PROFINET – SC6, SI6
Operating manual

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ID 443039.04

STÖBER

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1 Foreword

PROFINET, an open industrial Ethernet standard, is especially well-suited for applications that require fast communication with a high data rate combined with industrial IT functions. PROFINET is real-time capable and uses IT standards like TCP/IP.

STOBER 6th generation drive controllers support PROFINET, a development of the successful PROFIBUS standard. The drive controllers are tailored for real-time communication of I/O data and offer the ability to transfer all required data, parameters and IT functions at the same time.

The fieldbus functionality is integrated into the firmware in the SC6 or SI6 series drive controllers.

The SC6 and SI6 series drive controllers successfully passed the PROFINET as well as PROFIsafe conformance test. There, the communication interface was tested to ensure the reliability and function of the lower-level communication regardless of vendor.

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2 User information

This documentation assists you with commissioning the STOBER SC6 or SI6 series drive controllers (IO device) in combination with a higher-level controller (IO controller) using a PROFINET network.

Technical knowledge

Operating your PROFINET network requires having familiarity 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 so, follow the instructions in the manuals for the SC6 and SI6 drive controllers.

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:

SC6 or SI6 series drive controller in conjunction with the DriveControlSuite software (DS6) in V 6.5-D or higher and associated firmware in V 6.5-D-PN or higher.

2.3 Timeliness

Check whether this document is the latest version of the documentation. We make the latest document versions for our products available for download on our website:
http://www.stoeber.de/en/downloads/.

2.4 Original language

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

2.5 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.

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2.6 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.

2.6.1 Display of safety instructions

Safety instructions are identified with the following 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.

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2.6.2 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, shortcut
Table > Insert table	Navigation to menus/submenus (path specification)

2.6.3 Mathematics and formulas

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

-	Subtraction
+	Addition
×	Multiplication
÷	Division
| |	Amount

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2.7 Trademarks

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

Windows®, Windows® 7, Windows® 10	Windows®, das Windows®-Logo, Windows® XP, Windows® 7 und Windows® 10 are registered trademarks of Microsoft Corporation in the United States and/or other countries.
PROFIBUS®, PROFINET®	PROFIBUS® and PROFINET® are registered trademarks of PROFIBUS Nutzerorganisation e.V., Karlsruhe, Germany.
SIMATIC®, TIA Portal®	SIMATIC® and TIA Portal® are registered trademarks of Siemens AG, Munich, 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.

2.8 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 STOBER-specific terminology to the greatest extent possible. The correlation of STOBER-specific names to other sources can be found in the following table.

STOBER	PROFINET
Controller	IO controller
Drive controller	IO device

Tab. 1: Correlation of STOBER terminology to PROFINET

3 General safety instructions

There are risks associated with the product described in this documentation that can be prevented by complying with the described warning and safety instructions as well as the included technical rules and regulations.

3.1 Directives and standards

The European directives and standards relevant for the product specified in this documentation can be taken from the directives and standards of the corresponding drive controller.

3.2 Qualified personnel

In order to be able to perform the tasks described in this documentation, the persons instructed to perform them must have the appropriate professional qualification and be able to assess the risks and residual hazards when handling the products. For this reason, all work on the products as well as their operation and disposal may be performed only by professionally qualified personnel.

Qualified personnel are persons who have acquired the authorization to perform these activities either through training to become a specialist and/or instruction by specialists.

Furthermore, valid regulations, legal requirements, applicable basic rules, this documentation and the safety instructions included in it must be carefully read, understood and observed.

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3.3 Intended use

As defined by EN 50178, drive controllers are electrical devices operating as power electronics to control the flow of energy in high-voltage systems.

The drive controllers are intended solely for the operation of motors that meet the requirements of EN 60034-1:

- Lean motors of the LM series
- Synchronous servo motors (e.g. of the EZ series)
- Asynchronous motors
- Torque motors

The connection of other electronic loads or operation outside applicable technical specifications constitutes improper use.

When installing drive controllers in machines, commissioning (i.e. commencing intended operation) may not be performed until it has been determined that the machine is in compliance with local laws and directives. For example, in the European region, the following applies:

- Machinery Directive 2006/42/EC
- Low Voltage Directive 2014/35/EU
- EMC Directive 2014/30/EU

EMC-compliant installation

The drive controller and accessories must be installed and wired compliant for EMC

Modification

As the user, you may not make any physical, technical or electrical modifications to the drive controller and the accessories.

Maintenance

The drive controller and accessories are maintenance-free. However, take appropriate measures to detect or prevent possible errors in the connecting wiring.

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3.4 Operational environment and operation

The products are subject to sales restrictions in accordance with EN IEC 61800-3.

The products are not designed for use in a public low-voltage network that supplies residential areas. Radio-frequency interference can be expected if the products are used in this type of network.

The products are intended exclusively for installation in control cabinets with at least protection class IP54.

Always operate the products within the limits specified by the technical data.

The following applications are prohibited:

- Use in potentially explosive atmospheres
- Use in environments with harmful substances as specified by EN 60721, such as oils, acids, gases, vapors, dust and radiation

Implementation of the following applications is permitted only after approval from STOBER:

- Use in non-stationary applications
- The use of active components (drive controllers, supply modules, energy recovery units or discharge units) from third-party manufacturers

The products are designed exclusively for operation in TN networks or on wye sources.

The drive controller has a configurable restart. If the drive controller is designed for an automatic restart after energy shutdown, this must be clearly specified on the system in accordance with EN 61800-5-1.

The drive controller has the option of a Safe Torque Off safety function (STO) in accordance with EN 61800-5-2 for safely disconnecting the energy supply to the motor. Measures based on this for protection against unexpected startup are described in EN ISO 12100 and EN ISO 14118, for example.

3.5 Disposal

Observe the current national and regional regulations when disposing of the packaging and product! Dispose of the packaging and individual product parts depending on their properties, e.g. as:

- Cardboard
- Electronic waste (circuit boards)
- Plastic
- Sheet metal
- Copper
- Aluminum
- Battery

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4 Network structure

A PROFINET network generally consists of a PROFINET segment with a controller (IO controller) and all IO devices belonging to this area, i.e. SC6 or SI6 series drive controllers and a PC as the IO supervisor.

The PS6 supply module, which you also need for SI6 series drive controllers, is not part of the PROFINET network.

The PROFINET network structure is generally tailored to the specific requirements of the respective system. STOBER drive controllers support a star, line or tree topology.

All PROFINET nodes are integrated into the PROFINET network using internal or external switches (100 Mbps).

You can configure and parameterize the drive controllers using the DriveControlSuite DS6 software from STOBER; Siemens TIA Portal lets you do this for the entire PROFINET network, for instance.

The following graphic presents an abstract of a PROFINET network using the SI6 series as an example.

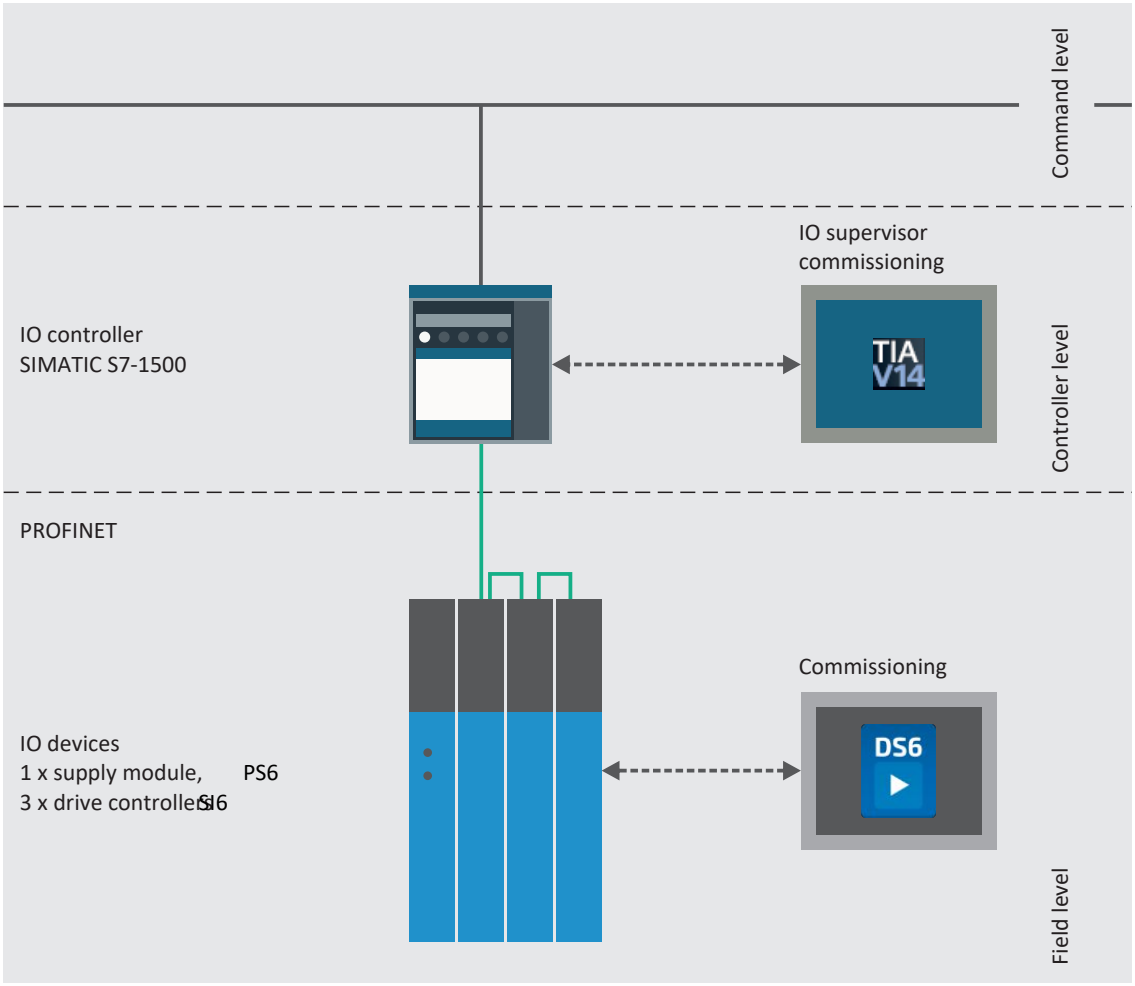


Fig. 1: PROFINET: Network structure, using the SI6 series as an example

5 Connection

For network connection, PROFINET only allows switches; these in turn allow for flexible network structure and nearly unlimited network expansion of several kilometers at maximum speed.

5.1 Selecting suitable lines

The PROFINET transmission technology is based on the Fast Ethernet standard.

The connections between the nodes of a PROFINET network generally consist of symmetrical, shielded copper cables twisted in pairs (shielded twisted pair, CAT 5e quality level). Fiber-optic cables are also a possible means of transmission.

Signals are transmitted according to the 100BASE TX method, i.e. with a transfer rate of 100 Mbps at a frequency of 125 MHz. A maximum of 1440 bytes can be transferred per frame. The maximum cable length is 100 m.

PROFINET cables exist in different versions that are tailored to different application scenarios and ambient conditions.

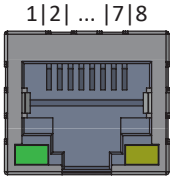
We recommend using the cables and plug connectors specified in the PROFINET installation guidelines. They are adjusted for use in automation technology with regard to usage, resistance, EMC properties and color coding.

There are type A, B and C cables, differentiated by installation type:

- Type A
  4-wire shielded copper cable for fixed installation
- Type B
  4-wire shielded copper cable for flexible installation
- Type C
  4-wire shielded copper cable for constant movements

5.2 X200, X201: Fieldbus connection

In order to be able to connect the drive controllers to other PROFINET nodes, an integrated switch with both X200 and X201 RJ-45 sockets is provided. The sockets are located on top of the device. The associated pin assignment and color coding correspond to the EIA/TIA-T568B standard.

Socket	Pin	Designation	Function
1|2| ... |7|8 	1	Tx+	Communication
	2	Tx–	
	3	Rx+	
	4	—	—
	5	—	—
	6	Rx–	Communication
	7	—	—
	8	—	—

Tab. 2: X200 and X201 connection description

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6 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.

6.1 Program interfaces

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

6.1.1 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.

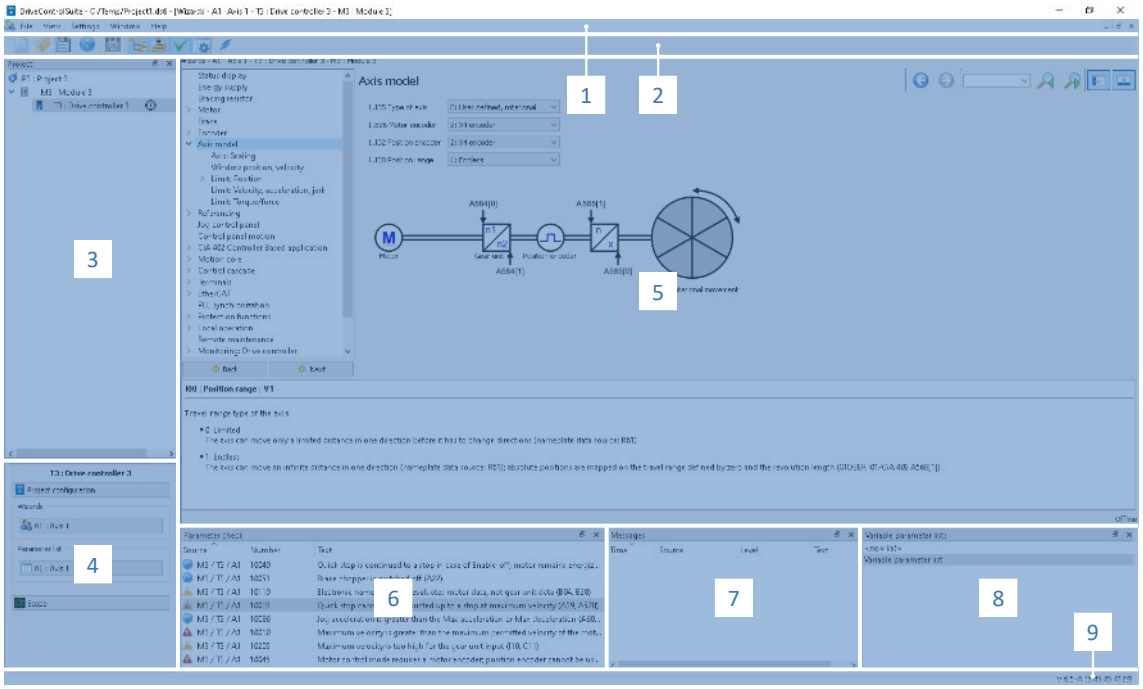

Fig. 2: DS6: Program interface

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.

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6.1.1.1 Individualized workspace

The project tree (1) and project menu (2) are connected and, like the parameter check and messages (5, 6), can also be docked at the left, right or bottom edge of the screen. This program window can also be displayed or hidden using the View menu.

The workspace (3) and parameter description (4) are also connected to each other and always positioned in the middle. Both areas can be minimized or maximized.

6.1.1.2 Navigation using sensitive circuit diagrams

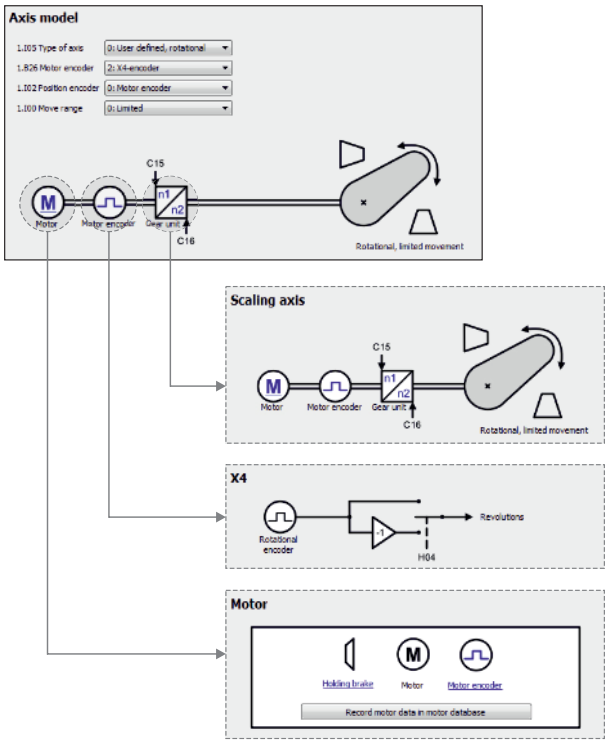

Fig. 3: DriveControlSuite: Navigation using text links and symbols

In order to illustrate graphically the processing sequence of actual and set values, the use of signals or certain drive component arrangements 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 just a click.

6.1.2 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.

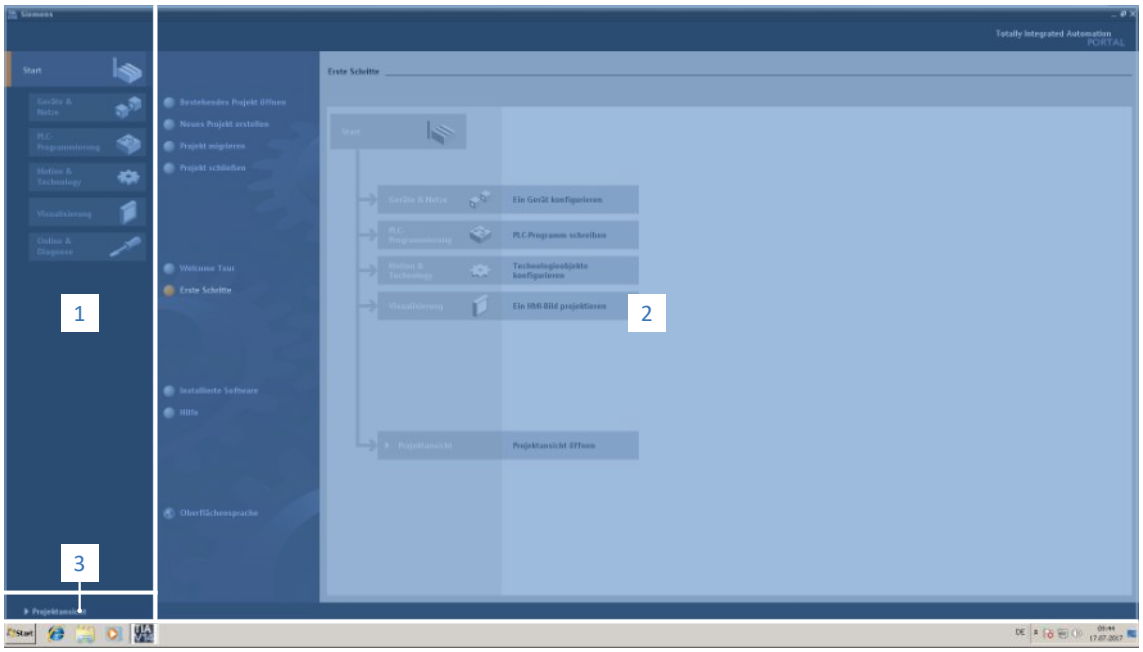

Fig. 4: TIA Portal: Program interface of the portal view

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.

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TIA project view

The TIA project view offers you access to all components of a project. The following graphic shows the interface elements of the TIA portal view relevant to this documentation.

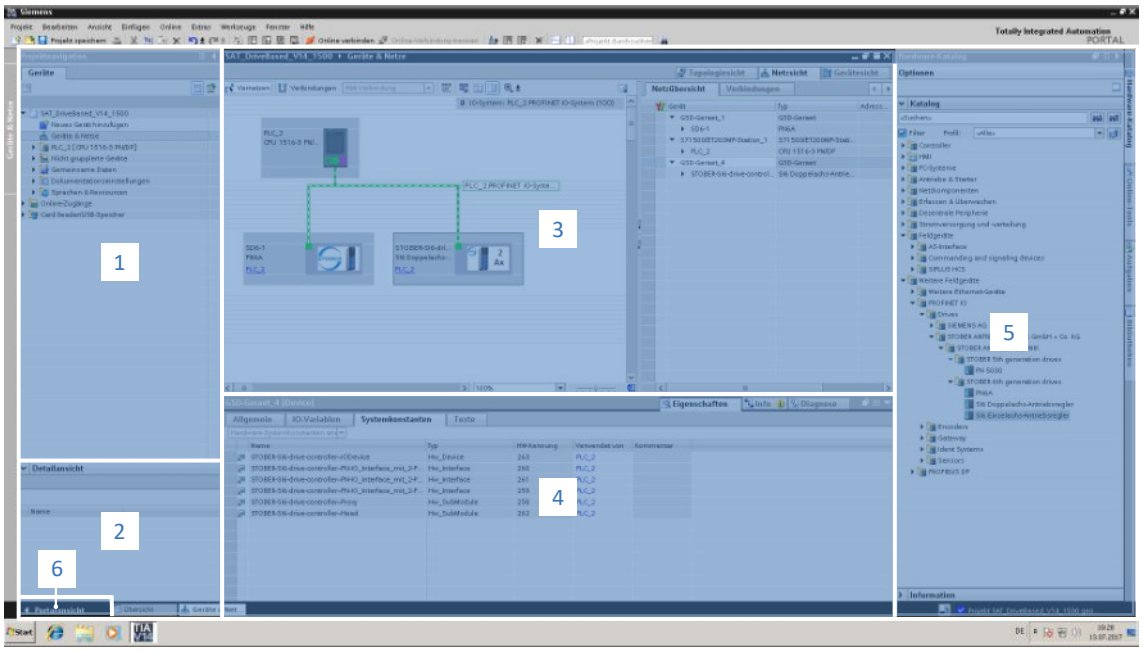


Fig. 5: TIA Portal: Program interface of the project view

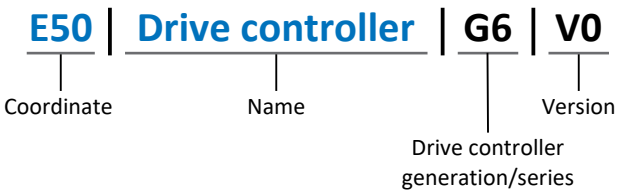
No.	Area	Description
1	Project navigation	Project navigation offers you access to all components of your TIA project.
2	Detail view	The detail view shows you additional information about a selected object.
3	Workspace	In the workspace, you can edit objects in the topology view, network view or device 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.

6.2 Meaning of parameters

You can adapt the function of the drive controller to your individual application using parameters. In addition, parameters visualize the current actual values (actual velocity, actual torque, etc.) and trigger actions like 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.



6.2.1 Parameter groups

Parameters are assigned to individual groups by topic. The 6th generation of STOBER drive controllers differentiates 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	Encoders
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; 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, gear unit and geared motor
S	Safety (safety technology)
T	Scope
U	Protection functions
Z	Fault counter

Tab. 3: Parameter groups

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6.2.2 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.

Type	Style	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)	-2147483648 – 2147483647
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 – 4294967295
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, styles, 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 the associated units and decimal places
  Example: Actual and set values for velocity, acceleration, deceleration, jerk
- Parameter address
  Corresponds to the storage location of another parameter
  Example: Indirect read sources for analog and digital outputs and for fieldbus mapping
- Text
  Outputs or messages

6.2.3 Parameter types

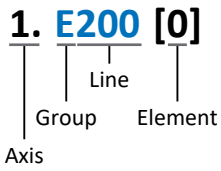
The following types of parameters are differentiated.

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

6.2.4 Parameter structure

Every parameter has specific coordinates with the following pattern.



- Axis
  The axis to which a parameter is assigned in the case of multiple axes (optional).
- Group
  The thematic group to which a parameter belongs.
- Line
  Distinguishes the parameters within a parameter group.
- Element
  Elements of an array or record parameter (optional).

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6.2.5 Parameter visibility

The visibility of a parameter depends on the access level defined in the software, the dependency of other parameters, the selected application and the version of the associated firmware.

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. 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

Parameter A10 Access level controls general access to parameters:

- Over CANopen or EtherCAT (A10[2])
- Over PROFINET (A10[3])

Hiding functions

Hiding functions are used to hide parameters with regard to their logical relationships to other option modules or parameters.

Information

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

Applications

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

Firmware

A newer version of the firmware may introduce new parameters. Parameters that have been configured for files of an older firmware function may not be visible in newer versions. In such cases, the respective parameter description includes a corresponding note.

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6.3 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 either controlled 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 data 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

If you are working with a fieldbus system and have selected the source parameters for control signals and set values, configure the fieldbus-specific settings, e.g. the layout of process data channels for transmitting receive and transmit process data, as the last step.

6.4 Power-loss protected storage

All project configurations, parameterizations and related changes to parameter values are in effect after transmission to the drive controller, but are not yet stored in non-volatile memory.

Saving to a drive controller

You have the following options for saving the configuration to a drive controller in non-volatile memory:

- 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 to all drive controllers within a project

You have the following options for saving the configuration to multiple drive controllers in non-volatile memory:

- Saving the configuration using the toolbar:
  Toolbar > Save values symbol: Click on the Save values symbol
- Saving the configuration using the Online connection window:
  Project menu > Online connection area > Projected axis > Online connection 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 starts without an executable configuration when it is next switched on. In this case, the configuration must be transferred to the drive controller again and saved in non-volatile memory.

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7 Commissioning

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

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

- Drive controllers from the SC6 or SI6 series with firmware version 6.5-D-PN or later
- DS6 commissioning software in version 6.5-D or later

in combination with

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

Commissioning is divided into the following steps:

1. DriveControlSuite:
   Project all drive controllers (device control, application, process data, axis model, etc.), parameterize all general PROFINET settings as well as the PZD transmission, then transmit your configuration to the drive controllers of your PROFINET network.
2. TIA Portal:
   Next, map your actual PROFINET network in TIA Portal and configure the individual nodes. 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.

7.1 DS6: Configuring the drive controller

Project and configure all drive controllers for your drive system in DriveControlSuite DS6 (see the chapter DS6 program interface [▶ 15]).

Information

The steps required for commissioning PROFINET are described based on the drive-based Drive Based application in combination with Drive Based device control.

The process for mapping your axis model and parameterizing the Drive Based device control or the different operating modes of the Drive Based application can be found in the accompanying manual (see the chapter Detailed information [▶ 72]).

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.

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7.1.1 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.

7.1.1.1 Projecting the drive controller and axis

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

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.
   Reference: Specify the reference code (equipment code) of the drive controller.
   Designation: Give the drive controller a unique name.
   Version: Version your project configuration.
   Description: If necessary, specify additional supporting information, such as the change history of the project configuration.
2. Drive controller tab:
   Select the series and device type of the drive controller.
   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:
   Device control: Select Drive Based.
   Rx process data, Tx process data: Select PROFINET Rx and PROFINET Tx for transmitting PROFINET process data.

Information

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

Projecting the axis

1. Click on Axis 1.
2. Properties tab:
   Establish the connection between your circuit diagram and the axis to be projected in DriveControlSuite.
   Reference: Specify the reference code (equipment code) of the axis.
   Designation: Give the axis a unique name.
   Version: Version your project configuration.
   Description: If necessary, specify additional supporting information, such as the change history of the project configuration.
3. Application tab:
   Select Drive Based.
4. Motor tab:
   Select the type of motor operated using this axis. If you are working with motors from third-party suppliers, enter the accompanying motor data at a later time.
5. Repeat steps 2 – 4 for the 2nd axis (only for double-axis controllers).
6. Confirm with OK.

7.1.1.2 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.

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7.1.2 Parameterizing general PROFINET settings

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

1. Highlight the relevant drive controller in the project tree and click on the first projected axis in the project menu > Wizard area.
2. Select the PROFINET wizard.
3. A100 Fieldbus scaling:
   Leave the default setting at 1: Native (values are passed unchanged).
4. A273 PN device name:
   Shows the PROFINET device name that was assigned in TIA Portal if there is an online connection between the drive controller and controller.
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: response monitoring time) in the PROFINET network (default value: 20 ms).

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7.1.3 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 IO distinguishes between receive PZD (RxPZD) and transmit PZD (TxPZD). STOBER drive controllers of the 6th generation support a flexible assignment of the parameter values to be transmitted.

The RxPZD and TxPZD process data that is exchanged between the controller and drive controller during cyclical data transmission depends on the projected application. In the PROFIdrive application, the mapping of the process data is specified by the controller in online operation. In Drive Based applications, the process data is pre-assigned by the standard mapping accordingly. Check the standard mapping and adjust it if necessary.

You can transfer process data with a maximum of 48 parameters to be transferred over axes A and B (24 per axis).

Information

The PZD processing is WORD-oriented in some controllers (16 bit). In Drive Based applications, the standard mapping is pre-assigned appropriately. If changes are made to the standard mapping, take the parameter data type that you are adding to or removing from the mapping into account.

If you add or remove parameters of the BYTE or INT8 data type (8 bit), this can cause problems in the data structures of the controller. If necessary, use parameter A101 Dummy byte to fill the 8-bit gaps that result in the process data and implement the necessary data structure for the controller.

7.1.3.1 Adapting RxPZD

Information

You define the scope of transmission of cyclical PZD in TIA Portal by projecting a corresponding process data module for each axis of the drive controller.

✓ You have projected the Drive Based application.

1. Highlight the relevant drive controller in the project tree and click on the first projected axis in the project menu > Wizard area.
2. Select the PROFINET wizard > Received process data RxPZD.
3. Check the standard mapping and adapt it to be transferred to your requirements if necessary.
   A90[0] – A90[23], A91[0] – A91[23]:
   Target parameters whose values are received by the drive controller from the controller. The position provides information about the receiving sequence.
4. Resulting data length:
   Shows the overall length of the PZD to be transmitted if there is an online connection to the controller. The value must not exceed the data volume of the process data module that you project in TIA Portal.[1]

[1] Max. 72 bytes/36 words

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7.1.3.2 Adapting TxPZD

Information

You define the scope of transmission of cyclical PZD in TIA Portal by projecting a corresponding process data module for each axis of the drive controller.

✓ You have projected the Drive Based application.

1. Highlight the relevant drive controller in the project tree and click on the first projected axis in the project menu > Wizard area.
2. Select the PROFINET wizard > Transmitted process data TxPZD.
3. Check the standard mapping and adapt it to be transferred to your requirements if necessary.
   A94[0] – A94[23], A95[0] – A95[23]:
   Source parameters whose values the drive controller sends to the controller. The position provides information about the transmission sequence.
4. Resulting data length:
   Shows the overall length of the PZD to be transmitted if there is an online connection to the controller. The value must not exceed the data volume of the process data module that you project in TIA Portal.[2]

[2] Max. 72 bytes/36 words

7.1.4 Mapping the mechanical axis model

To be able to put your real drive train with one or more drive controllers into operation, you must map your complete mechanical environment in DriveControlSuite.

7.1.4.1 Parameterizing the STOBER motor

You have projected one of the following motors:

STOBER synchronous servo motor with EnDat 2.2 digital, EnDat 3 or HIPERFACE DSL 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. All additional data on the brake and encoder is transferred at the same time.

STOBER 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. Highlight the relevant drive controller in the project tree and click on the first projected axis in the project menu > Wizard area.
2. Select the Motor wizard.
3. B101Cable 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. Highlight 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

All models of the 6th STOBER drive controller generation feature a certified i^2t model, a computational model for thermal monitoring of the motor. In order to activate it and start the protective function, set the parameters as follows (deviating from the default values): U10 = 2: Warning and U11 = 1.00 s. This model can be used instead of or in addition to temperature-monitored motor protection.

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7.1.4.2 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.

7.1.4.2.1 Define the axis model

1. Highlight the relevant drive controller in the project tree and click on the first 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 position set values, 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 position set values, 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 have selected 1: Endless for I00, parameterize a revolution length (see Scale the axis [▶ 35]).

Information

If you parameterize I05 Type of axis, you can either use the selections 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 the selections 2: Rotational and 3: Translational to revert to default values.

Selecting 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.

Selecting 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.

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7.1.4.2.2 Scale the axis

1. Highlight the relevant drive controller in the project tree and click on the first 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 position, velocities, accelerations, torque/force**, which calculates the effects of changed movement 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.

Information

A change to parameter I06 moves the decimal separator for all axis-specific values!
Ideally, change I06 before parameterizing other axis-specific values and then check them afterwards.

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 for Drive Based or A585 Feed constant for CiA 402. If you have made changes to one of the parameters listed, select I297 accordingly as well.

7.1.4.2.3 Parameterize 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 range for velocity tests.
3. I22 Target window:
   Parameterize a tolerance range for position tests.
4. I87 Actual position in window time:
   Parameterize how long a drive must stay in the specified position range before a corresponding status message is output.
5. Parameterize a tolerance range for lag tests.

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7.1.4.2.4 Limiting the axis

If necessary, limit the movement variables for position, velocity, acceleration, jerk as well as torque/force according to the applicable conditions for your axis model.

Limiting the position (optional)

1. Highlight the relevant drive controller in the project tree and click on the first projected axis in the project menu > Wizard area.
2. Select the Axis model wizard > Limit: Position.
3. If necessary, limit the position of your axis using a software or hardware limit switch to secure the travel range.

Limiting velocity, acceleration, jerk (optional)

The specified default values are designed for slow velocities without gear units. For this reason, adapt the saved values.

Note that the velocity of the motor is parameterized in units other than that of the axis model. Verify the velocity of the motor against the velocity of the output accordingly.

1. Select the Motor wizard.
2. To determine the maximum velocity at the output, copy the value of the B13 Nominal motor speed parameter to the clipboard.
3. Select the Axis model wizard > Axis: Scaling > Conversion of positions, velocities, accelerations, torque/force area.
4. Velocity line:
   Paste the copied value of the B13 parameter from the clipboard without the unit and confirm with ENTER.
   ⇨ The maximum velocity of the motor has been transferred to the output.
5. Select the Axis model wizard > Limit: Velocity, acceleration, jerk.
6. I10 Maximal speed:
   Limit the maximum velocity of the output taking into account the configured Nominal motor speed in B13.
7. Determine the limiting values for acceleration and jerk if necessary and enter them into the associated parameters.

Limiting torque/force (optional)

The specified default values take into account the rated operation together with the overload reserves.

1. Select the Axis model wizard > Limit: Torque/force.
2. If the motor force must be limited, adapt the saved values as necessary.

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7.1.5 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.

Information

During the search, all drive controllers within the broadcast domain are found via IPv4 limited broadcast.

Prerequisites for finding a drive controller in the network:

- Network supports IPv4 limited broadcast
- All drive controllers are in the same subnet (broadcast domain)

Transmitting the configuration

✓ The drive controllers are switched on.

1. In the project tree, highlight the module under which you have recorded your drive controller and click Online connection in the project menu.
   ⇨ The Add connection window 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 connection window opens. All drive controllers connected through the selected IP addresses are displayed.
3. Select 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 on Establish online connections.

⇨ The configurations are transferred to the drive controllers.

Saving the configuration

✓ You have successfully transferred the configurations.

1. Online connection window:
   Click on Save values (A00).
   ⇨ The Save values (A00) window opens.
2. Click on Start action.
   ⇨ The configurations are saved.
3. Close the Save values (A00) window.
4. Online connection window:
   Click on Restart (A09).
   ⇨ The Restart (A09) window opens.
5. Click on Start action.
6. Confirm the safety instruction with OK.
   ⇨ The Restart (A09) window closes.
   ⇨ The fieldbus communication and connection to DriveControlSuite are interrupted.
   ⇨ The drive controllers restart.

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7.1.6 Activating the control panel and testing the configuration

⚠ WARNING!

Injury to persons and material damage due to axis movement!

By activating the control panel, you have sole control over the movements of the axis using DriveControlSuite. 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.

- 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.

✓ You have successfully saved the configurations.

✓ There must not be any active safety function.

1. Highlight the relevant drive controller in the project tree and click on the first projected axis in the project menu > Wizard area.
2. Select the Jog control panel wizard.
3. Click Control panel on and then Enable.
   ⇨ The drive is controlled using the activated control panel.
4. Move the axis step-by-step and test the direction of motion, velocity, distances, etc. using the Jog+, Jog–, Jog step+ and Jog step– buttons.
5. Optimize your project configuration based on your test results as necessary.
6. 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–.

7.2 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.

7.2.1 Installing the GSD file

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

Information

If you have already downloaded a GSD file from the STOBER 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 STOBER 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 STOBER-specific GSD file 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 STOBER drive controllers are available in the hardware catalog.

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7.2.2 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.

7.2.2.1 Projecting the controller

Project the controller of your PROFINET network.

✓ You have created a TIA project and installed the STOBER-specific GSD.

✓ 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 belong to your controller.
2. Drag and drop the desired controller into the network view.

⇨ The controller is incorporated into your TIA project.

7.2.2.2 Projecting the drive controller

Project all drive controllers of your PROFINET network.

✓ You have created a TIA project and installed the STOBER-specific GSD.

✓ 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/SI6, SC6 single-axis controllers.
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.

7.2.2.3 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 are in the TIA network view.

✓ You have projected the controller and drive controllers.

1. Click on the port of the controller and drag a connection to the port 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.

Information

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

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7.2.3 Configuring the controller

Configure the network addresses for the controller as needed.

7.2.3.1 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. Network view:
   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. General tab:
   Select PROFINET interface > Ethernet addresses in the area navigation.
3. IP protocol area > Set IP address in the project:
   If it is not active 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.

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7.2.4 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. Then, project the process data modules and configure the settings for PZD transmission between the controller and drive controller.

7.2.4.1 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. Network view:
   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. General tab:
   Select General in the area navigation.
   ⇨ The general settings for the drive controller open.
3. Name:
   Assign a device name for the drive controller that corresponds to the PROFINET naming conventions.
4. Device view:
   Mark the drive controller in question 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.

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).

7.2.4.2 Projecting the process data module

Define the data volume for the PZD transmission of the PROFINET communication by projecting a process data module for each axis.

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

1. Network view:
   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. Hardware catalog > Module > Cat 1: Process data modules (PZD), all consistent:
   Select a process data module with a data volume that at least corresponds to your process data map in the drive controller.
3. Drag and drop the selected module into the device overview of the drive controller at slot 1 provided for this.
4. If you are using a double-axis controller, repeat the process for the second axis and slot 2.
   ⇨ The input and output addresses of the drive controller are generated automatically.

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7.2.4.3 Configuring PZD transmission

For the PZD transmission, configure the cycle time for the data exchange as well as the watchdog time for the monitoring of PROFINET communication between the controller and drive controller.

✓ You are in the TIA network view.

1. Network view:
   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. In the area navigation, select PROFINET interface [X1] > Advanced options > Real-time settings > IO cycle.
   ⇨ The settings for the IO cycle open.
3. Update time:
   Configure the cycle time in which the controller and drive controller exchange data.
   3.1. Calculate update time automatically:
   If the cycle time is to be calculated automatically, select this option.
   3.2. Set update time manually:
   If you want to set the cycle time manually, select this option and specify the desired time.
   3.3. Adapt update time when send clock changes:
   If you have set the cycle time manually and if the ratio between cycle time and transmission cycle is to remain constant, also select this option.
4. Watchdog time area:
   Configure the watchdog time for monitoring the PROFINET communication.
   4.1. Accepted update cycles without IO data:
   Enter the number of permitted cycles after which the PROFINET watchdog is triggered in case of an interruption in PROFINET communication.
   4.2. Watchdog time:
   The watchdog time for PROFINET communication is calculated automatically based on the cycle time and the permitted cycles without data exchange and must not exceed 1.92 seconds.

Information

The application-dependent cycle time of the drive controller can be read off in parameter A150 Cycle time in DriveControlSuite.

7.2.5 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.

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.

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7.2.6 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 navigation > Devices tab:
   By double-clicking on Online & diagnostics, open the Online access detail view of the controller in question.
   ⇨ This switches you to the respective device view.
2. Online access area:
   Click on Connect online.
   ⇨ An online connection to the selected controller is being established.
3. In the area navigation, select Diagnostics > Diagnostics buffer.
4. 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.

Information

Setup of the PROFINET network is complete. As an option, you can continue by programming the acyclical communication services, as described in Programming acyclical communication services [▶ 60].

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8 Monitoring and diagnostics

For monitoring purposes and in the event of a fault, the various monitoring and diagnostic options described below are available.

8.1 Connection monitoring

In order that the drive does not respond in an unwanted manner in the event of an interruption of the PROFINET connection (cable break, etc.), we recommend monitoring the arrival of cyclical process data.

PROFINET provides the watchdog time (TIA Portal: response monitoring time) for connection monitoring. This time, in combination with the cycle time (TIA Portal: update time), defines the IO cycle in the controller (IO controller).

The cycle time determines the interval in which data is transmitted from the controller to the drive controller in question (IO device) and vice versa. It depends on various factors including the data volume to be transferred and is generally calculated in TIA Portal automatically for each drive controller.

The watchdog time corresponds to the number of permitted cycles without a data transfer (see the chapter Configuring PZD transmission [▶ 45]).

In addition to the watchdog time of the controller, the parameter A109 PZD-Timeout can also be activated in DriveControlSuite. At the end of the watchdog time projected for the controller, the PZD timeout also takes effect in the firmware of the drive controller.

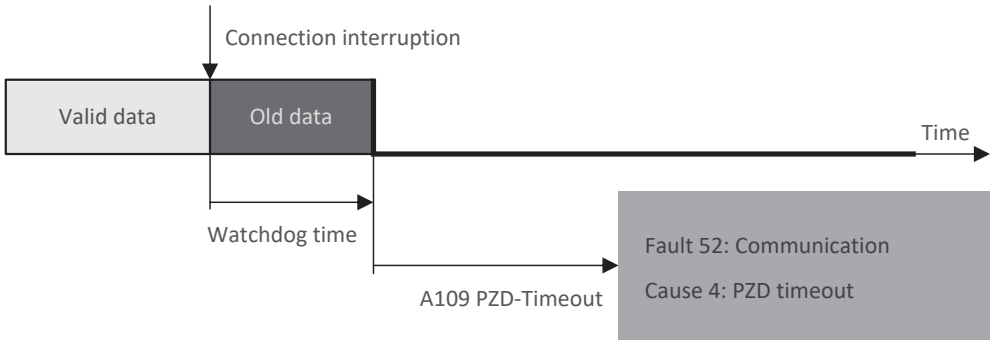

Fig. 6: PROFINET: Connection monitoring

The configured watchdog time runs down as soon as an error has occurred, and then the timeout parameterized in A109. Once the timeout has also elapsed, the drive controller changes to the **Fault** device state with the accompanying event 52: communication, cause 4: PZD timeout.

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8.2 LED display

The drive controllers feature diagnostic LEDs that visualize the state of fieldbus communication and the states of the physical connection.

8.2.1 PROFINET state

There are 2 LEDs on the front of the drive controller that provide information about the connection between controller and drive controller and about the state of the data exchange. This information can also be read out in parameter A271 PN state.

Fig. 7: LEDs for the PROFINET state

1 Red: BF (bus error)
2 Green: Run

Red LED	Conduct	Description
	Off	No error
	Rapid flashing	Data exchange with controller not active
	On	No network connection

Tab. 6: Meaning of the red LED (BF)

Green LED	Conduct	Description
	Off	No connection
	Flash	Connection is set up to controller
	Flash, inverse	Controller activates DHCP signal service
	Flashing	Existing connection to controller; data exchange expected
	On	Existing connection to controller

Tab. 7: Meaning of the green LED (Run)

8.2.2 PROFINET network connection

The Act. and Link LEDs at X200 and X201 on the top of the device indicate the state of the PROFINET network connection.

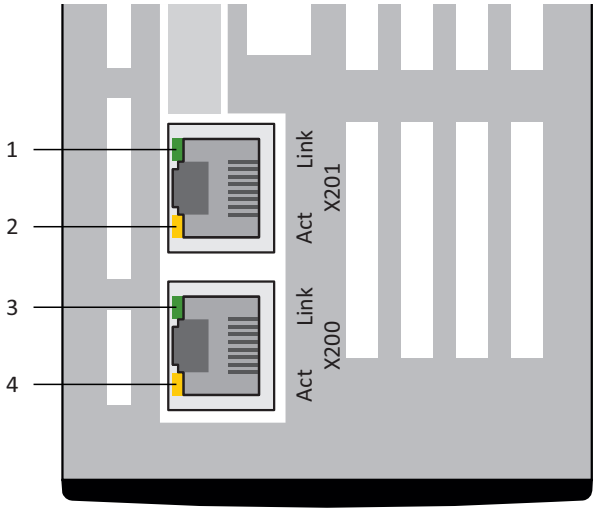

Fig. 8: LEDs for the state of the PROFINET network connection

1 Green: Link at X201
2 Yellow: Activity at X201
3 Green: Link at X200
4 Yellow: Activity at X200

Green LED	Conduct	Description
	Off	No network connection
	On	Network connection exists

Tab. 8: Meaning of the green LEDs (Link)

Yellow LED	Conduct	Description
	Off	No data exchange
	Flashing	Active data exchange with controller

Tab. 9: Meaning of the yellow LEDs (Act.)

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8.3 Events

The drive controller has a self-monitoring system that uses test rules to protect the drive system from damage. Violating the test rules triggers a corresponding event. There is no possible way for you as the user to intervene in some events, such as the Short/ground event. In others, you can influence the effects and responses.

Possible effects include:

- Message: Information that can be evaluated by the controller
- Warning: Information that can be evaluated by the controller and becomes a fault after a defined time span has elapsed without the cause being resolved
- Fault: Immediate drive controller response; the power unit is disabled and axis movement is no longer controlled by the drive controller or the axis is brought to a standstill by a quick stop or emergency braking

ATTENTION!

Damage to property due to interruption of a quick stop or emergency braking!

If, when executing a quick stop or emergency braking, a fault occurs or STO is active, the quick stop or emergency braking is interrupted. In this case, the machine can be damaged by the uncontrolled axis movement.

Events, their causes and suitable measures are listed below. If the cause of the error is corrected, you can usually acknowledge the error immediately. If the drive controller has to be restarted instead, a corresponding note can be found in the measures.

Information

To make it easier for control programmers to set up the human-machine interface (HMI), a list of events and their causes can be found in the STOBER download center at http://www.stoeber.de/en/downloads/.

8.3.1 Event 52: Communication

The drive controller is interrupted if:

- A29 = 0: Inactive for Drive Based or PROFIdrive device control

Response:

- The power unit is disabled and axis movement is no longer controlled by the drive controller
- The brakes are applied in the event of an inactive release override (F06)

The drive controller has a fault and a quick stop occurs if:

- A29 = 1: Active for Drive Based or PROFIdrive device control

Response:

- The axis is stopped by a quick stop; meanwhile, the brakes remain released
- At the end of the quick stop, the power unit is disabled and the axis movement is no longer controlled by the drive controller; the brakes engage if release override is inactive (F06)

Cause		Check and action
4: PZD-Timeout	Missing process data	Check the cycle time in the controller and tolerated failure time for monitoring the PZD communication in the drive controller and correct if necessary (A109)
14: PZD parameter figure faulty	Missing mapping	Check the mapping for unmappable parameters and correct them if necessary
15: Wrong firmware for applicataion	Projected fieldbus identification and that of the drive controller do not match	Check the projected fieldbus identification and the fieldbus identification of the drive controller and change the fieldbus if necessary (E59[2], E52[3])

Tab. 10: Event 52 – Causes and actions

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8.4 Parameters

The following diagnostic parameters are available for you in PROFINET communication in combination with SC6 or SI6 series drive controllers.

8.4.1 A270 | X20x state | G6 | V0

State of the network connection (fieldbus).

- [0]: X200
  - 0: Error
  - 1: No connection
    No network cable plugged in
  - 2: 10 MBit/s
    Connection active; transfer rate of 10 Mbps
  - 3: 100 MBit/s
    Connection active; transfer rate of 100 Mbps, half-duplex
  - 4: Link OK
    Connection active; transfer rate of 100 Mbps, full-duplex
- [1]: X201
  See [0]: X200

8.4.2 A271 | PN state | G6 | V0

State of the drive controller in the PROFINET network.

- 0: offline
  Hardware not ready for use
- 1: step 1
  Hardware ready for use; no connection to the IO controller
- 2: step 2
  IP address received; connection to the IO controller is set up
- 3: phase 1
  Drive controller is configured by the IO controller
- 4: phase 2
  Device start-up of IO controller and drive controller completed; process data communication is started
- 5: cyclic data exchange
  Process data communication active

8.4.3 A272 | PN module/submodule | G6 | V1

Module configurations of the drive controller in the PROFINET network (source: IO controller; format: WW XX YYY ZZZ; WW = module ID, XX = submodule ID, YYY = RxPZD data length in bytes, ZZZ = TxPZD data length in bytes).

- [0]: Single-axis controller, double-axis controller axis A
- [1]: Double-axis controller axis B

8.4.4 A273 | PN device name | G6 | V0

Device name of the drive controller (IO device) in the PROFINET network (source: IO controller).

- [0] – [2]: Current device name; parts 1 – 3 (additional use: DriveControlSuite connection dialog)
- [3] – [5]: Device name after the next fieldbus restart; parts 1 – 3

8.4.5 A274 | PN IP address | G6 | V0

IP address of the drive controller in the PROFINET network (source: IO controller).

- [0]: Current IP address
- [1]: IP address after the next fieldbus restart

8.4.6 A275 | PN subnet mask | G6 | V0

Subnet mask of the drive controller in the PROFINET network (source: IO controller).

- [0]: Current subnet mask
- [1]: Subnet mask after the next fieldbus restart

8.4.7 A276 | PN gateway | G6 | V0

Gateway address of the drive controller in the PROFINET network (source: IO controller).

- [0]: Current gateway address
- [1]: Gateway address after the next fieldbus restart

8.4.8 A279 | PN MAC addresses | G6 | V0

MAC addresses of the drive controller in the PROFINET network.

- [0]: PROFINET device
- [1]: X200
- [2]: X201

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9 More on PROFINET?

The following chapters summarize the key terms, services and relationships relating to PROFINET.

9.1 PROFINET

PROFINET (process field network) is the open industrial Ethernet standard for automation from Siemens, developed in collaboration with the PROFIBUS-Nutzerorganisation e. V. PROFINET is standardized in IEC 61158 and IEC 61784.

PROFINET is based on Ethernet TCP/IP and is primarily used in cases where fast data communication over Ethernet networks combined with industrial IT functions are needed.

PROFINET IO

PROFINET IO was designed in addition to PROFINET CBA as a technological variant for quick data exchange between a controller and decentralized field devices (decentral peripherals, DP). PROFINET IO is based on PROFIBUS DP and uses Fast Ethernet as the means of transmission. Process data (PZD), data for parameterization (parameter channel data), data for diagnostic purposes, alarms and IT applications are all transferred—over a single network.

PROFINET transmits data with and without a real-time request, while process data and alarms are exclusively transferred using the real-time communication. PROFINET IO provides two versions in order to scale this optimally:
PROFINET IO-RT for unsynchronized communication and PROFINET IO-IRT for cycle-synchronized real-time communication.

STOBER drive controllers of the 6th generation support PROFINET IO-RT.

PROFINET follows the provider-consumer model where communication partners are on equal footing. Data can be sent without a request from another network node. Normally, in the case of a data exchange, a controller (IO controller) reads in the signals from the drive controllers (IO devices), processes them and provides them back to the drive controllers.

9.2 Device classes

PROFINET IO classifies network nodes into the following device classes based on their tasks.

IO supervisor (PC)

An IO supervisor is typically a piece of engineering and diagnostics software that can access all process and configuration data and process alarms or diagnostic messages. The supervisor is normally only integrated into the network on a temporary basis.

IO controller (controller)

An IO controller controls data communication, i.e. it receives process data and event-controlled messages and processes them. A programmable logic controller (PLC, e.g. SIMATIC S7-1500) normally handles the role of the IO controller.

IO device (drive controller)

An IO device is typically a decentrally located field device (e.g. a drive controller) that is assigned to at least one IO controller.

An IO device transmits process and configuration data as well as alarms. It normally consists of modules that contain the individual input and output signals of the respective process.

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9.3 Communication

A controller (IO controller) controls and regulates communication with drive controllers (IO devices) in the PROFINET network. In the process, the controller transmits cyclical process data (PZD), such as control information, to the drive controllers and receives current status information from them.

In addition, the controller and drive controller acyclically exchange data that is not time-critical, such as configuration parameter values or one-time events, using parameter channel data.

Both communication services run in parallel, with transmission of cyclical PZD having higher priority. In each cyclical exchange of data, an acyclical frame is injected as needed.

Information

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

9.3.1 Cyclical communication: Process data

Process data (PZD) is normally data that is required for controlling and observing the ongoing process, such as set positions, travel velocities or acceleration information.
It is generally used for data exchange in real time. It also gives you simultaneous access to multiple drive parameters. Process data is exchanged quickly and cyclically with a high priority over the RT real-time channel.

For PROFINET IO, the cyclical data traffic relies directly on the MAC address of a device and does not contain any IP addresses. This keeps the overall length of a data packet relatively small.
The direction of data flow is of critical importance in this data transfer. From the perspective of the respective nodes, a distinction is made between receive PZD (RxPZD) and transmit PZD (TxPZD).

The specific communication elements that are sent and received in specific PZD can be freely selected. The length and structure of the process data are defined as part of the project configuration by means of the process data modules (see the chapter Process data modules [▶ 71]).
Currently, 48 parameter values with a maximum total length of 72 bytes (36 words) can be exchanged between the IO controller and IO device per drive controller.

9.3.2 Acyclical communication: Parameter channel data

Information

If you use the example project provided by STOBER for programming acyclical communication services, this chapter is not relevant in practice.

The parameter channel is used to transfer data that is not time-critical. Parameter channel data enables read and write access to the configuration parameters of a drive controller and transfers one-time events.

Parameter channel data is transmitted acyclically in ongoing cyclical PROFINET operation, without impairing PZD communication. This requires drive-specific acyclical communication services. You can either program them based on the RDREC and WRREC SIMATIC system function blocks (see the following chapters) or load a STOBER-specific example project specifically tailored to the STOBER drive controllers of the 6th generation from the STOBER download area in your TIA Portal and parameterize the parameters appropriately for your system environment.

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9.3.2.1 RDREC and WRREC: Input and output parameters

In order to transfer acyclical parameter channel data, PROFINET offers the **Read record** and **Write record** functions. The associated interfaces are controlled using the RDREC (read record) and WRREC (write record) SIMANTIC system function blocks that operate asynchronously.

RDREC and WRREC contain special input and output parameters in a defined sequence. Both blocks communicate with the IO devices in the network using the input and output parameters described below.

RDREC: Input and output parameters

The RDREC block reads a RECORD out of a hardware component addressed in the **ID** parameter.

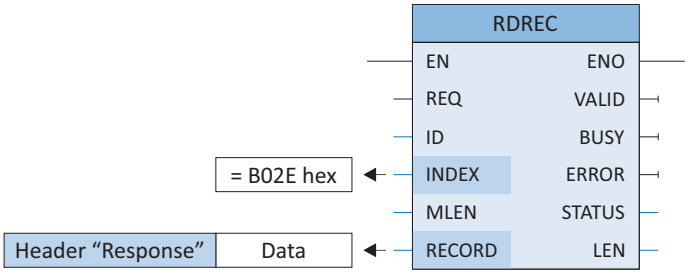

Fig. 9: RDREC system function block: Input and output parameters

Parameters	Data type	Declaration	
EN	BOOL	IN	Release input
REQ	BOOL	IN	Transfer record (REQ = 1: Start transfer)
ID	HW_IO	IN	Hardware identifier for an IO device; is issued automatically and can be read out in the device properties (System constants tab), for example
INDEX	DINT	IN	Record number (the associated value must always be **B02E hex**)
MLEN	UINT	IN	Maximum length of the record to be transferred
ENO	BOOL	OUT	Release output
VALID	BOOL	OUT	Record was received and is valid
BUSY	BOOL	OUT	Status of the reading (BUSY = 1: still not finished)
ERROR	BOOL	OUT	Status of the reading (ERROR = 1: faulty)
STATUS	DWORD	OUT	Status of the RDREC block or error information
LEN	UINT	OUT	Length of the record that was read
RECORD	Variant	IN/OUT	Record (consisting of header + data, see the chapter RDREC, WRREC: RECORD [▶ 67])

Tab. 11: Parameters of the RDREC system function block

WRREC: Input and output parameters

The WRREC system function block transfers the RECORD to a hardware component addressed in the **ID** parameter.

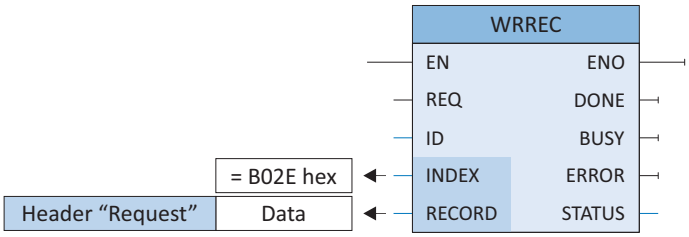

Fig. 10: WRREC system function block: Input and output parameters

Parameters	Data type	Declaration	
EN	BOOL	IN	Release input
REQ	BOOL	IN	Transfer record (REQ = 1: Start transfer)
ID	HW_IO	IN	Hardware ID for an IO device; is issued automatically and can be read out using TIA Hardware Manager > Device > Properties, for example
INDEX	DINT	IN	Record number (the associated value must always be **B02E hex**)
ENO	BOOL	OUT	Release output
DONE	BOOL	OUT	Status of the communication: Record was transferred
BUSY	BOOL	OUT	Status of the writing (BUSY = 1: still not finished)
ERROR	BOOL	OUT	Status of the writing (ERROR = 1: faulty)
STATUS	DWORD	OUT	Status of the WRREC block or error information
RECORD	Variant	IN/OUT	Record (consisting of header + data, see the chapter RDREC, WRREC: RECORD [▶ 67])

Tab. 12: Parameters of the WRREC system function block

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9.3.2.2 RDREC and WRREC: Acyclical communication flow

The following diagrams clarify the communication flow of the RDREC and WRREC system function blocks.

Read record flow

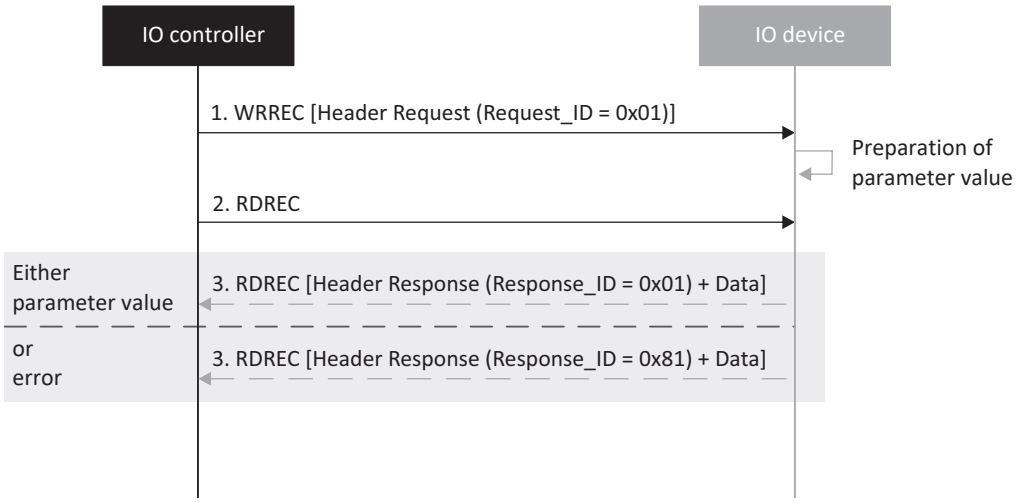

Fig. 11: RDREC flow

During RDREC, be aware that each parameter service begins with a read record request and ends with a read record response.

Write record flow

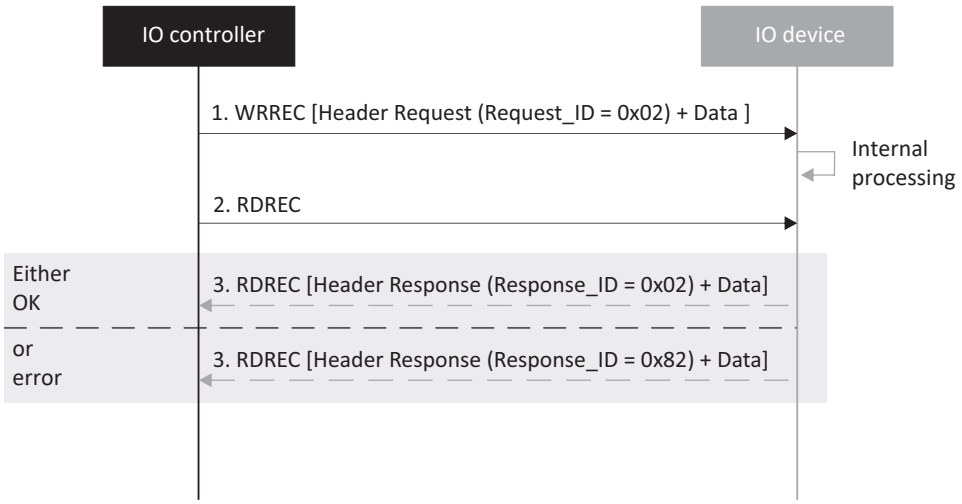

Fig. 12: WRREC flow

9.3.3 Programming acyclical communication services

To be able to transfer parameters acyclically, PROFINET provides the **Read record** and **Write record** services.

The services are controlled using SIMATIC function blocks RDREC and WRREC. You can either integrate this into the PLC program yourself or load and parameterize one of the example projects provided for download by STOBER in the TIA Portal.

Information

In the context of the latter, observe the documentation belonging to the example projects.

1. To get the latest project version, switch to the download area on the STOBER website http://www.stoeber.de/en/downloads/ and enter the term `TIA Portal` in the search field.
   ⇨ The TIA Portal Parameter Services (examples for generation 6) project is displayed in the result list.
2. Start the download and save the file to your PC.
3. Unpack the ZIP file.
   ⇨ The ZIP file contains a ZAP15_1 file (SAT_Param_Example_V15_1500) for the SIMATIC S7-1500 controller from Siemens.
4. TIA Portal:
   Select Project > Retrieve and navigate to the directory where you saved the example project.
5. Open the example project.
   ⇨ The example project is loaded in the TIA project view.
6. Project tree > Devices tab:
   Open the folder of the controller > Program blocks
7. G6_Read_Acyclic and G6_Write_Acyclic function blocks:
   Parameterize the blocks as described in the documentation of the example project.

Information

Specifically for double-axis controllers, note that only one acyclic access per device may be active at the same time! When using the services in combination with internal function blocks, access coordination must be resolved in the application.

In the example project provided by STOBER, the xLockAcyclic bit coordinates simultaneous acyclical access to a drive controller. The bit locks the communication for other blocks. Every block that acyclically accesses a drive controller locks access using the xLockAcyclic bit and enables it again by resetting the bit as soon as the data exchange has ended.

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9.4 Communication protocols

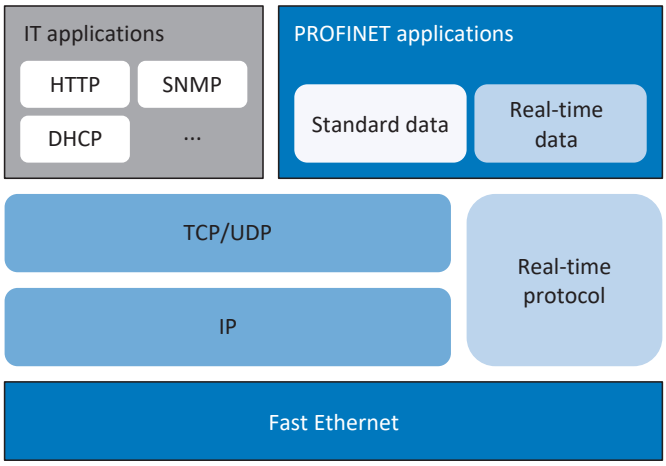

Fig. 13: PROFINET communication protocols

One protocol optimized for fast Ethernet is suitable for real-time communication: the real-time protocol.
It allows for a high-performance transfer of cyclical real-time data and event-driven messages.

Standard PROFINET data without a real-time request, such as parameter values or diagnostic data, is usually transferred using the TCP/IP or UDP/IP protocols. For typical IT applications such as the transfer of websites, e-mails, etc., PROFINET relies on standard IT protocols such as HTTP or SNMP.

9.5 Service communication via PROFINET

Using PROFINET, it is possible to transport any Ethernet data traffic between nodes in a PROFINET network. This is how STOBER enables service communication between DriveControlSuite and STOBER SC6 and SI6 drive controllers using the PROFINET network.

The controller (IO controller) is used as a gateway to the Ethernet network, where the IP address, subnet mask and gateway of the PROFINET nodes are stored. Ethernet data is transmitted acyclically, i.e. the PROFINET real-time properties (process data communication) remain unaffected.

There are 2 different topologies for service communication via PROFINET:

- Topology 1
  TIA Portal and DriveControlSuite are operated on a PC; only the PROFINET network is used
- Topology 2
  TIA Portal and DriveControlSuite are operated on different PCs; transmission takes place between the PROFINET network and Ethernet

Information

To be able to use the service communication via PROFINET, DriveControlSuite must be connected with the PROFINET network and be in the same subnet as TIA Portal.

If you assign the IP address to the drive controller in non-volatile memory, DriveControlSuite can find the drive controller even without the controller.

9.6 Ethernet network addressing

All PROFINET IO nodes are based on the Industrial Ethernet Standard, meaning that the assignment of the following addresses and names is important to be able to communicate with drive controllers in the PROFINET IO system.

9.6.1 MAC address

Each network interface of a device in an Ethernet network requires its own address – a MAC address. The MAC address is used as a source and destination address for cyclical data exchange.

A MAC address consists of a fixed and a variable part. The fixed part identifies the manufacturer (3 bytes) and the variable part distinguishes the individual Ethernet nodes and must be globally unique (also 3 bytes). A MAC address can only communicate between two nodes of the same subnet.

The MAC addresses of the interfaces are issued by STOBER and cannot be changed.

Information

The MAC address range of the STOBER hardware is: 00:11:39:00:00:00 – 00:11:39:FF:FF:FF

You can read out the MAC address of the PROFINET interface using parameter A279 PN MAC addresses.

9.6.2 IP address

Each PROFINET IO node has to support various Ethernet-based protocols, at least TCP/IP and UDP/IP.

All data packets sent over the IP protocol contain the respective recipient and sender addresses. Consequently, each PROFINET node needs a unique IP address to be able to receive communication.

The IP protocol is hardware-independent; unlike the fixed MAC address, the IP address is explicitly assigned to each drive controller.

The IP address is for acyclical data exchange, e.g. transferring the configuration to the controller, configuring the drive controllers and reading out device and diagnostic information.

An IPv4 address consists of 4 decimal numbers from the value range 0 – 255 separated by a decimal.

Read out the IP address of a drive controller using parameter A274 PN IP address.

9.6.3 Subnet mask

An IP address always consists of a network ID (for identifying the network) and a host ID (for identifying the node). A subnet mask defines which parts of the IP address are assigned to the network ID. It has the structure of the IP address but only marks the network ID.

Read out the subnet mask using the A275 PN subnet mask parameter.

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9.6.4 Subnets and gateways

The IP addresses of a network are usually subdivided into subnets. The purpose of subnets is to provide autonomous networks with an address range. All PROFINET IO nodes connected by switches are in a subnet, meaning that they communicate over a direct path. All nodes of a subnet have the same subnet mask.

Gateways are components of a subnet and are responsible for forwarding subnet-specific network queries to other subnets.

Information

Be aware that real-time communication is only possible within a subnet due to addressing with MAC addresses. It is not possible to use routers for real-time communication via PROFINET.

9.6.5 MAC and IP addressing using device names

To be able to provide unique identification of a drive controller (IO device) in a PROFINET IO system, it must have a symbolic device name that is unique in the system. It is assigned during the project planning phase in TIA Portal and then transferred to the drive controllers. The device name is used for parameterizing the individual drive controllers during system start-up and assigning the respective MAC and IP addresses, the latter using DCP or DHCP.

Observe the following conventions when specifying device names:

- The device name must be limited to a maximum of 240 characters.
  Letters, numbers, periods and dashes are permitted.
- A name component, i.e. a character string between 2 periods, may be a maximum of 63 characters long.
- Special characters like umlauts, brackets, question marks, slashes, spaces, etc. are not allowed.
- The device name may not begin with numbers.
- The device name may neither begin nor end with a minus sign (–) or a period (.).
- The device name may not take the form n.n.n.n (n = 0 – 999).
- The device name may not begin with the character sequence **port-xyz-** (x, y, z = 0 – 9).
- Underscores (_) are not allowed.

9.7 Cycle times

Possible cycle times can be found in the following table.

Type	Cycle times	Relevant parameters
PROFINET fieldbus, cyclical communication	1 ms, 2 ms, 4 ms, 8 ms	Adjustable in A150

Tab. 13: Cycle times

10 Appendix

10.1 Standard mapping of PROFINET and Drive Based

Information

The PZD processing is WORD-oriented in some controllers (16 bit). In Drive Based applications, the standard mapping is pre-assigned appropriately. If changes are made to the standard mapping, take the parameter data type that you are adding to or removing from the mapping into account.

If you add or remove parameters of the BYTE or INT8 data type (8 bit), this can cause problems in the data structures of the controller. If necessary, use parameter A101 Dummy byte to fill the 8-bit gaps that result in the process data and implement the necessary data structure for the controller.

10.1.1 SC6, SI6: RxPZD

The following tables shows the PROFINET standard RxPZD mapping of the Drive Based and Drive Based synchronous applications. The mapping is defined in parameter array A90 for axis A and in A91 for axis B and can be adapted individually.

Byte	Data type	Name	Parameters
0	BYTE	Control byte device	1.A180
1	BYTE	Control byte command	1.J37
2 – 3	WORD	Control word application	1.I210
4	SINT	Command	1.J40
5	SINT	Motion-ID	1.J41
6 – 9	DINT	Position	1.J42
10– 13	REAL	Velocity 1	1.J43
14 – 17	REAL	Velocity Override	1.J56
18 – 21	REAL	Torque/Force reference	1.G469
22	BYTE	Control byte motion block	1.J01
23 – 24	INT	Reference motion block	1.J02

Tab. 14: SC6, SI6: PROFINET standard RxPZD mapping; first part, axis A

Byte	Data type	Name	Parameters
0	BYTE	Control byte device	2.A180
1	BYTE	Control byte command	2.J37
2 – 3	WORD	Control word application	2.I210
4	SINT	Command	2.J40
5	SINT	Motion-ID	2.J41
6 – 9	DINT	Position	2.J42
10– 13	REAL	Velocity 1	2.J43
14 – 17	REAL	Velocity Override	2.J56
18 – 21	REAL	Torque/Force reference	2.G469
22	BYTE	Control byte motion block	2.J01
23 – 24	INT	Reference motion block	2.J02

Tab. 15: SC6, SI6: PROFINET standard RxPZD mapping; second part, axis B

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10.1.2 SC6, SI6: TxPZD

The following tables show the PROFINET standard TxPZD mapping of the Drive Based and Drive Based synchronous applications. The mapping is defined in parameter array A94 for axis A and in A95 for axis B and can be adapted individually.

Byte	Data type	Name	Parameters
0	BYTE	Status byte device	1.E200[0]
1	BYTE	Status byte device	1.E200[1]
2 – 3	WORD	Status word 2	1.E201
4	BYTE	Status byte application	1.I212
5	BYTE	Status byte command	1.J39
6 – 7	WORD	Status word application	1.I200
8 – 11	DINT	Current position	1.I80
12 – 15	REAL	Actual speed	1.I88
16 – 19	REAL	Actual torque/force	1.E90
20 – 21	WORD	Status word user-defined	1.A67
22	SINT	Operating condition	1.E80
23	BYTE	Status byte motion block	1.J302
24 – 25	INT	Actual motion block	1.J300
26	SINT	Device control state	1.E48

Tab. 16: SC6, SI6: PROFINET standard TxPZD mapping; first part, axis A

Byte	Data type	Name	Parameters
0	BYTE	Status byte device	2.E200[0]
1	BYTE	Status byte device	2.E200[1]
2 – 3	WORD	Status word 2	2.E201
4	BYTE	Status byte application	2.I212
5	BYTE	Status byte command	2.J39
6 – 7	WORD	Status word application	2.I200
8 – 11	DINT	Current position	2.I80
12 – 15	REAL	Actual speed	2.I88
16 – 19	REAL	Actual torque/force	2.E90
20 – 21	WORD	Status word user-defined	2.A67
22	SINT	Operating condition	2.E80
23	BYTE	Status byte motion block	2.J302
24 – 25	INT	Actual motion block	2.J300
26	SINT	Device control state	2.E48

Tab. 17: SC6, SI6: PROFINET standard TxPZD mapping; second part, axis B

10.2 Addressing parameters for RECORD record

To be able to address a parameter via fieldbus, you need its Axis_number, Parameter_number and subindex. These are calculated from the STOBER parameter coordinates (axis, group, line, element).

Basic information on the parameters can be found in the chapter Meaning of parameters [▶ 20].

10.2.1 Determining the Axis_number

The Axis_number corresponds to the axis of the parameter.

10.2.2 Calculating the Parameter_number

Information

Note that the Parameter_number in the RECORD record must be specified in hexadecimal form.

The Parameter_number is calculated from the group and line of the parameter according to the following formula:

Parameter_number decimal = 8192 + (number of the group × 512) + number of the line

Calculation example for parameter E200 (number of the group = 4 ,
number of the line = 200):
Parameter_number E200 = 8192 + (4 × 512) + 200 = 10440 = 28C8 hex

Group	Number	Addressable parameters
A: Drive controller	0	A00 – A511
B: Motor	1	B00 – B511
C: Machine	2	C00 – C511
D: Target value	3	D00 – D511
E: Display	4	E00 – E511
F: Terminals	5	F00 – F511
G: Technology	6	G00 – G511
H: Encoder	7	H00 – H511
I: Motion	8	I00 – I511
J: Motion blocks	9	J00 – J511
K: Control panel	10	K00 – K511
M: Profile	12	M00 – M511
P: Customer-specific parameters	15	P00 – P511
Q: Customer-specific parameters, instance-dependent	16	Q00 – Q511
R: Production data	17	R00 – R511
S: Safety	18	S00 – S511
T: Scope	19	T00 – T511
U: Safety functions	20	U00 – U511
Z: Fault counter	25	Z00 – Z511

Tab. 18: Groups and parameters

10.2.3 Determining the subindex

The subindex corresponds to the element of the array or record parameter. The subindex of simple parameters is 0.

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10.3 RDREC, WRREC: RECORD

10.3.1 WRREC: RECORD request: Header structure

Parameter values are generally transferred using the RECORD header. For a RECORD request, the header consists of the following elements in the specified sequence.

Element	Data type	Value, value range	
Request_reference	BYTE	0 hex – FF hex	Freely selectable request number
Request_ID	BYTE	1 hex	Read request
		2 hex	Write request
		All other values	Reserved
Axis_number	BYTE	0 – 3	Addressing the axis
Number_of_parameters	BYTE	1	Number of parameters to be processed
		All other values	Reserved
Attributes	BYTE	10 hex	Access type: Value
		80 hex	Access type: Raw value
		81 hex	Access type: Integer
		82 hex	Access type: Floating point
Number_of_elements	BYTE	1 – 32 hex	1 – 50 Parameters are to be written or read
Parameter_number	WORD	2000 hex – 5FFF hex	Group and line of a parameter
Subindex	WORD	0 – 3E80 hex	Element of an array and record parameter; in single parameters, the value = 0
Format (Condition: Request_ID = 2 hex)	BYTE	8 hex	Transfer format: FLOAT
		41 hex	Transfer format: BYTE
		42 hex	Transfer format: WORD
		43 hex	Transfer format: DWORD
		1C hex, 1D hex, 1E hex	Transfer format: STRING with 8, 16 or 80 characters
Number_of_values (Condition: Request_ID = 2 hex)	BYTE	1 – 50	Number of values to be processed; value = 1 (in a simple parameter) or value = value of Number_of_elements; since a RECORD request may not exceed a length of 240 bytes, it is not always possible – depending on the respective format – to transfer max. 50 elements
1st value (Condition: Request_ID = 2 hex)	DINT	1st parameter value	Value in a simple parameter
2nd value – 50th value (Condition: Request_ID = 2 hex)	DINT	1 – 32 hex	Value = Value of Number_of_elements

Tab. 19: WRREC: RECORD request: Header structure

10.3.2 RDREC: RECORD response: Header structure

Parameter values are generally transferred using the RECORD header. For a RECORD response, the header consists of the following elements in the specified sequence.

Element	Data type	Value, value range	
Response_reference	BYTE	0 hex – FF hex	Value = Request number of RECORD request
Response_ID	BYTE	1 hex	Positive answer to a read request
		2 hex	Positive answer to a write request
		81 hex	Negative answer to a read request
		82 hex	Negative answer to a write request
Axis_number	BYTE	0 – 3	Addressing the axis
Number_of_parameters	BYTE	1	Number of parameters to be processed
Format	BYTE	8 hex	Transfer format: FLOAT
		41 hex	Transfer format: BYTE
		42 hex	Transfer format: WORD
		43 hex	Transfer format: DWORD
		1C hex, 1D hex, 1E hex	Transfer format: STRING with 8, 16 or 80 characters
		44 hex	Error in case of error
Number_of_values	BYTE	1	Number of values to be processed
1st value or error code	DINT	1st parameter value	Value in a simple parameter
	WORD		Error code in case of error (see table RDREC, WRREC: Error codes [▶ 69])
2nd value – 50th value	DINT	1 – 32 hex	Value = Value of Number_of_elements

Tab. 20: RDREC: RECORD response: Header structure

10.3.3 RDREC, WRREC: Error codes

The following table shows the possible error codes for the RDREC and WRREC system function blocks.

Error code	Cause
0 hex	Parameter unfamiliar or configuration stopped
1 hex	Access to read-only parameter
2 hex	Access to parameter with value outside the limit
3 hex	Access to unavailable subindex (array parameter)
B hex	User level not reached
11 hex	Parameter may not be changed in the current device state; deactivate release
14 hex	Invalid value within maximum limits; only occurs in the case of selection parameters with a broken definition range
16 hex	One or more incorrect values in the attribute, Number_of_elements, Parameter_number and subindex elements
17 hex	Invalid format specification
18 hex	Contrary value in the Number_of_elements and Number_of_values elements
21 hex	Invalid Request_ID = Service not supported; applies to errors in the header of the request block
A5 hex	Error cannot be specified in more detail
B0 hex	Parameter service currently not possible or valid parameter description not present
B2 hex	Unfamiliar parameter address (parameter or element does not exist)
B3 hex	Read/write access not possible for specified parameter address
B9 hex	Parameter service: Value in definition gap (observe ENUM list)
BA hex	Parameter service: Clash with other values
C0 hex	Parameter service: Error in pre-read function
C1 hex	Parameter service: Error in post-write function; value has already been received

Tab. 21: RDREC, WRREC: Error codes

10.3.4 Attribute and format elements: Possible combinations

The **attribute** element describes the access to a parameter structure (e.g. to values, descriptive texts, etc.); the **format** element describes the transfer format of a parameter. The values of both elements can be combined as follows.

Attribute	Format				
	FLOAT (8 hex)	BYTE (41 hex)	WORD (42 hex)	DWORD (43 hex)	STRING (1C hex, 1D hex, 1E hex)
Value (10 hex)	Not permitted	Not permitted	Not permitted	Scaled value for all parameters represented as integer (4 bytes)	8, 16 or 80 characters
Raw value (80 hex)	Unscaled raw value, specifically for FLOAT data type (4 bytes)	Unscaled raw value, specifically for BOOL, WORD, I8 data types (1 byte)	Unscaled raw value, specifically for WORD, I16 data types (2 bytes)	Unscaled raw value, specifically for DWORD, I32 data types (4 bytes)	Not permitted
Integer (81 hex)	Not permitted	Not permitted	Not permitted	Scaled value for all parameters represented as integer (4 bytes)	Not permitted
Floating point (82 hex)	Scaled representation for all parameters as floating point (4 bytes)	Not permitted	Not permitted	Not permitted	Not permitted

Tab. 22: Attribute, format: Possible combinations

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10.4 Process data modules

Process data modules determine the data volume for the PZD transmission. During configuration in TIA Portal, one of the following process data modules must be configured for each axis of the drive controller. When creating a new project, we recommend the **all consistent** transfer type.

Module	Input data [byte]	Output data [byte]	Transfer
M101 02W PZD all cons.	4	4	2 words (inputs, outputs), all consistent*
M102 04W PZD all cons.	8	8	4 words (inputs, outputs), all consistent
M103 06W PZD all cons.	12	12	6 words (inputs, outputs), all consistent
M104 12W PZD all cons.	24	24	12 words (inputs, outputs), all consistent
M105 18W PZD all cons.	36	36	18 words (inputs, outputs), all consistent
M106 24W PZD all cons.	48	48	24 words (inputs, outputs), all consistent
M107 36W PZD all cons.	72	72	36 words (inputs, outputs), all consistent
M111 02W PZD Item cons.	4	4	2 words (inputs, outputs), Items consistent**
M112 04W PZD Item cons.	8	8	4 words (inputs, outputs), Items consistent
M113 06W PZD Item cons.	12	12	6 words (inputs, outputs), Items consistent
M114 12W PZD Item cons.	24	24	12 words (inputs, outputs), Items consistent
M115 18W PZD Item cons.	36	36	18 words (inputs, outputs), Items consistent
M116 24W PZD Item cons.	48	48	24 words (inputs, outputs), Items consistent
M117 36W PZD Item cons.	72	72	36 words (inputs, outputs), Items consistent

Tab. 23: Process data modules

*) all consistent: Process data packet is processed once the packet has been fully received

**) Items consistent: Individual parameters of the packet are processed once the parameter has been fully received

10.5 Detailed information

The documentation listed in the following table offers additional relevant information about the associated drive controllers.

Current document versions can be found at http://www.stoeber.de/en/downloads/.

Device/Software	Documentation	Contents	ID
SC6 drive controller	Manual	System design, technical data, project configuration, storage, installation, connection, commissioning, operation, service, diagnostics	442790
Multi-axis drive system with SI6 and PS6	Manual	System design, technical data, project configuration, storage, installation, connection, commissioning, operation, service, diagnostics	442728
Drive Based (DB) application	Manual	Project planning, configuration, parameterization, function test, detailed information	442706
PROFIdrive application – SC6, SI6	Manual	Project planning, configuration, parameterization, function test, detailed information	443270

Additional information and sources that form the basis of this documentation or are referenced by the documentation:

Information concerning PROFINET

You can find general information on PROFINET on the PROFIBUS & PROFINET International (PI) website at http://www.profibus.com. PROFINET-specific guidelines, profiles, presentations, brochures and software are available in the corresponding download area.

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.

SC6, SI6 – Device description

A GSD file for easily integrating the drive controllers of the SC6 and SI6 series into the respective system environment can be found in the STOBER download center http://www.stoeber.de/en/downloads/ using the search term `GSD`.

STOBER TIA Portal example projects – Programming acyclical communication services

STOBER-specific example projects along with the accompanying documentation for programming acyclical communication services in TIA Portal can be found in the STOBER download center http://www.stoeber.de/en/downloads/ using the search term `TIA Portal`.

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10.6 Abbreviations

Abbreviation	Meaning
BF	Busfehler (en: Bus error)
CBA	Component Based Automation
CPU	Central Processing Unit
DCP	Discovery and Configuration Protocol
DHCP	Dynamic Host Configuration Protocol
DP	Decentral peripherals
EMC	Electromagnetic Compatibility
GSD	General Station Description data
GSDML	General Station Description Markup Language
HMI	Human Machine Interface
HTTP	Hypertext Transfer Protocol
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
I/O	Input/Output
IP	Internet Protocol
IRT	Isochronous Real-Time
LAN	Local Area Network
LSB	Least Significant Bit
MAC	Media Access Control
PG	Programmiergerät (en: Programming device)
PROFIBUS	Process Field Bus
PROFINET	Process Field Network
PZD	Process Data
RDREC	Read Record
RT	Real-Time
RxPZD	Receive PZD (receive process data)
SNMP	Simple Network Management Protocol
PLC	Programmable Logic Controller
TIA	Totally Integrated Automation
TCP	Transmission Control Protocol
TxPZD	Transmit PZD (transmit process data)
UDP	User Data Protocol
WRREC	Write Record

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11 Contact

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Glossary

100Base-TX

Ethernet network standard based on symmetrical copper cables in which the nodes are connected to a switch via copper cables twisted in pairs (shielded twisted pair, CAT 5e quality level). 100Base-TX is the subsequent progression from 10Base-T and includes those properties with the option of a transfer speed of 100 Mbps (Fast Ethernet).

Broadcast domain

Logical grouping of network devices within a local network that reaches all nodes via broadcast.

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.

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.

IO supervisor

Generally, engineering software that can access all process and configuration data. An IO supervisor is only engaged temporarily for parameterizing the IO devices, commissioning the IO system and for diagnostic purposes.

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.

MAC address

Also: Ethernet 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.

PROFINET

Open Ethernet standard of PROFIBUS Nutzerorganisation e. V. (PNO) for automation.

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).

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RxPZD

Output data that a node receives with RxPZDs.

System function block (Siemens)

Code block as part of a distributed, structured Siemens user program used to call up important system functions for PROFINET IO. Parameters for the associated input and output interfaces can be configured individually. The variable values stored in a function block are saved and are not lost after processing. Typical Siemens system function blocks are WRREC (Write record) and RDREC (Read record).

TCP/IP

Protocol family composed of the transmission control protocol (TCP) and the Internet protocol (IP). TCP is responsible for transmission, i.e. actual data traffic; IP handles unique communication with a PC in a network.

TxPZD

Input data that a node transmits with TxPZDs.

UDP/IP

Minimalist transport protocol for networks such as LAN that only provides the essential functions for data transport. UDP/IP is a simple service that functions without a continuous connection on both sides. There is no connection or disconnection and no acknowledgment of the received data packets. There is the option to control data traffic using a checksum. As with TCP/IP, there are no troubleshooting mechanisms. Therefore, it is entirely possible for the transferred data to experience data loss, data duplication or sequence errors.

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