SIEMENS

SINAMICS

SINAMICS V90
SINAMICS V-ASSISTANT
Online Help

Operating Manual

07/2015

A5E32187373-004

Legal information

Warning notice system

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

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

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

⚠ WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

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

Disclaimer of Liability

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

Siemens AG
Division Digital Factory
Postfach 48 48
90026 NÜRNBERG
GERMANY

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Preface

Technical support

Country	Hotline
China	+86 400 810 4288
Germany	+49 911 895 7222
Italy	+39 (02) 24362000
India	+91 22 2760 0150
Turkey	+90 (216) 4440747
Further service contact information: Support contacts (http://support.automation.siemens.com/WW/view/en/16604999)	

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1.1 Fundamental safety instructions

1.1.1 General safety instructions

⚠ WARNING

Risk of death if the safety instructions and remaining risks are not carefully observed

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

- Observe the safety instructions given in the hardware documentation.
- Consider the residual risks for the risk evaluation.

⚠ WARNING

Danger to life or malfunctions of the machine as a result of incorrect or changed parameterization

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

- Protect the parameterization (parameter assignments) against unauthorized access.
- Respond to possible malfunctions by applying suitable measures (e.g. EMERGENCY STOP or EMERGENCY OFF).

1.1.2 Industrial security

Note

Industrial security

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, solutions, machines, equipment and/or networks. They are important components in a holistic industrial security concept. With this in mind, Siemens' products and solutions undergo continuous development. Siemens recommends strongly that you regularly check for product updates.

For the secure operation of Siemens products and solutions, it is necessary to take suitable preventive action (e.g. cell protection concept) and integrate each component into a holistic, state-of-the-art industrial security concept. Third-party products that may be in use should also be considered. For more information about industrial security, visit this address (http://www.siemens.com/industrialsecurity).

To stay informed about product updates as they occur, sign up for a product-specific newsletter. For more information, visit this address (http://support.automation.siemens.com).

⚠ WARNING

Danger as a result of unsafe operating states resulting from software manipulation

Software manipulation (e.g. by viruses, Trojan horses, malware, worms) can cause unsafe operating states to develop in your installation which can result in death, severe injuries and/or material damage.

- Keep the software up to date.

  You will find relevant information and newsletters at this address (http://support.automation.siemens.com).
- Incorporate the automation and drive components into a holistic, state-of-the-art industrial security concept for the installation or machine.

  You will find further information at this address (http://www.siemens.com/industrialsecurity).
- Make sure that you include all installed products into the holistic industrial security concept.

SINAMICS V-ASSISTANT

2

SINAMICS V90

SINAMICS V-ASSISTANT engineering tool is designed for faster commissioning and diagnostics for SINAMICS V90 drive. The software runs on a personal computer with Windows operating systems and utilizes graphical user interface to interact with users and communicates with V90 drive via USB. It can be used to modify parameters and monitor status of SINAMICS V90 drive.

2.1 SINAMICS V-ASSISTANT operating environment

SINAMICS V-ASSISTANT runs on the following operating systems:

- Windows XP SP3 (Home)
- Windows XP SP3 (Professional)
- Windows 7 32 bit (Home Premium)
- Windows 7 32 bit (Professional)
- Windows 7 32 bit (Ultimate)
- Windows 7 64 bit (Home Premium)
- Windows 7 64 bit (Professional)
- Windows 7 64 bit (Ultimate)

Note

The minimum screen resolution must be 1024*768.

2.2 Device combination

The table below shows the combination of SINAMICS V90 servo drives and SIMOTICS S-1FL6 servo motors.

SIMOTICS S-1FL6 servo motor							SINAMICS V90 servo drive	
Rated torque (Nm)	Rated power (kW)	Rated speed (rpm)	Shaft height (mm)	Motor ID		Order number[1)]	Order number	Frame size
				Without brake	With brake			
1.27	0.4	3000	45	18	19	1FL6042-1AF61-0A❑1	6SL3210-5FE10-4UA0	FSAA
				10009	10038	1FL6042-1AF61-0L❑1		
2.39	0.75	3000	45	20	21	1FL6044-1AF61-0A❑1	6SL3210-5FE10-8UA0	FSA
				10010	10039	1FL6044-1AF61-0L❑1		
3.58	0.75	2000	65	22	23	1FL6061-1AC61-0A❑1	6SL3210-5FE11-0UA0	
				10011	10040	1FL6061-1AC61-0L❑1		
4.78	1.0	2000	65	24	25	1FL6062-1AC61-0A❑1		
				10012	10041	1FL6062-1AC61-0L❑1		
7.16	1.5	2000	65	26	27	1FL6064-1AC61-0A❑1	6SL3210-5FE11-5UA0	FSB
				10013	10042	1FL6064-1AC61-0L❑1		
8.36	1.75	2000	65	28	29	1FL6066-1AC61-0A❑1		
				10014	10043	1FL6066-1AC61-0L❑1		
9.55	2.0	2000	65	30	31	1FL6067-1AC61-0A❑1	6SL3210-5FE12-0UA0	
				10015	10044	1FL6067-1AC61-0L❑1		
11.9	2.5	2000	90	32	33	1FL6090-1AC61-0A❑1		
				10016	10045	1FL6090-1AC61-0L❑1		
16.7	3.5	2000	90	34	35	1FL6092-1AC61-0A❑1	6SL3210-5FE13-5UA0	FSC
				10017	10046	1FL6092-1AC61-0L❑1		
23.9	5.0	2000	90	36	37	1FL6094-1AC61-0A❑1	6SL3210-5FE15-0UA0	
				10018	10047	1FL6094-1AC61-0L❑1		
33.4	7.0	2000	90	38	39	1FL6096-1AC61-0A❑1	6SL3210-5FE17-0UA0	
				10019	10048	1FL6096-1AC61-0L❑1		

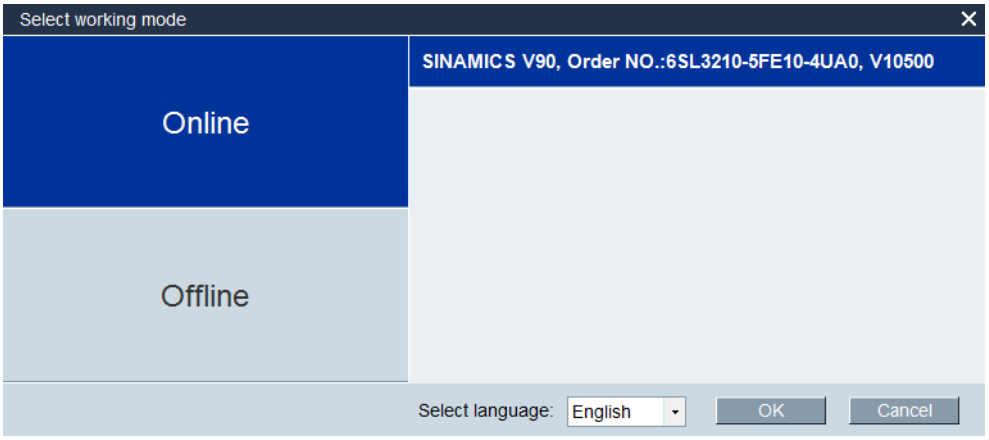
[1)] The symbol ❑ in the motor order numbers is for optional configurations (mechanics). For detailed motor rating plate explanation, refer to SINAMICS V90, SIMOTICS S-1FL6 Operating Instructions.

User interface

3

3.1 Working modes

When you start the SINAMICS V-ASSISTANT, the following window appears for you to select a working mode:



The functions of SINAMICS V-ASSISTANT vary with the working modes.

- Online mode: SINAMICS V-ASSISTANT communicates with the target drive, which is connected with PC by a USB cable.

  Select the online mode, a list of all the connected drives is displayed. Select the target drive and click the following button.

  OK

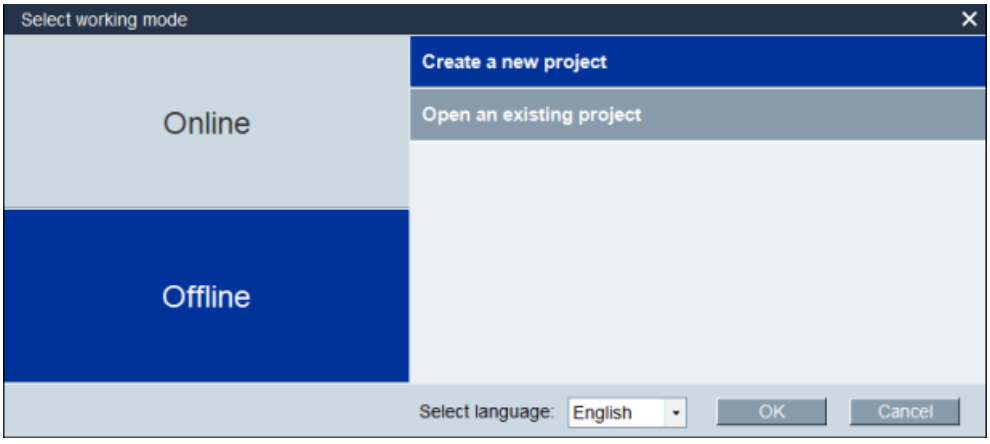
  SINAMICS V-ASSISTANT automatically creates a new project to save all the parameter settings from the target drive and enters the main window.

  Note

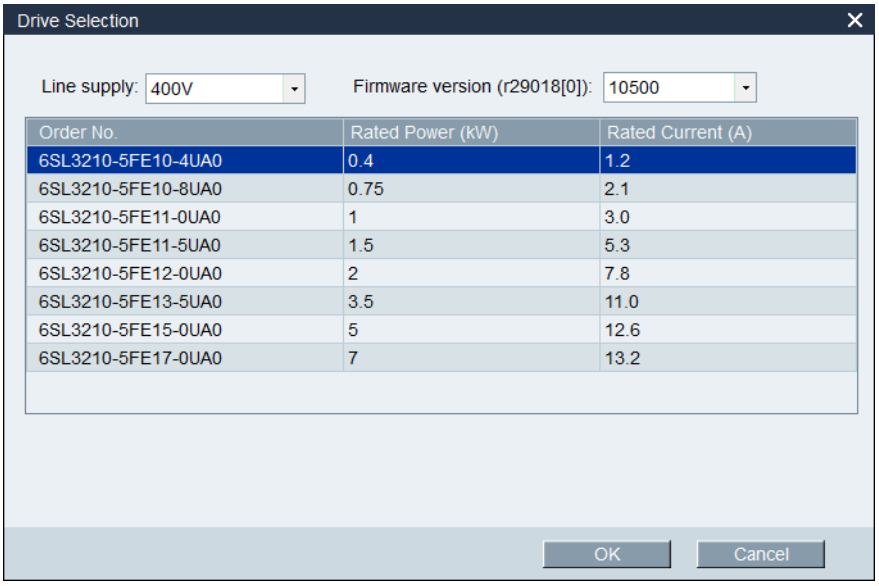
  If SINAMICS V-ASSISTANT fails to detect the connected drive immediately, please wait for a while and then plug in the USB cable again.

- Offline mode: SINAMICS V-ASSISTANT does not communicate with any connected drive.

  Two options are available for your choice:



  – If you select the first option, you must select a drive from the following window:

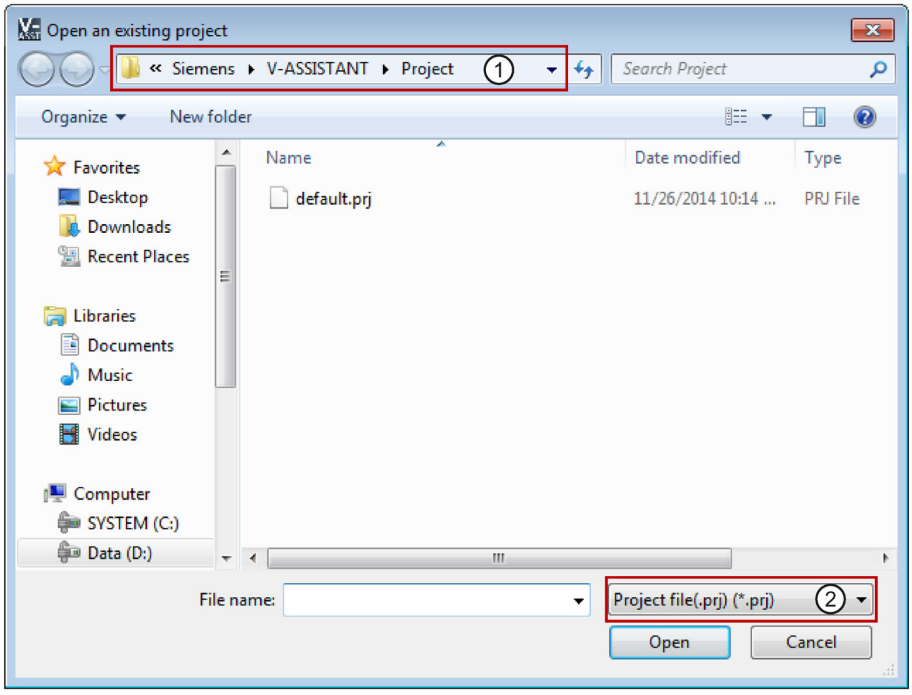


  Select the line supply and firmware version from the drop-down lists respectively. Select the order number of a drive. Click OK to save the factory settings of the selected drive to the new project and enter the main window; or otherwise, click Cancel to cancel.

Note

To obtain the firmware version, you can view r29018 on BOP (Basic Operator Panel). For more information, refer to SINAMICS V90, SIMOTICS S-1FL6 Operating Instructions.

– If you select the second option, you need to select an existing project in the following directory as the current project and enter the main window:



①	The default location is: xxx/Siemens/V-ASSISTANT/Project. xxx: SINAMICS V-ASSISTANT setup root directory.
②	Only .prj format is available.

Status indicators

In the SINAMICS V-ASSISTANT main window, the current working mode is indicated by the status indicators at the upper right of the main window:

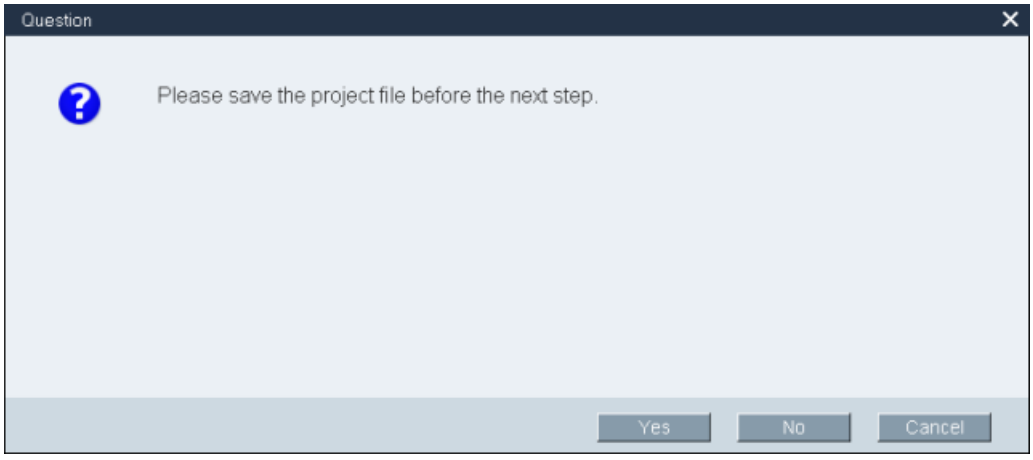
Online

Offline

You can switch the working mode between the two modes. For more information, refer to Section "Switch menu (Page 24)".

Compare parameters

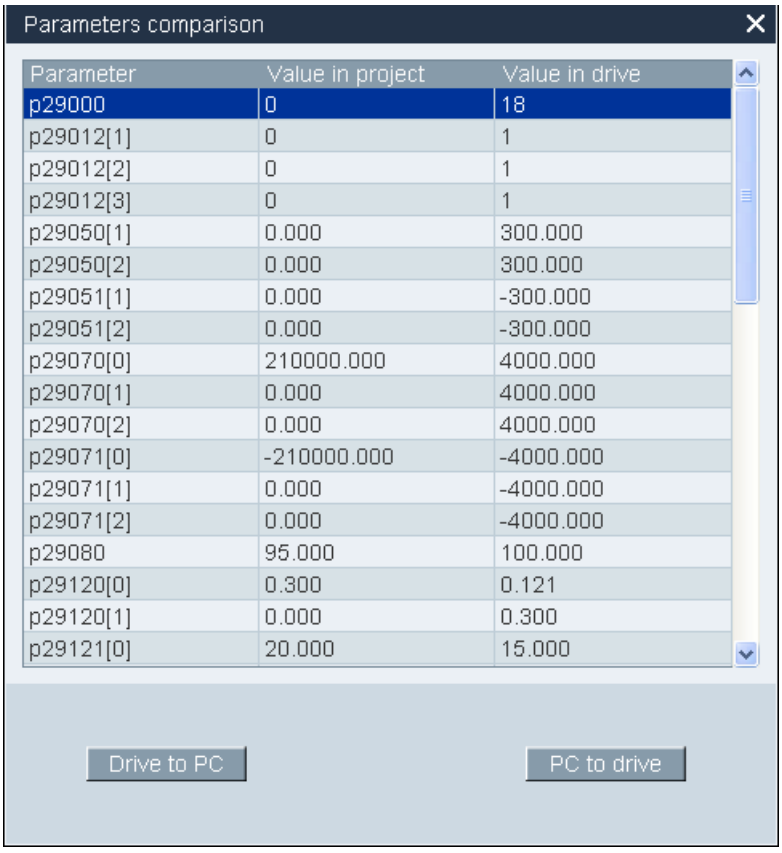
When you switch the working mode from offline to online, the following question will appear to remind you to save the current project:



You can click Yes to save the project; or otherwise, you can click No or Cancel to give up saving.

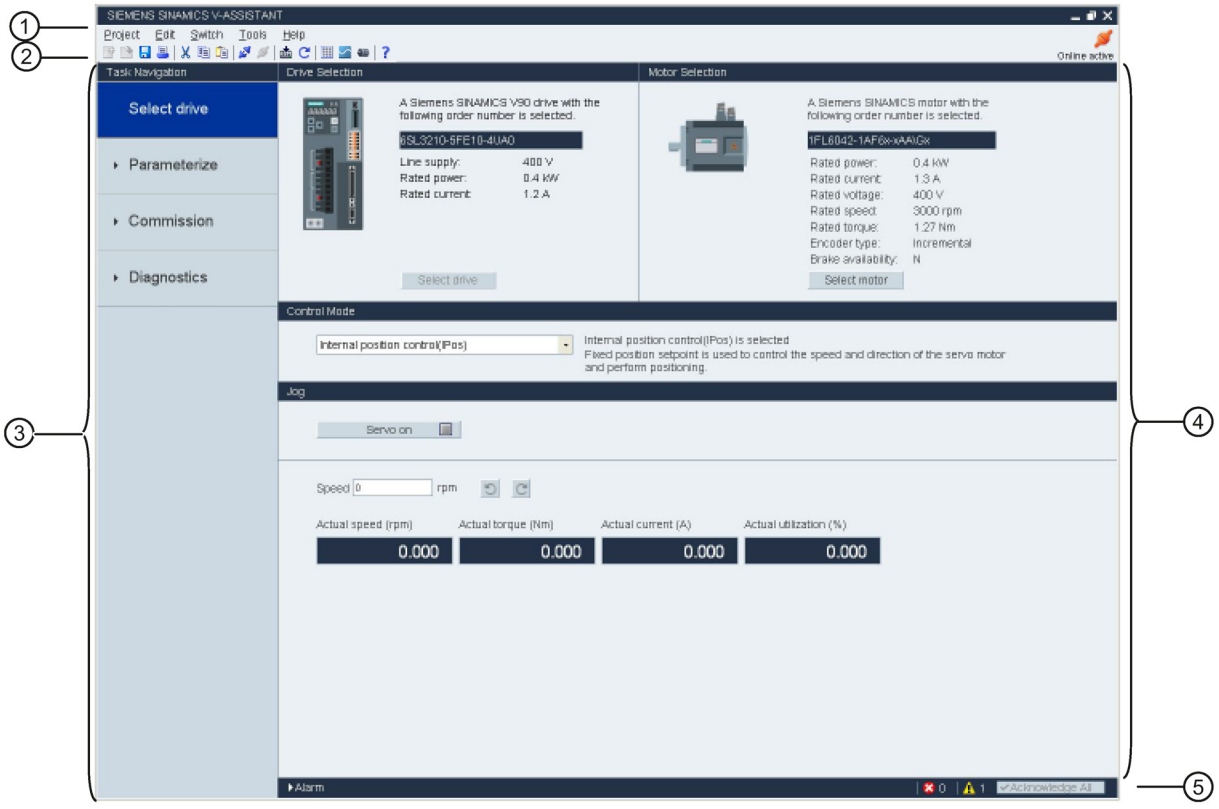
Then SINAMICS V-ASSISTANT automatically compares all parameter settings between the current project and the connected drive:

If any inconsistency is detected, the following window will appear:



Click the first button to upload all parameter values of the connected drive to the current project; or otherwise, click the second button to upload all parameter values of the current project to the connected drive.

3.2 User interface - overview



① Menu bar
② Toolbar
③ Task navigation
④ Function mask
⑤ Alarm window

Menu bar

The menu bar is located at the top of the SINAMICS V-ASSISTANT window. You can find various commands and functions for basic operations of SINAMICS V-ASSISTANT. For more information, see Section "Menu bar (Page 19)".

Toolbar

The toolbar is located below the menu bar and provides direct access to the essential functions of SINAMICS V-ASSISTANT. For more information, see Section "Toolbar (Page 29)".

Task navigation

Task navigation lists the user tasks for users to fulfill. Each task contains different functions which facilitate users to parameterize all functions of V90 drives and monitor or diagnose the drives. For more information, see Section "Task navigation (Page 31)".

Function mask

The function mask provides the user interface of each user task for users to implement related functions.

Alarm window

In online mode, the current faults and alarms are displayed in a list with the corresponding type, number and name. In offline mode, the alarm window is disabled. For more information, see Section "Alarm window (Page 30)".

3.3 Menu bar

3.3.1 Menu bar - overview

The menu bar lists the menu items for users to manage the projects, switch the interface language, or view the online help:

Project menu (Page 19)

Edit menu (Page 23)

Switch menu (Page 24)

Tools menu (Page 25)

Help menu (Page 28)

3.3.2 Project menu

This menu contains commands for creating, opening, saving, printing,or exiting from a project as well as switching the interface language. You can choose any menu command here for project management.

- New project (Page 20)
- Open project (Page 20)
- Save project (Page 21)
- Save project as (Page 22)
- Print (Page 22)

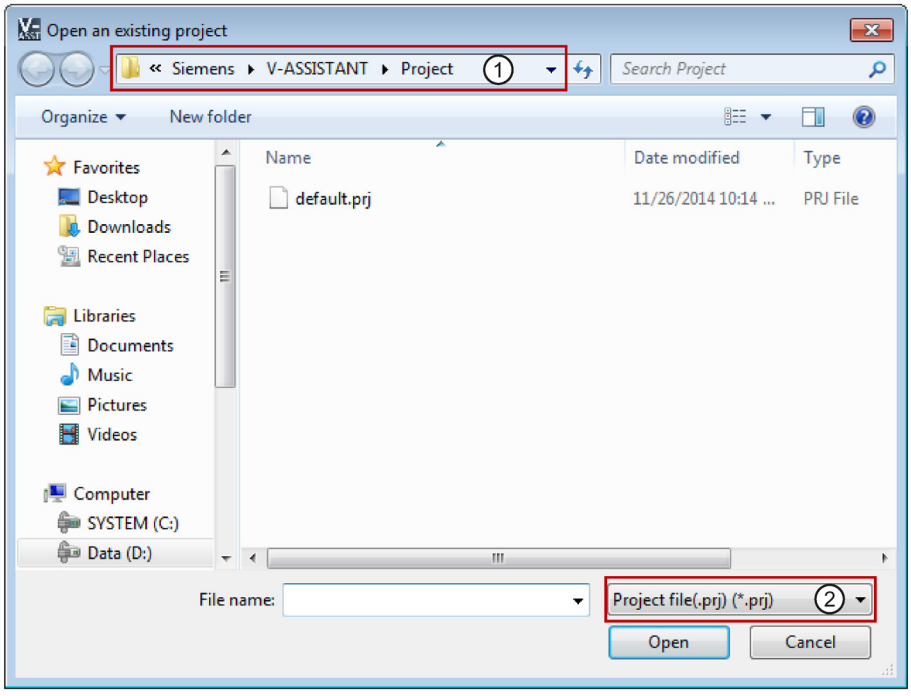
- Language (Page 23)
- Exit (Page 23)

3.3.2.1 Project -> New project

When SINAMICS V-ASSISTANT is working in offline mode, you can use this menu command to create a new project. To proceed, refer to Selecting drive (Page 34).

3.3.2.2 Project -> Open project

When SINAMICS V-ASSISTANT is working in offline mode, you can use this menu command to open an existing project in the following window:



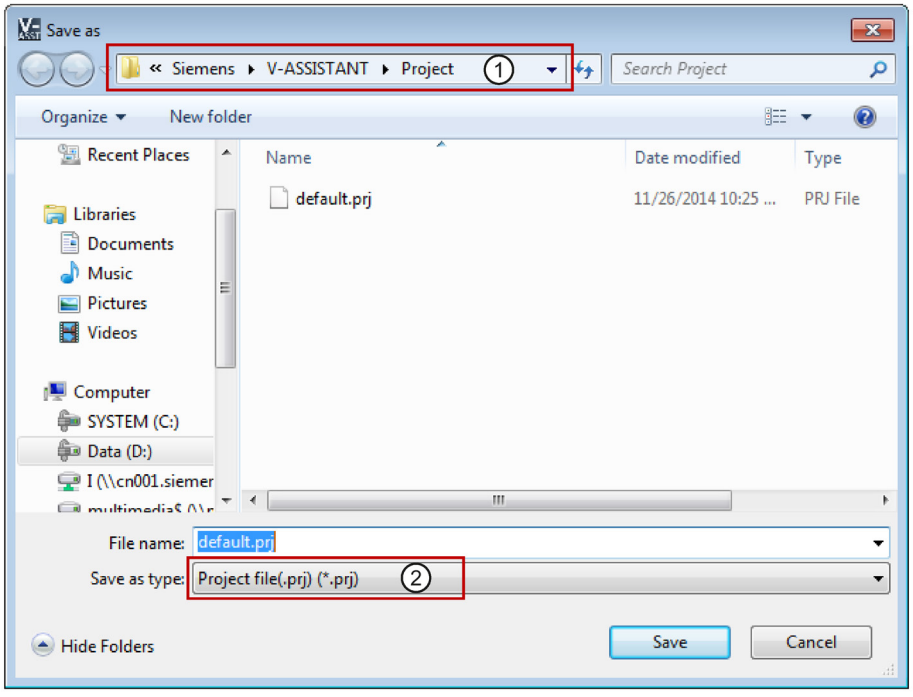
① The default location is: xxx/Siemens/V-ASSISTANT/Project.
xxx: SINAMICS V-ASSISTANT setup root directory.

② Only .prj format is available.

3.3.2.3 Project -> Save project

Online mode/offline mode

You can use this menu command to save the changed configuration to the current project. If this menu command is used for the first time, it is the same as "Project -> Save project as... (Page 22)". You can specify the file name and directory in the following window:



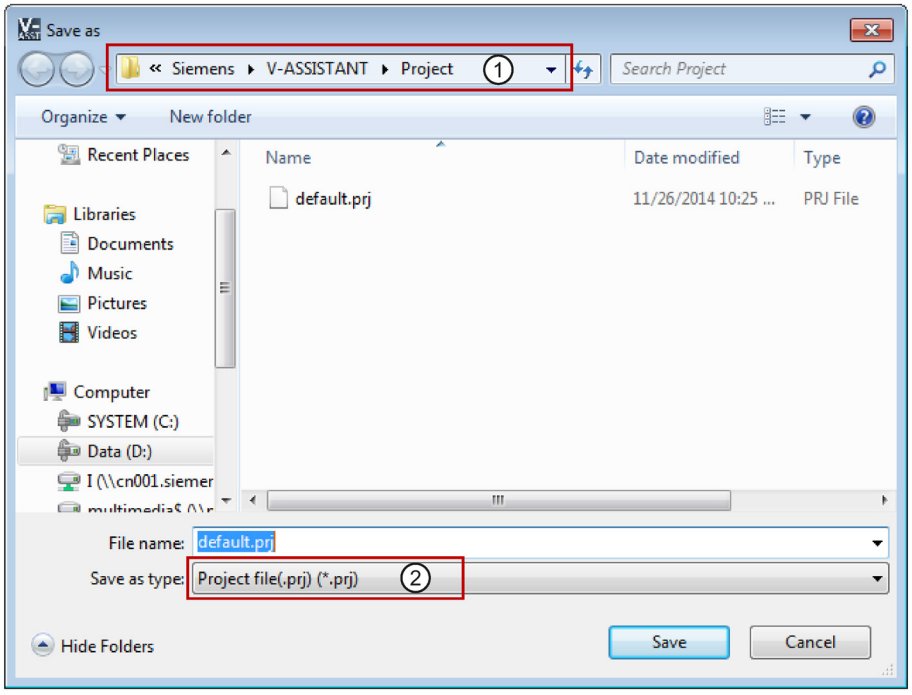
① The default location is: xxx/Siemens/V-ASSISTANT/Project.
xxx: SINAMICS V-ASSISTANT setup root directory.

② Only .prj format is available.

3.3.2.4 Project -> Save project as...

Online mode/offline mode

You can use this menu command to save the current project with a specified file name and directory in the following window:



① The default location is: xxx/Siemens/V-ASSISTANT/Project.
xxx: SINAMICS V-ASSISTANT setup root directory.

② Only .prj format is available.

3.3.2.5 Project -> Print

Online mode/offline mode

You can use this menu command to print the user interface of the selected function from "Task navigation (Page 31)".

3.3.2.6 Project -> Language

Online mode/offline mode

You can use this menu command to switch the interface language among the following languages including English, Chinese, German, French, Italian, Trukish, Spanish and Portuguese.

3.3.2.7 Project -> Exit

Online mode/offline mode

You can use this menu command to exit from the SINAMICS V-ASSISTANT directly.

3.3.3 Edit menu

This menu contains commands for cutting, copying and editing the parameter values or technical data related to the motor and drive.

- Cut (Page 23)
- Copy (Page 24)
- Paste (Page 24)

3.3.3.1 Edit -> Cut

The command deletes the selected objects, for example, the parameter values from the user interface, and copies them to the clipboard.

Alternatively, you can use  from the toolbar.

Note

This menu command can only be used to modify the values in "Viewing all parameters (Page 65)".

3.3.3.2 Edit -> Copy

The command is used to copy selected objects, for example, parameter values, order number or the rated power of the drive or motor, to the clipboard.

Alternatively, you can use  from the toolbar.

Note

You can only use this menu command on the following function masks:

- Selecting drive (Page 34)
- Selecting motor (Page 36)
- Viewing all parameters (Page 65)
- Signal (Page 67)

3.3.3.3 Edit -> Paste

This menu command copies the clipboard content to the input field. The copied content will be inserted in a position determined with a mouse click.

Alternatively, you can use  from the toolbar.

Note

You can only use this menu command to modify the values in Viewing all parameters (Page 65).

3.3.4 Switch menu

This menu contains the following two commands to switch the SINAMICS V-ASSISTANT between online mode and offline mode.

-  Go offline (Page 24)
-  Go online (Page 24)

3.3.4.1 Switch -> Go offline

When SINAMICS V-ASSISTANT is working in online mode, you can use this menu command to switch to offline mode.

Alternatively, you can use  from the toolbar.

3.3.4.2 Switch -> Go online

When SINAMICS V-ASSISTANT is working in offline mode, you can use this menu command to switch to online mode.

Alternatively, you can use  from the toolbar.

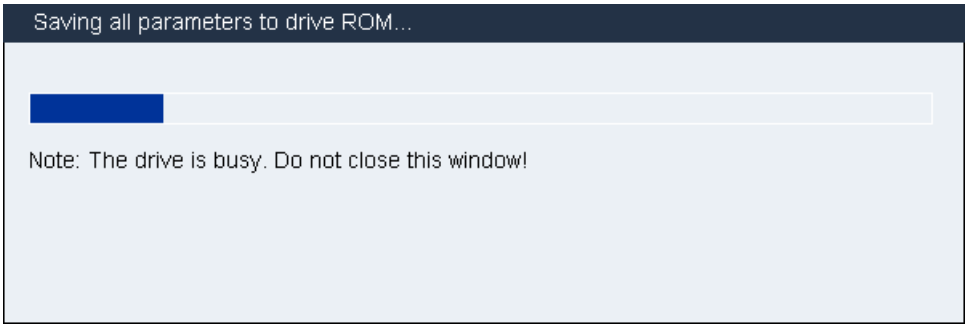
3.3.5 Tools menu

The tools menu contains the following menu commands:

- Tools -> Save parameters to ROM (Page 25)
- Tools -> Restart drive (Page 25)
- Tools -> Reset absolute encoder (Page 26)
- Tools -> Factory default (Page 26)
- Tools -> Upload parameters (Page 28)

3.3.5.1 Tools -> Save parameters to ROM

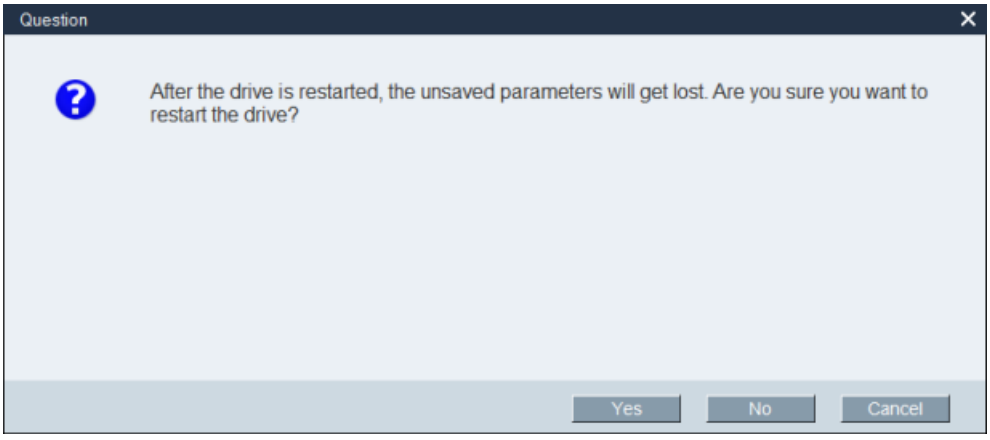
You can use this menu command to save the parameters from RAM to ROM in the drive. The following window will appear to display the saving process:



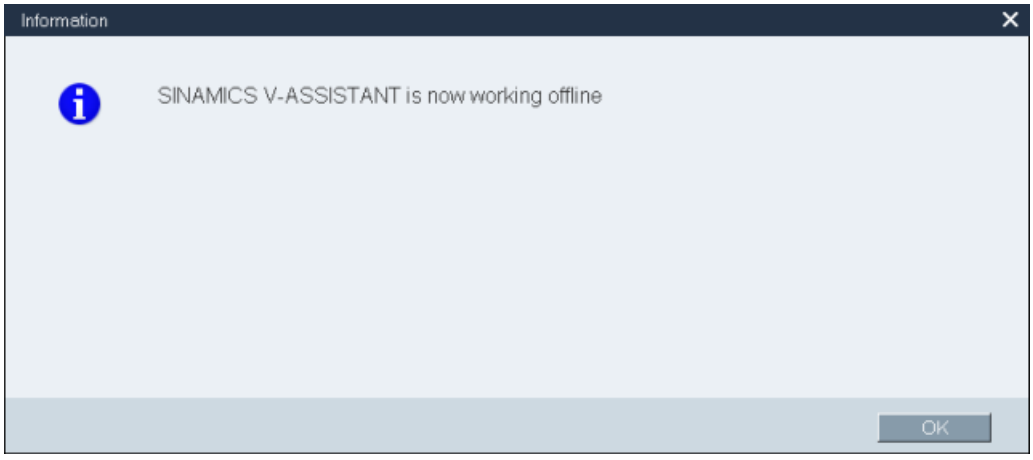
Alternatively, you can use  from the toolbar.

3.3.5.2 Tools -> Restart drive

You can use this menu command to restart the drive. The following reminder will appear:



If you click Yes, then the following information will appear:



Click OK and the drive is reset successfully.

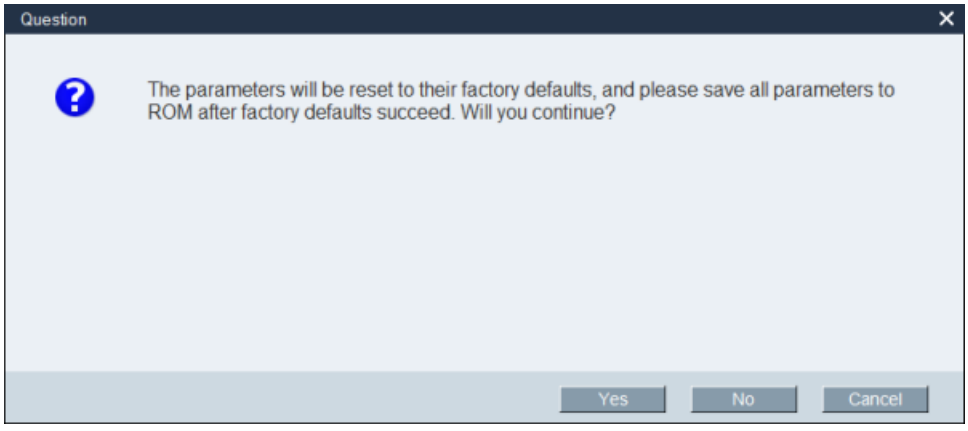
3.3.5.3 Tools -> Reset absolute encoder

In online mode, if SINAMICS V-ASSISTANT is connected with an absolute encoder, you can use this menu command to set the current position of the absolute encoder as the reference point.

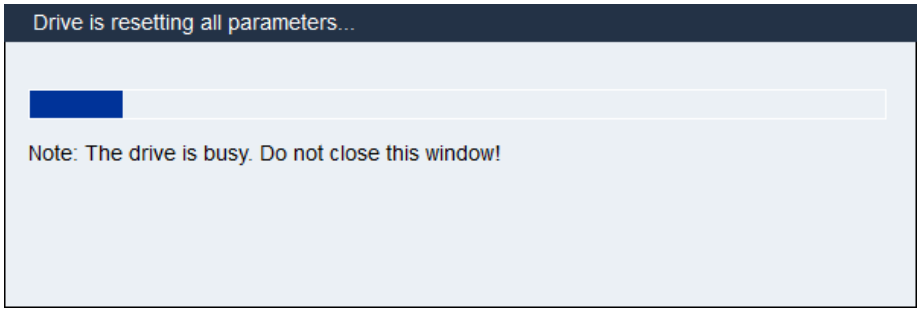
3.3.5.4 Tools -> Factory default

Online

Select this menu command and the following reminder will appear:



- If you click Yes, then the following information window will appear:

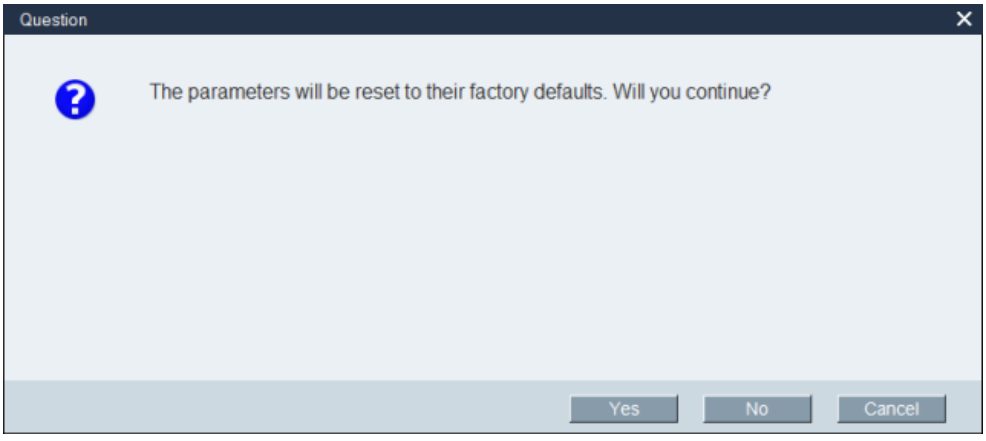


When the process is finished, the window disappears automatically.

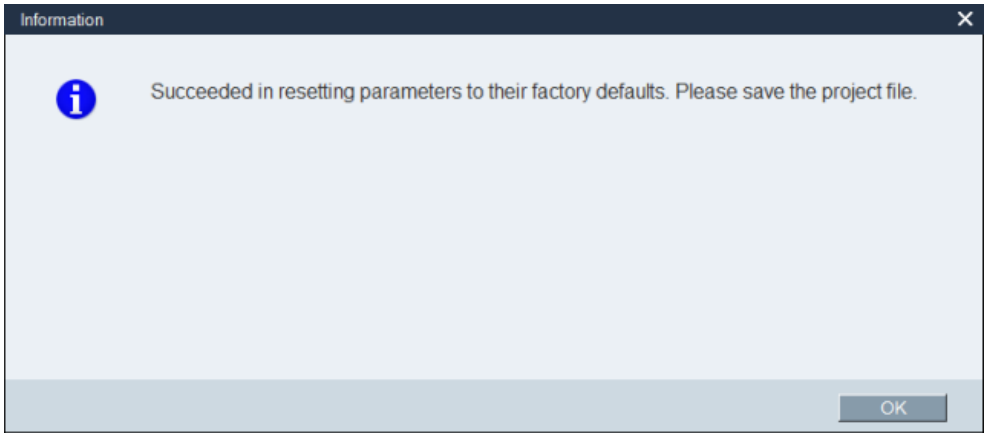
- If you click No or Cancel, the operation will be aborted.

Offline

Select this menu command and the following reminder will appear:



- If you click Yes, after the parameters are reset to their factory defaults, the following information will appear:



Click OK to close the information window. To save the project, please refer to Section "Project -> Save project (Page 21)".

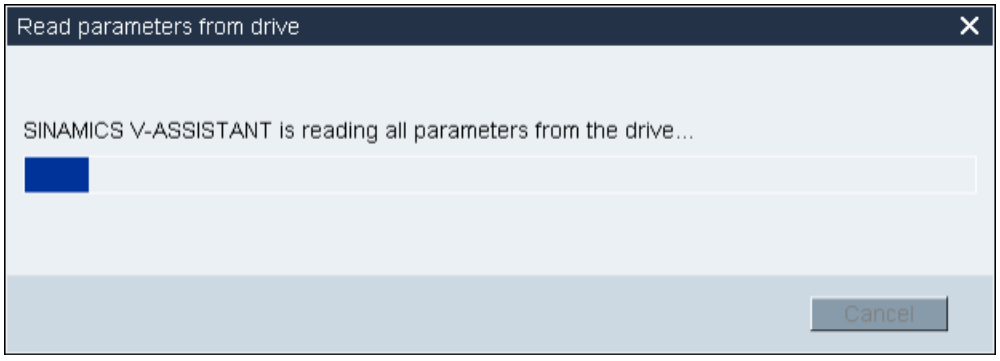
- If you click No or Cancel, the operation is aborted.

3.3.5.5 Tools -> Upload parameters

Note

This menu command is only available in online mode.

You can use the menu command to upload parameters from the drive to SINAMICS V-ASSISTANT. The following window will appear to show the process:



After the process is complete, the values of the same parameters in SINAMICS V-ASSISTANT will be replaced by those in the drive automatically.

3.3.6 Help menu

The Online help quickly provides you with information about drive selection, parameterization, commissioning and diagnostics of SINAMICS V-ASSISTANT.

- Help -> View help (Page 28)
- Help -> About SINAMICS V-ASSISTANT... (Page 29)

3.3.6.1 Help -> View help

You can use this menu command to display the content of SINAMICS V-ASSISTANT Online help.

3.3.6.2 Help -> About SINAMICS V-ASSISTANT...

You can use this menu command to display the following information window for SINAMICS V-ASSISTANT.

3.4 Toolbar

The icons of the toolbar provide quick access to the commands in the menu bar or functions from Task navigation (Page 31).

- New project (Page 20)
- Open project (Page 20)
- Save project (Page 21)
- Print (Page 22)
- Cut (Page 23)
- Copy (Page 24)
- Paste (Page 24)
- Go offline (Page 24)
- Go online (Page 24)
- Save parameters to ROM (Page 25)


Upload parameters (Page 28)


Viewing all parameters (Page 65)

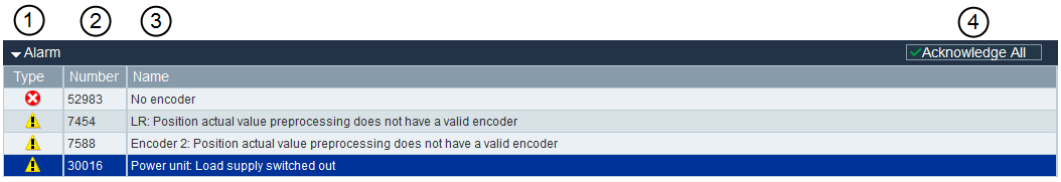

Trace (Page 96)


Test motor (Page 79)


Help (Page 28)

3.5 Alarm window

Alarm window overview



①	**Alarm type:** : Fault : Alarm Faults have priority over alarms in display.	③	**Alarm name and description**
②	**Alarm number**	④	**Acknowledge All:** Clears the faults in the buffer area of the drive

3.6 Function keys and shortcuts

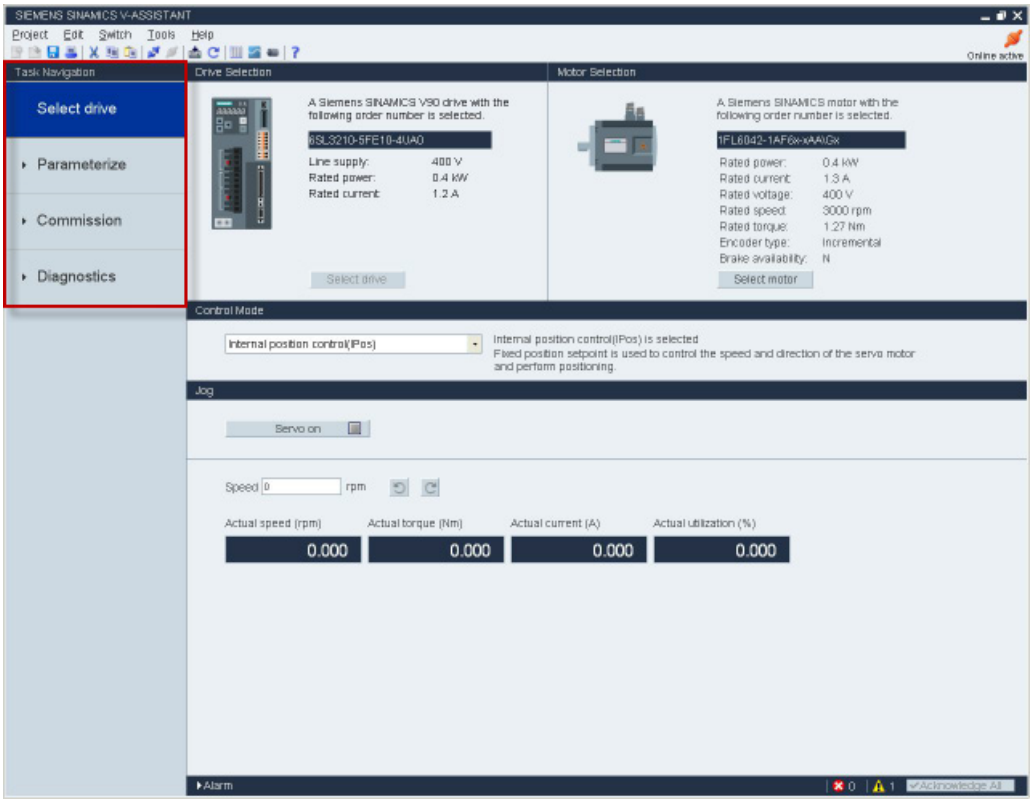
For frequently called functions, corresponding function keys and shortcuts are provided.

Function keys in SINAMICS V-ASSISTANT

[F1]	→ Calls the context sensitive Online help
[Ctrl+X]	→ Edit -> Cut (Page 23)
[Ctrl+C]	→ Edit -> Copy (Page 24)
[Ctrl+V]	→ Edit -> Paste (Page 24)

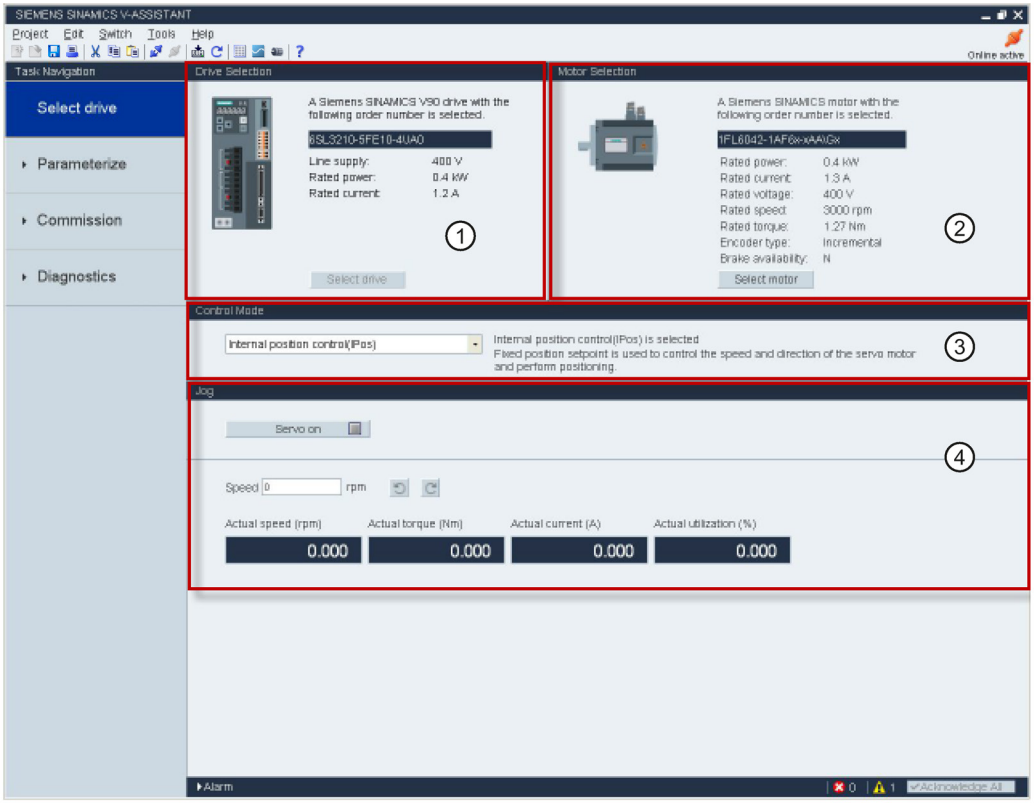
Task navigation

4



Task	Sub-functions
Selecting drive (Page 33)	• Selecting drive (Page 34) • Selecting motor (Page 36) • Control mode (Page 37) • Jog (Page 39)
Parameterizing (Page 41)	• Setting electronic gear ratio (Page 42) • Setting mechanism (Page 45) • Setting parameter setpoint (Page 46) • Setting limits (Page 53) • Configuring inputs/outputs (Page 56) • Configuring referencing (Page 58) • Setting encoder pulse output (Page 63) • Backlash compensation (Page 64) • Viewing all parameters (Page 65)
Commissioning (Page 67)	• Testing interface (Page 67) • Testing motor (Page 79) • Optimizing drive (Page 82)
Diagnostics (Page 95)	• Monitoring status (Page 95) • Tracing signals (Page 96) • Measuring machine (Page 101)

4.1 Selecting drive

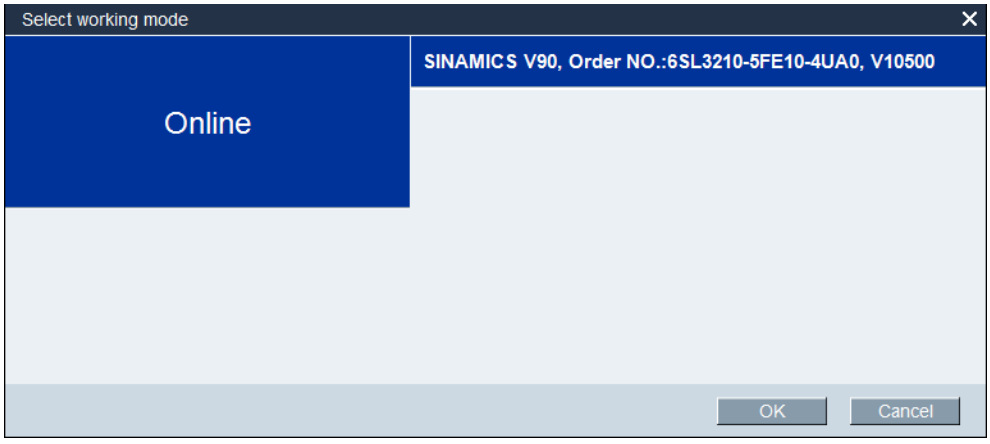


①	Drive selection	Select a drive in this field. For more information, refer to Section "Selecting drive (Page 34)".
②	Motor selection	Select a motor in this field. For more information, refer to Section "Selecting motor (Page 36)".
③	Control mode	Select a control mode in this field. For more information, refer to Section "Control mode (Page 37)".
④	Jog	Test the Jog function in this field. For more information, refer to Section "Jog (Page 39).

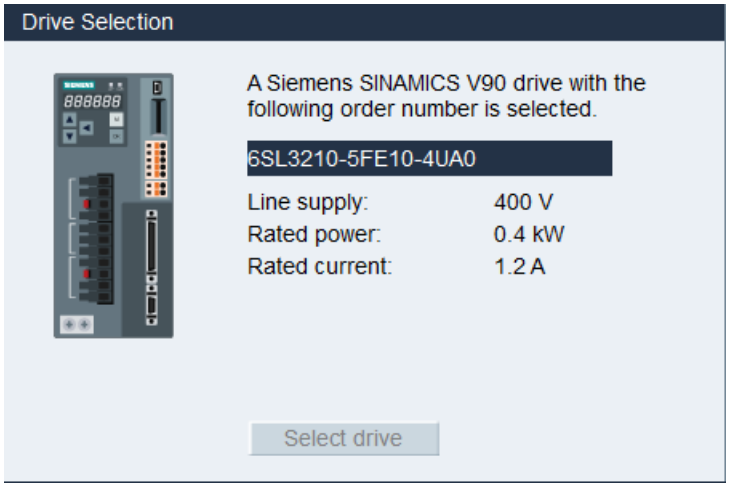
4.1.1 Selecting drive

Online mode

When you choose to work in online mode, a list of connected drive type(s) is displayed for your selection:



Select the target drive type, and click OK to establish communication between the SINAMICS V-ASSISTANT and the drive. SINAMICS V-ASSISTANT reads all parameter settings from the connected drive and the main window displays the drive information on the following panel:



The following drive information is displayed:

- Order number
- Line supply

- Rated power
- Rated current

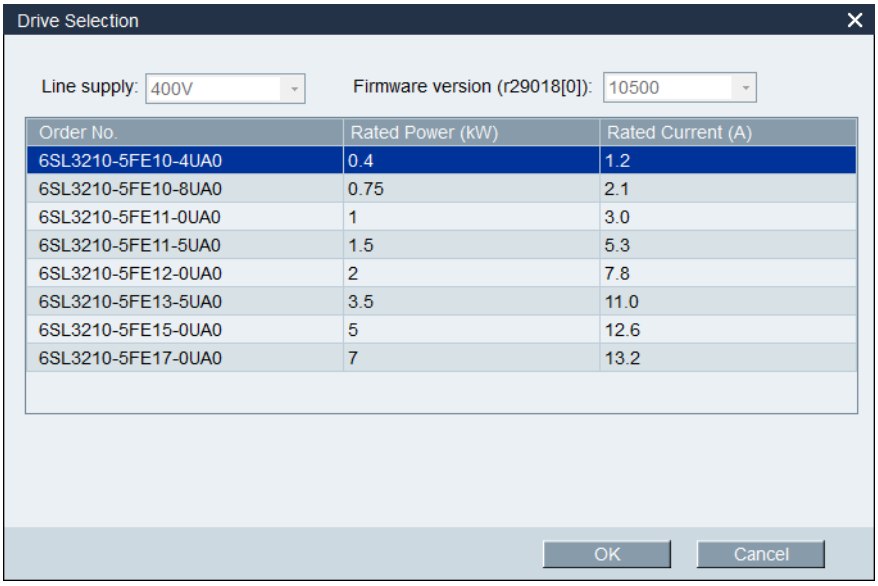
Note

Select drive is disabled in online mode.

Offline mode

When you are working in offline mode, the SINAMICS V-ASSISTANT does not communicate with the connected drive (s).

You can click Select drive to change the drive type in the following window:

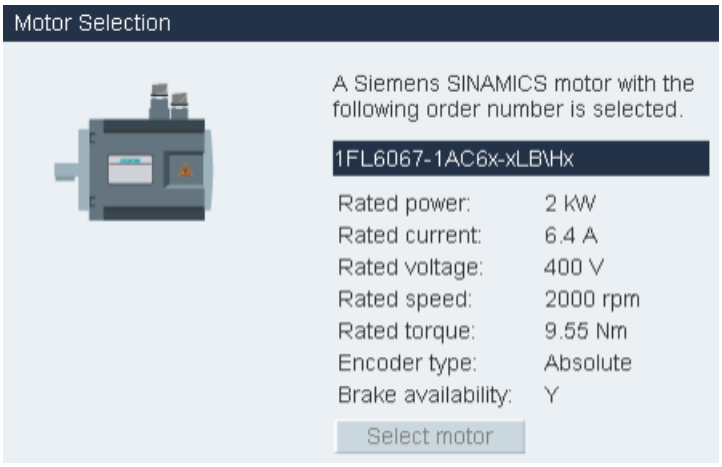


Select the order number of the target drive. Click OK to save the factory settings of the selected drive to the new project and enter the main window; or otherwise, click Cancel to cancel.

4.1.2 Selecting motor

Online mode

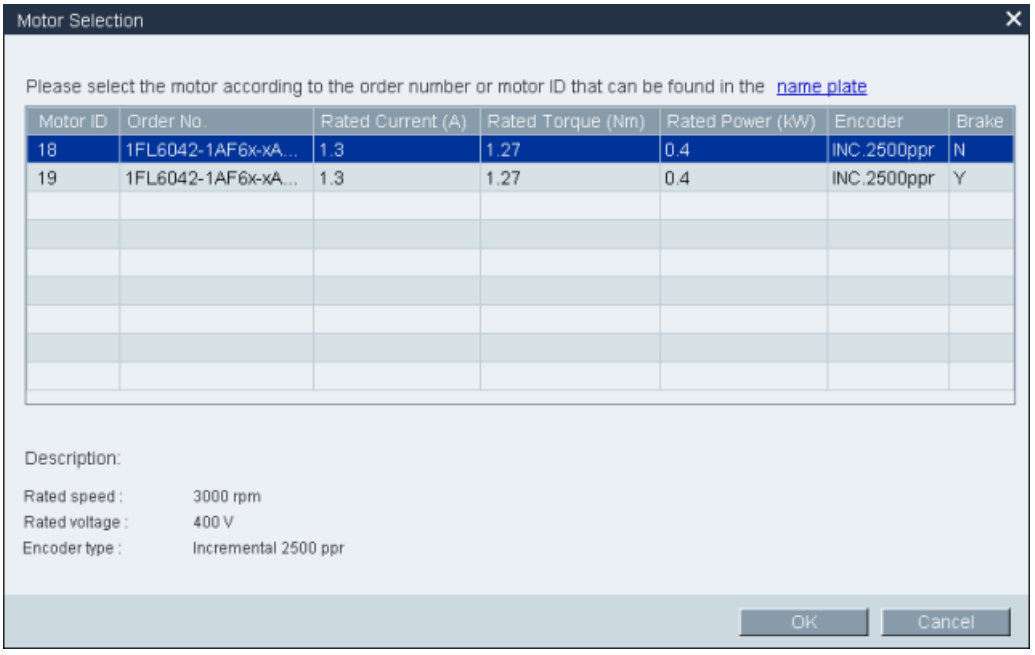
- If the connected motor is equipped with an absolute encoder, Select motor is disabled.



Note

In the order number, "x" is a wildcard; for more information about "A\G", please refer to SINAMICS V90, SIMOTICS S-1FL6 Operating Instructions.

- If the connected motor is equipped with an incremental encoder, click Select motor and the motor list is displayed.



Select a motor from the list and click the following button to confirm your selection:

OK

Note

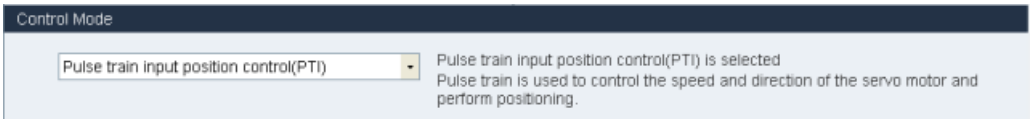
You can click "name plate" in the above window to see the specific location of the name plate on the motor.

Offline mode

- If you choose to create a new project, you need to select a drive first, then the information of the default motor is displayed.
- If you choose to open an existing project, the saved motor information is displayed.
- If you switch from online mode to offline mode, you can select the motor by clicking Select motor.

4.1.3 Control mode

Online mode/offline mode



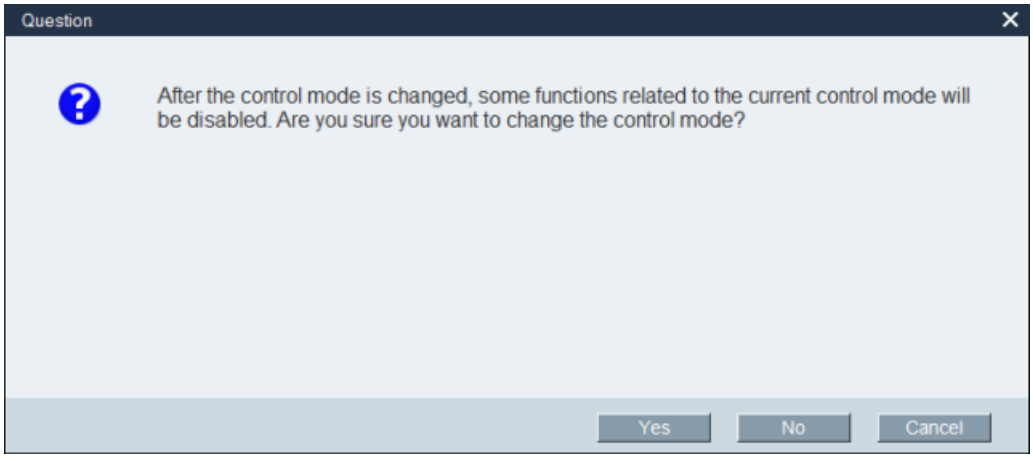
Totally, nine control modes are available:

Control modes		Abbreviation
Basic control modes	Pulse train input position control mode (PTI) [1]	PTI
	Internal position control mode (IPos)	IPos
	Speed control mode (S)	S
	Torque control mode (T)	T
Compound control modes	Control change mode: PTI/S	PTI/S
	Control change mode: IPos/S	IPos/S
	Control change mode: PTI/T	PTI/T
	Control change mode: IPos/T	IPos/T
	Control change mode: S/T	S/T

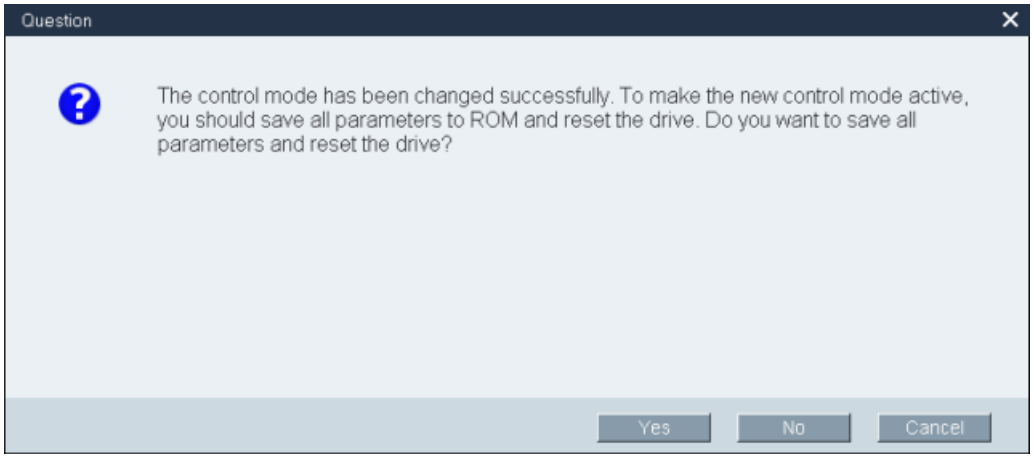
[1] Default control mode

Apply a control mode

After you select a control mode, a warning message appears:



Click Yes and the following message appears:



Click Yes to save all the parameters to ROM and reset the drive.

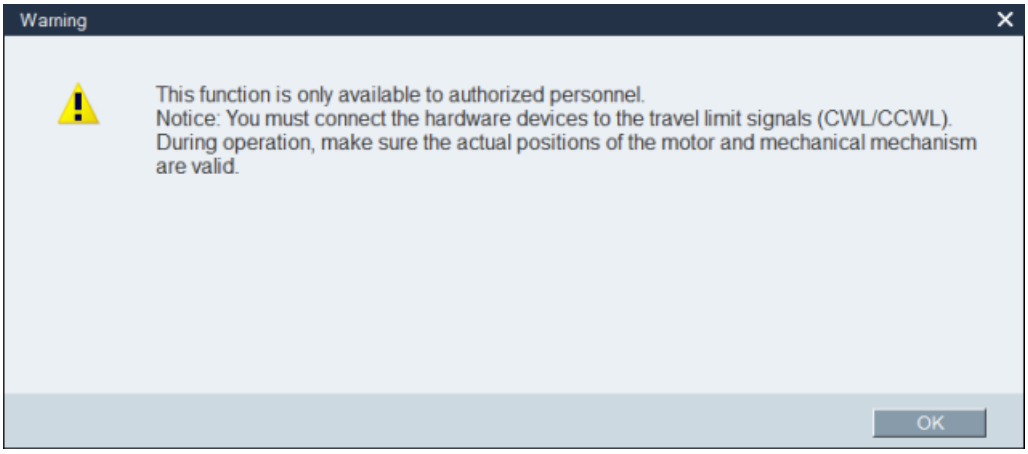
Otherwise, click the following button or directly close the dialog box, and the drive will work in the current control mode.

No

4.1.4 Jog

Jog function is only available in online mode. You can configure this function on the following panel:

- To start the Jog function, you can enter the Jog speed. Click Servo on, then the following warning will appear:



Click OK and run the drive counter-clockwisely/clockwisely by clicking the following two buttons respectively:

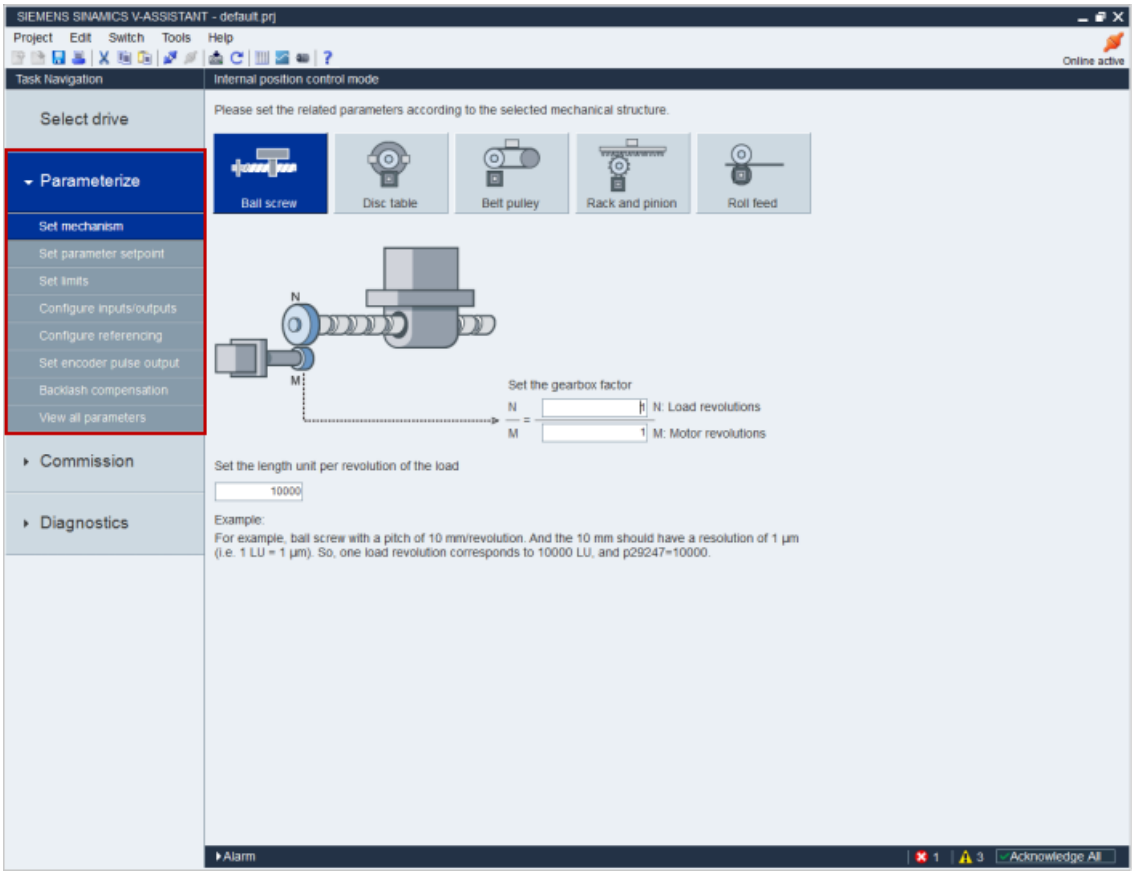
Then the actual speed, actual torque, actual current and actual utilization will be displayed.

- To stop the Jog function, you can click Servo off in the following window and the SINAMICS V-ASSISTANT will release the control priority.

Note

The Jog speed should not be too fast. Otherwise, the machine axes will get out of control due to possible communication delay.

4.2 Parameterizing



Totally, there are nine functions. The sub-function combinations vary with the control modes:

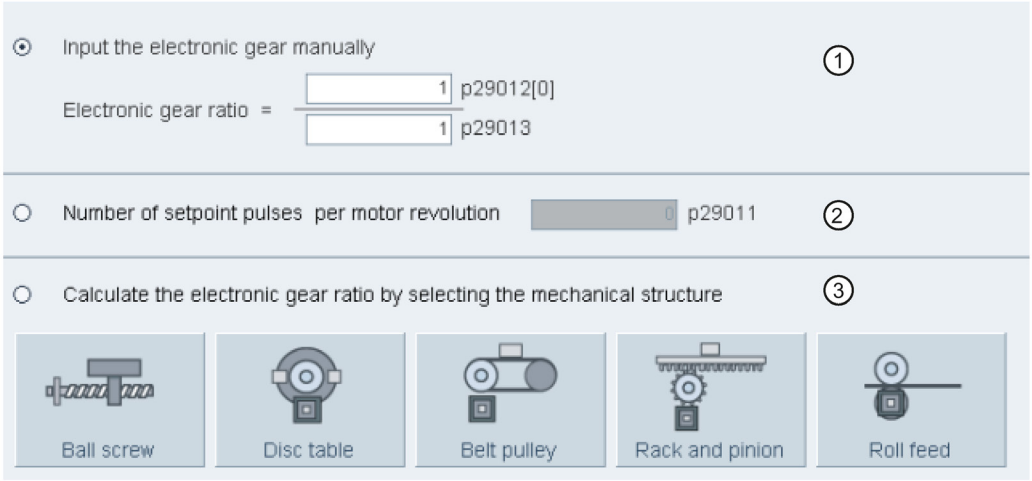
Function	Control mode			
	PTI	IPos	S	T
Setting electronic gear ratio (Page 42)	✓			
Setting mechanism (Page 45)		✓		
Setting parameter setpoint (Page 46)	✓	✓	✓	✓
Setting limits (Page 53)	✓	✓	✓	✓
Configuring inputs/outputs (Page 56)	✓	✓	✓	✓
Configuring referencing (Page 58)		✓		
Setting encoder pulse output (Page 63)	✓	✓		
Backlash compensation (Page 64)		✓		
Viewing all parameters (Page 65)	✓	✓	✓	✓

4.2.1 Setting electronic gear ratio

4.2.1.1 Overview

Setting electronic gear ratio is only available in pulse train input position control mode (PTI).

Select one of the following options for setting electronic gear ratio:

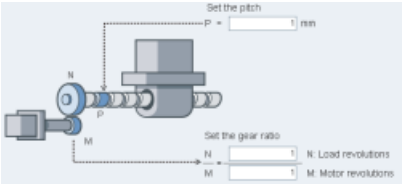
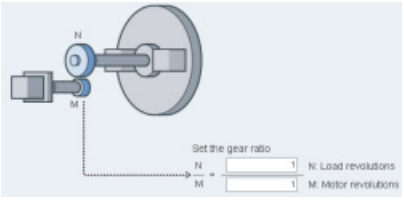
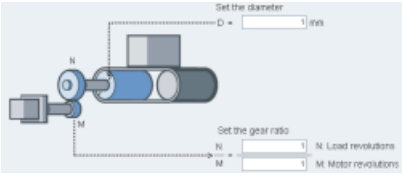
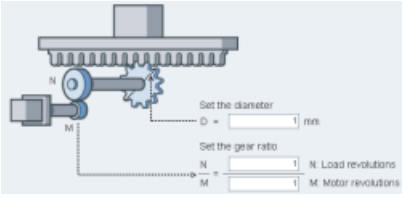
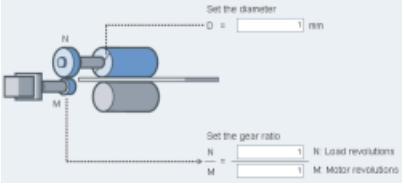


Options	Description
①	When number of setpoint pulses per motor revolution (p29011) is 0, configure electronic gear ratio by setting numerator (p29012) and denominator (p29013).
②	When number of setpoint pulses per motor revolution is not 0, enter the number of setpoint pulses per motor revolution here.
③	Calculate the electronic gear ratio according to different mechanical structures. Totally, five mechanical structures are available: 1. Ball screw 2. Disc table 3. Belt pulley 4. Rack and pinion 5. Roll feed For more information, refer to "Mechanical structure (Page 43)". You need to input the pitch value and gear ratio. Select a display unit and click Calculate. Then the electronic gear ratio will be worked out.

4.2.1.2 Mechanical structure

Variables

Configure variables according to the selected mechanical structure:

Mechanical structure	Graphical view	Variable settings	
		Variable	Range
Ball screw		P: Pitch value (mm)	0.0001 to 2147000000
		N: Load revolutions	1 to 2147000000
		M: Motor revolutions	1 to 2147000000
Disc table		N: Load revolutions	1 to 2147000000
		M: Motor revolutions	1 to 2147000000
Belt pulley		D: Diameter (mm)	0.0001 to 2147000000
		N: Load revolutions	1 to 2147000000
		M: Motor revolutions	1 to 2147000000
Rack and pinion		D: Diameter (mm)	0.0001 to 2147000000
		N: Load revolutions	1 to 2147000000
		M: Motor revolutions	1 to 2147000000
Roll feed		D: Diameter (mm)	0.0001 to 2147000000
		N: Load revolutions	1 to 2147000000
		M: Motor revolutions	1 to 2147000000

Unit

After configuring the variables for the selected mechanical structure, you must select one of the following units and input values within the scope:

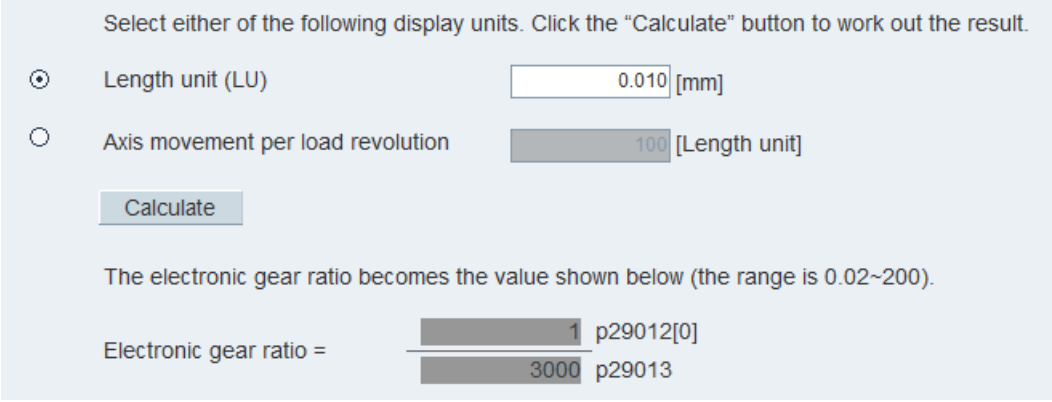
- Length unit

  Range: 0.0001 to 2147000000
- Axis movement per load revolution

  Range: 1 to 2147000000

Calculation

Click Calculate to calculate the electronic gear ratio and the calculated result is displayed as the following example:

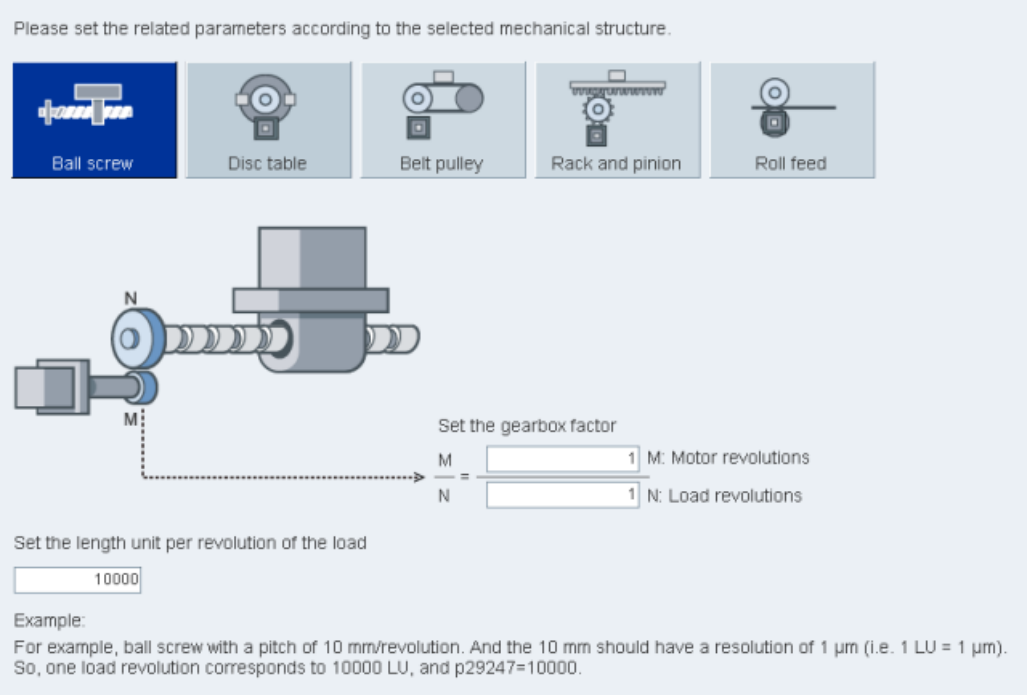


Note

If either the numerator or the denominator of the electronic gear ratio is larger than 10000, the ratio will be reduced automatically to make them smaller than 10000.

4.2.2 Setting mechanism

By parameterizing the mechanical system, the link between the physical moving part and the length unit (LU) is established. Select the mechanical structure. Set the gearbox factor and the length unit per revolution of the load on the following panel:



The unit of the fixed position setpoint is the Length Unit (LU). All subsequent position setpoint, related speed value, and acceleration value will maintain the LU as the unit in internal position control mode.

Taking a ball screw system for example, if the system has a pitch of 10 mm/revolution, the resolution of the length unit should be 1 µm (1 LU = 1 µm). Therefore, one load revolution corresponds to 10000 LU (p29247 = 10000).

4.2.3 Setting parameter setpoint

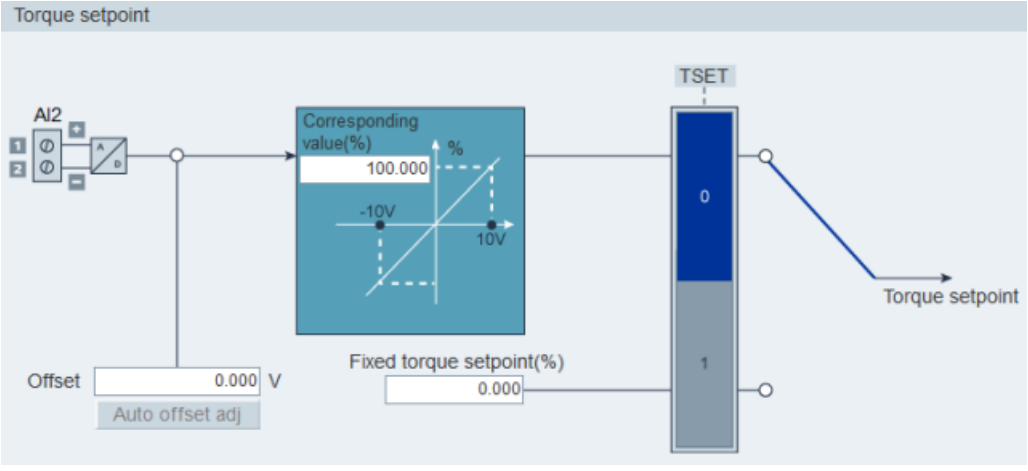
Setting parameter setpoint is used to specify parameters related to speed, torque and position.

Depending on the current control mode, you can configure parameters of the sub-functions as follows:

Function	Control mode			
	PTI	IPos	S	T
Signal form selection (Page 50)	✓			
Position setpoint smoothing time setting (Page 50)	✓	✓		
Position reached window setting (Page 50)	✓	✓		
Fixed position setpoint (Page 50)		✓		
Speed setpoint (Page 47)			✓	
Ramp-function generator (Page 47)			✓	
Speed reached window (Page 47)			✓	
Torque setpoint (Page 46)				✓

In compound control modes, setting parameter setpoint can be referred to the single control mode.

4.2.3.1 Torque setpoint



Source of torque setpoint

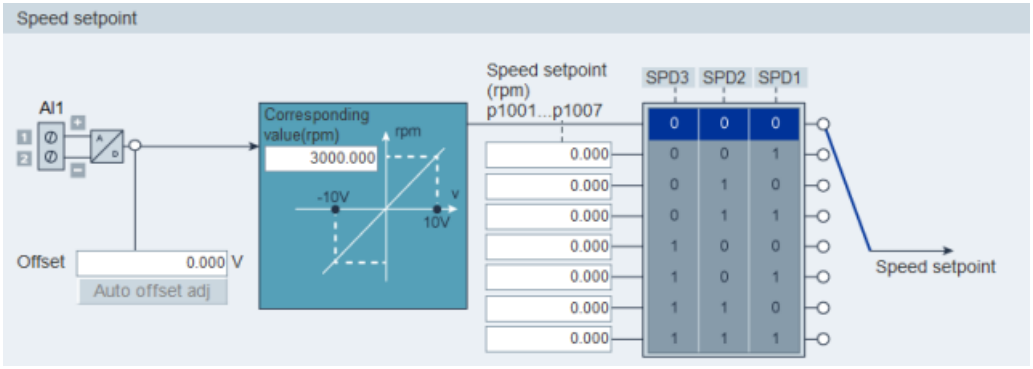
Two sources are available for torque setpoint:

- External setpoint: analog input 2
- Fixed setpoint: p29043

These two resources can be selected with the digital input signal TSET:

Signal	Level	Source of torque setpoint
TSET	0 (default)	Analog torque setpoint (analog input 2)
	1	Fixed torque setpoint (p29043)

4.2.3.2 Speed setpoint



Source of speed setpoint

Eight sources in total are available for speed setpoint. You can select one of them with the combination of digital input signals SPD1, SPD2 and SPD3:

Digital signal			Torque limit
SPD3	SPD2	SPD1	
0	0	0	External analog speed setpoint (analog input 1)
0	0	1	Fixed speed setpoint 1 (p1001)
0	1	0	Fixed speed setpoint 2 (p1002)
0	1	1	Fixed speed setpoint 3 (p1003)
1	0	0	Fixed speed setpoint 4 (p1004)
1	0	1	Fixed speed setpoint 5 (p1005)
1	1	0	Fixed speed setpoint 6 (p1006)
1	1	1	Fixed speed setpoint 7 (p1007)

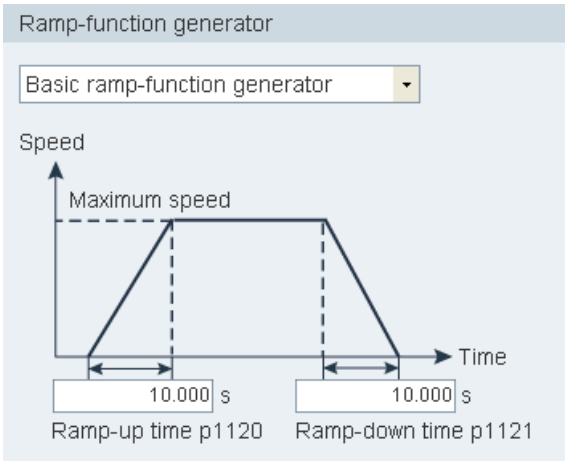
Ramp-function generator

The ramp-function generator is used to limit acceleration in the event of abrupt setpoint changes and thus helps prevent load surges during drive operation.

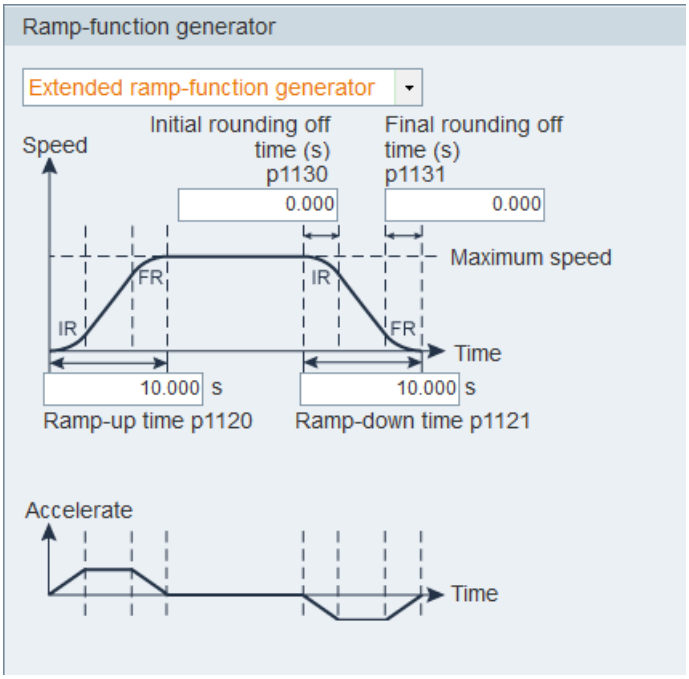
The ramp-up time p1120 and ramp-down time p1121 can be used to set acceleration and deceleration ramps separately. This allows a smoothed transition in the event of setpoint changes.

Two types of ramp-function generator are available. You can specify the parameters on the corresponding panels:

- Basic ramp-function generator

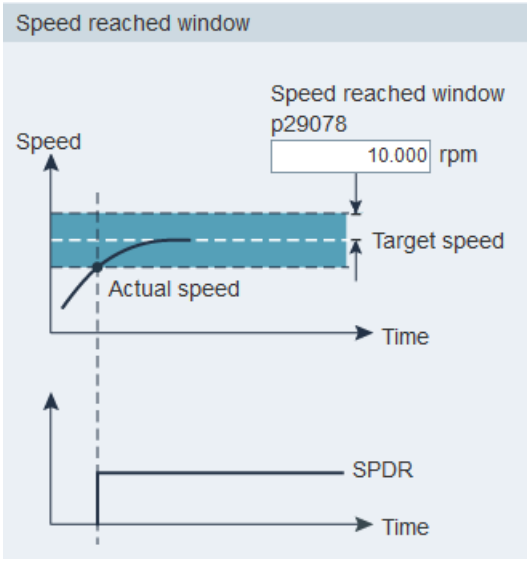


- Extended ramp-function generator



Speed reached window

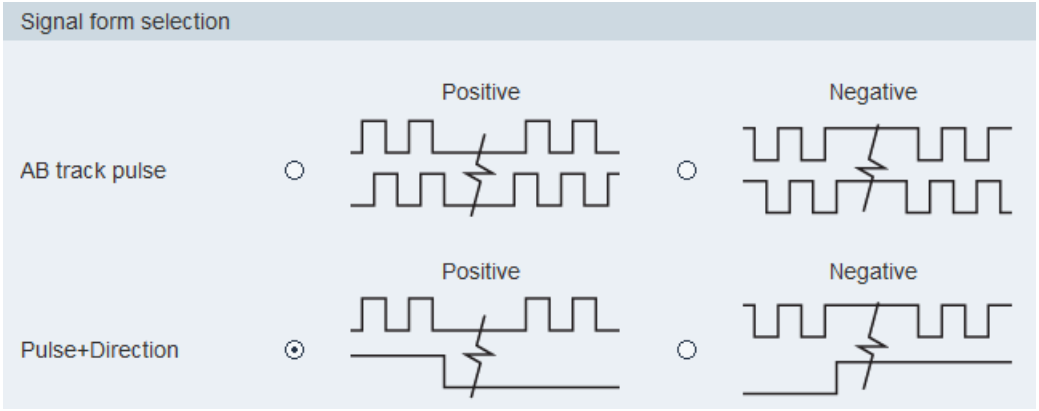
Set parameter p29078 for controller to decide whether the setpoint speed is reached on the following panel:



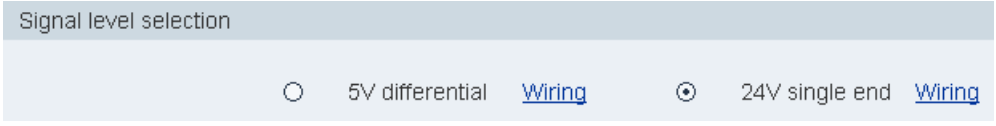
4.2.3.3 Position setpoint

Position setpoint

- In pulse train input position control mode, you can select one signal to link with pulse train input from the following options:

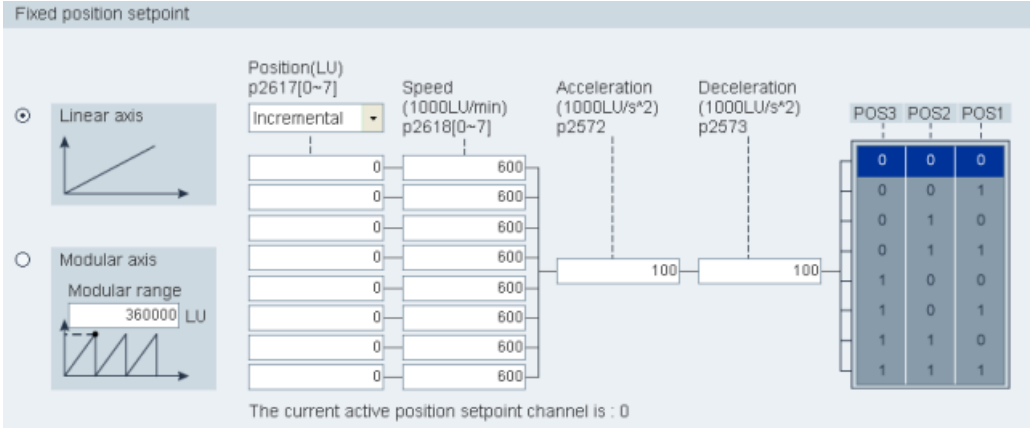


Select the signal level on the following panel:



For detailed information, refer to the Section "Pulse train inputs (PTIs) (Page 79)".

- In internal position control mode, you must specify position setpoint on the following panel:



Linear axis or modular axis can be used depending on your actual application.

– The linear axis has a restricted traversing range and it is the factory setting of the SINAMICS V90 servo drive.

– The modular axis has an unrestricted traversing range.

You can directly enter the digital value in the cells for the following items:

– Position

– Speed

– Acceleration

– Deceleration

The current active position setpoint channel is displayed at the bottom of this panel. The channels correspond with p2617 and p2618 as follows:

Position setpoint channel	Index of p2617	Index of p2618
0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7

Source for internal position setpoint

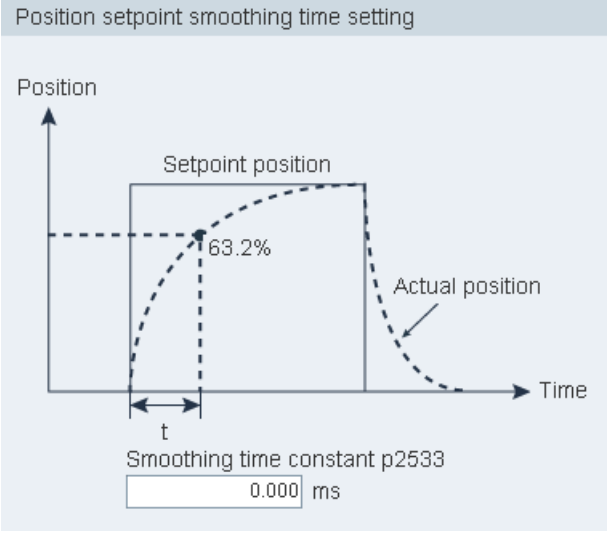
Eight position setpoints in total are available. Each position setpoint comes from one group of position data:

Fixed position setpoint	Corresponding parameters	
	Parameter	Description
Fixed position setpoint 1	p2617[0]	Fixed position setpoint 1 (P_pos1)
	p2618[0]	Speed of fixed position setpoint 1 (P_pos_spd1)
	p2572	IPos maximum acceleration
	p2573	IPos maximum deceleration
Fixed position setpoint 2	p2617[1]	Fixed position setpoint 2 (P_pos2)
	p2618[1]	Speed of fixed position setpoint 2 (P_pos_spd2)
	p2572	IPos maximum acceleration
	p2573	IPos maximum deceleration
Fixed position setpoint 3	p2617[2]	Fixed position setpoint 3 (P_pos3)
	p2618[2]	Speed of fixed position setpoint 3 (P_pos_spd3)
	p2572	IPos maximum acceleration
	p2573	IPos maximum deceleration
Fixed position setpoint 4	p2617[3]	Fixed position setpoint 4 (P_pos4)
	p2618[3]	Speed of fixed position setpoint 4 (P_pos_spd4)
	p2572	IPos maximum acceleration
	p2573	IPos maximum deceleration
Fixed position setpoint 5	p2617[4]	Fixed position setpoint 5 (P_pos5)
	p2618[4]	Speed of fixed position setpoint 5 (P_pos_spd5)
	p2572	IPos maximum acceleration
	p2573	IPos maximum deceleration
Fixed position setpoint 6	p2617[5]	Fixed position setpoint 6 (P_pos6)
	p2618[5]	Speed of fixed position setpoint 6 (P_pos_spd6)
	p2572	IPos maximum acceleration
	p2573	IPos maximum deceleration

Fixed position setpoint	Corresponding parameters	
	Parameter	Description
Fixed position setpoint 7	p2617[6]	Fixed position setpoint 7 (P_pos7)
	p2618[6]	Speed of fixed position setpoint 7 (P_pos_spd7)
	p2572	IPos maximum acceleration
	p2573	IPos maximum deceleration
Fixed position setpoint 8	p2617[7]	Fixed position setpoint 8 (P_pos8)
	p2618[7]	Speed of fixed position setpoint 8 (P_pos_spd8)
	p2572	IPos maximum acceleration
	p2573	IPos maximum deceleration

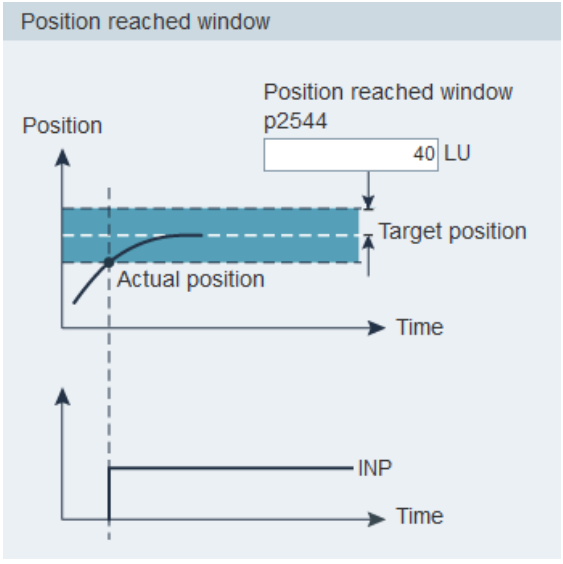
Position setpoint smoothing time setting

With the smoothing function, the position characteristics curve from the pulse train input setpoint can be transformed into an S-curve profile with a time constant specified in p2533.



Position reached window setting

Set parameter p2544 to specify the monitoring window for controller to decide whether the setpoint position is reached on the following panel:



Refer to Section "Digital outputs (DOs) (Page 75)" for more information about signal INP.

4.2.4 Setting limits

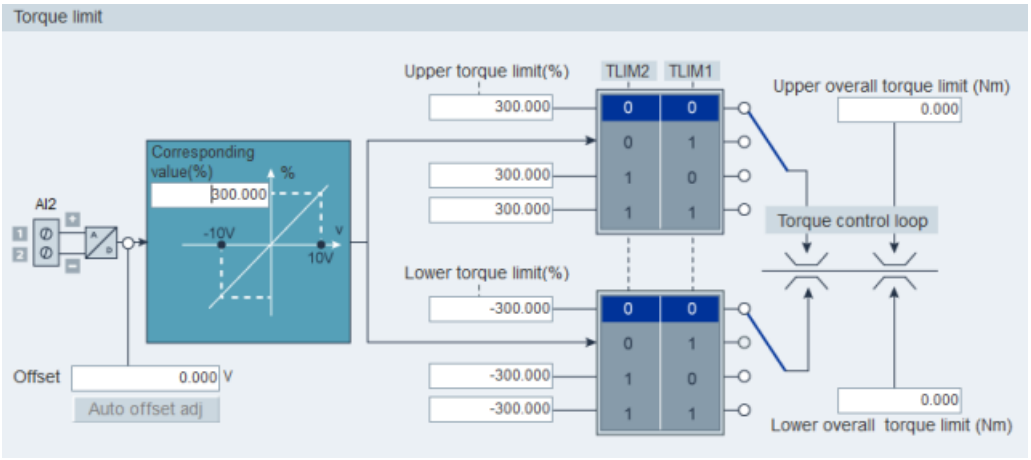
You can configure speed limit, torque limit and software position limit with this function. The sub-functions vary with the selected control mode as follows:

Functions	Control Mode			
	PTI	IPos	S	T
Torque limit (Page 54)	✓	✓	✓	
Overall torque limit	✓	✓	✓	✓
Speed limit (Page 55)	✓	✓	✓	✓
Overall speed limit	✓	✓	✓	✓
Software Position limit (Page 62)		✓		

4.2.4.1 Torque limit

Torque limit is available in control modes PTI, IPos and S.

You can specify the corresponding parameters on the following panel:



Source of torque limit

Four sources in total are available for torque limit. You can select one of them via a combination of digital input signals TLIM1 and TLIM2:

Digital signal		Torque limit
TLIM2	TLIM1	
0	0	Internal torque limit 1
0	1	External torque limit (analog input 2)
1	0	Internal torque limit 2
1	1	Internal torque limit 3

When the torque setpoint reaches torque limit, the torque is limited to the value selected by TLIM1/TLIM2.

Note

Control mode

These four sources are valid in the PTI mode, the IPos mode and the S mode. You can switch among them when the servo drive is running.

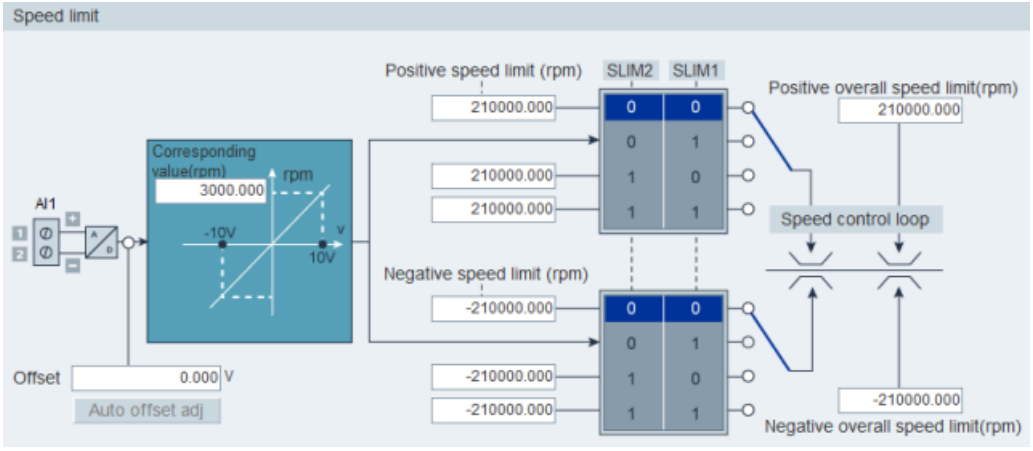
Refer to Section "Digital inputs (DIs) (Page 70)" for more information about the digital input signals TLIM1 and TLIM2.

Overall torque limit

Besides the above four sources, an overall torque limit is available for **all** control modes. The overall torque limit takes effect when an emergency stop (OFF3) happens. In this case, the servo drive brakes with a maximum torque.

4.2.4.2 Speed limit

You can specify the corresponding parameters on the following panel:



Source of speed Limit

Four sources in total are available for speed limit. You can select one of them via a combination of digital input signals SLIM1 and SLIM2:

Digital signal		Speed limit
SLIM2	SLIM1	
0	0	Internal speed limit 1
0	1	External speed limit (analog input 1)
1	0	Internal speed limit 2
1	1	Internal speed limit 3

Note

Control mode

The above four sources are valid in all control modes. You can switch among them when the servo drive is running.

When the speed setpoint reaches the speed limit, an alarm occurs.

Refer to Section "Digital inputs (DIs) (Page 70)" for more information about the digital input signals SLIM1 and SLIM2.

Overall speed limit

Besides the above four channels, an overall speed limit is available for all control modes.

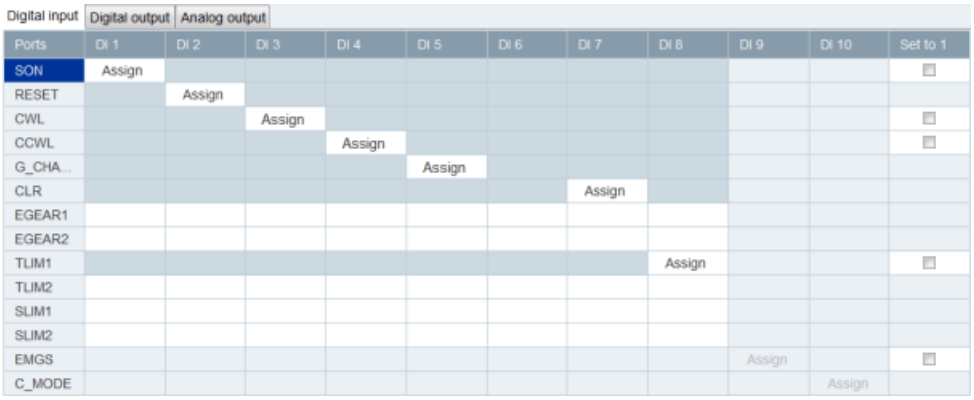
4.2.5 Configuring inputs/outputs

Three sub-functions are available as follows:

- Assigning digital inputs (Page 56)
- Assigning digital outputs (Page 57)
- Assigning analog outputs (Page 57)

4.2.5.1 Assigning digital inputs

You can assign digital inputs on the following panel:



28 signals in total can be freely linked to digital inputs except for DI9 and DI10 linked with E_Stop and C_Mode signals, for more information, refer to Section "Digital inputs (DIs) (Page 70)".

Click the cells with white background in the table. Two options are displayed in the drop-down list: **Assign** and **Cancel**. Select **"Assign"** to link the digital input with the corresponding signal. Then the current row displays grey. Otherwise, select **"Cancel"** to release the link. The current row will then display white.

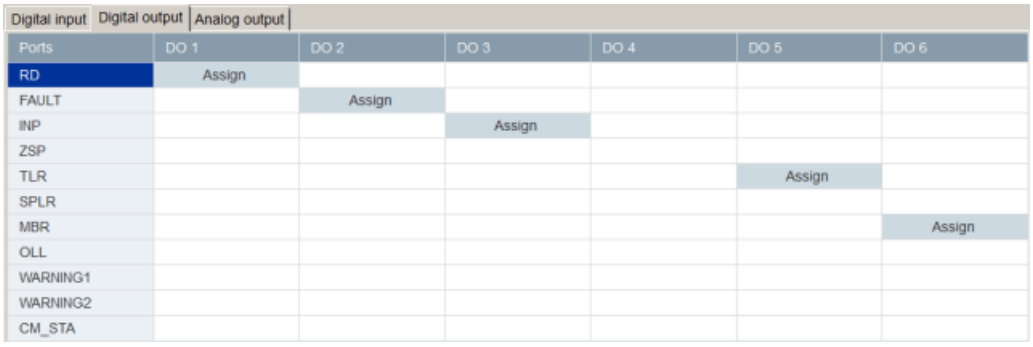
You can activate the checkbox in column "**Set to 1"** to forcely set the signal status to 1. For the signal EMGS, it can be forcely set to 1 when the drive firmware version is V1.04 and higher.

Note

Signal P_TRG in PTI mode is reserved for future use.

4.2.5.2 Assigning digital outputs

You can assign digital outputs on the following panel:

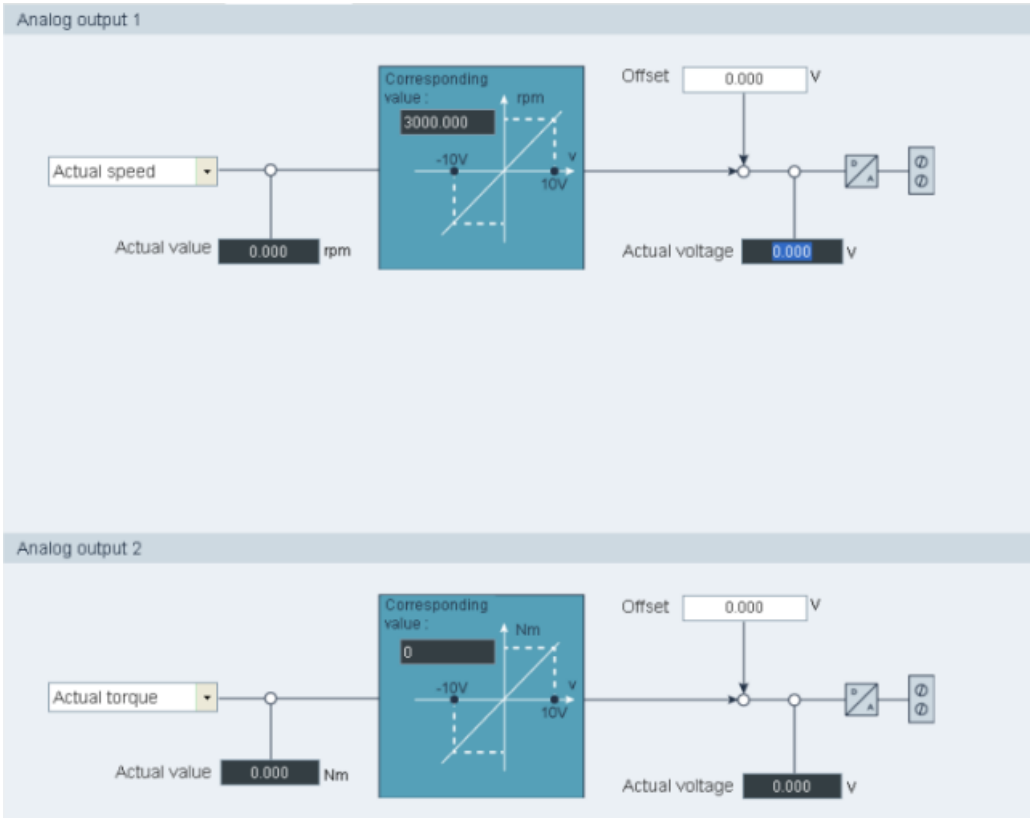


12 signals in total can be freely linked to digital outputs. For more information, refer to Digital outputs (DOs) (Page 75).

Click the cells with white background in the table. Select **"Assign"** to link the digital input with the corresponding signal. Then the current cell displays grey.

4.2.5.3 Assigning analog outputs

You can assign analog outputs on the panel below:



Seven signals in total can be linked with either analog output. For more information, refer to Section "Analog outputs (AOs) (Page 78)".

By default, analog output 1and analog output 2 are linked with actual speed and actual torque respectively. You can freely select the target signal in the drop-down list to link with analog outputs.

4.2.6 Configuring referencing

Referencing is only available in internal position control mode (IPos).

Two functions are available under referencing:

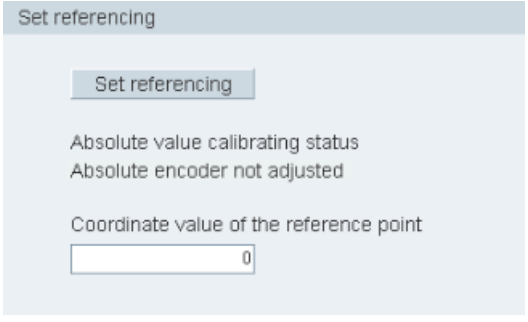
- Setting referencing (Page 58)
- Setting software position limit (Page 62)

4.2.6.1 Setting referencing

Setting referencing is **only** available in online mode.

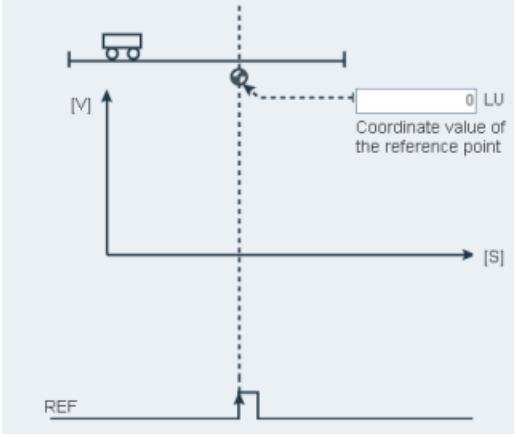
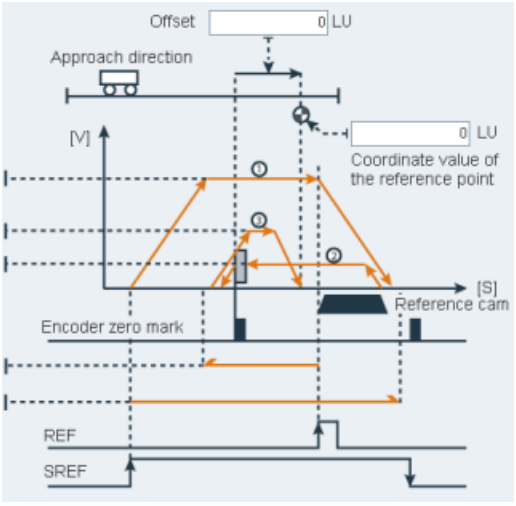
- **Absolute encoder**

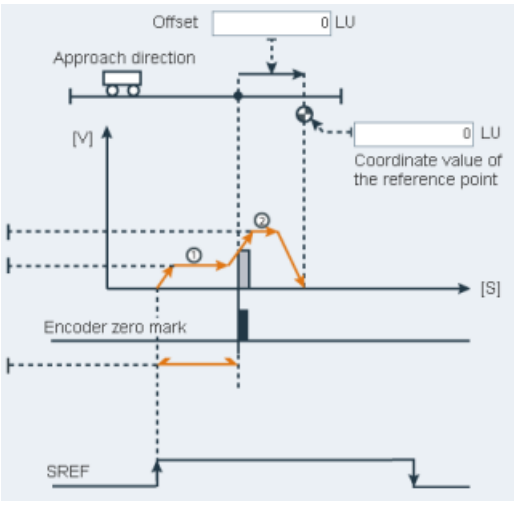
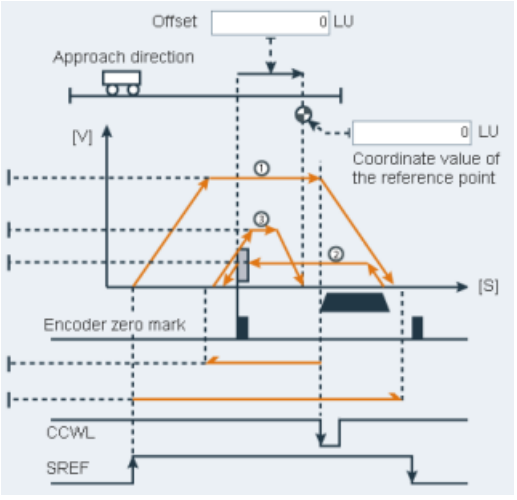
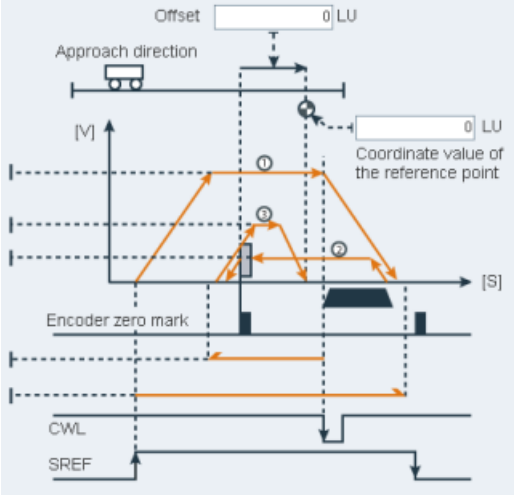
  If the motor is equipped with an absolute encoder, click Set referencing on the folllowing panel to configure referencing:



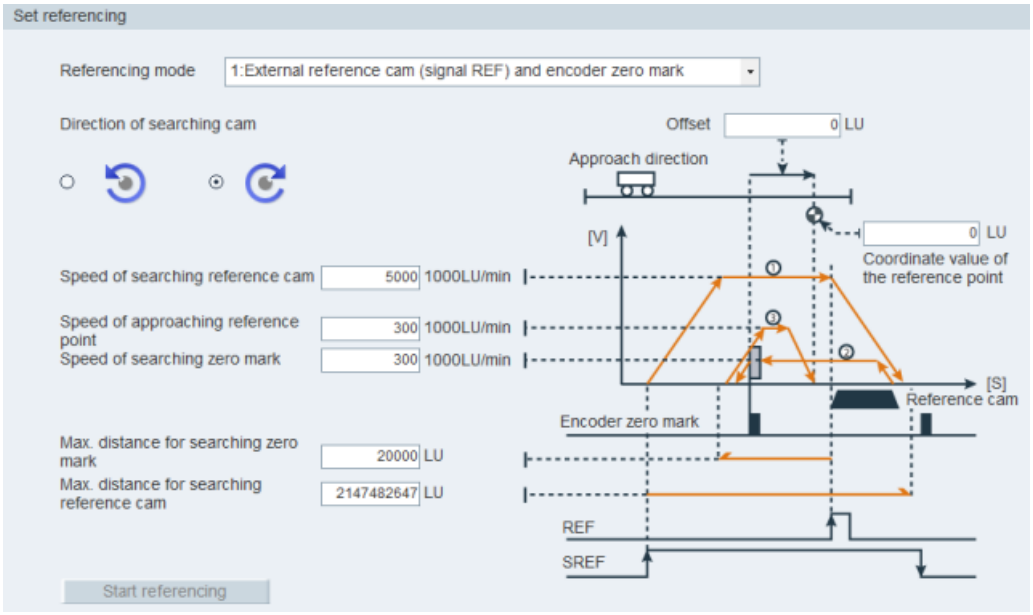
- **Incremental encoder**

  If the motor is equipped with an incremental encoder, five referencing modes in total are available:

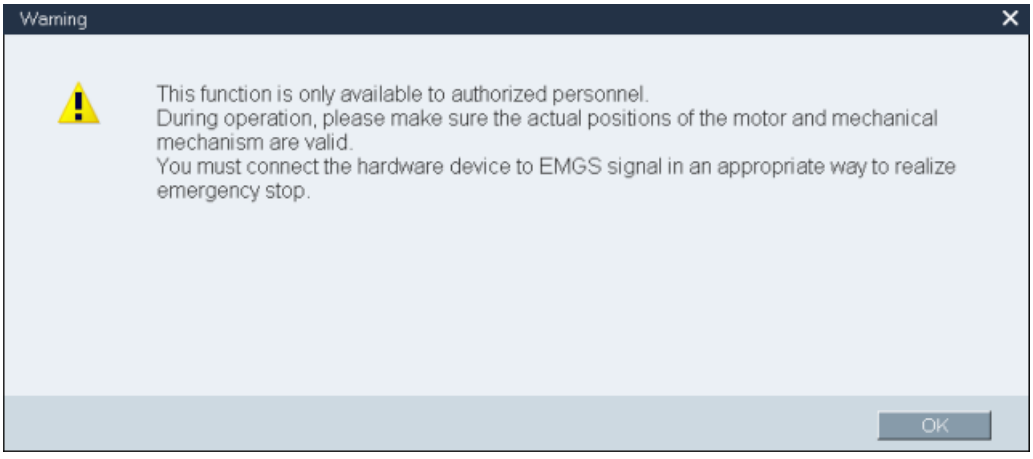
Parameter	Value	Referencing mode	Illustration
p29240	0	Setting the reference point via digital input (signal REF)	
	1	External reference cam (signal REF) and encoder zero mark	

Parame-ter	Val-ue	Referencing mode	Illustration
	2	Encoder zero mark only	
	3	External reference cam (CCWL signal) and encoder zero mark	
	4	External reference cam (CWL signal) and encoder zero mark	

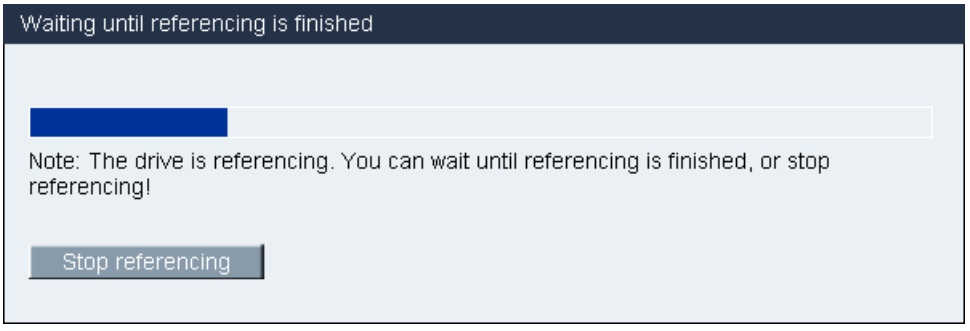
Taking the second referencing mode as an example, you can configure relevant parameters on the following panel:



Assign signals REF and SREF(for more information, refer to "Configuring inputs/outputs (Page 56)"). Click Start referencing and the following warning appears:



Click OK to start referencing and the following window appears:



Click the button below to stop the referencing process.

Stop referencing

4.2.6.2 Setting software position limit

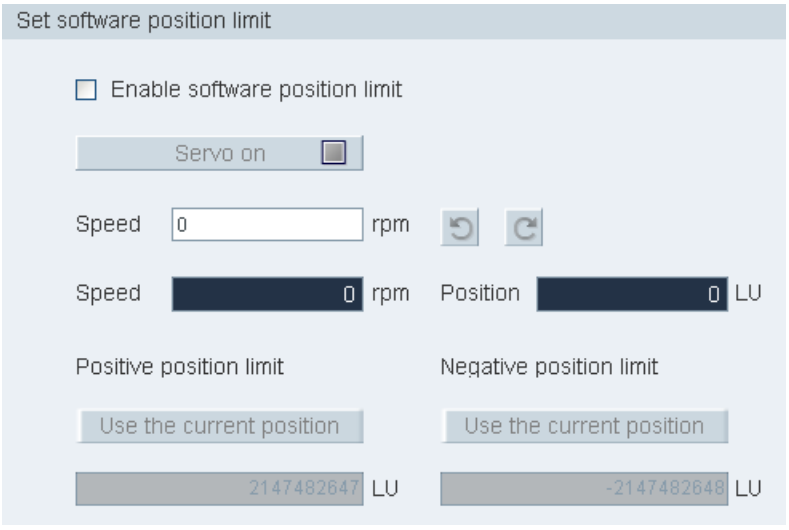
The following two software position limits are available in the internal position control mode (IPos):

- positive position limit
- negative position limit

Note

The function of software position limit only becomes active after referencing. When the actual position reaches one of the above-mentioned software position limits, motor speed decelerates to 0.

You can set the software position limit on the following panel:



Method 1: Setting through manual input

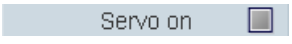
Click the check box to enable the software position limit. Enter the desired position values in the bottom input fields directly.

Method 2: Setting through the Jog function

1. Click the checkbox to enable the software position limit.
2. Enter the speed value.

   Note:

   The Jog speed should not be too fast. Otherwise, the machine axes will get out of control due to possible communication delay.



3. Click this button to execute servo-on and a warning message will appear. Confirm your selection by clicking OK in the message window.

4. Click this button to rotate the motor clockwisely and the motor will reach the maximum position.

5. Obtain the current position by clicking this button.

6. Click this button to rotate the motor counter-clockwisely and the motor will reach the minimum position.

7. Obtain the current position by clicking this button.

8. If you desire to disable this function, you can click this button and the checkbox.

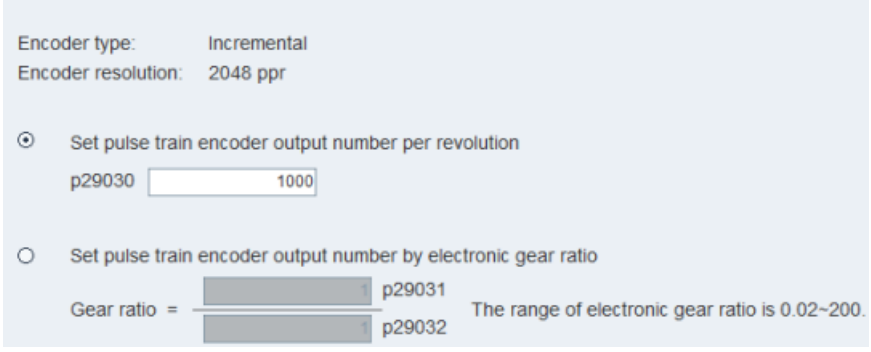
Note

Prerequisites for setting the software position limit:

- Referencing is completed successfully
- Linear axis working mode is selected

4.2.7 Setting encoder pulse output

When SINAMICS V-ASSISTANT is working in position control modes (PTI and IPos), you can configure pulse output on the following panel:



SINAMICS V-ASSISTANT automatically identifies the encoder type and resolution.

Two options are listed for you to configure relevant parameters:

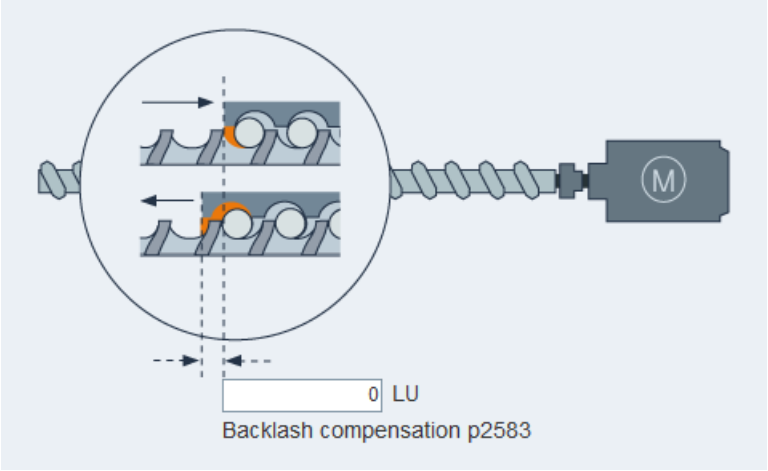
- Set PTO number per revolution
- Set PTO number by gear ratio

4.2.8 Backlash compensation

Generally, backlash occurs when the mechanical force is transferred between a machine part and its drive.

If the mechanical system was to be adjusted/designed so that there was absolutely no backlash, this would result in high wear. Thus, backlash can occur between the machine component and the encoder. For axes with indirect position sensing, mechanical backlash results in a false traversing distance because the axis, at direction reversal, travels either too far or not far enough corresponding to the absolute value of the backlash.

You can configure backlash compensation on the following panel:



In order to compensate the backlash, the determined backlash must be specified in p2583 with correct polarity. At each direction of rotation reversal, the axis actual value is corrected dependent on the actual traversing direction.

Note

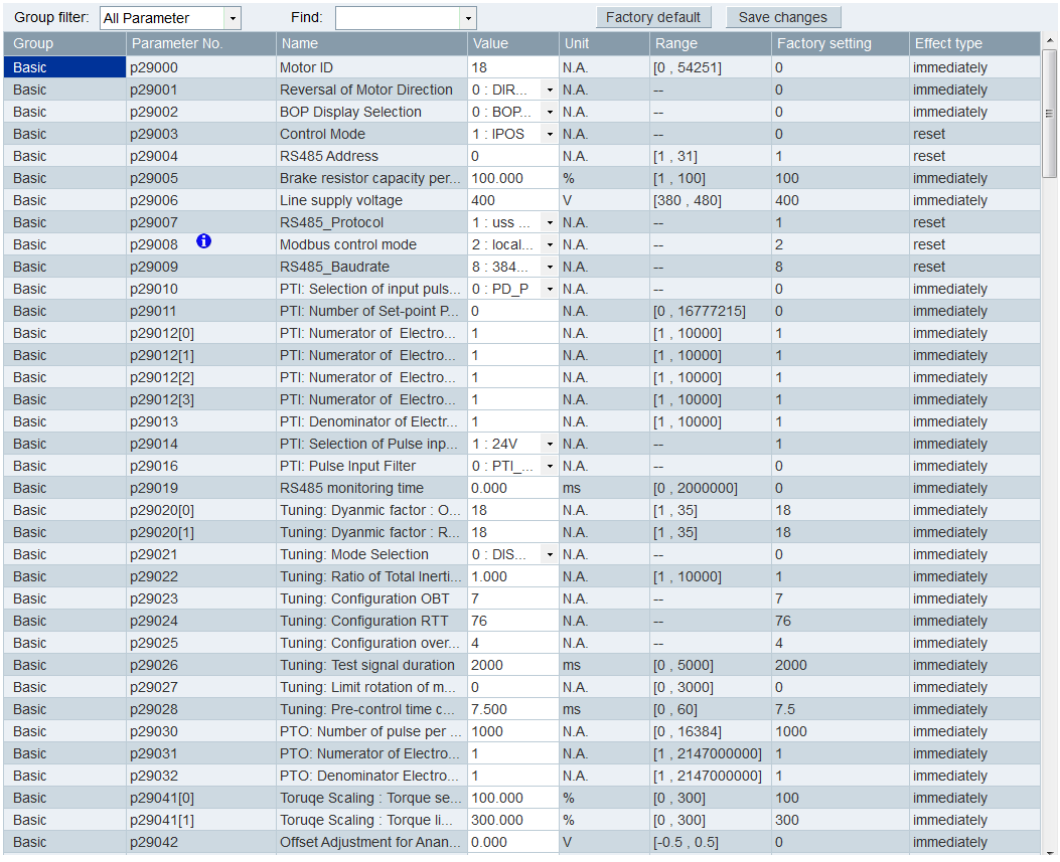
Pre-conditions for backlash compensation

The backlash compensation is active after

- the axis has been referenced for incremental measuring system. Refer to Section "Setting referencing (Page 58)" for detailed information about referencing.
- the axis has been adjusted for absolute measuring system.

4.2.9 Viewing all parameters

You can configure all editable parameters in this field:

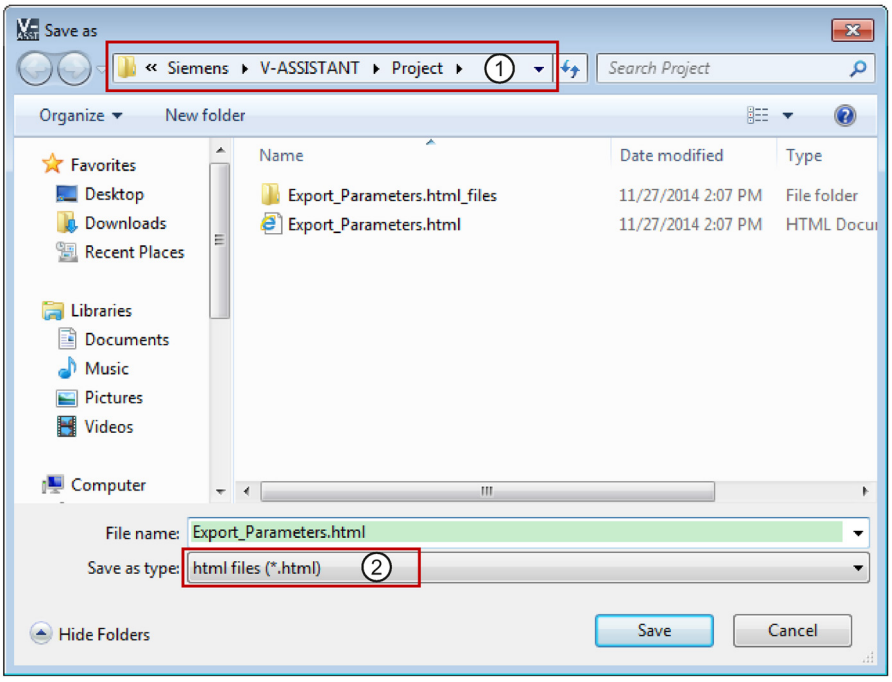


Group	Parameter No.	Name	Value	Unit	Range	Factory setting	Effect type
Basic	p29000	Motor ID	18	N.A.	[0 , 54251]	0	immediately
Basic	p29001	Reversal of Motor Direction	0 : DIR...	N.A.	--	0	immediately
Basic	p29002	BOP Display Selection	0 : BOP...	N.A.	--	0	immediately
Basic	p29003	Control Mode	1 : IPOS	N.A.	--	0	reset
Basic	p29004	RS485 Address	0	N.A.	[1 , 31]	1	reset
Basic	p29005	Brake resistor capacity per...	100.000	%	[1 , 100]	100	immediately
Basic	p29006	Line supply voltage	400	V	[380 , 480]	400	immediately
Basic	p29007	RS485_Protocol	1 : uss ...	N.A.	--	1	reset
Basic	p29008	Modbus control mode	2 : local...	N.A.	--	2	reset
Basic	p29009	RS485_Baudrate	8 : 384...	N.A.	--	8	reset
Basic	p29010	PTI: Selection of input puls...	0 : PD_P	N.A.	--	0	immediately
Basic	p29011	PTI: Number of Set-point P...	0	N.A.	[0 , 16777215]	0	immediately
Basic	p29012[0]	PTI: Numerator of Electro...	1	N.A.	[1 , 10000]	1	immediately
Basic	p29012[1]	PTI: Numerator of Electro...	1	N.A.	[1 , 10000]	1	immediately
Basic	p29012[2]	PTI: Numerator of Electro...	1	N.A.	[1 , 10000]	1	immediately
Basic	p29012[3]	PTI: Numerator of Electro...	1	N.A.	[1 , 10000]	1	immediately
Basic	p29013	PTI: Denominator of Electr...	1	N.A.	[1 , 10000]	1	immediately
Basic	p29014	PTI: Selection of Pulse inp...	1 : 24V	N.A.	--	1	immediately
Basic	p29016	PTI: Pulse Input Filter	0 : PTI_...	N.A.	--	0	immediately
Basic	p29019	RS485 monitoring time	0.000	ms	[0 , 2000000]	0	immediately
Basic	p29020[0]	Tuning: Dyanmic factor : O...	18	N.A.	[1 , 35]	18	immediately
Basic	p29020[1]	Tuning: Dyanmic factor : R...	18	N.A.	[1 , 35]	18	immediately
Basic	p29021	Tuning: Mode Selection	0 : DIS...	N.A.	--	0	immediately
Basic	p29022	Tuning: Ratio of Total Inerti...	1.000	N.A.	[1 , 10000]	1	immediately
Basic	p29023	Tuning: Configuration OBT	7	N.A.	--	7	immediately
Basic	p29024	Tuning: Configuration RTT	76	N.A.	--	76	immediately
Basic	p29025	Tuning: Configuration over...	4	N.A.	--	4	immediately
Basic	p29026	Tuning: Test signal duration	2000	ms	[0 , 5000]	2000	immediately
Basic	p29027	Tuning: Limit rotation of m...	0	N.A.	[0 , 3000]	0	immediately
Basic	p29028	Tuning: Pre-control time c...	7.500	ms	[0 , 60]	7.5	immediately
Basic	p29030	PTO: Number of pulse per ...	1000	N.A.	[0 , 16384]	1000	immediately
Basic	p29031	PTO: Numerator of Electro...	1	N.A.	[1 , 2147000000]	1	immediately
Basic	p29032	PTO: Denominator Electro...	1	N.A.	[1 , 2147000000]	1	immediately
Basic	p29041[0]	Toruqe Scaling : Torque se...	100.000	%	[0 , 300]	100	immediately
Basic	p29041[1]	Toruqe Scaling : Torque li...	300.000	%	[0 , 300]	300	immediately
Basic	p29042	Offset Adjustment for Anan...	0.000	V	[-0.5 , 0.5]	0	immediately

Note

The parameter with an icon in the table means that the parameter is used by Modbus communication function. You can click on the icon to see the detailed information about the communication function.

Field	Description
Group filter	Views parameters according to different groups.
Find	Filters the parameter list according to the entered text. The filtering is done after you enter the desired text.
Factory default	You can click the following button to reset all parameters to their factory settings: Factory default For more information, refer to Section "Tools -> Factory default (Page 26)".

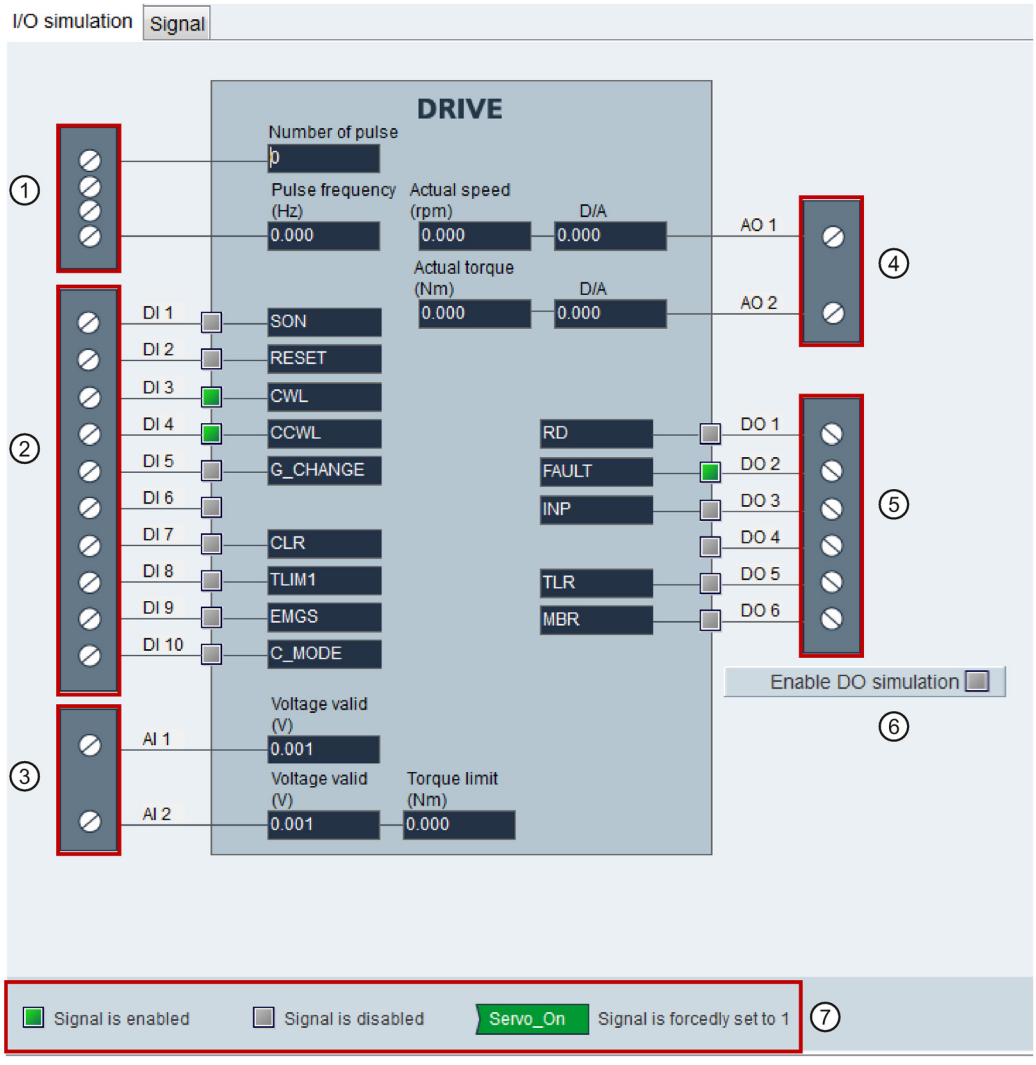
Field	Description
Save changes	You can click the following button to save the changes compared to the defaults/factory settings into an .html file which can be further used for documentation purposes or as an reference for BOP commisioning. Save changes Save in the following window:  ①: The default location is: xxx/Siemens/V-ASSISTANT/Project. xxx: SINAMICS V-ASSISTANT setup root directory ②: Only .html format is available.
Table	All parameters are displayed with the following information: • Group • Parameter number • Name • Value • Unit • Range • Factory setting • Effect type **Note:** In the value related column, values with white background are editable.

4.3 Commissioning

4.3.1 Testing interface

4.3.1.1 I/O simulation

When SINAMICS V-ASSISTANT is working in online mode, you can view the I/O status on the following panel:



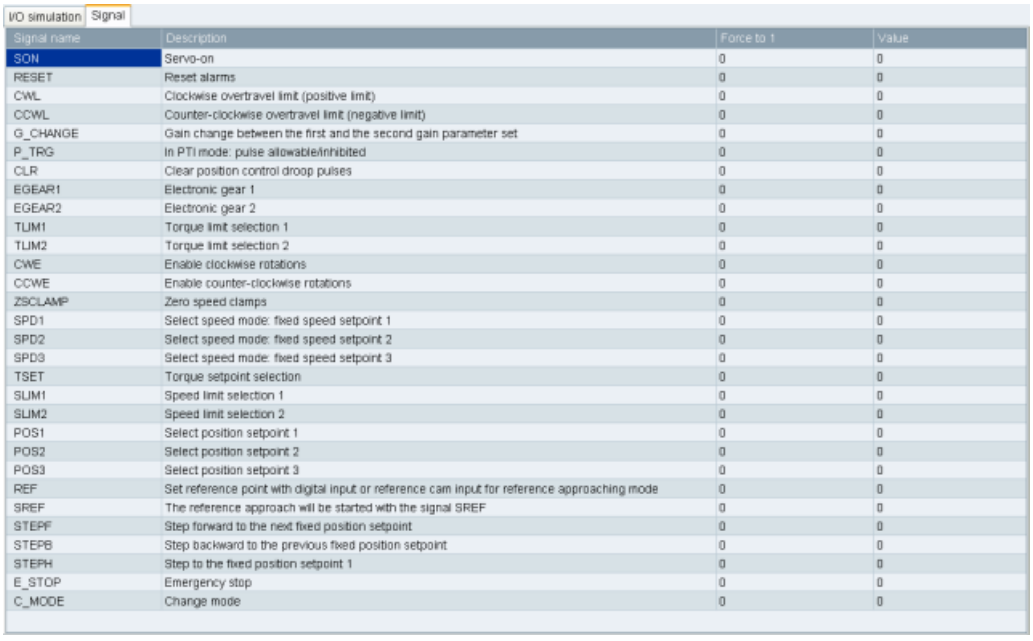
Area	Item		Description
①	Pulse train input		Information about pulse train input: • Received number of pulses. • Pulse frequency. For more information, refer to Section "Pulse train inputs (PTIs) (Page 79)".
②	DI1~DI8		Every digital input can be linked with either of the 28 internal signals.
	DI9		Linked with EMGS signal.
	DI10		Linked with C_MODE signal.
	Note: For more information about the number and definition of signals, refer to Section"Digital inputs (DIs) (Page 70)".		
③	AI1		Linked with speed related signals.
	AI2		Linked with torque related signals.
	Note: For more information about analog inputs, refer to Section "Analog inputs (AIs) (Page 77)".		
④	AO1		Linked with actual speed signal by default.
	AO2		Linked with actual torque signal by default.
	Note: For more information, refer to Section "Analog outputs (AOs) (Page 78)".		
⑤	DO1~DO6		Every digital output can be freely linked with either of the 12 internal signals. For more information, refer to Section "Digital outputs (DOs) (Page 75)".
⑥			Clicking this button enables DO simulation. If you desire to disable this function, click the following button: 
⑦		Signal is enabled	Indicates high-voltage (or logic 1) is on the digital input/output.
		Signal is disabled	Indicates low-voltage (or logic 0) is on the digital input/output.
		Signal is forcedly set to 1	Indicates the status of the assigned signal is forcedly set to 1.

Note

- This function is unavailable but can be displayed in offline mode.
- The status of each indicator and analog value are updated every 0.5 s.
- Signal P_TRG in PTI mode is reserved for future use.
- You can change the signal link as you desire. For more information, refer to Section "Configuring inputs/outputs (Page 56)".

Status of DI signals

You can view the name, description, value and status of individual DI signals on the following panel:


I/O simulation | Signal

Signal name	Description	Force to 1	Value
SON	Servo-on	0	0
RESET	Reset alarms	0	0
CWL	Clockwise overtravel limit (positive limit)	0	0
CCWL	Counter-clockwise overtravel limit (negative limit)	0	0
G_CHANGE	Gain change between the first and the second gain parameter set	0	0
P_TRG	In PTI mode: pulse allowable/inhibited	0	0
CLR	Clear position control droop pulses	0	0
EGEAR1	Electronic gear 1	0	0
EGEAR2	Electronic gear 2	0	0
TLIM1	Torque limit selection 1	0	0
TLIM2	Torque limit selection 2	0	0
CWE	Enable clockwise rotations	0	0
CCWE	Enable counter-clockwise rotations	0	0
ZSCLAMP	Zero speed clamps	0	0
SPD1	Select speed mode: fixed speed setpoint 1	0	0
SPD2	Select speed mode: fixed speed setpoint 2	0	0
SPD3	Select speed mode: fixed speed setpoint 3	0	0
TSET	Torque setpoint selection	0	0
SLIM1	Speed limit selection 1	0	0
SLIM2	Speed limit selection 2	0	0
POS1	Select position setpoint 1	0	0
POS2	Select position setpoint 2	0	0
POS3	Select position setpoint 3	0	0
REF	Set reference point with digital input or reference cam input for reference approaching mode	0	0
SREF	The reference approach will be started with the signal SREF	0	0
STEPF	Step forward to the next fixed position setpoint	0	0
STEPB	Step backward to the previous fixed position setpoint	0	0
STEPH	Step to the fixed position setpoint 1	0	0
E_STOP	Emergency stop	0	0
C_MODE	Change mode	0	0

4.3.1.2 Digital inputs (DIs)

You can assign a maximum of 28 internal digital input signals to the SINAMICS V90 servo drive. For detailed information about these signals, see the table below:

No.	Name	Type	Description	Control mode			
				PTI	IPos	S	T
1	SON	Edge 0→1 1→0	Servo-on • 0→1: powers on power circuit and makes servo drive ready to operate. • 1→0: motor ramps down (OFF1) in PTI, IPos, and S modes; motor coasts down (OFF2) in T mode.	✓	✓	✓	✓
2	RESET	Edge 0→1	Reset alarms • 0→1: Reset alarms	✓	✓	✓	✓
3	CWL	Edge 1→0	Clockwise over-travel limit (positive limit) • 1 = condition for operation • 1→0: emergency stop (OFF3)	✓	✓	✓	✓
4	CCWL	Edge 1→0	Counter-clockwise over-travel limit (negative limit). • 1 = condition for operation • 1→0: emergency stop (OFF3)	✓	✓	✓	✓
5	G-CHANGE	Level	Gain change between the first and the second gain parameter sets. • 0: the first gain parameter set • 1: the second gain parameter set	✓	✓	✓	X
6	P-TRG (P_TRG in PTI mode is reserved for future use)	Level Edge 0→1	In PTI mode: pulse allowable/inhibit. • 0: operation with pulse train setpoint is possible • 1: inhibit the pulse train setpoint In IPos mode: position trigger • 0→1: starts positioning of selected fixed position setpoint	✓	✓	X	X
7	CLR	Level	Clear position control droop pulses. • 0: not clearing • 1: clear droop pulses based on the setting of p29242	✓	X	X	X

No.	Name	Type	Description	Control mode			
				PTI	IPos	S	T
8	EGEAR1	Level	Electronic gear.	✓	✓	X	X
9	EGEAR2	Level	A combination of the signals EGEAR1 and EGEAR2 can select four electronic gear ratios. EGEAR2 : EGEAR1 • 0 : 0: electronic gear ratios 1 • 0 : 1: electronic gear ratios 2 • 1 : 0: electronic gear ratios 3 • 1 : 1: electronic gear ratios 4	✓	✓	X	X
10	TLIM1	Level	Torque limit selection. A combination of TLIM1 and TLIM2 can select four torque limit sources (one external torque limit, three internal torque limits). TLIM2 : TLIM1 • 0 : 0: internal torque limit 1 • 0 : 1: external torque limit (Analog Input 2) • 1 : 0: internal torque limit 2 • 1 : 1: internal torque limit 3	✓	✓	✓	X
11	TLIM2	Level					
12	CWE	Level	Enable clockwise rotations. • 1: Enable clockwise rotation, ramp up • 0: Disable clockwise rotation, ramp down	X	X	✓	✓
13	CCWE	Level	Enable counter-clockwise rotations. • 1: Enable counter-clockwise rotation, ramp down • 0: Disable counter-clockwise rotation, ramp up	X	X	✓	✓
14	ZSCLAMP	Level	Zero speed clamps. • 1 = when the motor speed setpoint is an analog signal and lower than the threshold level (p29075), the motor is clamped. • 0 = no action	X	X	✓	X

No.	Name	Type	Description	Control mode			
				PTI	IPos	S	T
15	SPD1	Level	Select speed mode: fixed speed setpoint. A combination of the signals SPD1, SPD2 and SPD3 can select eight speed setpoint sources (one external speed setpoint, seven fixed speed setpoint). SPD3 : SPD2 : SPD1 • 0 : 0 : 0: external analog speed setpoint • 0 : 0 : 1: fixed speed setpoint 1 • 0 : 1 : 0: fixed speed setpoint 2 • 0 : 1 : 1: fixed speed setpoint 3 • 1 : 0 : 0: fixed speed setpoint 4 • 1 : 0 : 1: fixed speed setpoint 5 • 1 : 1 : 0: fixed speed setpoint 6 • 1 : 1 : 1: fixed speed setpoint 7	X	X	✓	X
16	SPD2	Level					
17	SPD3	Level					
18	TSET	Level	Torque setpoint selection. This signal can select two torque setpoint sources (one external torque setpoint, one fixed torque setpoint). • 0: external torque setpoint (Analog Input 2) • 1: fixed torque setpoint	X	X	X	✓
19	SLIM1	Level	Speed limit selection. A combination of SLIM1 to SLIM2 can select four speed limit sources (one external speed limit, three internal speed limits). SLIM2 : SLIM1 • 0 : 0: internal speed limit 1 • 0 : 1: external speed limit (Analog Input 1) • 1 : 0: internal speed limit 2 • 1 : 1: internal speed limit 2	✓	✓	✓	✓
20	SLIM2	Level					

No.	Name	Type	Description	Control mode			
				PTI	IPos	S	T
21	POS1	Level	Select position setpoint. A combination of the signals POS1 to POS3 can select eight fixed position setpoint sources. POS3 : POS2 : POS1 • 0 : 0 : 0: fixed position setpoint 1 • 0 : 0 : 1: fixed position setpoint 2 • 0 : 1 : 0: fixed position setpoint 3 • 0 : 1 : 1: fixed position setpoint 4 • 1 : 0 : 0: fixed position setpoint 5 • 1 : 0 : 1: fixed position setpoint 6 • 1 : 1 : 0: fixed position setpoint 7 • 1 : 1 : 1: fixed position setpoint 8	X	✓	X	X
22	POS2	Level					
23	POS3	Level					
24	REF	Edge 0→1	Set reference point with digital input or reference cam input for reference approaching mode. • 0→1: reference input	X	✓	X	X
25	SREF	Edge 0→1	The reference approach will be started with the signal SREF. • 0→1 start reference approach	X	✓	X	X
26	STEPF	Edge 0→1	Step forward to the next fixed position setpoint. • 0→1 start step action	X	✓	X	X
27	STEPB	Edge 0→1	Step backward to the previous fixed position setpoint. • 0→1 start step action	X	✓	X	X
28	STEPH	Edge 0→1	Step to the fixed position setpoint 1. • 0→1 start step action	X	✓	X	X

Note

When working in the torque control mode, the torque setpoint equals to 0 if CWE and CCWE are at the same status. For more information, please refer to SINAMICS V90, SIMOTICS S-1FL6 Operating Instructions.

Note

Invalid circumstances for DI signals

- When SINAMICS V-ASSISTANT is communicating with the drive or you are operating the drive on SINAMICS V-ASSISTANT, some DI signals are invalid:
  - When referencing by SINAMICS V-ASSISTANT, the DI signal SREF is invalid.
  - During trial run test, the DI signal SON is invalid; meanwhile, DI7 and DI8 are occupied by SINAMICS V-ASSISTANT.

Direct signal map

Force the following six signals to logical "1" signals with parameter p29300 (P_DI_Mat):

- SON
- CWL
- CCWL
- TLIM1
- SPD1
- TSET
- EMGS

The definition for p29300 is as follows:

Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
EMGS	TSET	SPD1	TLIM1	CCWL	CWL	SON

For example, if you set p29300 = 1 to force SON to a logical high signal, DI1 can then be assigned to other desired signals.

Note

The parameter p29300 has higher priority than the DIs.

The bit 6 of p29300 is used for emergency stop. You are not allowed to modify it when the drive is in the servo on state.

4.3.1.3 Digital outputs (DOs)

You can assign a maximum of 13 internal digital output signals to the SINAMICS V90 servo drive. For detailed information about these signals, see the table below:

No.	Name	Descriptions	Control mode			
			PTI	IPos	S	T
1	RDY	Servo ready • 1: ready to operate • 0: drive not ready (alarm occurs or enable signal is missing)	✓	✓	✓	✓
2	FAULT	Fault • 1: in fault status • 0: no fault	✓	✓	✓	✓
3	INP	In-position signal • 1: number of droop pulses is in the preset in-position range (parameter p2544) • 0: droop pulses are beyond the in-position range	✓	✓	X	X
4	ZSP	Zero speed detection • 1: motor speed is equal with or lower than the zero speed (can be set with parameter p2161). • 0: motor speed is higher than zero speed + hysteresis (10 rpm).	✓	✓	✓	✓
5	SPDR	Speed reached • 1: motor actual speed has nearly (internal hysteresis 10 rpm) reached the speed of the internal speed command or analog speed command. The speed approaching range can be set via parameter p29078 • 0: speed difference between speed setpoint and actual is larger than internal hysteresis.	X	X	✓	X
6	TLR	Torque limit reached • 1: the generated torque has nearly (internal hysteresis) reached the value of the positive torque limit, negative torque limit or analog torque limit • 0: the generated torque has not reached the limit	✓	✓	✓	X
7	SPLR	Speed limit reached • 1: the speed has nearly (internal hysteresis, 10 rpm) reached the speed limit. • 0: the speed has not reached the speed limit.	✓	✓	✓	X

No.	Name	Descriptions	Control mode			
			PTI	IPos	S	T
8	MBR	Motor holding brake • 1: motor holding brake is closed • 0: motor holding brake is released Note: MBR is only status signal because the control and the power supply of the motor holding brake is realized with separate terminals.	✓	✓	✓	✓
9	OLL	Overload level reached • 1: motor has reached the parameterizable output overload level (p29080 in % of rated torque, default: 100%, max: 300%) • 0: motor has not reached the overload level	✓	✓	✓	✓
10	WARNING1	Warning 1 condition reached • 1: parameterizable warning 1 condition has been reached. • 0: warning 1 condition has not been reached. See note below.	✓	✓	✓	✓
11	WARNING2	Warning 2 condition reached • 1: parameterizable warning 2 condition has been reached • 0: warning 2 condition has not been reached. See note below	✓	✓	✓	✓
12	REFOK	Referenced • 1 = Referenced • 0 = Not referenced	X	✓	X	X
13	CM_STA	Current control mode • 1 = The second mode in five compound control modes (PTI/S, IPos/S, PTI/T, IPos/T, S/T) • 0 = The first mode in five compound control modes or four basic modes (PTI, IPos, S, T)	✓	✓	✓	✓

Assigning warning signals to digital outputs

You can assign two groups of warning signals to digital outputs with parameters p29340 (first group of warning signals active) and p29341 (second group of warning signals active).

Setting (p29340/p29341)	Warning conditions
1	Overload protection: load factor is 85% of or above the motor utilization.
2	Braking resistor: capacity of the braking resistor is 85% of or above the resistor power rating.
3	Fan alarm: fan has stopped for 1 second or longer.
4	Encoder alarm
5	Motor overheat: motor has reached 85% of the maximum allowed motor temperature.
6	Lifetime detection: the life expectancy of the capacity or the fan is shorter than the specified time.

If warning condition assigned to p29340 occurs, WARNING1 becomes ON.

If warning condition assigned to p29341 occurs, WARNING2 becomes ON.

4.3.1.4 Analog inputs (AIs)

Two analog inputs in total are available:

- AI1: linked with speed related signals.
- AI2: linked with torque related signals.

In different control modes, the analog inputs are linked with different signals:

Control mode	AI1	AI2
Position (PTI and IPos)	Not used	Torque limitation
S	Speed setpoint	Torque limitation
T	Speed limitation	Torque setpoint
PTI/S and IPos/S	Not used in position control modes --> Speed setpoint in S mode	Torque limitation
PTI/T and IPos/T	Not used in position control modes -->Speed limitation in T mode	Torque limitation in position control modes --> Torque setpoint in T mode
S/T	Speed setpoint in S mode --> Speed limitation in T mode	Torque limitation in S mode --> Torque setpoint in T mode

4.3.1.5 Analog outputs (AOs)

Two parameters, p29350 (selects signal sources for AO1) and p29351 (selects signal sources for AO2), are used to select the source of analog output:

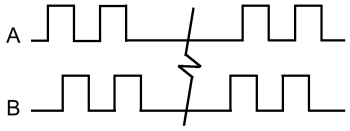
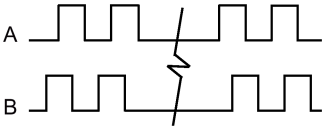
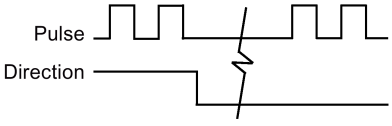
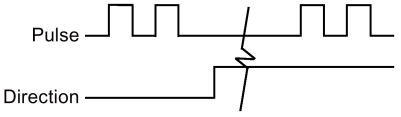
Parameter	Value	Source	Value	Source
p29350	0 (default)	Actual speed (reference p29060)	7	Pulse input frequency (reference 100 k)
	1	Actual torque (reference 3 × r0333)	8	Pulse input frequency (reference 1000 k)
	2	Speed setpoint (reference p29060)	9	Remaining number of pulses (reference 1 k)
	3	Torque setpoint (reference 3 × r0333)	10	Remaining number of pulses (reference 10 k)
	4	DC bus voltage (reference 1000 V)	11	Remaining number of pulses (reference 100 k)
	5	Pulse input frequency (reference 1 k)	12	Remaining number of pulses (reference 1000 k)
	6	Pulse input frequency (reference 10 k)		
p29351	0	Actual speed (reference p29060)	7	Pulse input frequency (reference 100 k)
	1 (default)	Actual torque (reference 3 × r0333)	8	Pulse input frequency (reference 1000 k)
	2	Speed setpoint (reference p29060)	9	Remaining number of pulses (reference 1 k)
	3	Torque setpoint (reference 3 × r0333)	10	Remaining number of pulses (reference 10 k)
	4	DC bus voltage (reference 1000 V)	11	Remaining number of pulses (reference 100 k)
	5	Pulse input frequency (reference 1 k)	12	Remaining number of pulses (reference 1000 k)
	6	Pulse input frequency (reference 10 k)		

4.3.1.6 Pulse train inputs (PTIs)

The SINAMICS V90 servo drive supports two kinds of setpoint pulse train input forms:

- AB track pulse
- Pulse + Direction

For both forms, positive logic and negative logic are supported:

Pulse train input form	Positive logic = 0		Negative logic = 1	
	Forward (CW)	Reverse (CCW)	Forward (CCW)	Reverse (CW)
AB track pulse				
Pulse + Direction				

4.3.1.7 Pulse train encoder outputs (PTOs)

Function

A pulse train encoder output (PTO) which provides pulse signals can transmit the signals to the controller to realize a closed-loop control system inside the controller, or transmit them to another drive as pulse train setpoint for a synchronous axis.

4.3.2 Testing motor

Two sub-functions are available:

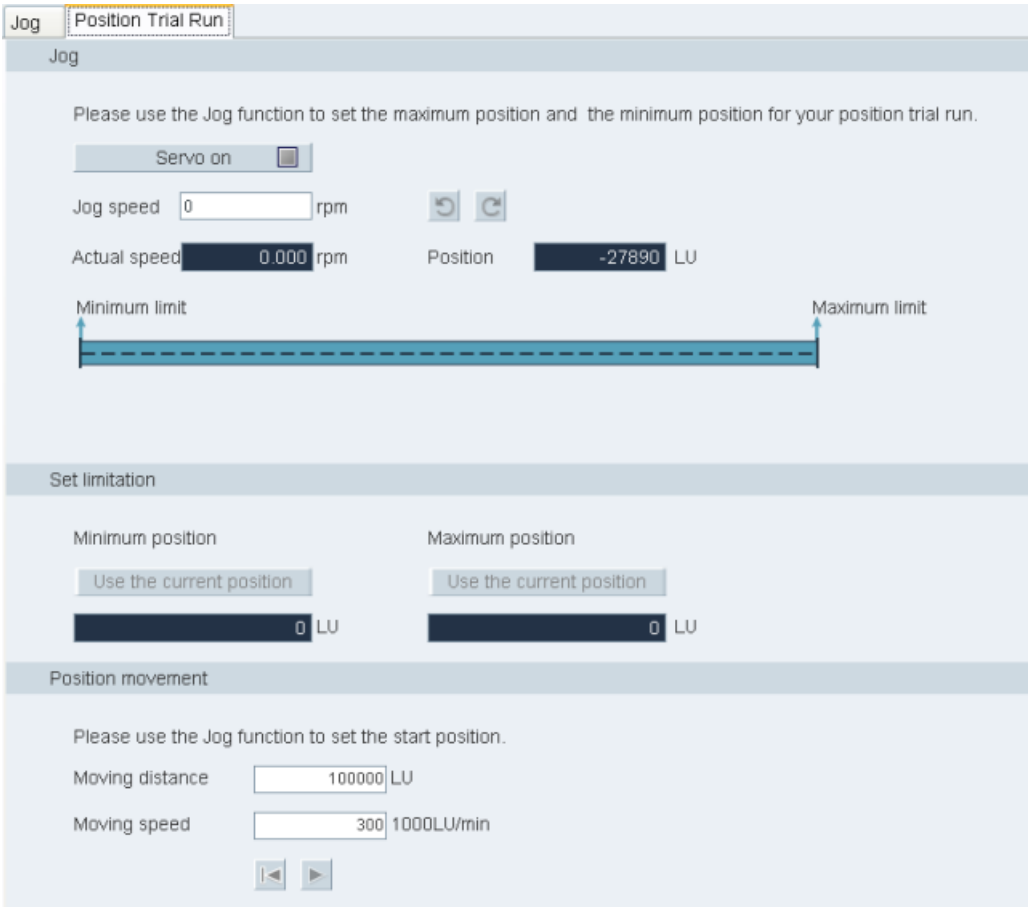
- Jog (Page 79)
- Position trial run (Page 80)

4.3.2.1 Jog

For detailed information about Jog function, refer to Section "Jog (Page 39)".

4.3.2.2 Position trial run

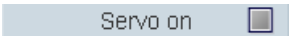
In online mode, you can configure this function on the following panel:



Note

Position trial run is only available in position control modes (PTI and IPos).

Operating sequence



1. Enter the Jog speed.
2. Use this button to enable the Jog function.

   Note:

   After clicking this button, a warning message will appear. Click OK in the message window to confirm executing servo-on.

3. Click this button to rotate the motor clockwisely and the motor will reach the maximum position.

4. Obtain the maximum position by clicking this button on the right of the panel.

5. Click this button to rotate the motor counter-clockwisely and the motor will reach the minimum position.

6. Obtain the minimum position by clicking this button on the left of the panel.

Note:

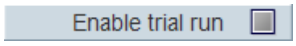
Make sure the actual position is within the scope. Otherwise, the position trial run cannot be started.

7. Use this button to disable the Jog function.

Note:

The Jog function must be disabled before position trial run is started.

8. Enter the moving distance and moving speed.



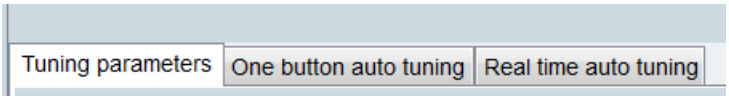
9. Click this button to enable the trial run function.

10. Start trial run by clicking this button. Or otherwise, click the following button to stop trial run:

11. If necessary, click this button to move back to the previous position.

4.3.3 Optimizing drive

You can select the desired tuning mode with the tabs on the following panel:



Note

The one-button auto tuning function is valid for firmware version V1.04 and higher.

Auto-tuning modes

The SINAMICS V90 supplies two auto-tuning modes: one-button auto tuning and real-time auto tuning. The auto tuning function can optimize control parameters with ratio of machine load moment of inertia (p29022) and set suitable current filter parameters to suppress the machine resonance automatically. You can change the dynamic performance of the system by setting different dynamic factors.

- One-button auto tuning
  - One-button auto tuning estimates the machine load moment of inertia and mechanical characteristics with internal motion commands. To achieve the desired performance, you can execute the process many times before you control the drive with the host controller. The maximum speed is limited by the rated speed.
- Real-time auto tuning
  - Real-time auto tuning estimates the machine load moment of inertia automatically while the drive is running with the host controller command. After enabling the servo on (SON), the real-time auto tuning function stays effective for the servo drive. If you do not need to estimate the load moment of inertia continuously, you can disable the function when the system performance is acceptable.

4.3.3.1 One-button auto tuning

Note

Before using the one-button auto tuning, move the servo motor to the middle of mechanical position to avoid approaching the actual machine position limit.

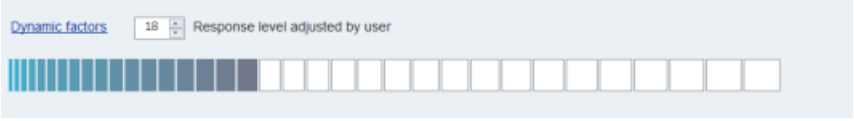
With one-button auto tuning, the servo drive can automatically estimate the ratio of load moment of inertia.

Pre-conditions for one-button auto tuning

- The ratio of machine load moment of inertia is unknown and needs to be estimated.
- The motor is allowed to rotate clockwise and counter clockwise.
- The motor rotation position (p29027 defines that one revolution equals to 360 degree) is allowed by the machine.
  - For the motor with an absolute encoder: position limitation is defined by p29027
  - For the motor with an incremental encoder: the motor must be allowed to rotate freely about two rounds when tuning starts

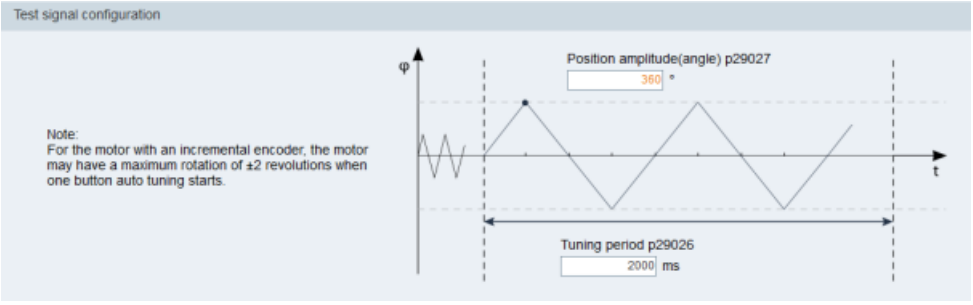
Implement the following steps to use the one-button auto tuning function:

1. Select the dynamic factor in the following area:



   For more information about selecting the dynamic factor, refer to chapter "one-button auto tuning" in SINAMICS V90, SIMOTICS S-1FL6 Operating Instructions.

2. Configure the test signal in the following area:



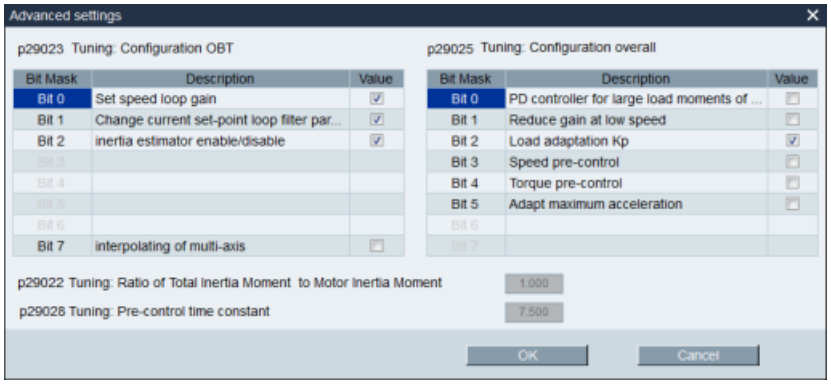
   Note:

   The recommended position amplitude (p29027) is 360°.

3. Click the following button to configure the parameters for the one-button auto tuning function.

   Advanced settings

4. Set the parameters in the window below:



Note:

You can set the ratio of machine load moment of inertia (p29022) with the following methods:

- Enter it manually if you have known the ratio of machine load moment of inertia
- Estimate the ratio of manchine load moment of inertia with one-button auto tuning (p29023.2 = 1). When you have executed the one-button tuning many times and obtained a stable value of p29022, you can stop estimating it by setting p29023.2 = 0.

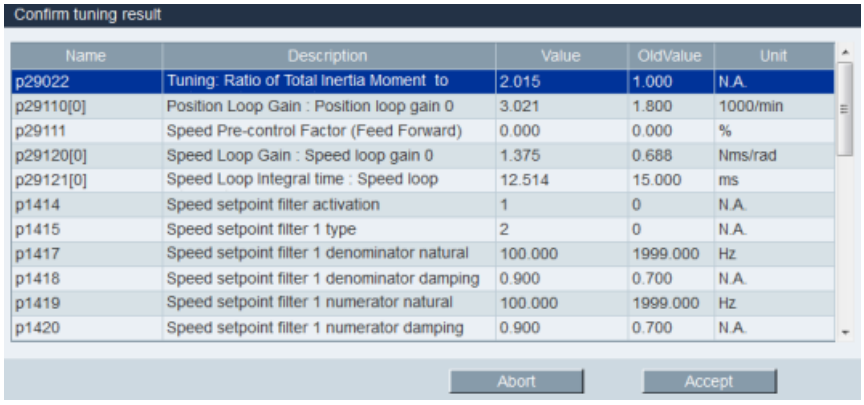
Parameter p29028 is available when the multi-axis interpolation function is activated (p29023.7 = 1). If the axes are used as the interpolation axes, you need to set the same pre-control time constants (p29028) for them. After tuning is completed, you need to manually set the same position loop gains (p29110 [0]) for them if the tuning results are different.

The parameters in advanced settings window must be set carefully when the auto-tuning function is disabled (p29021 = 0).

5. Click the following button to enable the function after the parameters are set.

6. Click this button to start tuning.

7. After the tuning is completed, the tuning results window appears.



Press this button to apply the tuning result.

Press this button to abort the tuning result.

8. Copy the tuned parameters from RAM to ROM to save them when the tuning is completed and the drive performance is acceptable.

Note

After servo on, the motor will run with the test signal.

When the one-button auto tuning process completes successfully, the parameter p29021 will be set to 0 automatically. You can also set the parameter p29021 to 0 before servo on to interrupt the one-button auto tuning. Before you save the parameters on the drive, make sure that p29021 has changed to 0.

Note

Do not use the JOG function when you use the one-button tuning function.

Note

After the one-button tuning function is activated, no operation will be allowed except the servo off and emergency stop.

Note

After one-button auto tuning is activated, do not change other auto tuning related control/filter parameters since these parameters can be set automatically and your changes will not be accepted.

Note

One-button auto tuning can cause some changes of the control parameters. When the system rigidity is low, this may lead to a situation that when you set EMGS = 0, the motor needs take long time to emergency stop.

Resonance suppression with one-button auto tuning (p29021=1, p29023.1=1)

The resonance suppression function is used together with the one-button auto tuning function. The function is activated by default.

The function can be activated/deactivated with bit 1 of p29023.

Before you use the resonance suppression function with one-button auto tuning, make sure the load is mounted as required and the servo motor can rotate freely. When the one-button auto tuning process completes successfully, the servo drive automatically sets the following notch filter relevant parameters with actual machine characteristic. Four current setpoint filters can be activated at most. You can check the following parameters in the tuning result window.

Parame-ter	Value range	Default value	Unit	Description
p1663	0.5 to 16000	1000	Hz	Natural frequency of current notch filter 2 denominator.
p1664	0.001 to 10	0.3	-	Damp of current notch filter 2 denominator.
p1665	0.5 to 16000	1000	Hz	Natural frequency of current notch filter 2 numerator.
p1666	0.0 to 10	0.01	-	Damp of current notch filter 2 numerator.
p1668	0.5 to 16000	1000	Hz	Natural frequency of current notch filter 3 denominator.
p1669	0.001 to 10	0.3	-	Damp of current notch filter 3 denominator.
p1670	0.5 to 16000	1000	Hz	Natural frequency of current notch filter 3 numerator.
p1671	0.0 to 10	0.01	-	Damp of current notch filter 3 numerator.
p1673	0.5 to 16000	1000	Hz	Natural frequency of current notch filter 4 denominator.
p1674	0.001 to 10	0.3	-	Damp of current notch filter 4 denominator.
p1675	0.5 to 16000	1000	Hz	Natural frequency of current notch filter 4 numerator.
p1676	0.0 to 10	0.01	-	Damp of current notch filter 4 numerator.

Note

Notch filter remains active when the resonance suppression function is activated automatically.

After one-button tuning, four filters can be activated at most. You can deactivate the notch filters by setting the parameter p1656.

4.3.3.2 Real-time auto tuning

Note

Under operating conditions that impose sudden disturbance torque during acceleration/deceleration or on a machine that its rigidity is poor, auto tuning may not function properly, either. In such cases, use one-button auto tuning or manual tuning to optimize the drive.

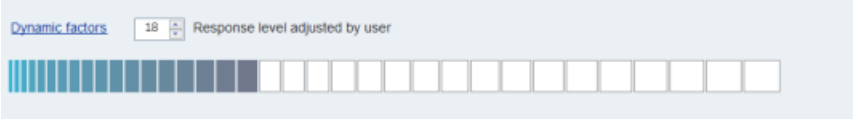
With real-time auto tuning, the servo drive can automatically estimate the ratio of load moment of inertia and set the optimum control parameters.

Pre-conditions for the real-time auto tuning

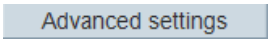
- The drive must be controlled by the host controller.
- The machine actual load moment of inertia is different when the machine moves to the different positions.
- Make sure that the motor has multiple accelerations and decelerations. Step command is recommended.
- Machine resonance frequency changes when the machine is running.

Implement the following steps to use the real-time auto tuning function:

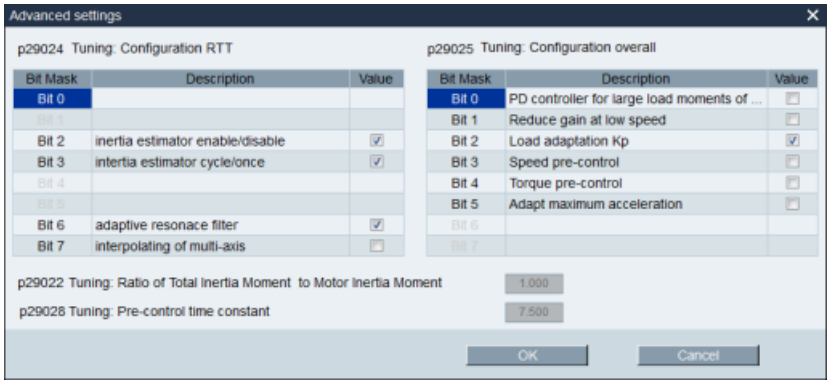
1. Select the dynamic factor in the following area:

   For more information about selecting the dynamic factor, refer to chapter "Real-time auto tuning" in SINAMICS V90, SIMOTICS S-1FL6 Operating Instructions.
2. Click the following button to configure the parameters for the real-time auto tuning function.

3. Set the parameters in the window below:



Note:

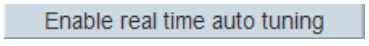
You can set the ratio of machine load moment of inertia (p29022) with the following methods:

- Enter it manually if you have known the ratio of machine load moment of inertia
- Use the ratio of machine load moment of inertia estimated by the one-button auto tuning function directly
- Estimate the ratio of machine load moment of inertia with real-time auto tuning (p29024.2 = 1). When you have obtained a stable value of p29022, you can stop estimating it by setting p29024.2 = 0.

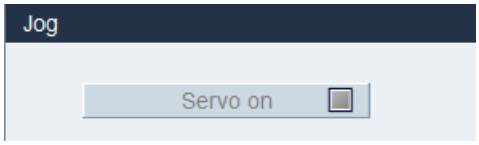
Parameter p29028 is available when the multi-axis interpolation function is activated (p29024.7 = 1). If the axes are used as the interpolation axes, you need to set the same pre-control time constants (p29028) for them. After tuning is completed, you need to manually set the same position loop gains (p29110 [0]) for them if the tuning results are different.

The parameters in advanced settings window must be set carefully when the auto-tuning function is disabled (p29021 = 0).

4. Click the following button to start tuning after the parameters are set.



5. Perform the servo on for the drive with host controller and tuning starts.
   For example, you can use the following method to run the motor.
   Implement servo on for the drive with Jog.



   Enter the speed for the motor and press the direction button to let the motor run.

6. To achieve the desired system performance, you can change the dynamic factors or related configuration parameters during tuning.
7. If the drive performance is acceptable, disable the tuning function by servo off and set p29021 = 0.
8. Copy the tuned parameters from RAM to ROM to save them.

Resonance suppression with real-time auto tuning (p29021=3, p29024.6=1)

The resonance suppression function is used together with the real-time auto tuning function. The function is activated by default.

When you use real-time auto tuning function, you are recommended to disable the resonance suppression function to get a high dynamic performance if there is no resonance in the machine.

The function can be activated/deactivated with the bit 6 of p29024.

When you choose to use the resonance suppression function with real-time auto tuning, the servo drive performs real-time detection of the resonance frequency and configures the following notch filter relevant parameters accordingly:

Parame-ter	Value range	Default value	Unit	Description
p1663	0.5 to 16000	1000	Hz	Natural frequency of current notch filter 2 denominator.
p1664	0.001 to 10	0.3	-	Damp of current notch filter 2 denominator.
p1665	0.5 to 16000	1000	Hz	Natural frequency of current notch filter 2 numerator.
p1666	0.0 to 10	0.01	-	Damp of current notch filter 2 numerator.

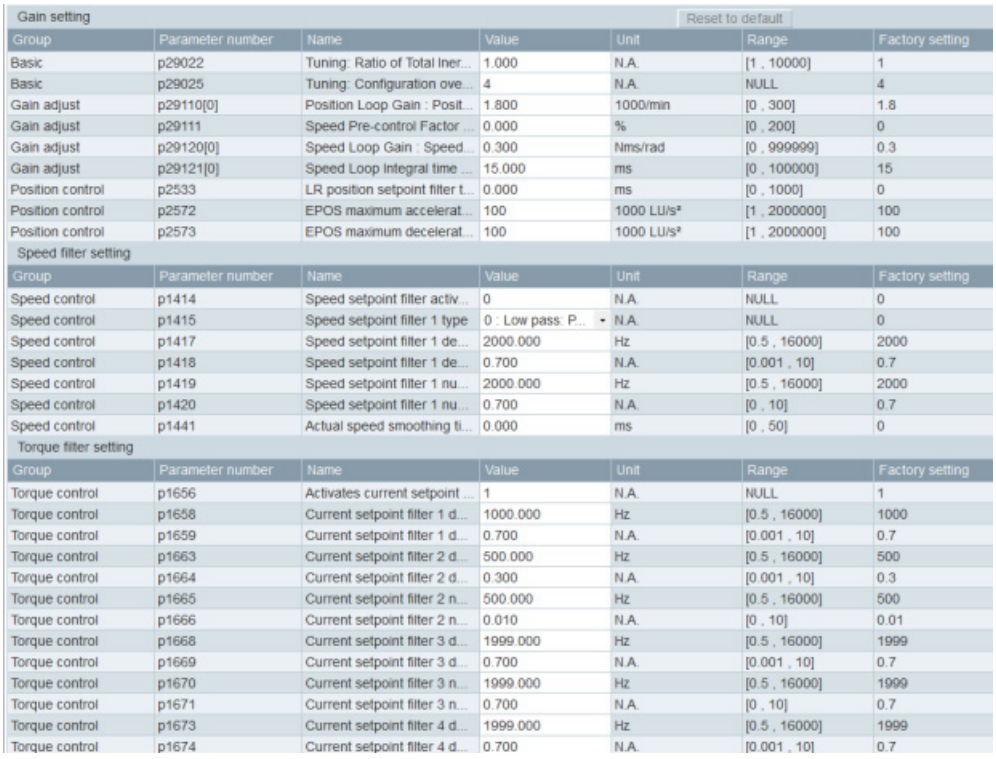
4.3.3.3 Manual tuning

When the auto tuning function cannot reach the expected tuning results, you can disable the auto tuning function by setting the parameter p29021 and manually perform tuning:

- p29021=5: auto tuning function is disabled and all control parameters are reset to tuning default values.
- p29021=0: auto tuning function is disabled without changing control parameters.

Parameter settings

You can set the parameters on the following panel:



Gain setting — Reset to default

Group	Parameter number	Name	Value	Unit	Range	Factory setting
Basic	p29022	Tuning: Ratio of Total Iner...	1.000	N.A.	[1 , 10000]	1
Basic	p29025	Tuning: Configuration ove...	4	N.A.	NULL	4
Gain adjust	p29110[0]	Position Loop Gain : Posit...	1.800	1000/min	[0 , 300]	1.8
Gain adjust	p29111	Speed Pre-control Factor ...	0.000	%	[0 , 200]	0
Gain adjust	p29120[0]	Speed Loop Gain : Speed...	0.300	Nms/rad	[0 , 999999]	0.3
Gain adjust	p29121[0]	Speed Loop Integral time ...	15.000	ms	[0 , 100000]	15
Position control	p2533	LR position setpoint filter t...	0.000	ms	[0 , 1000]	0
Position control	p2572	EPOS maximum accelerat...	100	1000 LU/s²	[1 , 2000000]	100
Position control	p2573	EPOS maximum decelerat...	100	1000 LU/s²	[1 , 2000000]	100

Speed filter setting

Group	Parameter number	Name	Value	Unit	Range	Factory setting
Speed control	p1414	Speed setpoint filter activ...	0	N.A.	NULL	0
Speed control	p1415	Speed setpoint filter 1 type	0 : Low pass: P...	N.A.	NULL	0
Speed control	p1417	Speed setpoint filter 1 de...	2000.000	Hz	[0.5 , 16000]	2000
Speed control	p1418	Speed setpoint filter 1 de...	0.700	N.A.	[0.001 , 10]	0.7
Speed control	p1419	Speed setpoint filter 1 nu...	2000.000	Hz	[0.5 , 16000]	2000
Speed control	p1420	Speed setpoint filter 1 nu...	0.700	N.A.	[0 , 10]	0.7
Speed control	p1441	Actual speed smoothing ti...	0.000	ms	[0 , 50]	0

Torque filter setting

Group	Parameter number	Name	Value	Unit	Range	Factory setting
Torque control	p1656	Activates current setpoint ...	1	N.A.	NULL	1
Torque control	p1658	Current setpoint filter 1 d...	1000.000	Hz	[0.5 , 16000]	1000
Torque control	p1659	Current setpoint filter 1 d...	0.700	N.A.	[0.001 , 10]	0.7
Torque control	p1663	Current setpoint filter 2 d...	500.000	Hz	[0.5 , 16000]	500
Torque control	p1664	Current setpoint filter 2 d...	0.300	N.A.	[0.001 , 10]	0.3
Torque control	p1665	Current setpoint filter 2 n...	500.000	Hz	[0.5 , 16000]	500
Torque control	p1666	Current setpoint filter 2 n...	0.010	N.A.	[0 , 10]	0.01
Torque control	p1668	Current setpoint filter 3 d...	1999.000	Hz	[0.5 , 16000]	1999
Torque control	p1669	Current setpoint filter 3 d...	0.700	N.A.	[0.001 , 10]	0.7
Torque control	p1670	Current setpoint filter 3 n...	1999.000	Hz	[0.5 , 16000]	1999
Torque control	p1671	Current setpoint filter 3 n...	0.700	N.A.	[0 , 10]	0.7
Torque control	p1673	Current setpoint filter 4 d...	1999.000	Hz	[0.5 , 16000]	1999
Torque control	p1674	Current setpoint filter 4 d...	0.700	N.A.	[0.001 , 10]	0.7

Click Reset to default to reset the following parameters to their tuning defaults. The tuning default values of the parameters are different when you use the different drives and motors. The function of the button is not drive default so the tuning default values of the control parameters are different with their factory settings.

- p1414
- p1415
- p1656
- p1658
- p1659
- p2533
- p29110[0]

- p29111
- p29120[0]
- p29121[0]

Resonance suppression with manual tuning (p29021=0)

When both the resonance suppression with real-time auto tuning and one-button tuning mode cannot reach the suppression effect, you can do the resonance suppression by manually setting the following parameters:

Parameter	Value range	Default value	Unit	Description
p1663	0.5 to 16000	1000	Hz	Natural frequency of current notch filter 2 denominator.
p1664	0.001 to 10	0.3	-	Damp of current notch filter 2 denominator.
p1665	0.5 to 16000	1000	Hz	Natural frequency of current notch filter 2 numerator.
p1666	0.0 to 10	0.01	-	Damp of current notch filter 2 numerator.
p1668	0.5 to 16000	1000	Hz	Natural frequency of current notch filter 3 denominator.
p1669	0.001 to 10	0.3	-	Damp of current notch filter 3 denominator.
p1670	0.5 to 16000	1000	Hz	Natural frequency of current notch filter 3 numerator.
p1671	0.0 to 10	0.01	-	Damp of current notch filter 3 numerator.
p1673	0.5 to 16000	1000	Hz	Natural frequency of current notch filter 4 denominator.
p1674	0.001 to 10	0.3	-	Damp of current notch filter 4 denominator.
p1675	0.5 to 16000	1000	Hz-	Natural frequency of current notch filter 4 numerator.
p1676	0.0 to 10	0.01	-	Damp of current notch filter 4 numerator.

Assume the notch frequency is $\mathbf{f_{sp}}$, notch width is $\mathbf{f_{BB}}$, and notch depth is **K**, then the filter parameters can be calculated as follows:

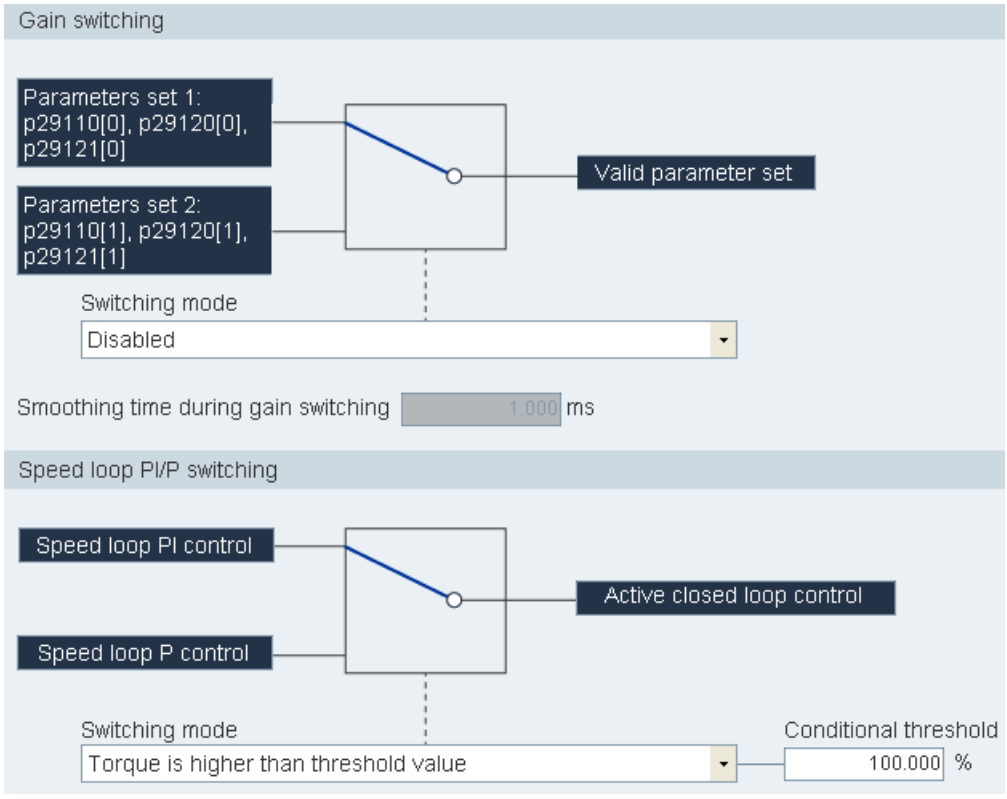
p1663=p1665=f_{sp}

p1664=$f_{BB} / (2 \times f_{sp})$

p1666=$(f_{BB} \times 10^{(k/20)})/ (2 \times f_{sp})$

Switching modes

Two switching modes are available as follows:



These two switching modes cannot be used at the same time. Once one mode is enabled, the other one will become disabled. The functions of auto-tuning and gain switching must be disabled so that the function of PI/P switching can be available. When the gain switching function is enabled, the PI/P switching function is disabled and the settings will not be cleared.

- Gain switching

  Five gain switching modes in total are available:

  – Gain switching disabled
  – Gain switching using digital input signal (G-CHANGE)
  – Gain switching using position deviation
  – Gain switching using position setpoint frequency
  – Gain switching using actual speed

  If you select either of the last three gain switching modes, you need to set the conditional threshold.

- Speed loop PI/P switching

  Five switching modes in total are available for PI/P switching:

  – using torque setpoint
  – using an external digital input signal (G-CHANGE)
  – using speed setpoint
  – using acceleration setpoint
  – using pulse deviation

  If you select either of the PI/P switching modes (except the second mode), you need to set the conditional threshold.

Note

PI/P switching

Function of PI/P switching is **not** available for the **T** mode (torque control mode).

The PI/P switching will respond with a delay time of several milliseconds.

4.3.3.4 Low frequency vibration suppression

Low frequency vibration suppression function is position setpoint filter function. It can suppression the vibration between 0.5 Hz to 62.5 Hz. The function is available in IPos control mode.

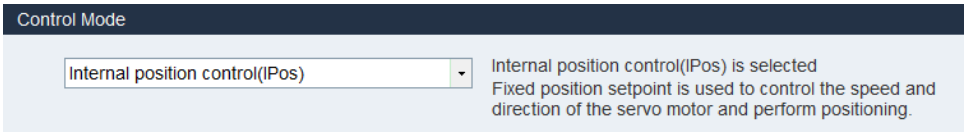
Related parameters

When you use the vibration suppression function, you need to configure the following parameters accordingly:

Parameter	Value range	Default value	Unit	Description
p29035	0 to 1	0	-	Vibration suppression activation. • 0: disble • 1: enable
p31581	0 to 1	0	-	Vibration suppression filter type. • 0: filter type rugged • 1: filter type sensitive
p31585	0.5 to 62.5	1	Hz	Vibration suppression filter frequency.
p31586	0 to 0.99	0.03	-	Vibration suppression filter damp.

Operating steps

1. Set the drive to servo off status.
2. Go to "View all parameters" panel and set the related parameters.
   - Set the filter type by p31581.
     – 0: filter type rugged
     – 1: filter type sensitive
   - Set the suppression frequency by p31585.
     – You can set the suppression frequency from 0.5 Hz to 62.5 Hz.
   - Set damp of the filter by p31586.
     – You can set the damp from 0 to 0.99.
3. Set control mode for the drive in the following panel.



4. Enable the vibration suppression function by p29035 in "View all parameters" panel.
   - Set p29035 = 1 to activate the function.
5. Set the drive to servo on status.

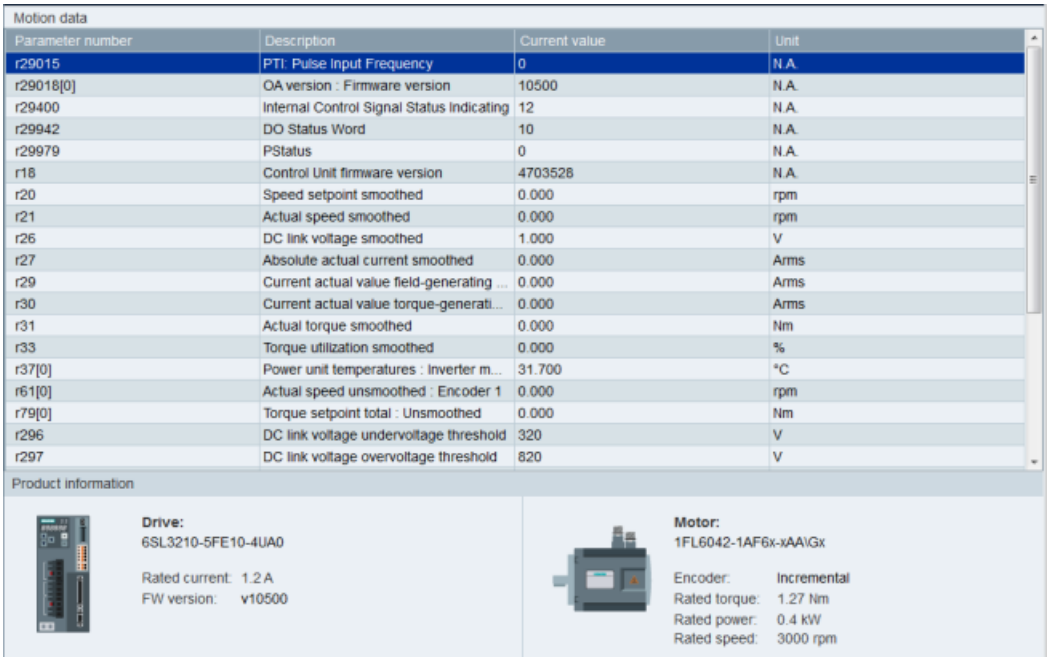
4.4 Diagnostics

4.4.1 Monitoring status

Note

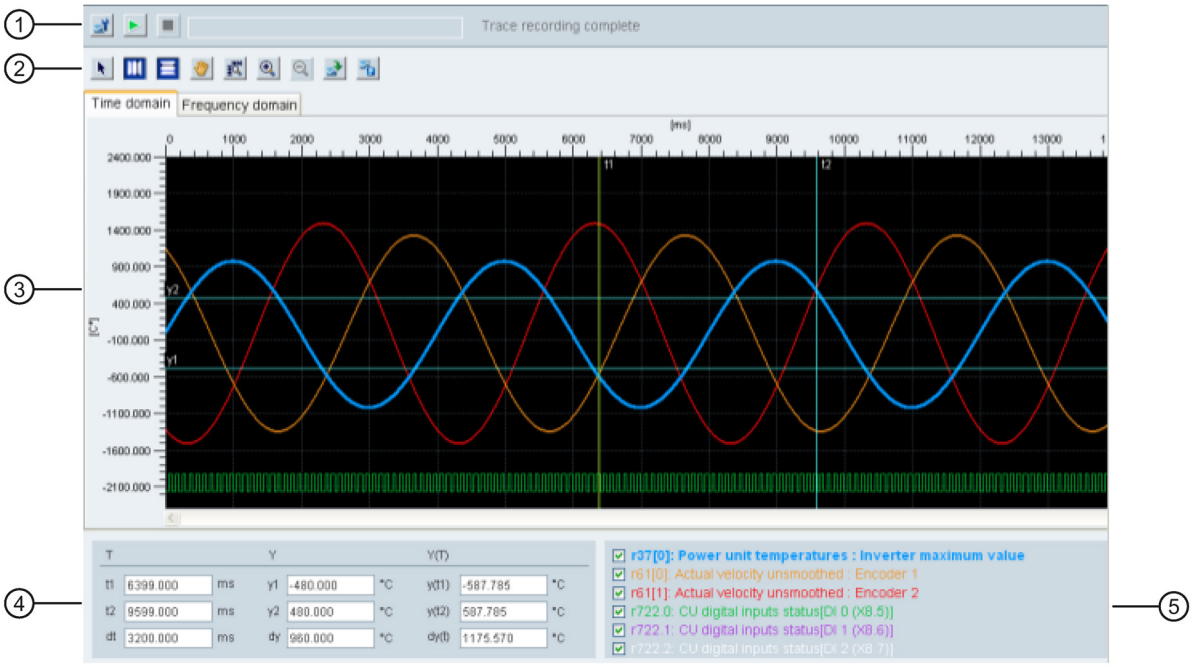
This function can **only** work in online mode.

You can monitor the real-time value of motion related parameters. The motion data and product information are displayed on the following panel:



4.4.2 Tracing signals

With this function, you can trace the performance of the connected drive in the current control mode on the following panel:

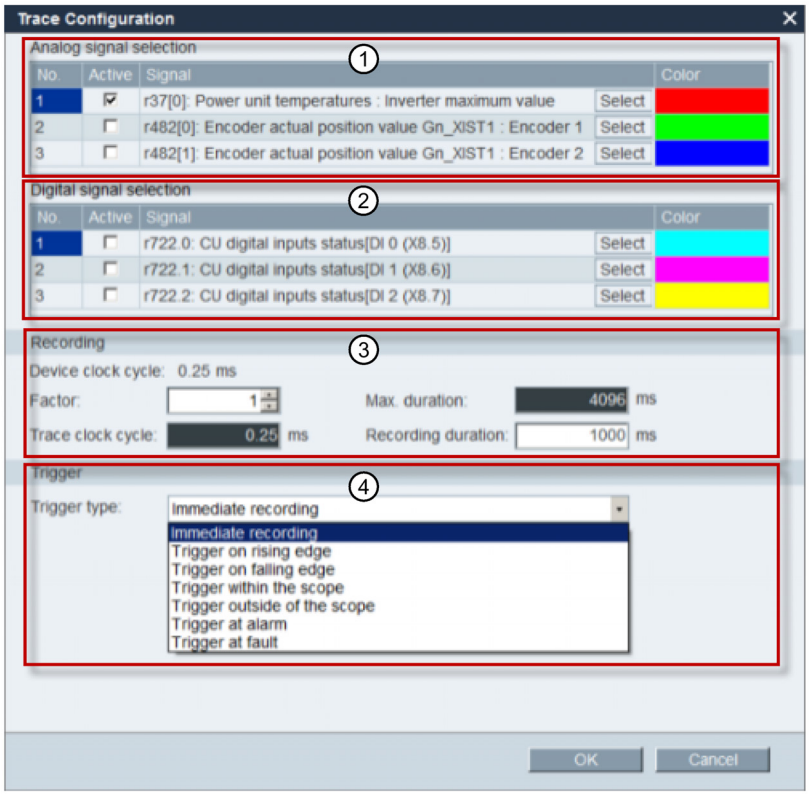


Area	Item		Description
①	Trace configuration		Opens the window of trace configuration. For more information, refer to "Trace configuration (Page 99)".
	Start/stop trace (**Only** available in online mode)		Starts recording the current trace. If you desire to stop the trace process, click the following button: 
②	Cursors		Changes the cursor shape from cross to arrow. When the cursor displays as an arrow, you can directly select a curve and use it for variable calculation. **Note:** The selected curve displays highlighted.
			If you click this button, you can move the selected curve freely after the cursor appears in the shape of a hand.

Area	Item		Description
	Auxiliary lines		Vertical cursor: • In time domain chart, you can click this button to display coordinates t1 and t2 in the chart. You can move t1 or t2 when the cursor changes to  . • In frequency domain chart, activate this button to display a highlighted coordinate in the chart. You can move this coordinate in the chart when the cursor changes to  .
			Horizontal cursor: • In time domain chart, you can click this button to display coordinates y1 and y2 in the chart. You can move y1 or y2 when the cursor changes to  . • In frequency domain chart, the button is not available.
	Zoom		Zooms in the current curves with a specified scale.
			Zooms out the current curves with a specified scale.
			Restores curves in the chart.
	File operation		Opens an existing .trc file for curve display in the chart.
			Saves the current recording of values as a .trc file.
	Note: In frequency domain chart, horizontal cursor button  is unavailable.		
③	Charts		• Time domain chart: Displays the time chart in curves and records measured values of parameters. • Frequency domain chart: Available for mathematically computed curves and displays the Fourier transformation.
④	**Time domain chart**		
	T		Coordinate T (time): • t1: Real-time value of coordinate t1 • t2: Real-time value of coordinate t2 • dt: Automatically calculated duration. The formula is as follows: dt = t2 - t1

Area	Item	Description
	Y	Coordinate Y: • y1: Real-time value of coordinate y1 • y2: Real-time value of coordinate y2 • dy: Automatically calculated value range. The formula is as follows: dy = y2 - y1
	Y(T)	• y(t1): Real-time value at the cross point of coordinate t1 and selected curve. • y(t2): Real-time value at the cross point of coordinate t2 and selected curve. • dy(t): Automatically calculated real-time value range. The formula is as follows: dy(t) = y(t2) - y(t1)
	Note: You can select a coordinate by clicking its designation, then the selected coordinate displays yellow.	
	Frequency domain chart	
	Frequency	Displays real-time frequency value of the horizontal cursor coordinate in the chart.
	Amplitude	Displays real-time amplitude value at the cross point of the horizontal cursor coordinate and curve.
⑤	Curve selection	Selects a curve to display in the chart. • Time domain chart: A maximum of six curves can be simultaneously displayed in the chart. • Frequency domain chart: Only one curve can be selected to display in the chart.

4.4.2.1 Trace configuration



Index	Function description
①	Click the following button to select the analog signal. Select Select a trace signal and click OK to confirm your selection. Or otherwise, you can click Cancel to cancel. Click the color bar to define the display color of the curve for the signal.
②	Click the following button to select the digital signal. Select Select a trace signal and click OK to confirm your selection. Or otherwise, you can click Cancel to cancel. Click the color bar to define the display color of the curve for the signal.
③	Recording settings: You can select the factor and define the trace cycle clock, maximum duration and recording duration.

Index	Function description
④	Seven trigger types are available for your selection: • Immediate recording (default settings) • Trigger on rising edge **Note**: The digital signals must be set to 1. Otherwise, the rising edge cannot be triggered. • Trigger on falling edge **Note**: The digital signals must be set to 0. Otherwise, the falling edge cannot be triggered. • Trigger within the scope • Trigger outside of the scope • Trigger at alarm • Trigger at fault
	Trigger type settings: • For the last six trigger types, you can select pre-trigger or post-trigger and the trigger signal. • For the fourth and fifth trigger types, you can enter the threshold upper/lower value in the textbox.

4.4.3 Measuring machine

The measuring function is used for controller optimization. With measuring function, you can directly inhibit the influence of higher-level control loops by means of simple parameterization, and analyze the dynamic response of individual drives.

For easier handling of the controller optimization, predefined measuring functions are available for selection. The operating mode is automatically set depending on the measuring function.

- Speed controller setpoint frequency response(before speed setpoint filter)

  The speed control loop is closed while all of the higher-level control loops are open. For the setpoint frequency response on the speed controller, the speed setpoint is activated by a PRBS signal. The evaluation of the signals is performed in the frequency range.

- Speed control system(excitation after current setpoint filter)

  The speed control loop is closed while all of the higher-level control loops are open. For the measurement of the speed controller system on the speed controller, the speed setpoint is activated by a PRBS signal. The evaluation of the signals is performed in the frequency range.

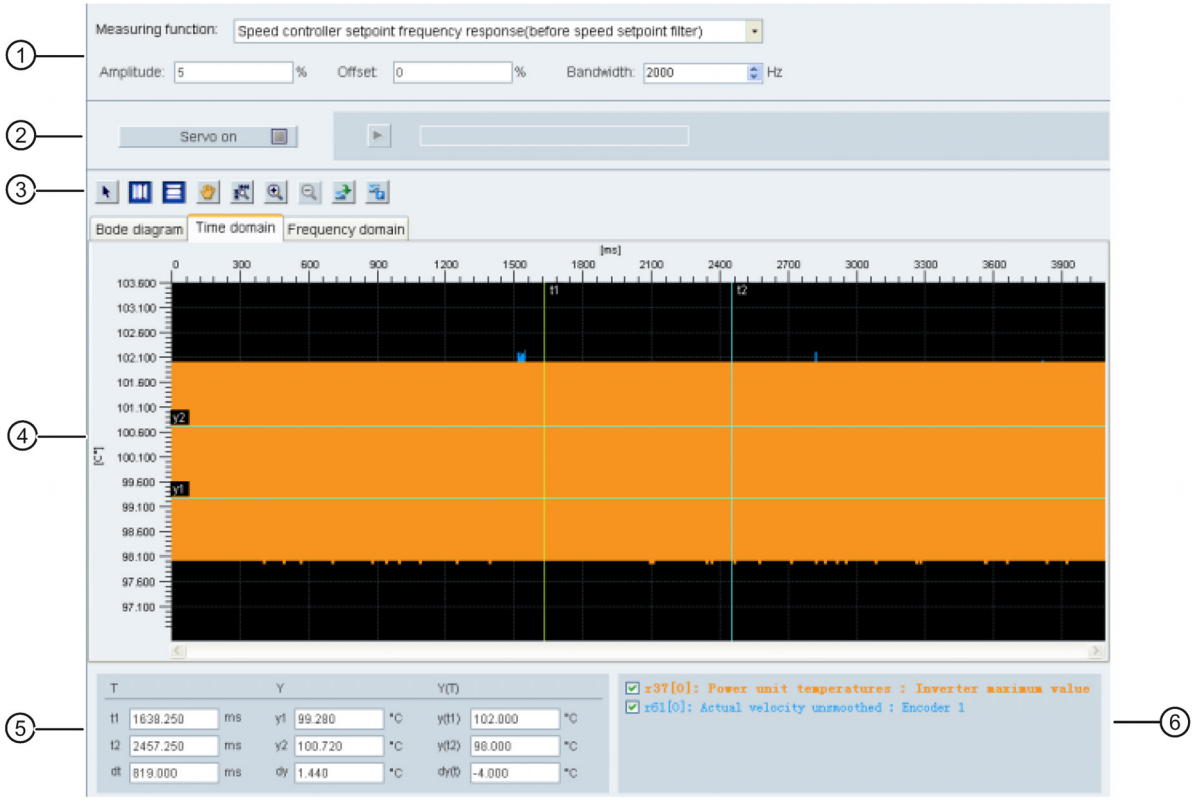
- Current controller setpoint frequency response(after current setpoint filter)

  For the reference frequency response on the current controller, the current setpoint is activated by a PRBS signal. The evaluation of the signals is performed in the frequency range.

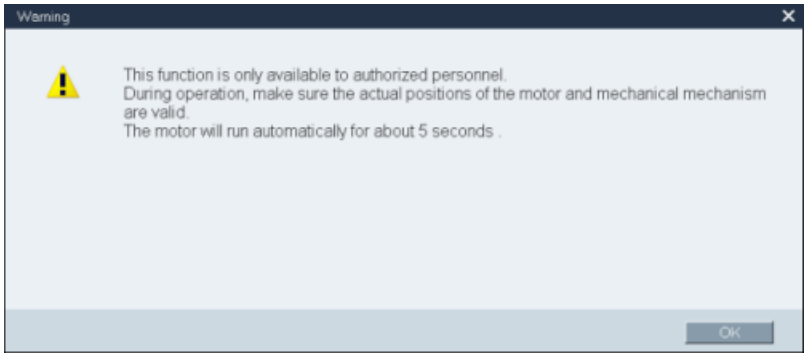
Note

Measuring machine is only available in online mode.

Overview



Area	Item	Description
①	Measuring functions	• Speed controller setpoint frequency response(before speed setpoint filter) • Speed control system(excitation after current setpoint filter) • Current controller setpoint frequency response(after current setpoint filter)
	Amplitude	The value of the signal amplitude to be applied. For the current controller, the specification is a relative value in percent. The value refers to the reference current (p2002). For the speed controller, the amplitude specification is always in physical units.
	Offset	DC component which is superimposed on the test signal. The value is normalized in the same way as the amplitude specification. Please note that the offset is subtracted again when the measured values are saved during runtime.
	Bandwidth	Bandwidth of the measurement activated by a PRBS signal. Bandwidth = 1/(2*sample frequency). As only multiply of 2^n for the minimum sampling time (0.25ms) is available, the bandwidths that can be implemented are quantized.

Area	Item		Description
②	Servo on/off		Click Servo on and the following warning appears:  Confirm by clicking OK to obtain the control priority for the connected drive. Then Servo on becomes Servo off. If you desire to give up the control priority, you can directly click it.
	Start trace		Click this button to start trace. **Note**: During the trace process, you cannot stop it but only wait until it is complete.
③	Cursor		Changes the cursor shape from cross to arrow. When the cursor displays as an arrow, you can directly select a curve and use it for variable calculation. **Note:** The selected curve displays highlighted.
			If you click this button, you can move the selected curve freely after the cursor appears in the shape of a hand.
	Auxiliary line		Vertical cursor: In time domain chart, you can click this button to display coordinates t1 and t2 in the chart. You can move t1 or t2 when the cursor changes to ⇹. In frequency domain chart, activate this button to display a highlighted coordinate in the chart. You can move this coordinate in the chart when the cursor changes to ⇹.
			Horizontal cursor: • In time domain chart, you can click this button to display coordinates y1 and y2 in the chart. You can move y1 or y2 when the cursor changes to ⇳. • In frequency domain chart, the button is not available.
	Zoom		Zooms in the current curves with a specified scale.
			Zooms out the current curves with a specified scale.
			Restores curves in the chart.
	File operation		Opens an existing .trc file for curve display in the chart.
			Saves the current recording of values as a .trc file.

Area	Item	Description
	Note: In frequency domain chart, horizontal cursor button is unavailable.	
④	Chart	• Time domain chart: Displays the time chart in curves and records measured values of parameters. • Frequency domain chart: Available for mathematically computed curves and displays the Fourier transformation. • Bode diagram: Available for mathematically computed curves.
⑤	**Time domain chart**	
	T	Coordinate T (time): • t1: Real-time value of coordinate t1 • t2: Real-time value of coordinate t2 • dt: Automatically calculated duration The calculation formula is as follows: dt = t2 - t1
	Y	Coordinate Y: • y1: Real-time value of coordinate y1 • y2: Real-time value of coordinate y2 • dy: Automatically calculated value range The calculation formula is as follows: dy = y2 - y1
	Y(T)	• y(t1): Real-time value at the cross point of coordinate t1 and selected curve. • y(t2): Real-time value at the cross point of coordinate t2 and selected curve. • dy(t): Automatically calculated real-time value range. The calculation formula is as follows: dy(t) = y(t2) - y(t1)
	Note: You can select a coordinate by clicking its designation, then the selected coordinate displays yellow.	
	Frequency domain chart	
	Frequency	Displays real-time frequency value of the horizontal cursor coordinate in the chart.
	Amplitude	Displays real-time amplitude value at the cross point of the horizontal cursor coordinate and curve.
	Bode diagram	
	Frequency	Displays real-time frequency value of the horizontal cursor coordinate in the diagram.
	Amplitude	Displays real-time amplitude value at the cross point of the horizontal cursor coordinate and the curve.
⑥	Curve selection	Selects a curve to display in the chart. • Time domain chart: A maximum of six curves can be simultaneously displayed in the chart. • Frequency domain chart: Only one curve can be selected to display in the chart.

4.5 Communicating with the PLC

The SINAMICS V90 supports communication with the PLC on RS485 interface. You can parameterize whether the RS485 interface shall apply USS or Modbus RTU protocol. USS is the default bus setting. A shielded twisted pair cable is recommended for the RS485 communication.

4.5.1 USS communication

The SINAMICS V90 can communicate with the PLC through an RS485 cable with the standard USS communication protocol. After the communication is established, you can change the position setpoint and speed setpoint through the USS communication protocol. The servo drive can also transmit the actual speed, torque, and alarm to the PLC through the USS communication protocol.

Telegram format

The telegram format is shown as follows:

STX	LGE	ADR	PKE	IND	PWE	PWE	BCC

STX: start of text

LGE: length

ADR: slave address

PKE: parameter ID

IND: sub-index

PWE: parameter value

BCC: block check character

Relevant parameters

You can access the following parameters by USS.

Parameter	Description	Parameter	Description
p1001	Fixed speed setpoint 1	r0020	Speed setpoint smoothed
p1002	Fixed speed setpoint 2	r0021	Actual speed smoothed
p1003	Fixed speed setpoint 3	r0026	DC link voltage smoothed
p1004	Fixed speed setpoint 4	r0027	Absolute actual current smoothed
p1005	Fixed speed setpoint 5	r0031	Actual torque smoothed
p1006	Fixed speed setpoint 6	r0032	Active power actual value smoothed
p1007	Fixed speed setpoint 7	r0034	Motor utilization thermal
p2617[0...7]	Fixed position setpoint	r0807	Master control active
p2618[0...7]	Speed of fixed position setpoint	r2521	LR position actual vaule

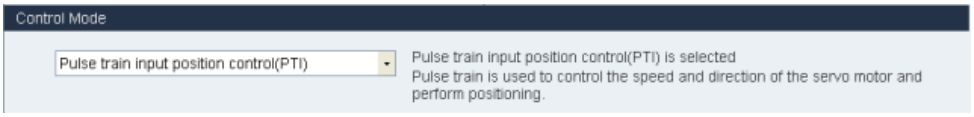
Parameter	Description	Parameter	Description
p2572	IPos maximum acceleration	r2556	LR position setpoint after setpoint smoothing
p2573	IPos maximum deceleration		

Note

There is no priority when BOP, V-ASSISTANT, and USS access the same parameter at the same time, the value of the parameter depends on the last access operation.

Operating steps

1. Set the drive to servo off status.
2. Go to "View all parameters" panel and set the related parameters.
   - Configure the RS485 bus address by parameter p29004.
     – You can configure the slaver address from 1 to 31.
   - Set the communication protocol by parameter p29007.
     – Set p29007 = 1 to use the USS protocol.
   - Set the transmission baud rate by parameter p29009.
3. Set control mode for the drive in the following panel.



4. Save the parameters and restart the drive.
5. Access the parameters via USS.
   - For IPos control mode, you can change the following parameters via USS:
     – p2617[0...7], p2618[0...7], p2572, p2573
   - For S control mode, you can change the following parameter via USS:
     – p1001 to p1007
   - Ten monitor parameters can be read by USS:
     – r0020, r0021, r0026, r0027, r0031, r0032, r0034, r0807, r2556, and r2521

Note

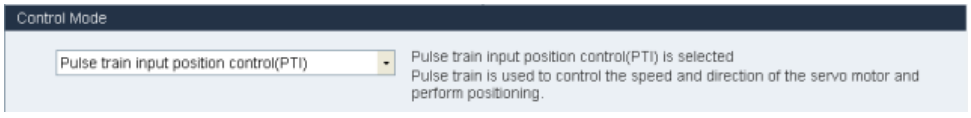
The USS protocol communication libraries of S7-200, S7-200 SMART V1.0, and S7-1200 do not support the communication with the SINAMICS V90 servo drive.

4.5.2 Modbus communication

The SINAMICS V90 servo drive can communicate with the PLC through an RS485 cable with the standard Modbus communication protocol. For Modbus data format, V90 supports Modbus RTU while Modbus ASCII is not supported. Registers of the servo drive can be read by Modbus function code FC3 and written via function code FC6 (single register) or FC16 (multiple registers). The SINAMICS V90 supports only three function codes. If a request with an unknown function code is received, an error message will be returned.

Operating steps

1. Set the drive to servo off status.
2. Go to "View all parameters" panel and set the related parameters.
   - Configure the RS485 bus address by parameter p29004.
     – You can configure the slaver address from 1 to 31.
   - Set the communication protocol by parameter p29007.
     – Set p29007 = 2 to use the Modbus protocol.
   - Select the Modbus control source by parameter p29008.
     – p29008 = 1: Setpoint and control word from Modbus PZD
     – p29008 = 2: No control word.
   - Set the transmission baud rate by parameter p29009.
3. Set control mode for the drive in the following panel.



4. Save the parameters and restart the drive.
5. Configure the PLC parameters.

   Note:

   Keep the PLC baud rate the same as the drive setting.

   Set even parity check for the PLC.
6. Write the control word via the PLC.

   Note:

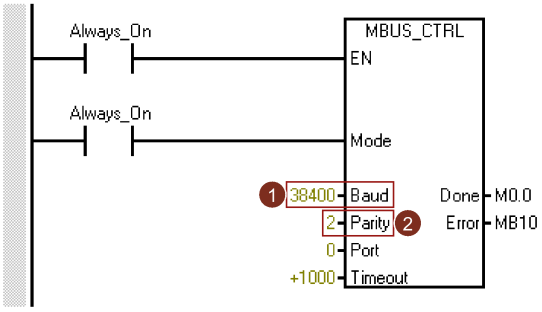
   Bit 10 of the register 40100 must be set to 1 to allow the PLC to control the drive.

   You need to trigger a rise edge for OFF1 to enable SON status for the motor, and OFF2 and OFF3 must be set to 1. The step must be executed when you enable SON for the first time.
7. Write the setpoint and read the status word via PLC.

Example

Here is an example which shows the operating procedures when we the use setpoint and control word from Modbus as the Modbus control source in S control mode.

1. Set RS485 bus address for the drive.
   - p29004 = 1
2. Select the Modbus protocol by p29007.
   - p29007 = 2
3. Select Modbus control source by p29008.
   - p29008 = 1
4. Set the transmission baud rate by p29009.
   - p29009 = 8 (38400 baud)
5. Save the parameters and restart the drive.
6. Set the drive work mode to S control mode.
7. Configure the PLC parameters.

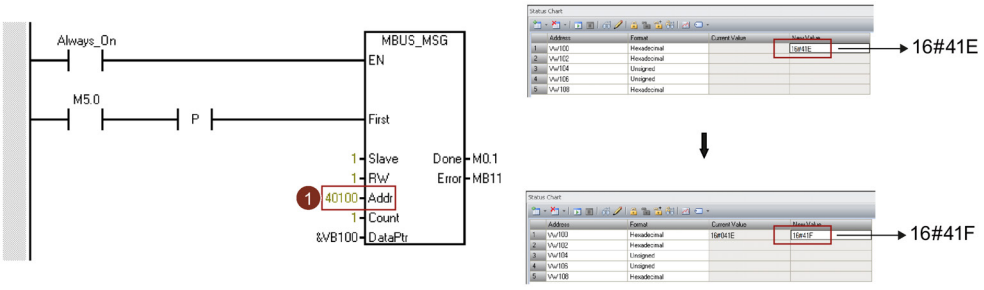


Note:

Keep the PLC baud rate the same as the drive setting.

Set even parity check for the PLC (parity = 2).

8. Write the control word you desired via the register 40100.



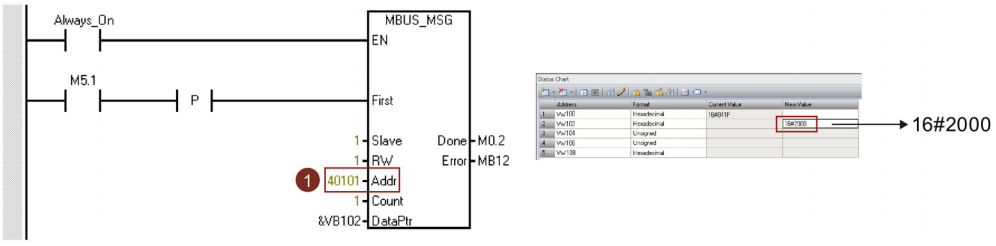
Note:

Bit 10 of the register 40100 must be set to 1 to allow the PLC to control the drive.

You need to trigger a rise edge for OFF1 to enable SON status for the motor, and OFF2 and OFF3 must be set to 1. The step must be executed when you enable SON for the first time.

For example, we write 0x41E to the register 40100 firstly and then write 0x41F to the register. The motor now is in SON status. You can check the control word definition table below to see the meaning of "0x41E" and "0x41F".

9. Write the speed setpoint via the register 40101.



Note:

You can calculate the actual speed value with the scale factor. Value 0x4000 represents the value of 100% × motor rated speed. Therefore, 0x2000 represents half of the motor rated speed.

Mapping table

The SINAMICS V90 servo drive supports the following registers. "R", "W", "R/W" in the column access stand for read, write, read/write.

Modbus register number	Description	Modbus access	Unit	Scaling factor	Range or On/Off text	Data/parameter
40100	Control word (PTI, IPos, S, T)	R/W	-	1	-	Process data 1, receive word, PZD1
40101	Speed setpoint (S)	R/W	-	0x4000 hex = 100% × motor rated speed	-	Process data 2, receive word, PZD2
40102	Position setpoint high-word (IPos)	R/W	LU	1	-2147482648 to 2147482647	Process data 3, receive word, PZD3
40103	Position setpoint low-word (IPos)	R/W	LU	1		Process data 4, receive word, PZD4
40110	Status word (PTI, IPos, S, T)	R	-	1	-	Process data 1, send word, PZD1
40111	Actual speed (PTI, IPos, S, T)	R	-	0x4000 hex = 100% × motor rated speed	-	Process data 2, send word, PZD2
40112	Actual position high-word (PTI, IPos)	R	LU	1	-2147482648 to 2147482647	Process data 3, send word, PZD3
40113	Actual position low-word (PTI, IPos)	R	LU	1		Process data 4, send word, PZD4
40200	DO 1	R/W	-	1	HIGH/LOW	r0747.0
40201	DO 2	R/W	-	1	HIGH/LOW	r0747.1
40202	DO 3	R/W	-	1	HIGH/LOW	r0747.2
40203	DO 4	R/W	-	1	HIGH/LOW	r0747.3
40204	DO 5	R/W	-	1	HIGH/LOW	r0747.4
40205	DO 6	R/W	-	1	HIGH/LOW	r0747.5
40220	AO 1	R	%	100	-100.0 to 100.0	-
40221	AO 2	R	%	100	-100.0 to 100.0	-
40240	DI 1	R	-	1	HIGH/LOW	r0722.0
40241	DI 2	R	-	1	HIGH/LOW	r0722.1
40242	DI 3	R	-	1	HIGH/LOW	r0722.2
40243	DI 4	R	-	1	HIGH/LOW	r0722.3
40244	DI 5	R	-	1	HIGH/LOW	r0722.4
40245	DI 6	R	-	1	HIGH/LOW	r0722.5
40246	DI 7	R	-	1	HIGH/LOW	r0722.6
40247	DI 8	R	-	1	HIGH/LOW	r0722.7
40248	DI 9	R	-	1	HIGH/LOW	r0722.8
40249	DI 10	R	-	1	HIGH/LOW	r0722.9
40260	AI 1	R	%	100	-300.0 to 300.0	-
40261	AI 2	R	%	100	-300.0 to 300.0	-

Modbus register number	Description	Modbus access	Unit	Scaling factor	Range or On/Off text	Data/parameter
40280	Enable DI simulation (high part)	R/W	-	1	HIGH/LOW	-
40281	Enable DI simulation (low part)	R/W	-	1	HIGH/LOW	-
40282	Setpoint DI simulation (high part)	R/W	-	1	HIGH/LOW	-
40283	Setpoint DI simulation (low part)	R/W	-	1	HIGH/LOW	-
40300	Power stack code number	R	-	1	0 to 32767	-
40301	V90 OA version	R	-	1	e.g. 104xx for V01.04.xx	p29018[0]/10000
40320	Rated power of the power unit	R	kW	100	0.00 to 327.67	-
40321	Current limit	R/W	%	10	10.0 to 400.0	-
40322	Ramp-up time	R/W	s	100	0.0 to 650.0	p1120
40323	Ramp-down time	R/W	s	100	0.0 to 650.0	p1121
40324	Reference speed	R	rpm	1	6 to 32767	Motor rated speed
40325	Control mode	R/W	-	1	0 to 8	p29003
40340	Speed setpoint	R	rpm	1	-16250 to 16250	r0020
40341	Actual speed value	R	rpm	1	-16250 to 16250	r0021
40344	DC-link voltage	R	V	1	0 to 32767	r0026
40345	Actual current value	R	A	100	0 to 163.83	r0027
40346	Actual torque value	R	Nm	100	-325.00 to 325.00	r0031
40347	Actual active power	R	kW	100	0 to 327.67	r0032
40348	Energy consumption	R	kWh	1	0 to 32767	-
40349	Control priority	R	-	1	Manual/Auto	r0807
40350/40351	Position setpoint	R	LU	1	-2147482648 to 2147482647	r2556
40352/40353	Actual position value	R	LU	1	-2147482648 to 2147482647	r2521[0]
40354	Motor utilization	R	%	100	-320.00 to 320.00	r0034
40400	Failure number, index 0	R	-	1	0 to 32767	-
40401	Failure number, index 1	R	-	1	0 to 32767	-
40402	Failure number, index 2	R	-	1	0 to 32767	-
40403	Failure number, index 3	R	-	1	0 to 32767	-
40404	Failure number, index 4	R	-	1	0 to 32767	-
40405	Failure number, index 5	R	-	1	0 to 32767	-
40406	Failure number, index 6	R	-	1	0 to 32767	-
40407	Failure number, index 7	R	-	1	0 to 32767	-

Modbus register number	Description	Modbus access	Unit	Scaling factor	Range or On/Off text	Data/parameter
40408	Alarm number	R	-	1	0 to 32767	-
40800/40801	Fixed position setpoint 1	R/W	LU	1	-2147482648 to 2147482647	p2617[0]
40802/40803	Fixed position setpoint 2	R/W	LU	1	-2147482648 to 2147482647	p2617[1]
40804/40805	Fixed position setpoint 3	R/W	LU	1	-2147482648 to 2147482647	p2617[2]
40806/40807	Fixed position setpoint 4	R/W	LU	1	-2147482648 to 2147482647	p2617[3]
40808/40809	Fixed position setpoint 5	R/W	LU	1	-2147482648 to 2147482647	p2617[4]
40810/40811	Fixed position setpoint 6	R/W	LU	1	-2147482648 to 2147482647	p2617[5]
40812/40813	Fixed position setpoint 7	R/W	LU	1	-2147482648 to 2147482647	p2617[6]
40814/40815	Fixed position setpoint 8	R/W	LU	1	-2147482648 to 2147482647	p2617[7]
40840/40841	Speed of the fixed position 1	R/W	1000 LU/min	1	1 to 40000000	p2618[0]
40842/40843	Speed of the fixed position 2	R/W	1000 LU/min	1	1 to 40000000	p2618[1]
40844/40845	Speed of the fixed position 3	R/W	1000 LU/min	1	1 to 40000000	p2618[2]
40846/40847	Speed of the fixed position 4	R/W	1000 LU/min	1	1 to 40000000	p2618[3]
40848/40849	Speed of the fixed position 5	R/W	1000 LU/min	1	1 to 40000000	p2618[4]
40850/40851	Speed of the fixed position 6	R/W	1000 LU/min	1	1 to 40000000	p2618[5]
40852/40853	Speed of the fixed position 7	R/W	1000 LU/min	1	1 to 40000000	p2618[6]
40854/40855	Speed of the fixed position 8	R/W	1000 LU/min	1	1 to 40000000	p2618[7]
40880/40881	IPos maximum acceleration	R/W	1000 LU/s^2	1	1 to 2000000	p2572
40882/40883	IPos maximum deceleration	R/W	1000 LU/s^2	1	1 to 2000000	p2573
40884/40885	EPos jerk limiting	R/W	1000 LU/s^3	1	1 to 100000000	p2574
40900	Fixed speed setpoint 1	R/W	-	0x4000 hex = 100% × motor rated speed	-210000.000 to 210000.00	p1001
40901	Fixed speed setpoint 2	R/W	-	0x4000 hex = 100% × motor rated speed	-210000.000 to 210000.00	p1002

Modbus register number	Description	Modbus access	Unit	Scaling factor	Range or On/Off text	Data/parameter
40902	Fixed speed setpoint 3	R/W	-	0x4000 hex = 100% × motor rated speed	-210000.000 to 210000.00	p1003
40903	Fixed speed setpoint 4	R/W	-	0x4000 hex = 100% × motor rated speed	-210000.000 to 210000.00	p1004
40904	Fixed speed setpoint 5	R/W	-	0x4000 hex = 100% × motor rated speed	-210000.000 to 210000.00	p1005
40905	Fixed speed setpoint 6	R/W	-	0x4000 hex = 100% × motor rated speed	-210000.000 to 210000.00	p1006
40906	Fixed speed setpoint 7	R/W	-	0x4000 hex = 100% × motor rated speed	-210000.000 to 210000.00	p1007
40932/40933	MDI speed of position setpoint	R/W	1000 LU/min	1	1 to 2147482647	-
40934	MDI acceleration override	R/W	%	100	0.1 to 100	-
40935	MDI deceleration override	R/W	%	100	0.1 to 100	-
40950	Fixed torque setpoint	R/W	%	100	-100 to 100	p29043

Process data overview

Control mode		PTI	IPos	S	T
Control data	40100	PTI mode control word	IPos mode control word	S mode control word	T mode control word
	40101	-	-	Speed setpoint	-
	40102	-	Position setpoint high word	-	-
	40103	-	Position setpoint low word	-	-
Status data	40110	Status word	Status word	Status word	Status word
	40111	Actual speed	Actual speed	Actual speed	Actual speed
	40112	Actual position high word	Actual position high word	-	-
	40113	Actual position low word	Actual position low word	-	-

Definition of the register 40100

Bit	PTI control mode		IPos control mode	
	Signals	Description	Signals	Description
0	SON_OFF1	Rising edge to enable SON (pulses can be enabled). 0: OFF1 (braking with ramp-function generator, then pulse cancellation, ready to power up)	SON_OFF1	Rising edge to enable SON (pulses can be enabled). 0: OFF1 (braking with ramp-function generator, then pulse cancellation, ready to power up)
1	OFF2	1: No OFF2 (enable is possible) 0: OFF2 (immediate pulse cancelation and power on inhibit)	OFF2	1: No OFF2 (enable is possible) 0: OFF2 (immediate pulse cancelation and power on inhibit)
2	OFF3	1: No OFF3 (enable is possible) 0: OFF3 (fast braking then pulse cancelation and power on inhibit)	OFF3	1: No OFF3 (enable is possible) 0: OFF3 (fast braking then pulse cancelation and power on inhibit)
3	OPER	1: Enable operation (pulses can be enabled) 0: Inhibit operation (cancel pulses)	OPER	1: Enable operation (pulses can be enabled) 0: Inhibit operation (cancel pulses)
4	Reserved	-	SETP_ACC	Rising edge to accept MDI setpoint
5	Reserved	-	TRANS_TYPE SE	1: Accept new setpoint immediately 0: Accept on rising edge of SETP_ACC
6	Reserved	-	POS_TYP	1: Absolute positioning 0: Relative positioning
7	RESET	Reset faults	RESET	Reset faults
8	Reserved	-	Reserved	-
9	Reserved	-	Reserved	-
10	PLC	Enable master control from the PLC	PLC	Enable master control from the PLC
11	Reserved	-	Reserved	-
12	Reserved	-	Reserved	-
13	Reserved	-	SREF	Start referencing (act as REF for reference mode 0)
14	Reserved	-	Reserved	-
15	Reserved	-	Reserved	-

Bit	S control mode		T control mode	
	Signals	Description	Signals	Description
0	SON_OFF1	Rising edge to enable SON (pulses can be enabled). 0: OFF1 (braking with ramp-function generator, then pulse cancellation, ready to power up)	SON_OFF1	Rising edge to enable SON (pulses can be enabled).
1	OFF2	1: No OFF2 (enable is possible) 0: OFF2 (immediate pulse cancelation and power on inhibit)	OFF2	1: No OFF2 (enable is possible) 0: OFF2 (immediate pulse cancelation and power on inhibit)

Bit	S control mode		T control mode	
	Signals	Description	Signals	Description
2	OFF3	1: no OFF3 (enable is possible) 0: OFF3 (fast braking then pulse cancelation and power on inhibit)	OFF3	1: no OFF3 (enable is possible) 0: OFF3 (fast braking then pulse cancelation and power on inhibit)
3	OPER	1: Enable operation (pulses can be enabled) 0: Inhibit operation (cancel pulses)	OPER	1: Enable operation (pulses can be enabled) 0: Inhibit operation (cancel pulses)
4	EN_PAMP	1: Operating condition (the ramp function generator can be enabled) 0: Inhibit ramp function generator (set the ramp function generator output to zero)	Reserved	-
5	Reserved	-	Reserved	-
6	Reserved	-	Reserved	-
7	RESET	Reset faults	RESET	Reset faults
8	Reserved	-	Reserved	-
9	Reserved	-	Reserved	-
10	PLC	Enable master control from the PLC	PLC	Enable master control from the PLC
11	Rev	Direction of rotation reversal	Reserved	-
12	Reserved	-	Reserved	-
13	Reserved	-	Reserved	-
14	Reserved	-	Reserved	-
15	Reserved	-	Reserved	-

Note

The following signals are occupied by Modbus control word when you use the setpoint and control word from Modbus as the Modbus control source (p29008 = 1). They can only be enabled by Modbus control word while cannot be enabled by DI terminals.

- PTI control mode: SON
- IPos control mode: SON, SREF (REF for reference mode 0)
- S control mode: SON, CWE/CCWE
- T control mode: SON

Note

All the reserved bits in register 40100 must be set to 0.

Definition of register 40110

Bit	PTI, IPos, S and T control modes	
	Signals	Description
0	RDY	Servo ready
1	FAULT	Fault status
2	INP	In-position signal
3	ZSP	Zero speed detection
4	SPDR	Speed reached
5	TLR	Torque limit reached
6	SPLR	Speed limit reached
7	MBR	Motor holding brake
8	OLL	Overload level reached
9	WARNING 1	Warning 1 condition reached
10	WARNING 2	Warning 2 condition reached
11	REFOK	Referenced
12	MODE 2	In the second control mode
13	Reserved	-
14	Reserved	-
15	Reserved	-

Parameter scaling

Due to the limits of the integer data in the Modbus protocol, it is necessary to convert the drive parameters before transmitting them. This is done by scaling, so that a parameter, which has a position after decimal point, is multiplied by a factor, to get rid of the fractional part. The scaling factor is as defined in the above table.

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