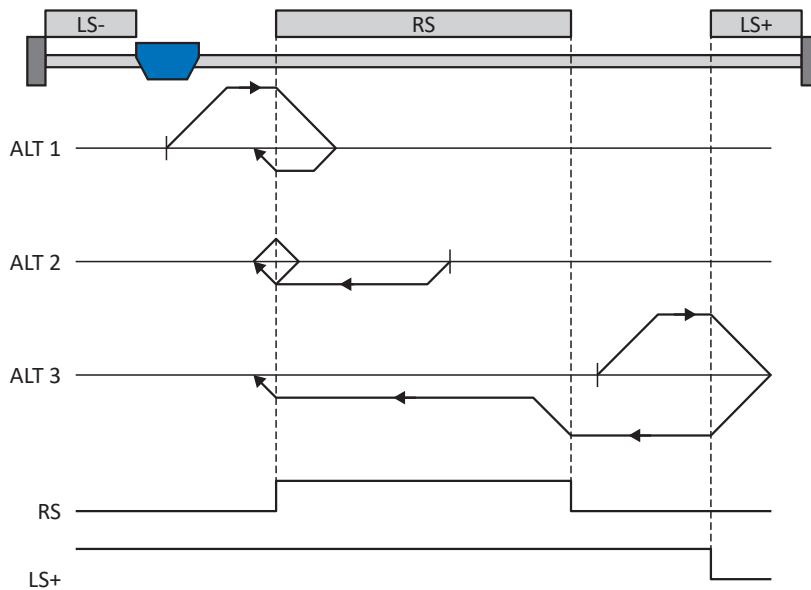
Preparation

1. Activate referencing method J by setting the following parameters to the specified values:
   I30 to 1: Reference input,
   I31 to 0: Positive,
   I35 to 0: Inactive.

2. I103:
   Enter the data source for the reference switch.

3. I32, I33, I39, I44, I34:
   Define the set values necessary for referencing.

Referencing

If the PLCopen command MC_Home is active, a distinction is made between three referencing sequences.

✓ Alternative 1: Drive is positioned between the negative limit and reference switches

1. The drive starts in the positive direction with acceleration I39 and velocity I32.

2. It changes its direction upon reaching the reference switch and continues its run with velocity I33 until it leaves the reference switch again.

3. The current actual position is set to the value of the reference position I34 upon leaving the reference switch.

4. The drive comes to a standstill with deceleration I39.

5. If I43 is set to 1: Active, the drive is positioned at reference position I34.
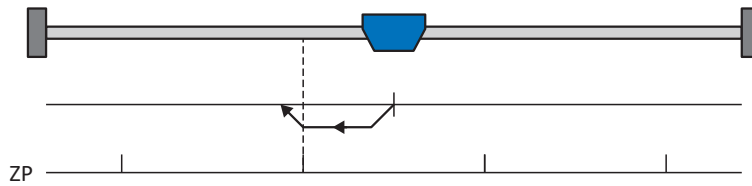
✓ Alternative 2: Drive stopped at reference switch

1. The drive starts in the negative direction with acceleration I39 and velocity I33.

2. It changes its direction upon reaching the reference switch and continues its run with velocity I32 until it leaves the reference switch.

3. When the drive comes to a stop after the reference switch, it changes direction and continues its run at velocity I33 until it reaches the reference switch again.

4. The current actual position is set to the value of the reference position I34 upon reaching the reference switch.

5. The drive comes to a standstill with deceleration I39.

6. If I43 is set to 1: Active, the drive is positioned at reference position I34.

✓ Alternative 3: Drive is positioned between the reference and positive limit switches

1. The drive starts in the positive direction with acceleration I39 and velocity I32.

2. Upon reaching the positive limit switch, the drive changes its direction and continues its run until it reaches the reference switch.

3. Upon reaching the reference switch, the drive changes its velocity to I33 until it leaves the reference switch again.

4. The current actual position is set to the value of the reference position I34 upon leaving the reference switch.

5. The drive comes to a standstill with deceleration I39.

6. If I43 is set to 1: Active, the drive is positioned at reference position I34.

6.5.2.1.1.11   Referencing method K

Referencing method K determines the reference using a run to the centered reference switch and zero pulse.

Preparation

1. Activate referencing method K by setting the following parameters to the specified values:
    I30 to 1: Reference input,
    I31 to 1: Negative,
    I35 to 1: Active.

2. I103:
    Enter the data source for the reference switch.

3. I32, I33, I39, I44, I34:
    Define the set values necessary for referencing.

4. I53:
    Define the start of the search for the zero pulse search

Referencing

If the PLCopen command MC_Home is active, a distinction is made between three referencing variants.

✓ Alternative 1: Drive is positioned between the reference and positive limit switches

1. The drive starts in the negative direction with acceleration I39 and velocity I32.

2. It changes its direction upon reaching the reference switch and continues its run with velocity I33 until it reaches the next zero pulse after leaving the reference switch.

3. The current actual position is set to the value of reference position I34 upon reaching the zero pulse.

4. The drive comes to a standstill with deceleration I39.

5. If I43 is set to 1: Active, the drive is positioned at reference position I34.

✓ Alternative 2: Drive stopped at reference switch

1. The drive starts in the positive direction with acceleration I39 and velocity I33.

2. It changes its direction upon reaching the reference switch and continues its run with velocity I32.

3. When the drive comes to a stop after the reference switch, it changes direction again and continues at velocity I33 until it reaches the zero pulse.

4. The current actual position is set to the value of reference position I34 upon reaching the zero pulse.

5. The drive comes to a standstill with deceleration I39.

6. If I43 is set to 1: Active, the drive is positioned at reference position I34.

✓ Alternative 3: Drive is positioned between the negative limit and reference switches

1. The drive starts in the negative direction with acceleration I39 and velocity I32.

2. It changes its direction upon reaching the negative limit switch and continues its run until the reference switch is reached.

3. Upon reaching the reference switch, the drive changes its velocity to I33 and continues its run until it reaches the next zero pulse after leaving the reference switch.

4. The current actual position is set to the value of reference position I34 upon reaching the zero pulse.

5. The drive comes to a standstill with deceleration I39.

6. If I43 is set to 1: Active, the drive is positioned at reference position I34.

6.5.2.1.1.12 Referencing method L

Referencing method L determines the reference using a run to the centered reference switch.
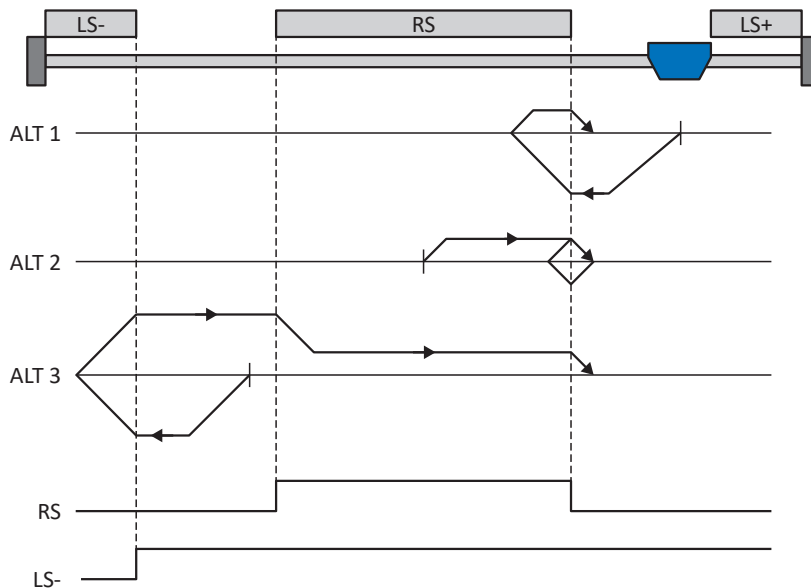
Preparation

1. Activate referencing method L by setting the following parameters to the specified values:
   I30 to 1: Reference input,
   I31 to 1: Negative,
   I35 to 0: Inactive.

2. I103:
   Enter the data source for the reference switch.

3. I32, I33, I39, I44, I34:
   Define the set values necessary for referencing.

Referencing

If the PLCopen command MC_Home is active, a distinction is made between three referencing variants.

✓ Alternative 1: Drive is positioned between the reference and positive limit switches

1. The drive starts in the negative direction with acceleration I39 and velocity I32.

2. It changes its direction upon reaching the reference switch and continues its run with velocity I33 until it leaves the reference switch again.

3. The current actual position is set to the value of the reference position I34 upon leaving the reference switch.

4. The drive comes to a standstill with deceleration I39.

5. If I43 is set to 1: Active, the drive is positioned at reference position I34.

✓ Alternative 2: Drive stopped at reference switch

1. The drive starts with acceleration I39 and velocity I33 in the positive direction until it leaves the reference switch.

2. It changes its direction upon leaving the reference switch and continues its run with velocity I32.

3. When the drive comes to a stop after the reference switch, it changes direction and continues its run at velocity I33 until it reaches the reference switch again.

4. The current actual position is set to the value of the reference position I34 upon reaching the reference switch.

5. The drive comes to a standstill with deceleration I39.

6. If I43 is set to 1: Active, the drive is positioned at reference position I34.

✓ Alternative 3: Drive is positioned between the negative limit and reference switches

1. The drive starts in the negative direction with acceleration I39 and velocity I32.

2. It changes its direction upon reaching the negative limit switch and continues its run until the reference switch is reached.

3. When the reference switch is reached, the drive changes its velocity to I33 and continues its run until it leaves the reference switch again.

4. The current actual position is set to the value of the reference position I34 upon leaving the reference switch.

5. The drive comes to a standstill with deceleration I39.

6. If I43 is set to 1: Active, the drive is positioned at reference position I34.

6.5.2.1.1.13   Referencing method M

This method determines the reference using a run to the zero pulse.

Preparation

1. Activate referencing method M by setting the following parameters to the specified values:
   I30 to 3: Zero pulse,
   I31 to 1: Negative,

2. I32, I39, I44, I34:
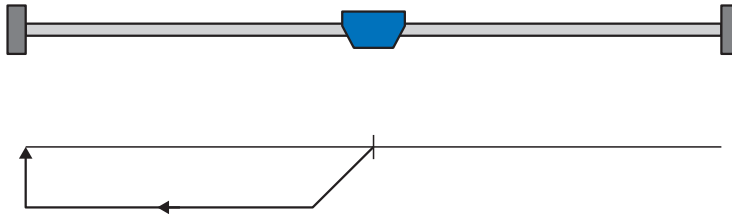   Define the set values necessary for the referencing.

Referencing

If the PLCopen command MC_Home is active, referencing takes places as follows:

1. The drive starts in the negative direction with acceleration I39 and velocity I32.

2. The current actual position is set to the value of reference position I34 upon reaching the zero pulse.

3. The drive comes to a standstill with deceleration I39.

4. If I43 is set to 1: Active, the drive is positioned at reference position I34.

6.5.2.1.1.14 Referencing method N

Referencing method N determines the reference using a run to the zero pulse.

ZP
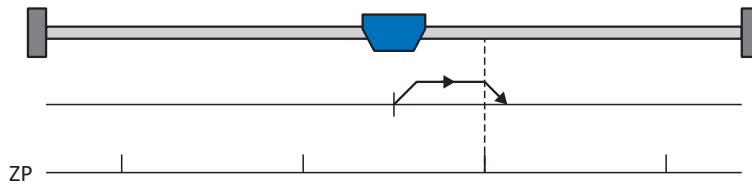
Preparation

1. Activate referencing method N by setting the following parameters to the specified values:
   I30 to 3: Zero pulse,
   I31 to 0: Positive,

2. I32, I39, I44, I34:
   Define the set values necessary for the referencing.

Referencing

If the PLCopen command MC_Home is active, referencing takes places as follows:

1. The drive starts in the positive direction with acceleration I39 and velocity I32.

2. The current actual position is set to the value of reference position I34 upon reaching the zero pulse.

3. The drive comes to a standstill with deceleration I39.

4. If I43 is set to 1: Active, the drive is positioned at reference position I34.

6.5.2.1.1.15 Referencing method O

Referencing method O determines the reference by setting the reference to any position.
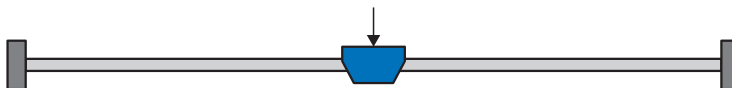
Preparation

1. I30:
   Activate referencing method O by setting this parameter to 5: Define home.

2. I34:
   Define the reference position.

Referencing

If the PLCopen command MC_Home is active, referencing takes places as follows:

The current actual position is set to the value of the reference position I34.

6.5.2.1.1.16   Referencing method P

Referencing method P determines the reference using a run with a torque/force stop.
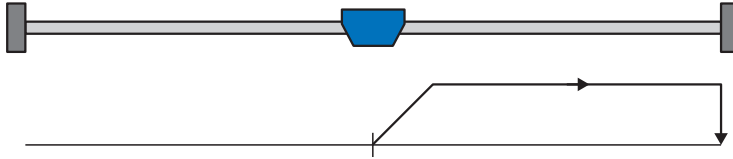
Preparation

1. Activate referencing method P by setting the following parameters to the specified values:
   I30 to 4: Torque/force stopper,
   I31 to 0: Positive,
   I35 to 0: Inactive.

2. I32, I39, I44, I34:
   Define the set values necessary for the referencing.

3. I28, I29:
   Define the torque/force limit. If the actual torque for the time stored in I29 is above the limit defined in I28 for an ongoing period, the torque/force limit is reached.

> **ℹ Information**
>
> In case of a selected value for the torque/force variable that is too big, the machine can be damaged. In case of a selected value that is too small, an incorrect reference position may be applied.

Referencing

If the PLCopen command MC_Home is active, referencing takes places as follows:

1. The drive starts in the positive direction with acceleration I39 and velocity I32.

2. The current actual position is set to the value of the reference position I34 when the torque/force limit is reached and the time stored in I29 has elapsed.

3. The set values are set to the value 0 with deceleration I39.

4. If I43 is set to 1: Active, the drive is positioned at reference position I34.

6.5.2.1.1.17   Referencing method Q

Referencing method Q determines the reference using a run with a torque/force stop and zero pulse.
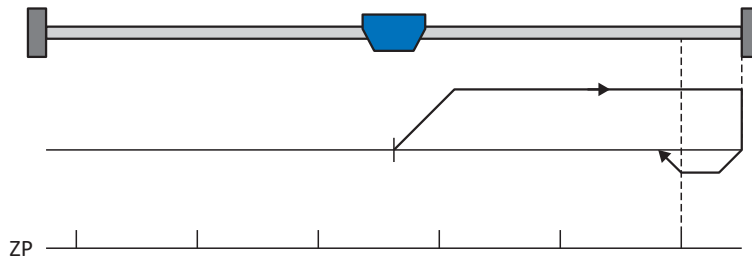
Preparation

1. Activate referencing method Q by setting the following parameters to the specified values:
    I30 to 4: Torque/force stopper,
    I31 to 0: Positive,
    I35 to 1: Active.

2. I32, I33, I39, I44, I34:
    Define the set values necessary for referencing.

3. I28, I29:
    Define the torque/force limit. If the actual torque for the time stored in I29 is above the limit defined in I28 for an ongoing period, the torque/force limit is reached.

4. I53:
    Define the start of the search for the zero pulse search.

> **ℹ Information**
>
> In case of a selected value for the torque/force variable that is too big, the machine can be damaged. In case of a selected value that is too small, an incorrect reference position may be applied.

Referencing

If the PLCopen command MC_Home is active, referencing takes places as follows:

1. The drive starts in the positive direction with acceleration I39 and velocity I32.

2. It changes its direction upon reaching the torque/force stop and when the time stored in I29 has passed, and continues its run with velocity I33 until it reaches the next zero pulse.

3. The current actual position is set to the value of reference position I34 upon reaching the zero pulse.

4. The set values are set to the value 0 with deceleration I39.

5. If I43 is set to 1: Active, the drive is positioned at reference position I34.

6.5.2.1.1.18   Referencing method R

Referencing method R determines the reference using a run with a torque/force stop.

Preparation

1. Activate referencing method R by setting the following parameters to the specified values:
    I30 to 4: Torque/force stopper,
    I31 to 1: Negative,
    I35 to 0: Inactive.

2. I32, I33, I39, I44, I34:
    Define the set values necessary for referencing.

3. I28, I29:
    Define the torque/force limit. If the actual torque for the time stored in I29 is above the limit defined in I28 for an ongoing period, the torque/force limit is reached.

> **ℹ Information**
>
> In case of a selected value for the torque/force variable that is too big, the machine can be damaged. In case of a selected value that is too small, an incorrect reference position may be applied.

Referencing

1. The drive starts in the negative direction with acceleration I39 and velocity I32.

2. The current actual position is set to the value of the reference position I34 when the torque/force stop is reached and the time stored in I29 has elapsed.

3. The set values are set to the value 0 with deceleration I39.

4. If I43 is set to 1: Active, the drive is positioned at reference position I34.

6.5.2.1.1.19   **Referencing method S**

Referencing method S determines the reference using a run with torque/force stop and zero pulse.
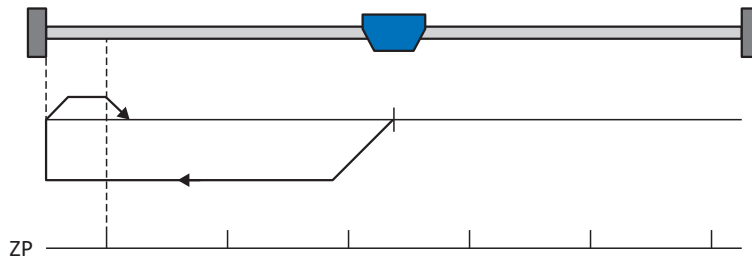
Preparation

1. Activate referencing method S by setting the following parameters to the specified values:
    I30 to 4: Torque/force stopper,
    I31 to 1: Negative,
    I35 to 1: Active.

2. I32, I33, I39, I44, I34:
    Define the set values necessary for referencing.

3. I28, I29:
    Define the torque/force limit. If the actual torque for the time stored in I29 is above the limit defined in I28 for an ongoing period, the torque/force limit is reached.

4. I53:
    Define the start of the search for the zero pulse search

> **ℹ Information**
>
> In case of a selected value for the torque/force variable that is too big, the machine can be damaged. In case of a selected value that is too small, an incorrect reference position may be applied.

Referencing

If the PLCopen command MC_Home is active, referencing takes places as follows:

1. The drive starts in the negative direction with acceleration I39 and velocity I32.

2. It changes its direction upon reaching the torque/force stop and after the time stored in I29 has passed, and continues its run with velocity I33 until it reaches the next zero pulse.

3. The current actual position is set to the value of reference position I34 upon reaching the zero pulse.

4. The set values are set to the value 0 with deceleration I39.

5. If I43 is set to 1: Active, the drive is positioned at reference position I34.

6.5.2.2 Reference position

Depending on the referencing type I30, the actual position I80 is replaced by the reference position I34 during the referencing event.

6.5.2.3 Reference retaining

Pilz offers a convenient drive-based referencing system. Depending on the encoder model used and the reference management, different types of reference retaining (I46) are offered.

6.5.2.4 Reference loss

Axis

In certain cases, an axis loses its reference and its state changes from I86 = 1: Active to I86 = 0: Inactive.

Normal operation (axis)

During normal operation, encoder faults or actions can lead to a loss of the reference. If the reference was deleted by an encoder event, it can subsequently be restored.

> **ℹ️ Information**
>
> Before restoring the reference, check the actual position displayed (I80). If in doubt, do the referencing again. If relative encoders are used or if the axis was still moving during the encoder fault, the actual position displayed may deviate from the real actual position of the axis.

Cause		Check and action
Event 76: Position encoder	Encoder fault	Actual position may still be correct, restoring the reference is not possible: ▸ Check the actual position (I80). ▸ Reference the axis again
Event 37: Motor encoder	Encoder fault	When using the motor encoder as a position encoder (I02 = 0: Motor encoder), 2 faults are triggered (37: Motor encoder and 76: Position encoder); in display parameter E82 and in the fault memory it is possible that only one fault is displayed. Actual position may still be correct, restoring the reference is not possible: ▸ Check the actual position (I80). ▸ Reference the axis again
Action I38	Deleted reference	Action I38 deletes the reference but does not change the actual position displayed. Actual position may still be correct, restoring the reference is not possible: ▸ Check the actual position (I80). ▸ Reference the axis again

Tab. 67: Reference loss of the axis in normal operation

Changing parameters (axis)

Changing individual parameters or transferring a new configuration with changed settings can lead to a loss of the reference.

Cause		Check and action
Changing parameters	Changed axis model	Actual position is undefined if one of the following parameters was changed: ▸ B26 Motor encoder ▸ C15 Gear ratio n1 ▸ C16 Gear ratio n2 ▸ C17 Feed constant numerator ▸ C18 Feed constant denominator ▸ I00 Position range ▸ I01 Circular length ▸ I02 Position encoder ▸ I03 Axis polarity ▸ I05 Type of axis ▸ I07 Distance factor numerator position ▸ I08 Distance factor denominator position It is not possible to restore the reference: ▸ Reference the axis again
Changing parameters	Changed encoder interface	Actual position is undefined if a parameter of the H group was changed. It is not possible to restore the reference: ▸ Reference the axis again

Tab. 68: Reference loss of the axis due to parameter changes

Restarting the drive controller (axis)

Depending on the encoder type and method for reference retaining (I46), the reference of a previously referenced axis is restored or deleted after a restart.

By default (I46 = 0: Normal), the reference for a multi-turn absolute encoder is retained after a restart if the axis was referenced with this encoder. In all other cases, the reference is deleted as soon as the drive controller is switched off.

The method for reference retaining can be adapted in I46. In addition to the preset, the following further options are available:

▸ Reference is retained if the measuring range covers the entire travel range

▸ Reference is retained as long as the position change in the switched-off state is less than the reference retention window (I48)

▸ Reference is retained regardless of the presence of an encoder

▸ Reference is retained regardless of the encoder type

▸ Reference is deleted when the drive controller is switched off

Special case of incorrect motor connection (axis)

If a motor is inadvertently connected to the incorrect axis or the incorrect drive controller, such as after a case of service, the drive controller behaves as follows after it is switched on:

▸ The axis changes to the non-referenced state (I86 = 0: Inactive)

▸ The actual position displayed is undefined

However, the information from the original motor and the associated reference data are stored in the drive controller. After switching off the drive controller, connecting the correct motor and restarting the drive controller, the reference is restored and the actual position is displayed correctly (prerequisites: multi-turn absolute encoder, referenced axis and preset for reference retaining I46 = 0: Normal).

Master encoder

Actual positions of the master encoder are used in the Drive Based Synchronous application for synchronous operation.

In all applications except the Drive Based Center Winder application, the actual position of the master encoder can be used to pass on the position of another encoder attached to the machine to the control system. The drive controller transfers the position from the encoder interface to the respective fieldbus.

Master encoders behave in a similar way to position encoders. In certain cases, a master encoder loses its reference and its state changes from G89 = 1: Active to G89 = 0: Inactive.

Normal operation (master encoder)

During normal operation, encoder faults can lead to a loss of the reference.

Cause		Check and action
Event 77: Master encoder	Encoder fault	Actual position of the master encoder is undefined, it is not possible to restore the reference: ▸ Reference the master encoder again

Tab. 69: Reference loss of the master encoder in normal operation

Changing parameters (master encoder)

Changing individual parameters or transferring a new configuration with changed settings can lead to a loss of the reference.

Cause		Check and action
Changing parameters	Changed axis model	Actual position of the master encoder is undefined if one of the following parameters was changed: ▸ G30 Position range master ▸ G40 Circular length master ▸ G47 Distance factor numerator master ▸ G48 Distance factor denominator master ▸ G104 Source master encoder It is not possible to restore the reference: ▸ Reference the master encoder again
Changing parameters	Changed encoder interface	Actual position of the master encoder is undefined if a parameter of the H group was changed. It is not possible to restore the reference: ▸ Reference the master encoder again

Tab. 70: Reference loss of the master encoder due to parameter changes

Restarting the drive controller (master encoder)

Depending on the encoder type and method for reference retaining (G35), the reference of a previously referenced master encoder is restored or deleted after a restart.

By default (G35 = 0: Normal), the reference for a multi-turn absolute encoder is retained after a restart if this encoder was used for referencing. In all other cases, the reference is deleted as soon as the drive controller is switched off.

The method for reference retaining can be adapted in G35. In addition to the preset, the following further options are available:

▸ Reference is retained if the measuring range covers the entire travel range

▸ Reference is retained as long as the position change in the switched-off state is less than the reference retention window (I48)

▸ Reference is retained regardless of the presence of an encoder

▸ Reference is retained regardless of the encoder type

▸ Reference is deleted when the drive controller is switched off

6.6 Synchronization: Sign-of-Life

Sign-of-Life is a life counter that helps the application in the motion controller (block in the controller that controls the movement) and the application in the drive controller monitor each other. As soon as the application in the drive controller has synchronized to the clock of the controller, the drive controller starts sending drive controller Sign-of-Life signals (DO-LS). This consists of four bits in the status word ZSW2 and follows the specification of the Sign-of-Life of the controller (C-LS). If the drive controller no longer responds correctly and on time due to a synchronization error, an alarm is triggered in the controller. If the controller or technology object do not behave in a synchronized manner, the drive controller triggers fault 52: Communication with cause 16: PROFINET Sign-of-Life synchronisation failed.

Information

The Sign-of-Life mechanism is only active when synchronized operation is active in application class 4 (AC4).

6.7 Measuring input

Using the measuring input function, when the signal of a measuring input is changed, e.g. by a limit switch, the drive controller can detect the current actual position of the axis, store it temporarily and transfer it to the controller via PROFINET.

In TIA Portal, the measuring input function is implemented via the TO_MeasuringInput technology object. This always requires an assignment to another technology object (TO_PositioningAxis or TO_SynchronousAxis), the position of which is evaluated by the measuring input. During the configuration in TIA Portal, you must define the number of the measuring input. If 1 is selected, the measuring input must be connected to terminal X101, pin 1 of the drive controller (DI1). If 2 is selected, the measuring input must be connected to pin 2 of X101 (DI2).

Different measuring jobs for one-time or cyclic measurement can be transferred to the drive controller. It monitors its local digital inputs DI1 or DI2, measures the actual position when a signal is received and transfers this to the controller via the PROFIdrive telegram.

Sequence of the measuring input function

The following figure shows an example of the measuring input function sequence when using the MC_MeasuringInput block.
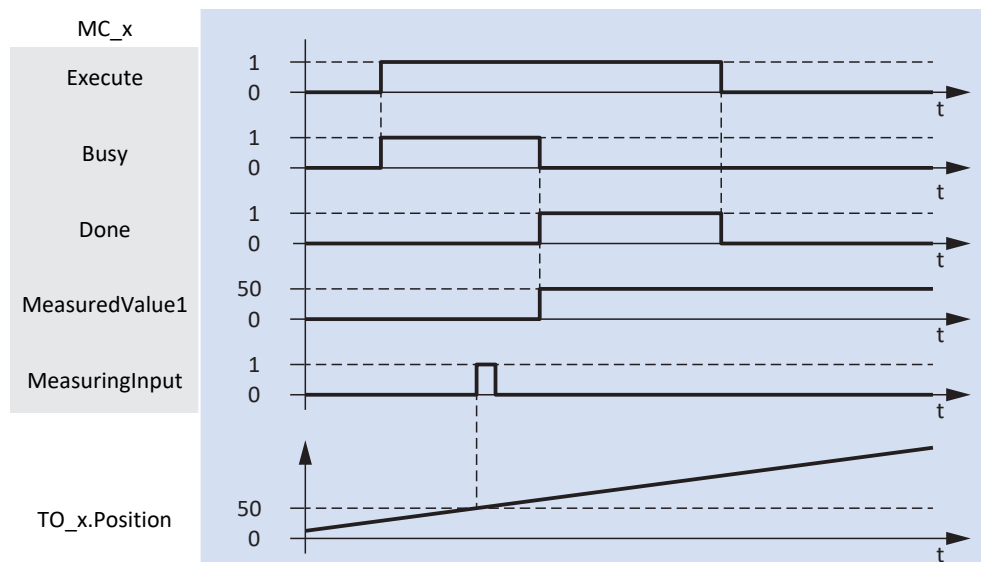
Fig. 44: Sequence of the measuring input function

The TO_MeasuringInput technology object is controlled using PLCopen blocks MC_MEASURINGINPUT and MC_ABORTMEASURINGINPUT.

At the Execute input of PLCopen block MC_MEASURINGINPUT, the measuring job is started with signal 1 (top line in the time diagram). This activates the measuring input function and the drive controller waits for a signal at the input of the measuring input. The block was parameterized with the measurement method Mode = 0, i.e. the measurement takes place with the next rising edge. If the measuring input causes a rising edge at the digital input of the drive controller, the controller measures the actual position of the axis exactly at this point in time. After a few milliseconds, the position value is available at the MeasuredValue1 output.

6.8 PROFIdrive device control

The PROFIdrive device control is based on the internationally standardized device profile PROFIdrive for electric drives. This profile describes the behavior of a drive controller based on a device state machine. Each device state represents a specific behavior.

For state transitions, the device state machine must receive certain bit combinations in control word 1 (STW1) according to PROFIdrive. The bit combination in status word 1 and status word 2 (ZSW1, ZSW2) provides information about the current state of the drive controller.

The following chapters describe the device states and the possible state transitions associated with them. You will also learn what measures may be necessary on your part and what options there are for parameterizing the transitions.

> **Information**
>
> If you work with technology objects in TIA Portal, these take over the control of the PROFIdrive device state machine.

6.8.1 PROFIdrive device state machine

The device state machine describes the different device states of the drive controller along with the possible state changes.
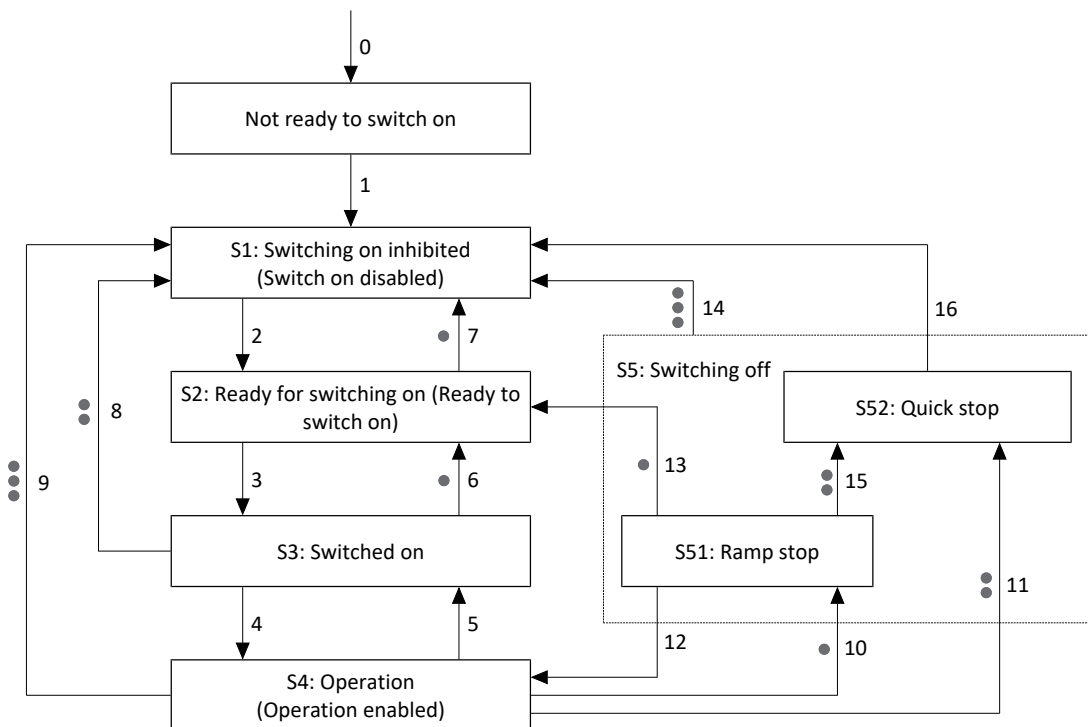
Fig. 45: PROFIdrive device state machine: Device states and state changes

Priority levels are marked by dots. The more dots a state change has, the higher its priority. Accordingly, a state change without any dots has the lowest priority.

Information

For the priority levels of stop reactions, the order is Ramp stop, Quick stop and Coast stop, with a Ramp stop having the lowest priority and a Coast stop having the highest priority. The effect and priority of the stop reactions is independent of their origin. A stop reaction with higher priority replaces a stop reaction with lower priority. All stop reactions triggered by errors (error with Ramp stop, error with Quick stop, error with Coast stop) lead to a change to the S1: Switching on inhibited or S2: Ready for switching on state. Depending on the type of fault, the change can be direct or indirect via the fault reaction. The STO safety function is mapped as Coast stop, while drive-based braking within the SS1 safety function is mapped as Quick stop.

Information

If you use a gravity-loaded axis with a brake, always switch off the drive using a controlled stop. This prevents the load from dropping until the brake is fully engaged. For a controlled stop, the Ramp stop or Quick stop function is used: state transition 10, 11 or 15 according to the device state machine.

6.8.2 States and transitions

All states and transitions provided by the device control according to PROFIdrive have specific features.

States

The bit combination in status word 1 and status word 2 (M516, M518) provides information about the state of the drive controller.

The following table shows the states of the device control and the corresponding bit combination in status word 1 and status word 2.

State of the drive controller	Status word 1 (M516)				Status word 2 (M518)
	Bit 0 Ready to switch on	Bit 1 Ready to operate	Bit 2 Operation enabled	Bit 6 Switching on inhibited	Bit 11 Pulses enabled
S1: Switching on inhibited (Switch on disabled)	0	0	0	1	0
S2: Ready for switching on (Ready to switch on)	1	0	0	0	0
S3: Switched on	1	1	0	0	0
S4: Operation (released)	1	1	1	0	1
S5: Switching Off	1	1	0	0	1

Tab. 71: State of the drive controller according to PROFIdrive

Transitions

One state either transitions automatically to another or the transition requires certain bit combinations in control word 1 (M515).

> **Information**
>
> Bits 0 – 9 and 11 – 15 of M515 are only effective if the status word reports Control requested (M516, bit 9 = 1) and control by the PLC is activated (M515, bit 10 = 1).

> **Information**
>
> The brake control is not defined by the PROFIdrive profile. The brake is either controlled by the drive controller (prerequisite: F00 = 1: Active and F108 = 0: Internal (automatic)) or externally by a controller (prerequisite: F00 = 1: Active and F108 = 1: External (plc), source: M515, bit 12).

6.8.2.1 Key

The following terms are used in the descriptions of the states and transitions:

Term	Meaning
Enable active	Additional enable signal is active (A300 = 1: Active, source: A60)
Enable inactive	Additional enable signal is inactive (A300 = 0: Inactive, source: A60)
Quick stop in case of Enable-off active	Quick stop in case of Enable-off is active (A44 = 1: Active)
Quick stop in case of Enable-off inactive	Quick stop in case of Enable-off is inactive (A44 = 0: Inactive)
Fault without quick stop fault reaction	Coast stop (A29 = 0: Inactive)
Fault with quick stop fault reaction	Quick stop (A29 = 1: Active; quick stop deceleration: I17)
Fault with stop fault reaction	Ramp stop

Tab. 72: States, transitions and conditions: Terms

6.8.2.2   **Not ready to switch on**

Features

▸ Drive controller and safety module are initialized and tested

▸ The power unit as well as drive and activation functions are locked

▸ Brakes remain engaged

Transition to S1: Switching on inhibited (1)

The drive controller switches to the S1: Switching on inhibited state automatically after initialization and successfully completing the self-test (typically approx. 30 s).

6.8.2.3   **S1: Switching on inhibited (Switch on disabled)**

Features

▸ Initialization has been completed

▸ Self-test was successfully completed

▸ The power unit as well as drive and activation functions are locked

Possible causes of a switch-on lockout include:

1.   Insufficient or no supply voltage/DC link feed-in

2.   STO safety function is active

3.   Coast stop is active (source: M515, bit 1 = 0)

4.   Quick stop is active (source: M515, bit 2 = 0; cause only in states S1, S2, S3, S4 and S52)

5.   Control by PLC is not active (source: M515, bit 10 = 0)

6.   Drive has a fault

7.   Release override is active (source: F06; cause only in states S1, S2 and S3)

8.   Control panel or local operation is active (cause only in states S1, S2 and S3)

For the exact cause of a switch-on lockout, refer to parameter E49.

Transition to S2: Ready for switching on (2)

M515, bit 0 (On) = 0

AND

M515, bit 1 (No coast stop) = 1

AND

M515, bit 2 (No quick stop) = 1

AND

No fault → M516, bit 3 (Fault present) = 0

AND

Enable active

AND

No cause for a switch-on lockout

| 6.8.2.4 | **S2: Ready for switching on (Ready to switch on)** |

Features

▸ Power unit and drive function are disabled

▸ Drive controller is ready to switch on

Transition to S3: Switched on (3)

M515, bit 0 (On) = 1

AND

M515, bit 1 (No coast stop) = 1

AND

M515, bit 2 (No quick stop) = 1

Transition to S1: Switching on inhibited (7), priority: ●

M515, bit 1 (No coast stop) = 0

OR

M515, bit 2 (No quick stop) = 0

OR

Enable inactive

OR

Fault with or without fault reaction

OR

Cause for a switch-on lockout

6.8.2.5   **S3: Switched on**

Features

  ▸ Power unit is ready for operation

  ▸ Drive function is locked; set values are not processed

Transition to S4: Operation (4)

M515, bit 0 (On) = 1

AND

M515, bit 1 (No coast stop) = 1

AND

M515, bit 2 (No quick stop) = 1

AND

M515, bit 3 (Enable operation) = 1

Transition to S2: Ready for switching on (6), priority: ●

M515, bit 0 (On) = 0

Transition to S1: Switching on inhibited (8), priority: ● ●

M515, bit 1 (No coast stop) = 0

OR

M515, bit 2 (No quick stop) = 0

OR

Enable inactive

OR

Fault with or without fault reaction

OR

Cause for a switch-on lockout

6.8.2.6 **S4: Operation (Operation enabled)**

> **Information**
>
> If you use a gravity-loaded axis with a brake, always switch off the drive using a controlled stop. This prevents the load from dropping until the brake is fully engaged. For a controlled stop, the Ramp stop or Quick stop function is used: state transition 10, 11 or 15 according to the device state machine.

Features

▷ Power unit is switched on

▷ Drive function is enabled, set values are processed

Transition to S3: Switched on (5)

This transition brings the drive to an uncontrolled standstill. The power unit is disabled and axis movement is no longer controlled by the drive controller.

M515, bit 3 (Enable operation) = 0

Transition to S1: Switching on inhibited (9), priority: ●●●

This transition brings the drive to an uncontrolled standstill. The power unit is disabled and axis movement is no longer controlled by the drive controller.

M515, bit 1 (No coast stop) = 0

OR

Enable inactive AND quick stop in case of Enable-off inactive

OR

Fault without quick stop fault reaction (Coast stop)

OR

Cause for a switch-on lockout

Transition to S51: Ramp stop (10), priority: ●

M515, bit 0 (On) = 0

OR

Fault with stop fault reaction (Ramp stop)

Transition to S52: Quick stop (11), priority: ●●

M515, bit 2 (No quick stop) = 0

OR

Enable inactive AND quick stop in case of Enable-off active

OR

Fault with quick stop fault reaction (Quick stop)

OR

Request for drive-controlled SS1

6.8.2.7   **S5: Switching off**

Various stop reactions are available. For the priority levels of stop reactions, the order is Ramp stop, Quick stop and Coast stop, with a Ramp stop having the lowest priority and a Coast stop having the highest priority. Within the S5: Switching off state, the prioritization of the different stop reactions is mapped using the S51: Ramp stop and S52: Quick stop states.

6.8.2.7.1   **S51: Ramp stop**

Features

▸ Power unit is switched on; drive function is enabled

Transition to S4: Operation enabled (12)

M515, bit 0 (On) = 1

Transition to S2: Ready for switching on (13), priority: ●

M515, bit 3 (Enable operation) = 0

OR

Standstill detected

Transition to S1: Switching on inhibited (14), priority: ● ● ●

M515, bit 1 (No coast stop) = 0

OR

Enable inactive AND quick stop in case of Enable-off inactive

OR

Cause for a switch-on lockout

Transition to S52: Quick stop (15), priority: ● ●

M515, bit 2 (No quick stop) = 0

OR

Enable inactive AND quick stop in case of Enable-off active

OR

Request for drive-controlled SS1

6.8.2.7.2   **S52: Quick stop**

Features

- Power unit is switched on; drive function is enabled

- A quick stop is executed

Transition to S1: Switching on inhibited (14), priority: ● ● ●

M515, bit 1 (No coast stop) = 0

OR

Enable inactive AND quick stop in case of Enable-off inactive

OR

Cause for a switch-on lockout

Transition to S1: Switching on inhibited (16)

M515, bit 3 (Enable operation) = 0

OR

Standstill detected

6.9   General control

In addition to the signals of the device control, which are implemented via the control word 1 (STW1, parameter M515) and the status word 1 (ZSW1, parameter M516), a general control signal from STW1 is also used to influence the application. On the application level, an MC_Stop is executed if bit 0 is set to the value 0. To operate the application, bit 0 must be set to the value 1.

Bit	Designation	Comment
0	On	Switch on voltage: 0 = inactive; 1 = active

Tab. 73: General control: Bit 0 in control word 1

6.10   General presets

The control signals are transmitted from the controller to the drive controller via fieldbus. For the start of a movement and for the jog function, which is defined in the PROFIdrive profile, the following presets are therefore implemented in the DriveControlSuite:

Parameter	Default value
I100 Source execute	2: Parameter
I104 Source jog enable	2: Parameter
I105 Source positive jog	2: Parameter
I106 Source negativ jog	2: Parameter

Tab. 74: Presets: Source digital signals (application)

6.11 Jog

The jog function is activated for all application classes and telegrams via control word 1 (M515). In control word 1, the following bits are assigned for the jog function:

Bit	Designation	Comment
8	Jog 1 ON	Positive jog (prerequisite: I104 = I105 = 2: Parameter): 0 = inactive; 1 = active
9	Jog 2 ON	Negative jog (prerequisite: I104 = I106 = 2: Parameter): 0 = inactive; 1 = active

Tab. 75: Jog: Bit 8 + 9 in control word 1

The jog function is defined by the following parameters:

▸ I12 Jog velocity

▸ I13 Jog acceleration

▸ I18 Jog jerk

6.12 Required encoder values

In DriveControlSuite, H09 provides information about the encoder connection. If automatic readout from the drive controller is not supported by the controller, you can find the necessary information in DriveControlSuite, Application PROFIdrive wizard > Additional functions > Encoder data.

The following table contains the required values for Pilz encoders as an example:

Encoder model	H09[0]	Encoder type	Measuring system	Increments per revolution	Number of revolutions	Bit in Gx_XIST1	Bit in Gx_XIST2
ECI 1118 -G2	ECI 1118	Absolute	Rotational	262 144	1	0	0
ECN 1123	ECN 1123	Absolute	Rotational	8 388 608	1	0	0
EQI 1131 (EnDat 2.2)	EQI 1131	(Cyclic) absolute	Rotational	524 288	4096	0	0
EQI 1131 (EnDat 3)	EQI 1131	(Cyclic) absolute	Rotational	65536	4096	8	0
EQN 1135	EQN 1135	(Cyclic) absolute	Rotational	1 048 576	4096	3	0

Tab. 76: Required encoder values

For more information on the encoders, refer to the operating manual for the motor (see Further information [📖 161]).

> **Information**
>
> In TIA Portal, under Encoder type, you can choose between Incremental, Absolute and Cyclic absolute. For multi-turn absolute encoders (number of revolutions > 1), select the setting Cyclic absolute. The encoder overrun (zero crossing of the encoder) is automatically taken into account by the technology object with this setting.

6.13 Cycle times

Possible cycle times can be found in the following table.

Type	Cycle times	Relevant parameters
PROFINET RT fieldbus, cyclical communication	1 ms, 2 ms, 4 ms, 8 ms	Adjustable in the TIA Portal
PROFINET IRT fieldbus, cyclical communication	1 ms, 2 ms, 4 ms	Adjustable in the TIA Portal

Tab. 77: Cycle times

6.14 Lag monitoring

In PROFIdrive type applications, you can monitor the lag of the axis with active position control in order to detect increasing position deviations at an early stage. Monitoring the lag allows you to react quickly before material damage can occur, e.g. in the event of stiffness or a mechanical blockage of the output.

To monitor the lag, the difference between the actual position of the axis and the set position $x2_{set}$ of the control is determined and compared with the maximum permissible lag (actual position: I80; set position: I96; permissible lag: I21; result: I187). If the permitted lag is exceeded, event 54: Following error is triggered with the corresponding protection level (protection level: U22).

7 Appendix

7.1 Supported communication objects

7.1.1 PROFIdrive Profile specific; parameter number (PNU): 900 – 999

The following table contains the supported profile-specific communication objects of the standardized PROFIdrive profile and their mapping to the corresponding parameters of Pilz.

Parameter number (PNU)	Transmit PZD	Receive PZD	Name	Comment
922	—	—	Telegram selection	M513
925	—	—	Number of controller Sign-of-Life failures which may be tolerated	M538
930	—	—	Operating mode	Constant value 1
944	—	—	Fault message counter	M540
947	—	—	Fault number	M543
950	—	—	Scaling of the fault buffer	Constant value 8
952	—	—	Fault situation counter	
964	—	—	Drive unit identification	
965	—	—	Profile identification number	
972	—	—	Drive reset	A09
977	—	—	Transfer to non-volatile memory	A00
979	—	—	Sensor format	M537
980	—	—	Number list of defined parameter	

Tab. 78: PROFIdrive Profile specific; PNU: 900 – 999

7.1.2 PROFIdrive Velocity reference value; parameter number (PNU): 60000

The following table contains the supported Velocity reference value communication object of the standardized PROFIdrive profile as well as its mapping to the corresponding parameter of Pilz.

Parameter number (PNU)	Transmit PZD	Receive PZD	Name	Comment
60000	—	—	Velocity reference value	M571

Tab. 79: PROFIdrive Velocity reference value; PNU: 60000

7.1.3 PROFIdrive Communication system interfaces; parameter number (PNU): 61000 – 61999

The following table contains the supported communication objects for the transmission of the standardized PROFIdrive profile as well as their mapping to the corresponding parameters of Pilz.

Parameter number (PNU)	Transmit PZD	Receive PZD	Name	Comment
61000	—	—	Name of station	A273
61001	—	—	IP of station	A274
61002	—	—	MAC of station	A279
61003	—	—	Default gateway of station	A276
61004	—	—	Subnet mask of station	A275

Tab. 80: PROFIdrive Communication system interfaces; PNU: 61000 – 61999

7.2 Further information

The documentation listed below provides you with further relevant information on the drive controllers. The current status of the documentation can be found at:
https://www.pilz.com/en-INT.

Title	Documentation	Contents	ID
PMC SC6 drive controller	Manual	System design, technical data, project configuration, storage, installation, connection, commissioning, operation, service, diagnostics	1005343
Multi-axis drive system with PMC SI6 and PMC PS6	Manual	System design, technical data, project configuration, storage, installation, connection, commissioning, operation, service, diagnostics	1005342
PROFINET communication – PMC SC6, PMC SI6	Manual	Electrical installation, data transfer, commissioning, diagnostics, detailed information	1006907
PMC SU6 safety technology – STO and SS1 via PROFIsafe	Manual	Technical data, installation, commissioning, diagnostics, detailed information	1006910
PMC SR6 safety technology – STO via terminals	Manual	Technical data, installation, commissioning, diagnostics, detailed information	1005344
Motion commands	Manual	Control and status information, denials and limitations, motion	1006913

The following documentation provides you with further relevant information on the motors. The current status of the documentation can be found at:
https://www.pilz.com/en-INT.

Title	Documentation	Contents	ID
PMC EZ synchronous servo motors	Operating manual	Technical data, storage, installation, connection, commissioning, service	1005461

Additional information and sources that form the basis of this documentation or are referenced by the documentation:

PROFIBUS Nutzerorganisation e. V. (PNO), 2015. *Profile Drive Technology – PROFIdrive Profile*. Technical specification for PROFIBUS and PROFINET. Specification. Version 4.2, October 2015.

Information concerning the Siemens TIA Portal

The most important information about the Siemens TIA Portal and additional documents, links and training courses can be found at
http://www.industry.siemens.com/topics/global/en/tia-portal/pages/default.aspx.

PMC SC6, PMC SI6 – Device description

A GSD file for easily integrating the drive controllers of the PMC SC6 and PMC SI6 series into the respective system environment can be found at:
https://www.pilz.com/en-INT, search term GSD.

7.3 Formula symbols

Symbol	Unit	Explanation
F	N	Force
M	Nm	Torque
n	rpm	Speed
n_1	rpm	Speed at gearbox input
n_2	rpm	Speed at the gearbox output
x	mm	Position

7.4 Abbreviations

Abbreviation	Meaning
AC	Application class
C-LS	Controller life counter
DO-LS	Drive controller life counter
DSC	Dynamic Servo Control
FB	Function Block
GSD	General Station Description data
GSDML	General Station Description Markup Language
IEC	International Electrotechnical Commission
IP	Internet Protocol
IRT	Isochronous Real-Time
LS	Limit Switch
LSB	Least Significant Bit
M	Motor
M/F	Torque or force
MAC	Media Access Control
MDI	Manual Data Input
MEnc	Motor Encoder
PEnc	Position Encoder
PNU	Parameter Number
PROFIBUS	Process Field Bus
PROFINET	Process Field Network
PZD	Prozessdaten (process data)
RS	Reference Switch
RxPZD	Receive PZD (receive process data)
S	Switch
STW	Steuerwort (control word)
TIA	Totally Integrated Automation
TO	Technology Object
TxPZD	Transmit PZD (transmit process data)
ZP	Zero Pulse
ZSW	Zustandswort (status word)

Application class (AC)

Standardized drive functions according to the PROFIdrive device profile. In view of its wide range of possible applications, six classes specified according to functionality have been defined for PROFIdrive. A drive can cover one or more classes.

Broadcast domain

Logical grouping of network devices within a local network that reaches all nodes via broadcast.

Command

Operating mode in the Drive Based and Drive Based Synchronous applications. This enables configurable movements to be shut down. The associated motion commands correspond to the PLCopen standard. An absolutely necessary, higher-level controller coordinates the associated time-dependent sequences.

Dynamic Servo Control (DSC)

Concept of the PROFIdrive application to increase dynamic control performance. It requires application class 4 and transmits the proportional coefficient KP of the position controller and the control difference e (position deviation) in addition to the velocity feedforward control.

Function block

Functional software unit that includes a named copy of a data structure and associated operations defined by a corresponding function block type.

GSD file

Includes the technical features of a PROFINET IO device (type, configuration data, parameters, diagnostic information, etc.) in XML format in accordance with the GSDML specification. A GSD file serves as the configuration basis for project configuration systems and is generally provided by the respective device manufacturer.

i²t model

Computational model for thermal monitoring.

IO controller

Generally, a programmable logic controller that controls automation tasks and regulates data communication.

IO device

A decentralized field device that is assigned logically to a PROFINET IO controller that manages and controls it. An IO device consists of multiple modules and submodules.

IPv4 limited broadcast

Type of broadcast in a network with IPv4 (Internet Protocol version 4). The IP address 255.255.255.255 is entered as the destination. The content of the broadcast is not forwarded by a router, which limits it to the local network.

Jog

Step-by-step movement that can be used to move the drive incrementally and independently of the controller, such as during commissioning, in emergency operation or during setup and repair work. Also: Name of a CiA 402 application operating mode.

Limit switches

Element that triggers a signal when a certain position of a machine part needing to be moved is reached, as a result of which further movement in this direction is prevented.

MAC address

Hardware address for unique identification of a device in an Ethernet network. The MAC address is assigned by the manufacturer and consists of a 3-byte manufacturer ID and 3-byte device ID.

Measuring input

Function of the PROFIdrive application which the drive controller can use when the signal of a measurement input is changed, e.g. by a limit switch, to detect the current actual position of the axis, store it temporarily and transfer it to the controller via PROFINET.

Motion block

Operating mode in the Drive Based and Drive Based Synchronous applications. Summarizes the properties of movements in the form of pre-defined motion blocks. Linking these enables the definition of complete motion sequences, which makes it possible to execute sequences quickly – regardless of whether the motion sequences are specified by a controller or executed through digital signals.

Process data (PZD)

Control and status information that is time-critical and transmitted in the PROFINET network cyclically using telegrams. Depending on the view of the respective node, a distinction is made between receive PZD (RxPZD) and transmit PZD (TxPZD).

PROFIdrive

Standardized drive interface for PROFIBUS and PROFINET open standard buses. It defines the device behavior and procedure for accessing internal device data for electrical drives on PROFINET and PROFIBUS. The interface is specified by PROFIBUS and PROFINET International (PI) user organizations, and is specified as the future-proof standard by standard IEC 61800-7-303.

PROFINET

Open Ethernet standard of PROFIBUS Nutzerorganisation e. V. (PNO) for automation.

PROFINET IRT

Transmission method for high-precision as well as synchronized processes in a PROFINET IO system.

PROFINET RT

Transmission method for time-critical process data in a PROFINET IO system.

PROFIsafe

Communication standard for safety standard IEC 61508 that includes both standard as well as fail-safe communication. The standard enables reliable communication for PROFIBUS and PROFINET open standard buses based on standard network components, and is defined as the international standard in standard IEC 61784-3-3.

Receive PZD (RxPZD)

Process data received by a node in the PROFINET network.

Referencing

When commissioning a system with a position measurement system, the relation of a measured axis to an actual axis position must be determined. As a rule, a defined starting position is identified through either a reference search or a reference setting. The associated process is referred to as referencing. Absolute movements can be performed only in a referenced state.

Siemens telegram

Data with specified sequence and standardized contents that is exchanged cyclically between the controller and drive controller during PROFIdrive communication. The standard telegram is structured according to the manufacturer-specific specifications from Siemens.

Standard telegram

Data with specified sequence and standardized contents that is exchanged cyclically between the controller and drive controller during PROFIdrive communication. The standard telegram is structured according to the PROFIdrive device profile.

Technology object (TO)

Software object in a Siemens controller that represents a mechanical component. It encapsulates the technological functionality and allows uniform configuration and parameterization.

Torque reduction

Function of the PROFIdrive application for limiting the torque during operation in application class 1 or 4.

Transmit PZD (TxPZD)

Process data sent by a node.

▶ Support

Technical support is available from Pilz round the clock.

Americas

Brazil
+55 11 97569-2804

Canada
+1 888 315 7459

Mexico
+52 55 5572 1300

USA (toll-free)
+1 877-PILZUSA (745-9872)

Asia

China
+86 400-088-3566

Japan
+81 45 471-2281

South Korea
+82 31 778 3300

Australia and Oceania

Australia
+61 3 95600621

New Zealand
+64 9 6345350

Europe

Austria
+43 1 7986263-444

Belgium, Luxembourg
+32 9 3217570

France
+33 3 88104003

Germany
+49 711 3409-444

Ireland
+353 21 4804983

Italy, Malta
+39 0362 1826711

Scandinavia
+45 74436332

Spain
+34 938497433

Switzerland
+41 62 88979-32

The Netherlands
+31 347 320477

Türkiye
+90 216 5775552

United Kingdom
+44 1536 462203

You can reach our international hotline on:
+49 711 3409-222
support@pilz.com

Pilz develops environmentally-friendly products using ecological materials and energy-saving technologies. Offices and production facilities are ecologically designed, environmentally-aware and energy-saving. So Pilz offers sustainability, plus the security of using energy-efficient products and environmentally-friendly solutions.

BLU**e**COMPETENCE
Alliance Member
Partner of the Engineering Industry
Sustainability Initiative

German Standards
BRAND OF THE CENTURY
2022

Quality Management
ISO 9001:2015
REG. NO. 2462

Environmental Management
ISO 14001
REG. NO. 2462

Energy Management
ISO 50001
REG. NO. 2462

We are represented internationally. Please refer to our homepage www.pilz.com for further details or contact our headquarters.