SIEMENS

SINAMICS

SINAMICS V90 PROFINET SINAMICS V-ASSISTANT Online Help

Operating Manual

05/2016

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Legal information

Warning notice system

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

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

Qualified Personnel

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

Proper use of Siemens products

Note the following:

⚠ WARNING

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

Trademarks

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

Disclaimer of Liability

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

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Preface

Technical support

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Fundamental safety instructions

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1.1 General safety instructions

⚠ WARNING

Danger to life if the safety instructions and residual risks are not observed

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

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

⚠ WARNING

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).

1.2 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.

⚠ WARNING

Danger to life due to software manipulation when using exchangeable storage media

Storing files onto exchangeable storage media amounts to an increased risk of infection, e.g. with viruses and malware. As a result of incorrect parameterization, machines can malfunction, which in turn can lead to injuries or death.

- Protect files stored on exchangeable storage media from malicious software by taking suitable protection measures, e.g. virus scanners.

SINAMICS V-ASSISTANT 2

SINAMICS V90

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

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 tables below show the combination of SINAMICS V90 PN servo drives and SIMOTICS S-1FL6 servo motors.

Combination between V90 PN 200 V variant drives and low inertia motors

SIMOTICS S-1FL6 servo motor								SINAMICS V90 PN servo drive		
Type	Rated torque (Nm)	Rated power (kW)	Rated speed (rpm)	Shaft height (mm)	Motor ID		Order number[1)]	Order number	Frame size	Power supply
					Without brake	With brake				
Low inertia	0.16	0.05	3000	20	42 *	43	1FL6022-2AF21-1A❑1	6SL3210-5FB10-1UF0	FSB	1/3-phase 200 VAC to 240 VAC
					10001	10030	1FL6022-2AF21-1M❑1			
	0.32	0.1	3000	20	46	47	1FL6024-2AF21-1A❑1			
					10002	10031	1FL6024-2AF21-1M❑1			
	0.64	0.2	3000	30	50 *	51	1FL6032-2AF21-1A❑1	6SL3210-5FB10-2UF0		
					10003	10032	1FL6032-2AF21-1M❑1			
	1.27	0.4	3000	30	54 *	55	1FL6034-2AF21-1A❑1	6SL3210-5FB10-4UF1		
					10004	10033	1FL6034-2AF21-1M❑1			
	2.39	0.75	3000	40	58 *	59	1FL6042-2AF21-1A❑1	6SL3210-5FB10-8UF0	FSC	
					10005	10034	1FL6042-2AF21-1M❑1			
	3.18	1	3000	40	62 *	63	1FL6044-2AF21-1A❑1	6SL3210-5FB11-0UF1	FSD	3-phase 200 VAC to 240 VAC
					10006	10035	1FL6044-2AF21-1M❑1			
	4.78	1.5	3000	50	66 *	67	1FL6052-2AF21-0A❑1	6SL3210-5FB11-5UF0		
					10007	10036	1FL6052-2AF21-0M❑1			
	6.37	2	3000	50	70 *	71	1FL6054-2AF21-0A❑1	6SL3210-5FB12-0UF0		
					10008	10037	1FL6054-2AF21-0M❑1			

Combination between V90 PN 400V variant drives and high inertia motors

SIMOTICS S-1FL6 servo motor								SINAMICS V90 PN servo drive		
Type	Rated torque (Nm)	Rated power (kW)	Rated speed (rpm)	Shaft height (mm)	Motor ID		Order number[1)]	Order number	Frame size	Power supply
					Without brake	With brake				
High inertia	1.27	0.4	3000	45	18 *	19	1FL6042-1AF61-0A❑1	6SL3210-5FE10-4UF0	FSAA	3-phase 380 VAC to 480 VAC
					10009	10038	1FL6042-1AF61-0L❑1			
	2.39	0.75	3000	45	20 *	21	1FL6044-1AF61-0A❑1	6SL3210-5FE10-8UF0	FSA	
					10010	10039	1FL6044-1AF61-0L❑1			
	3.58	0.75	2000	65	22	23	1FL6061-1AC61-0A❑1	6SL3210-5FE11-0UF0		
					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	6SL3210-5FE11-5UF0	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	6SL3210-5FE12-0UF0		
					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	6SL3210-5FE13-5UF0	FSC	
					10017	10046	1FL6092-1AC61-0L❑1			
	23.9	5.0	2000	90	36 *	37	1FL6094-1AC61-0A❑1	6SL3210-5FE15-0UF0		
					10018	10047	1FL6094-1AC61-0L❑1			
	33.4	7.0	2000	90	38 *	39	1FL6096-1AC61-0A❑1	6SL3210-5FE17-0UF0		
					10019	10048	1FL6096-1AC61-0L❑1			

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

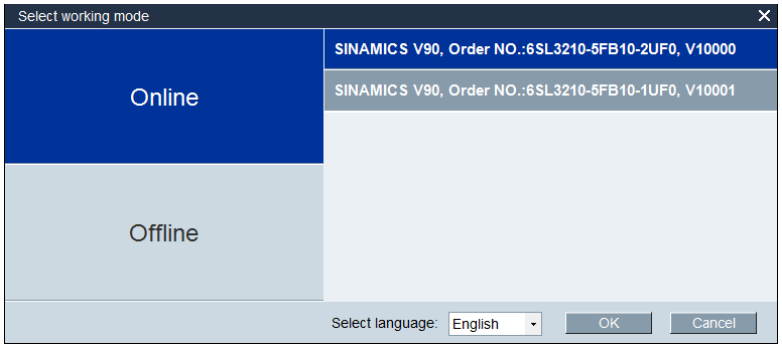
[2)] The Motor ID values marked with an asterisk (*) are the default incremental motor IDs for V90 PN drives. If you have connected a different motor to the drive, you need to configure the motor ID manually.

User interface

3

3.1 Working modes

When you start 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

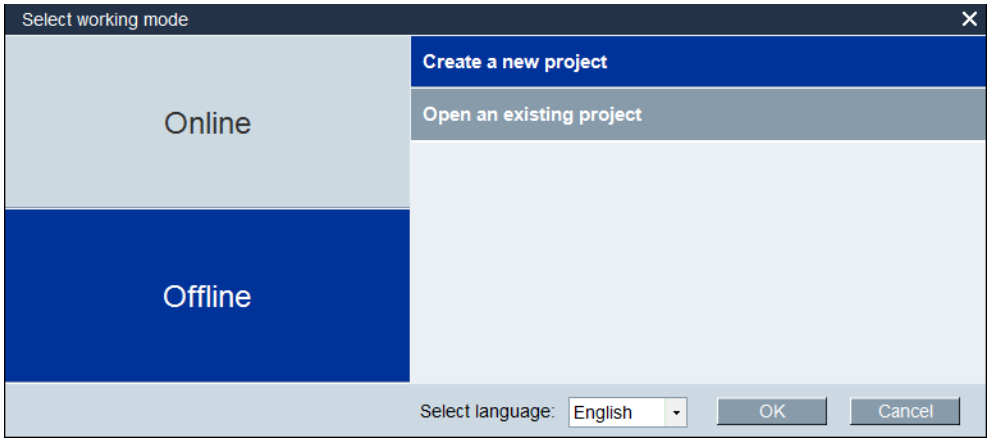
  SINAMICS V-ASSISTANT automatically creates a new project to save all the parameter settings from the target drive and enters the main window.

  Note

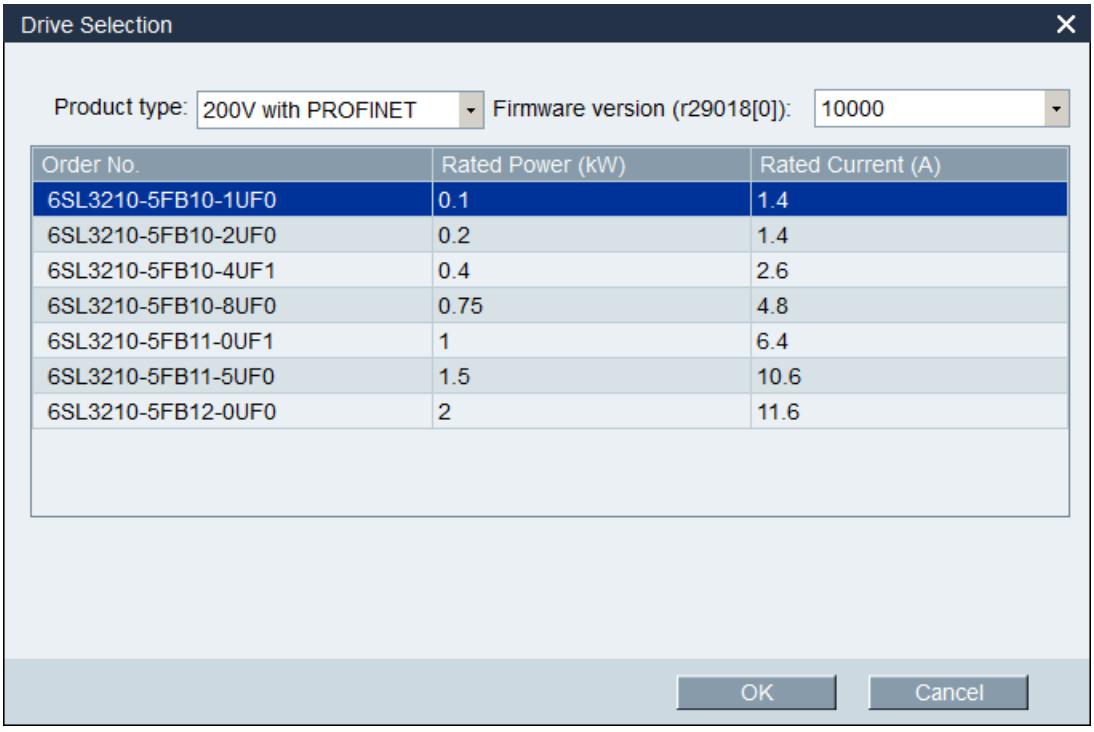
  If SINAMICS V-ASSISTANT fails to detect the connected drive immediately, please wait for a while and then plug in the USB cable again.

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

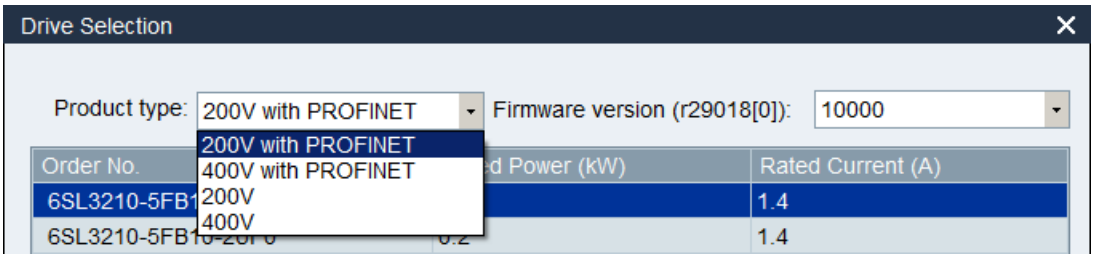
  Two options are available for your choice:



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



Select the product type and firmware version from the drop-down lists respectively.

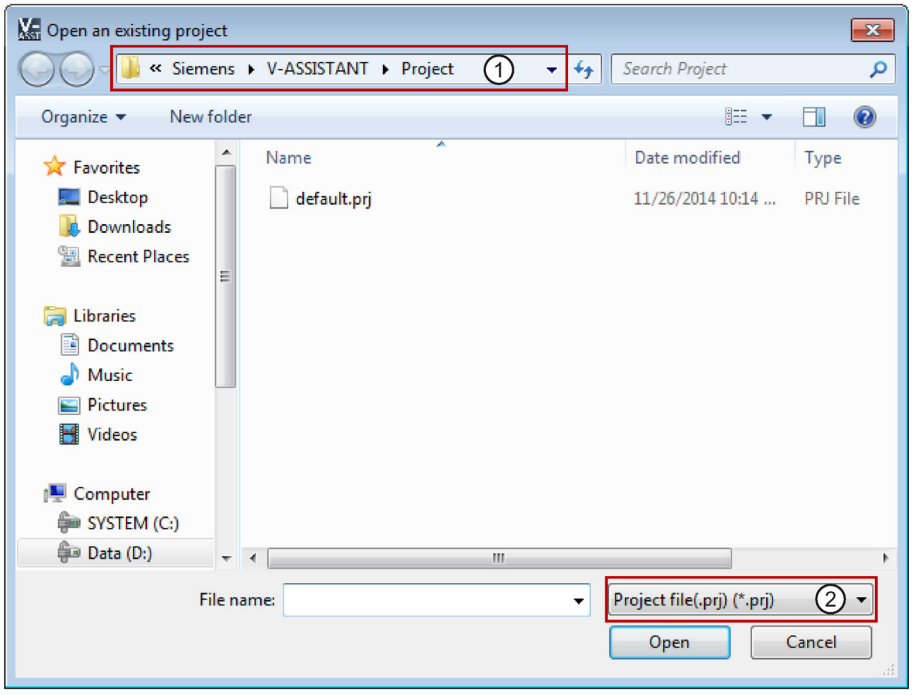


Select the order number of a drive. Click OK to save the factory settings of the selected drive to the new project and enter the main window; or otherwise, click Cancel to cancel.

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

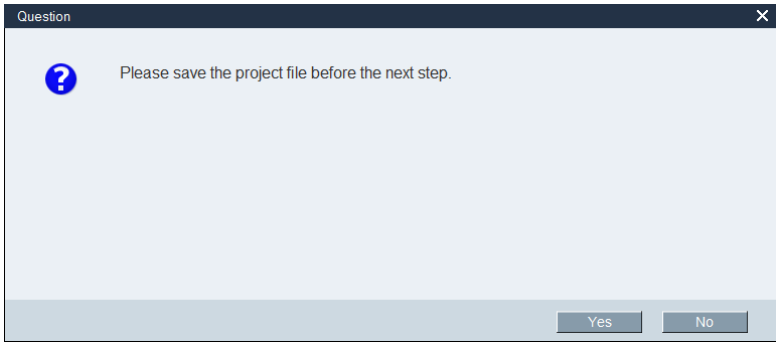
Online

Offline

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

Compare parameters

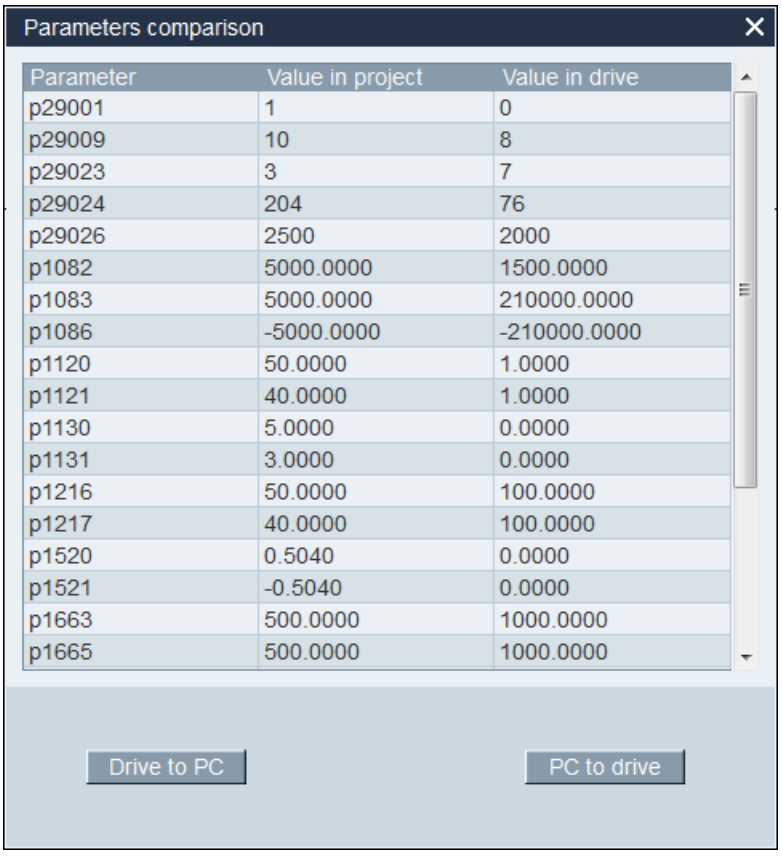
When you switch the working mode from offline to online, the following question will appear to remind you to save the current project:



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

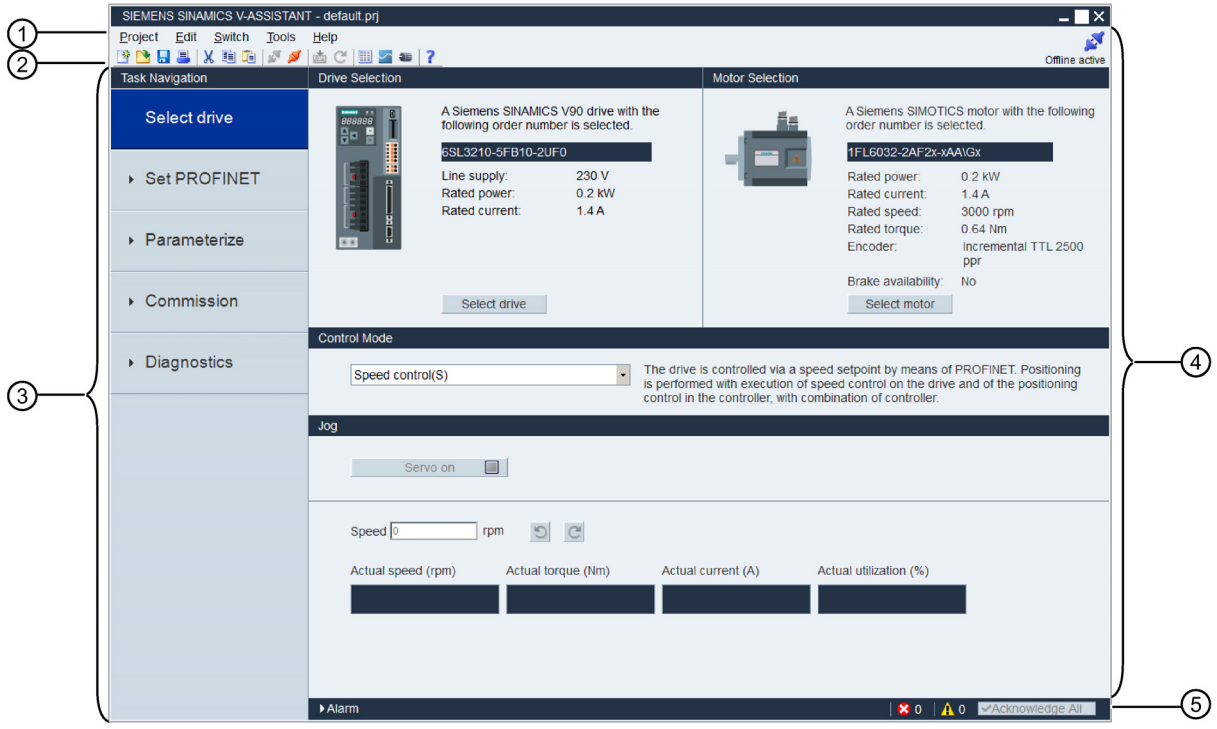
Then SINAMICS V-ASSISTANT automatically compares all parameter settings between the current project and the connected drive:

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 user interface. 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 Chapter "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 29)

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.

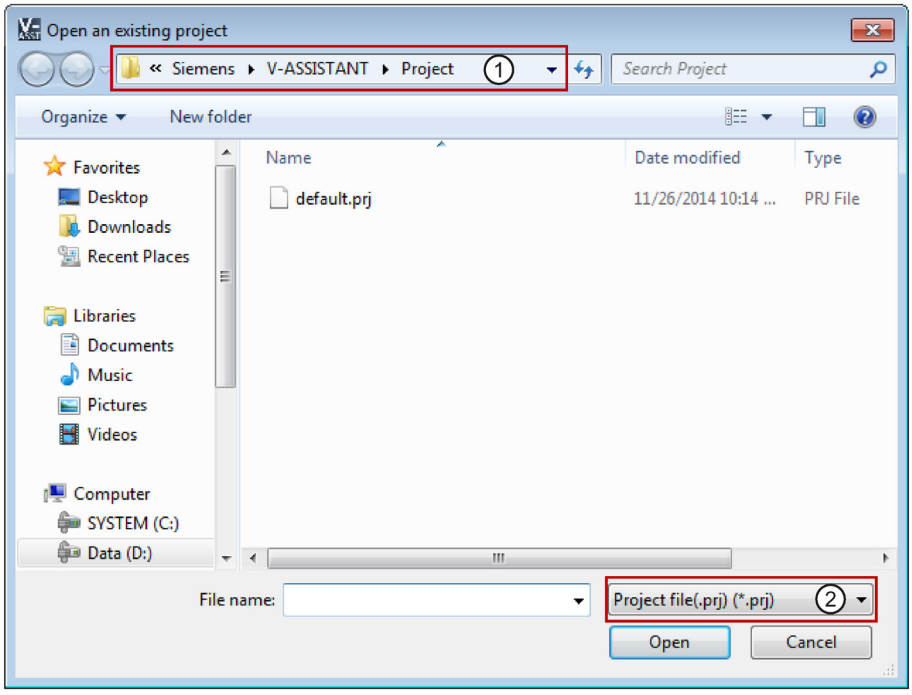
- New project
- Open project
- Save project
- Save project as
- Print
- Language
- Exit

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 33).

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:



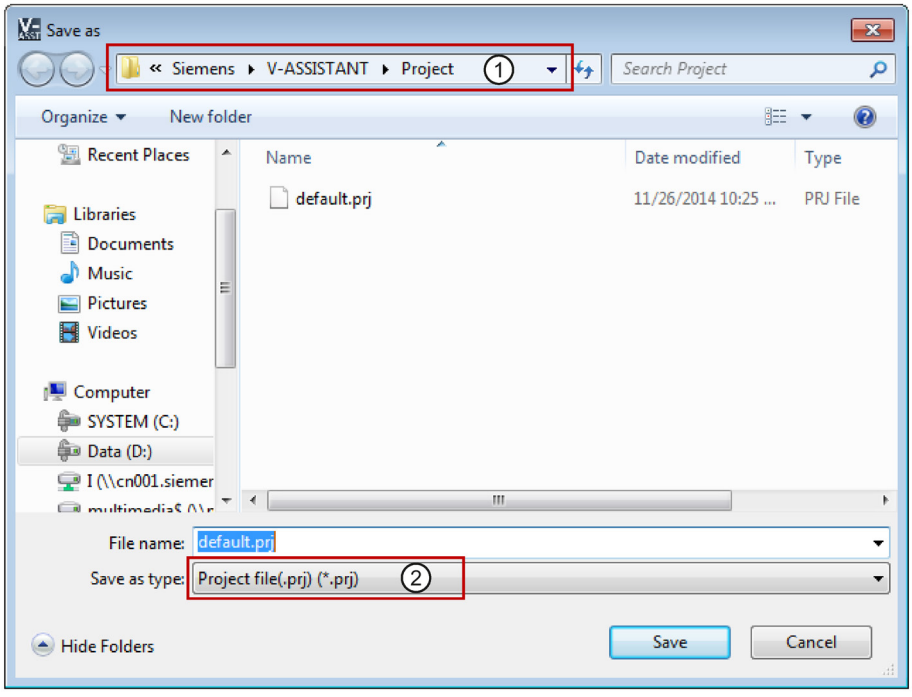
① The default location is: xxx/Siemens/V-ASSISTANT/Project.
xxx: SINAMICS V-ASSISTANT setup root directory.

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:



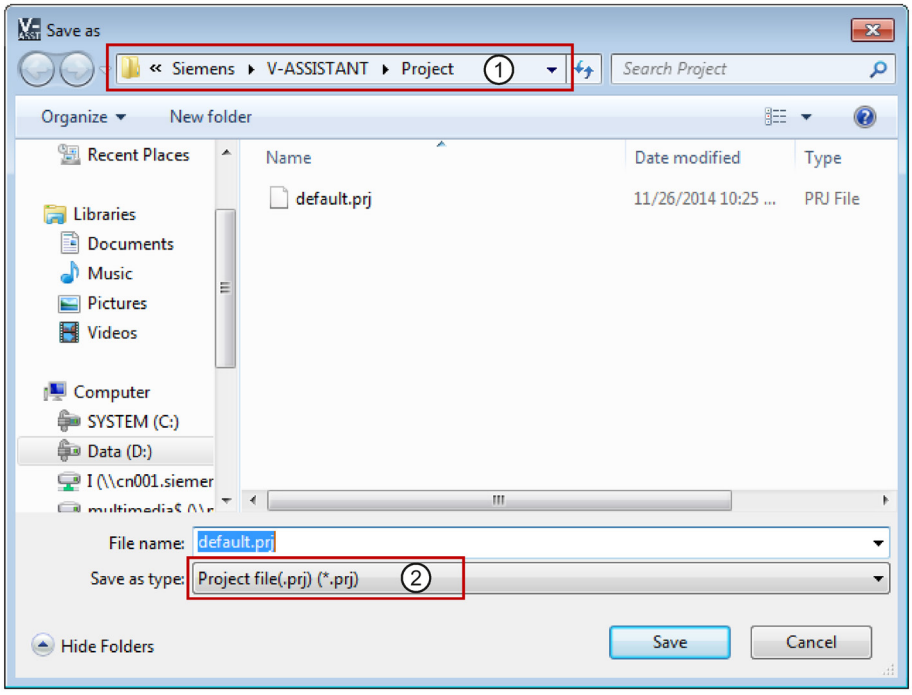
① The default location is: xxx/Siemens/V-ASSISTANT/Project.
xxx: SINAMICS V-ASSISTANT setup root directory.

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 as desired. The default languages of SINAMICS V-ASSISTANT are English and Chinese. For installation packages of more languages, visit this address (http://www.siemens.com/sinamics-v-assistant). After you download the desired installation package to your PC and run it, you can switch the interface language to the corresponding language.

3.3.2.7 Project -> Exit

Online mode/offline mode

You can use this menu command to exit from 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
- Copy
- Paste

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 47)".

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 33)
- Selecting motor (Page 35)
- Viewing all parameters (Page 47)
- Signal (Page 49)

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 47).

3.3.4 Switch menu

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

-  Go offline
-  Go online

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.

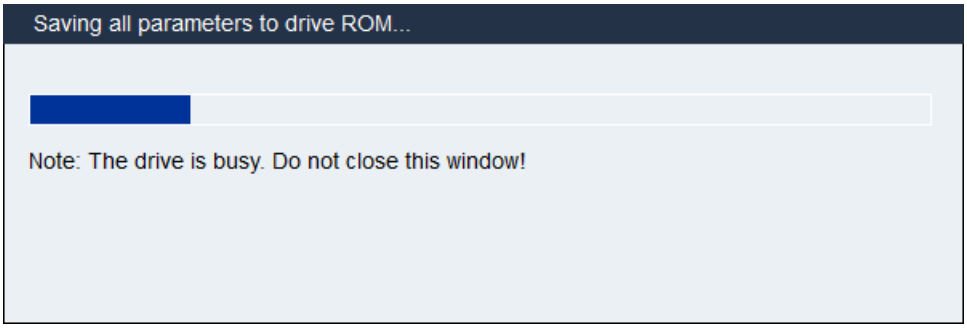
3.3.5 Tools menu

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

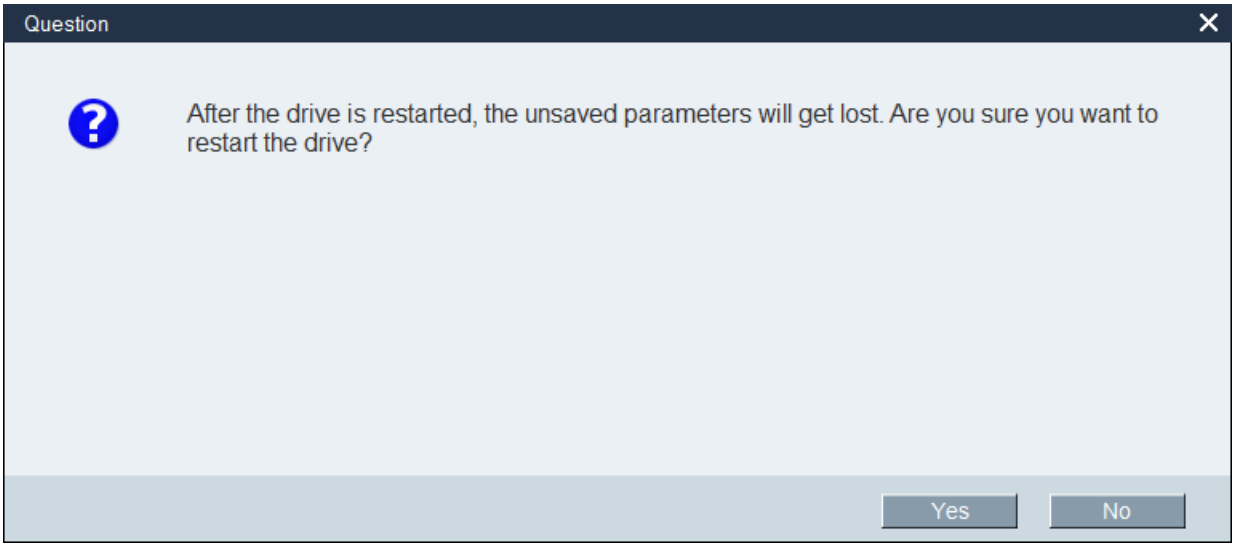
You can use this menu command to save the parameters from RAM to ROM in the drive. The following window will appear to display the saving process:



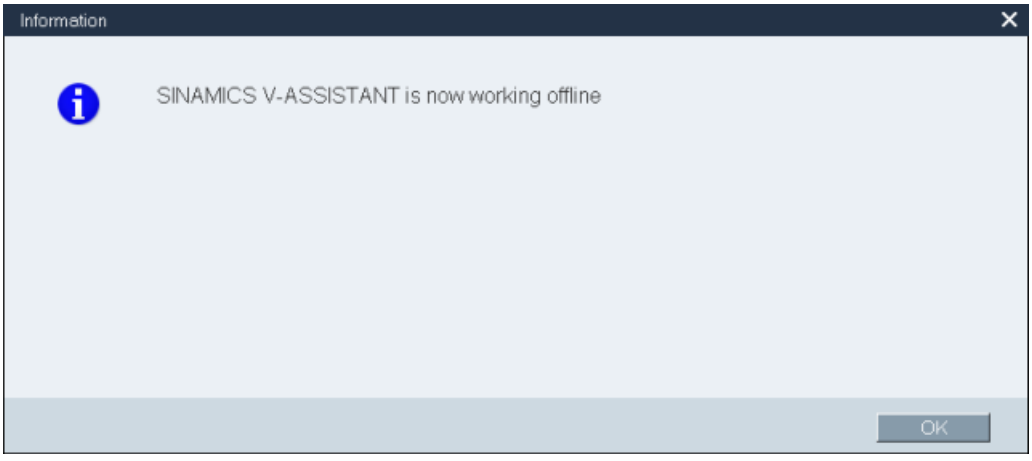
Alternatively, you can use  from the toolbar.

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.

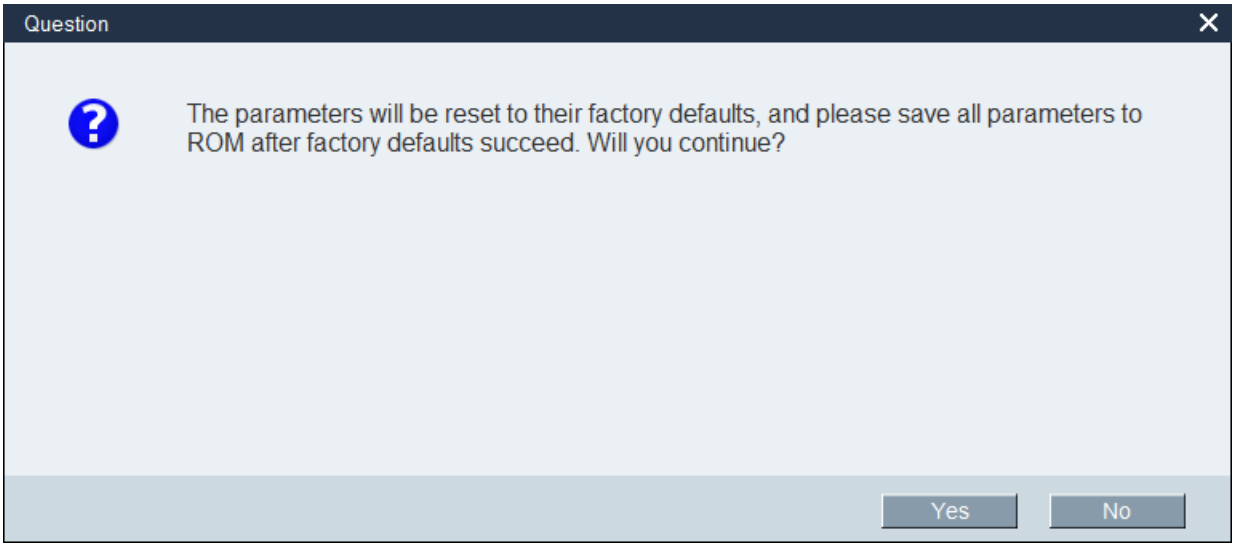
3.3.5.3 Tools -> Reset absolute encoder

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.

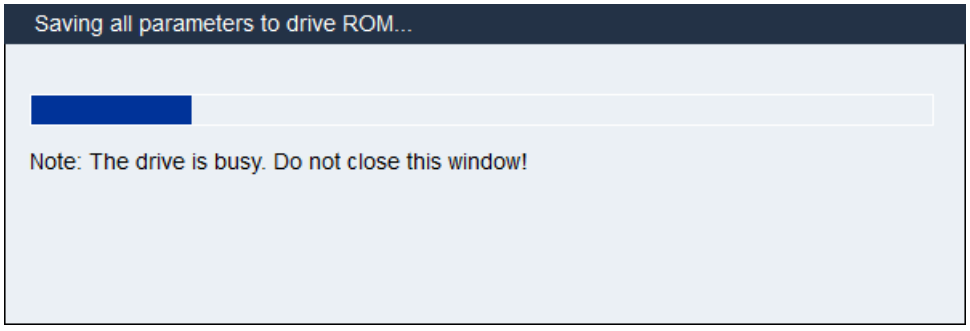
3.3.5.4 Tools -> Factory default

Online

Select this menu command and the following reminder will appear:



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

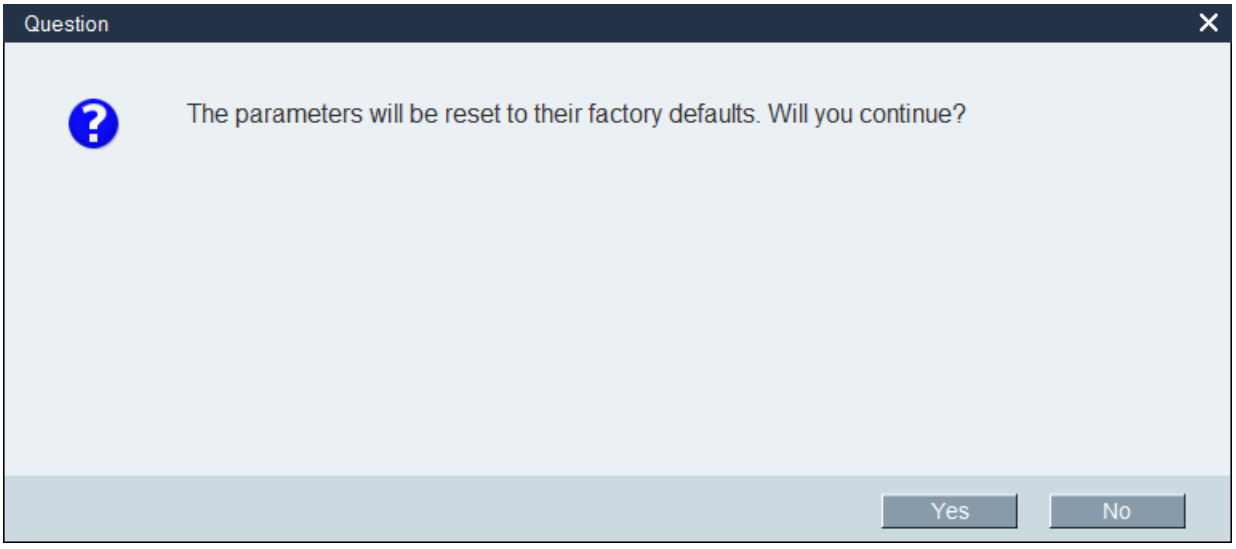


When the process is finished, the window disappears automatically.

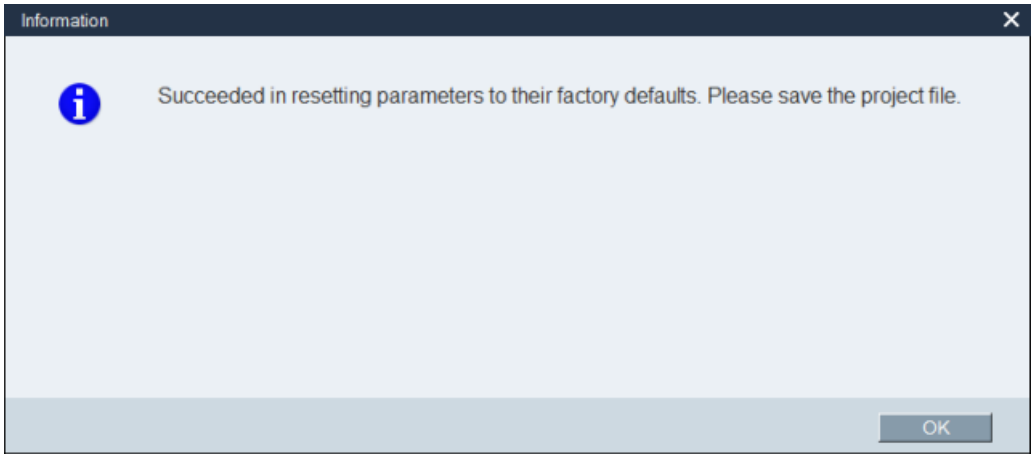
- If you click No, the operation will be aborted.

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)".

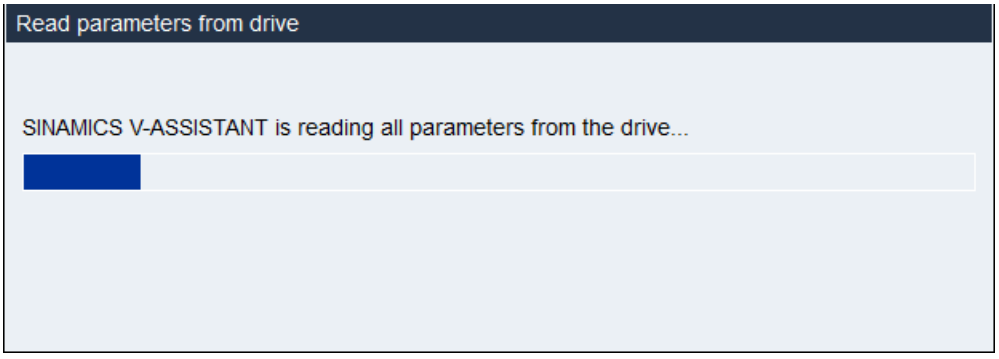
- If you click No, the operation is aborted.

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 29)
- 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 19)

 Open project (Page 20)

 Save project (Page 21)

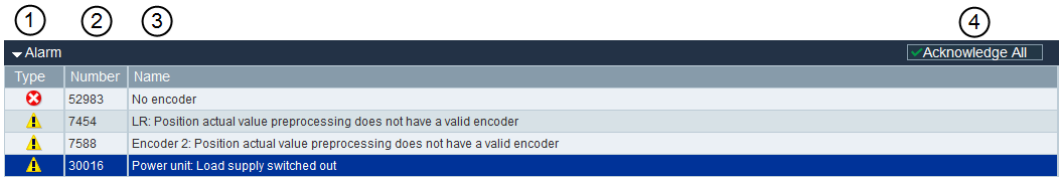
 Print (Page 22)

 Cut (Page 23)

- Copy (Page 23)
- 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 47)
- Trace (Page 65)
- Test motor (Page 54)
- Help (Page 29)

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

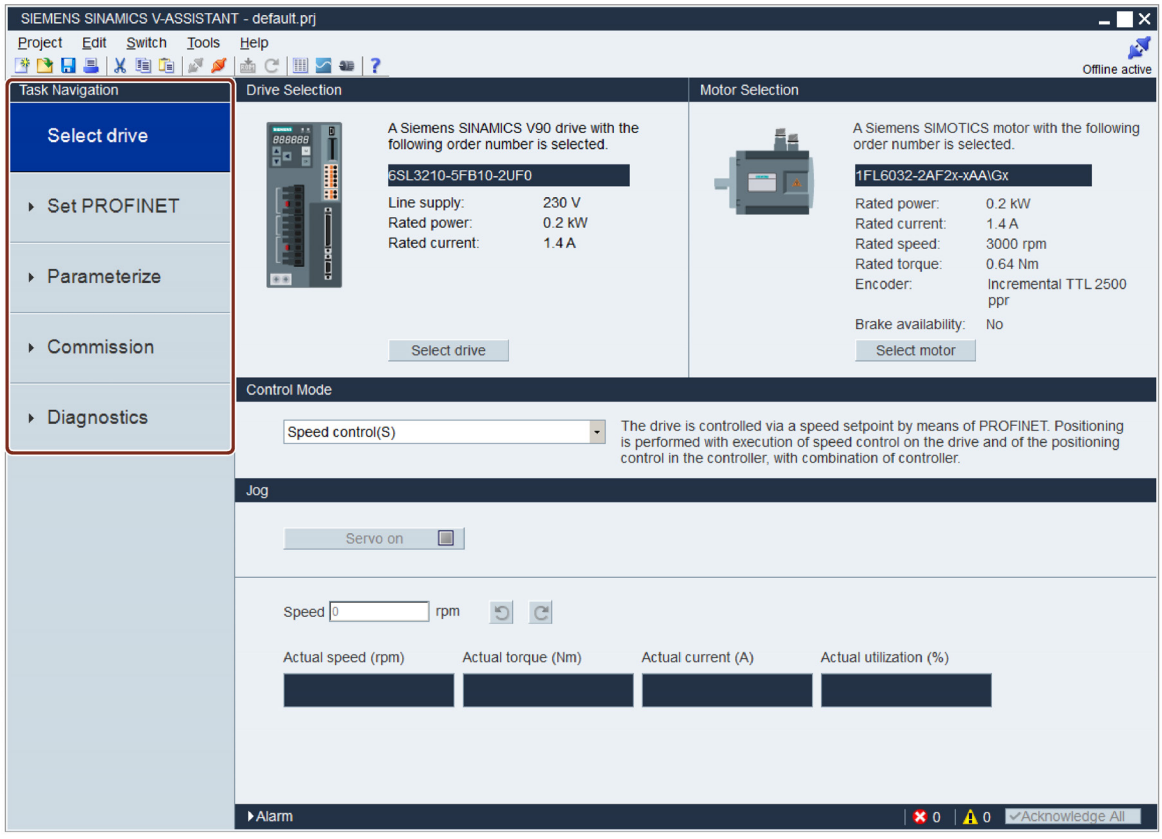
For frequently called functions, corresponding function keys and shortcuts are provided.

Function keys in SINAMICS V-ASSISTANT

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

Task navigation

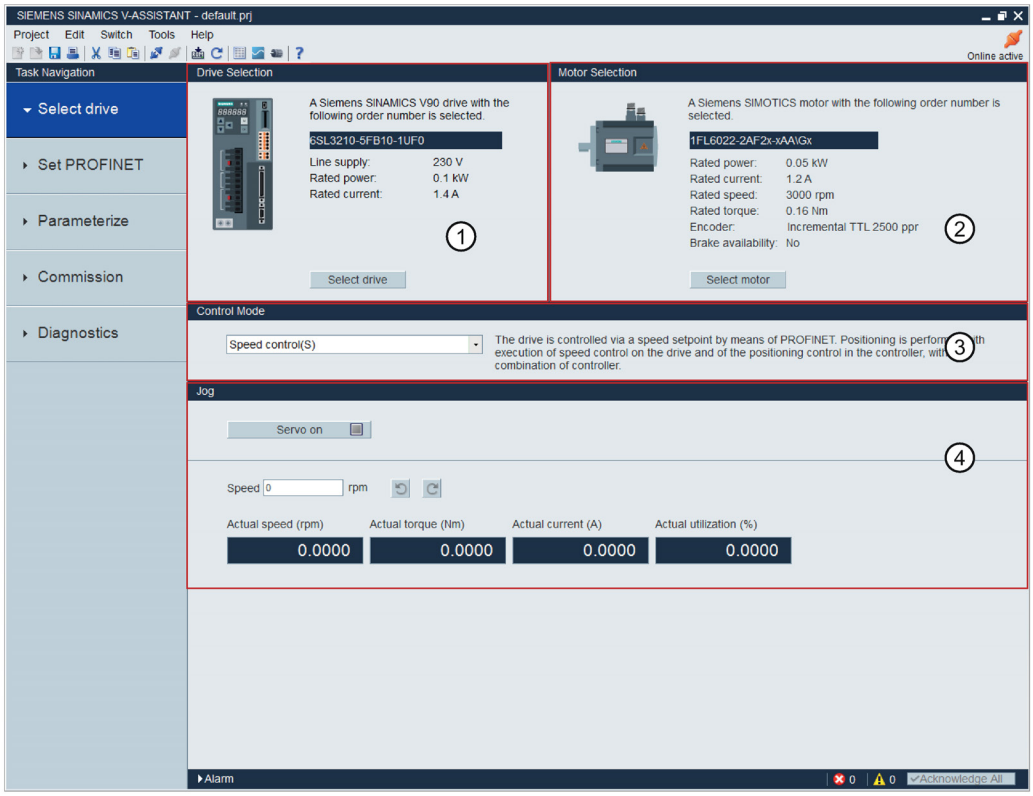
4



Task	Sub-functions
Selecting drive (Page 32)	• Selecting drive (Page 33) • Selecting motor (Page 35) • Control mode (Page 36) • Jog (Page 36)
Setting PROFINET (Page 38)	• Selecting telegram (Page 38) • Configuring network (Page 40)
Parameterizing (Page 41)	• Configuring ramp function (Page 42) • Setting limits (Page 43) • Configuring inputs/outputs (Page 45) • Viewing all parameters (Page 47)

Task	Sub-functions
Commissioning (Page 49)	• Testing interface (Page 49) • Testing motor (Page 54) • Optimizing drive (Page 54)
Diagnostics (Page 64)	• Monitoring status (Page 64) • Tracing signals (Page 65) • Measuring machine (Page 69)

4.1 Selecting drive

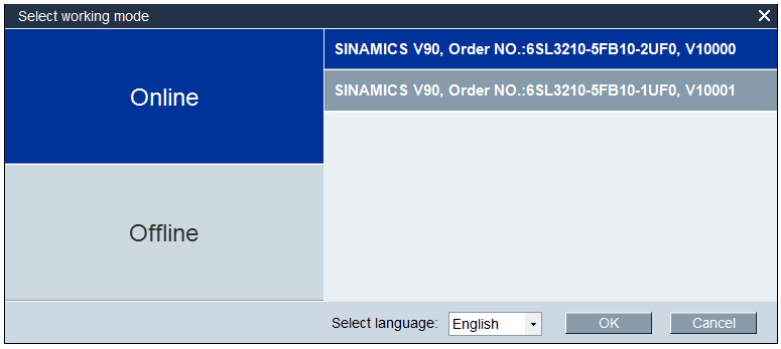


①	Drive selection	Select a drive in this field. For more information, refer to Section "Selecting drive (Page 33)".
②	Motor selection	Select a motor in this field. For more information, refer to Section "Selecting motor (Page 35)".
③	Control mode	Select a control mode in this field. For more information, refer to Section "Control mode (Page 36)".
④	Jog	Test the Jog function in this field. For more information, refer to Section "Jog (Page 36).

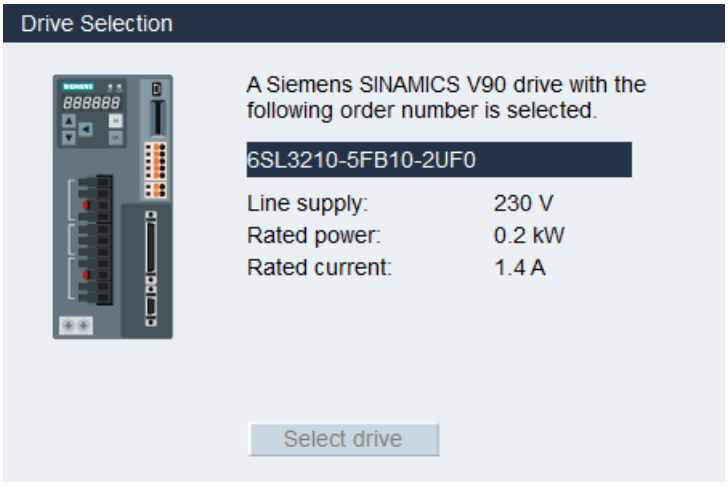
4.1.1 Selecting drive

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 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

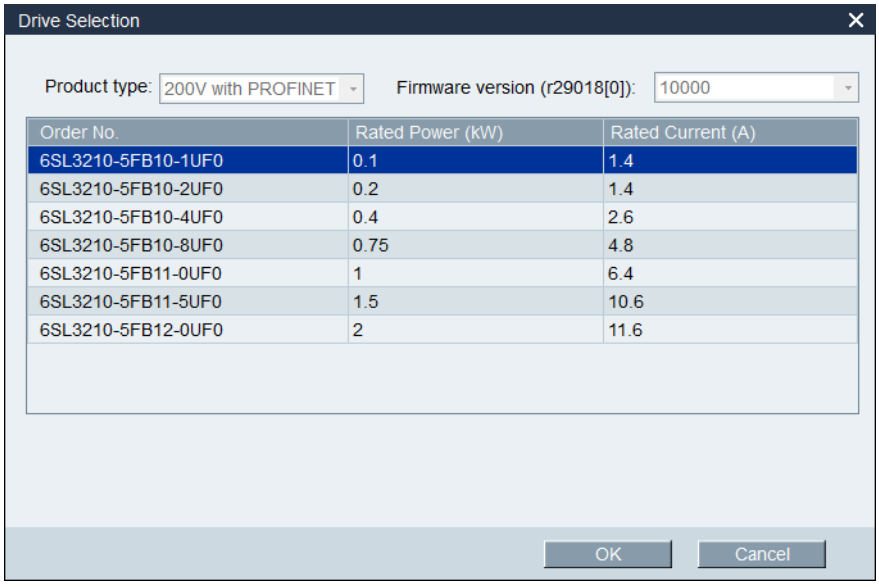
Note

Select drive is disabled in online mode as shown in the above drive selection window.

Offline mode

When you are working in offline mode, 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:

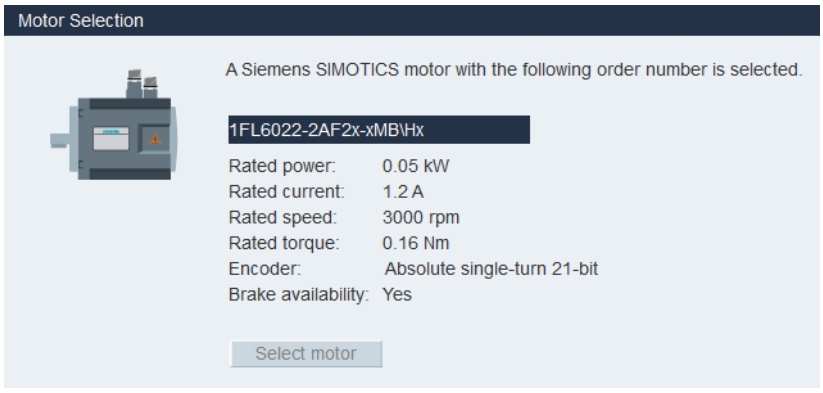


Select the order number of the target drive. Click OK to save the factory settings of the selected drive to the new project and enter the main window; or otherwise, click Cancel to cancel.

4.1.2 Selecting motor

Online mode

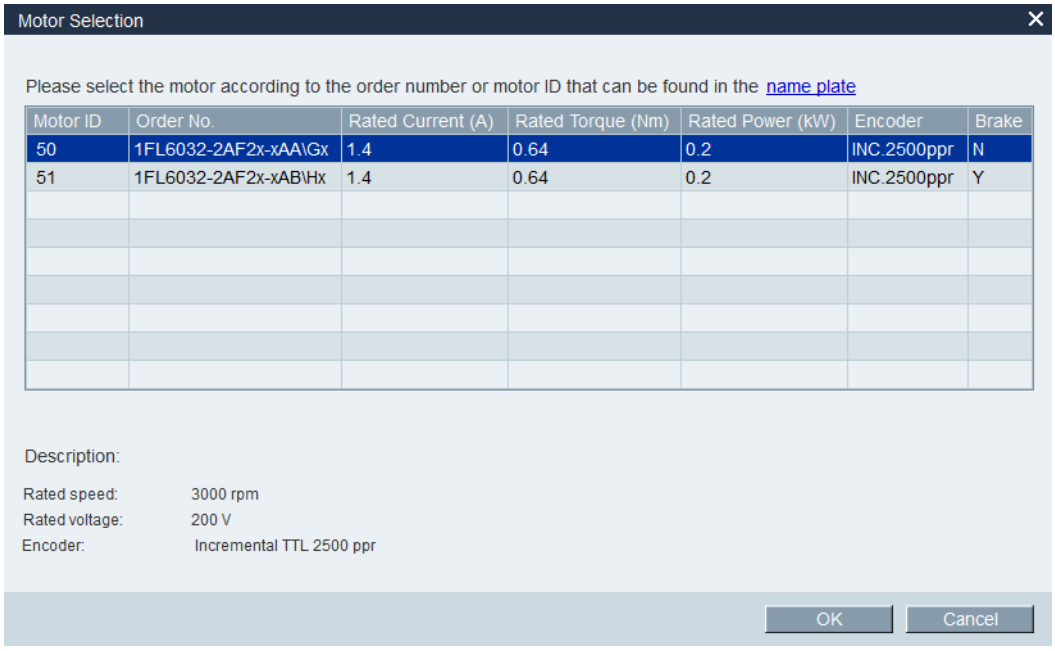
- If the connected motor is equipped with an absolute encoder, Select motor is disabled.



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.

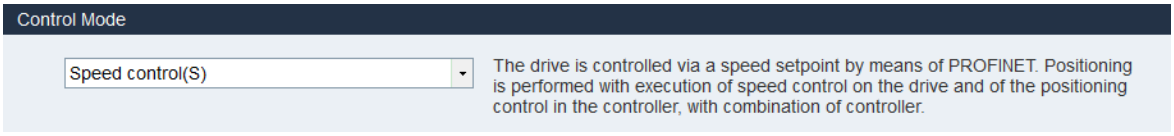
Offline mode

- 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

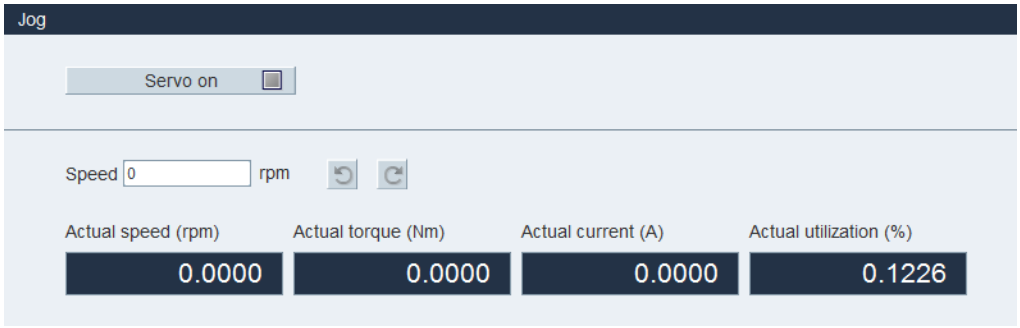
Online mode/offline mode

SINAMICS V90 PN can work in speed control mode. You can see it from the window below:

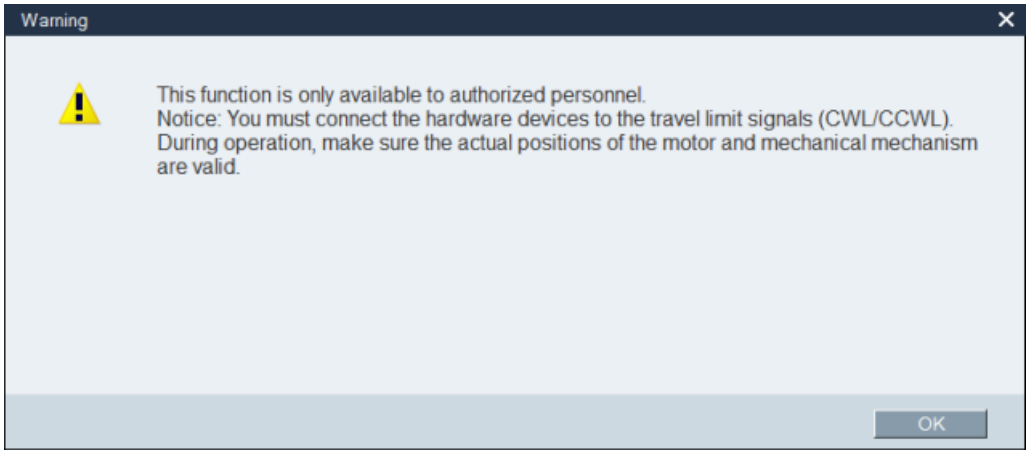


4.1.4 Jog

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-clockwise/clockwise by clicking the following two buttons respectively:

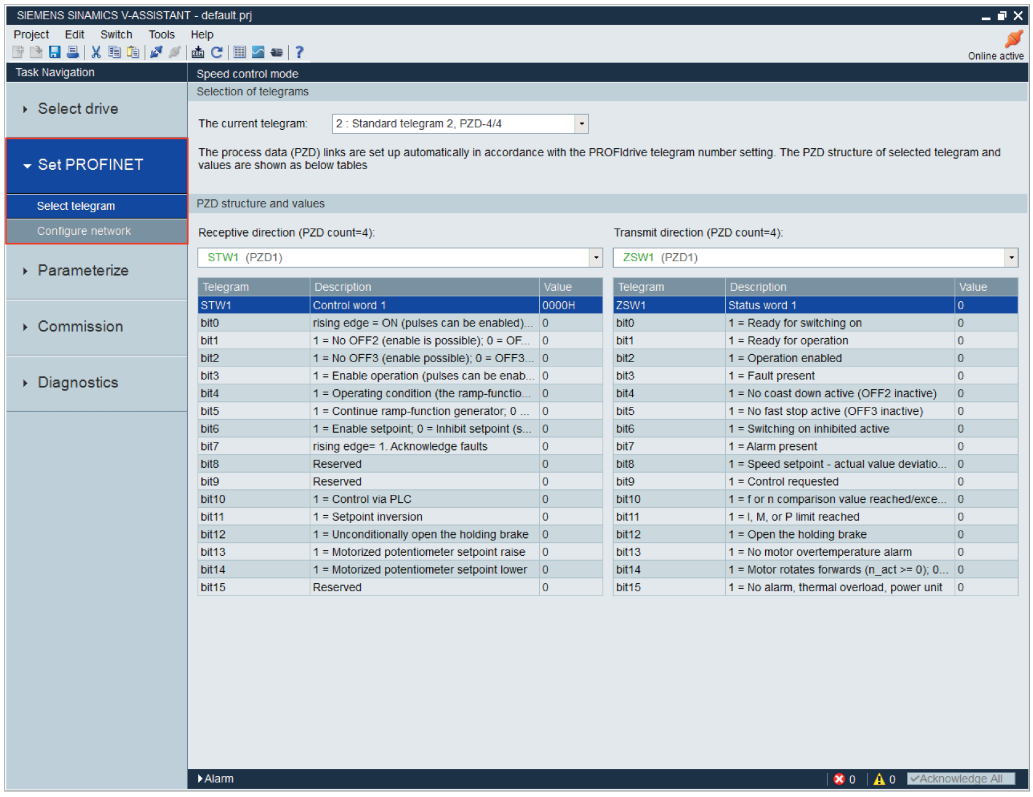
Then the actual speed, actual torque, actual current and actual utilization will be displayed.

- To stop the Jog function, you can click Servo off in the following window and 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.

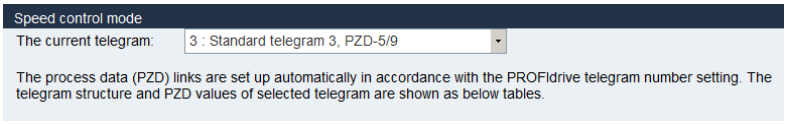
4.2 Setting PROFINET



You can select the desired telegram and configure the network under this mask.

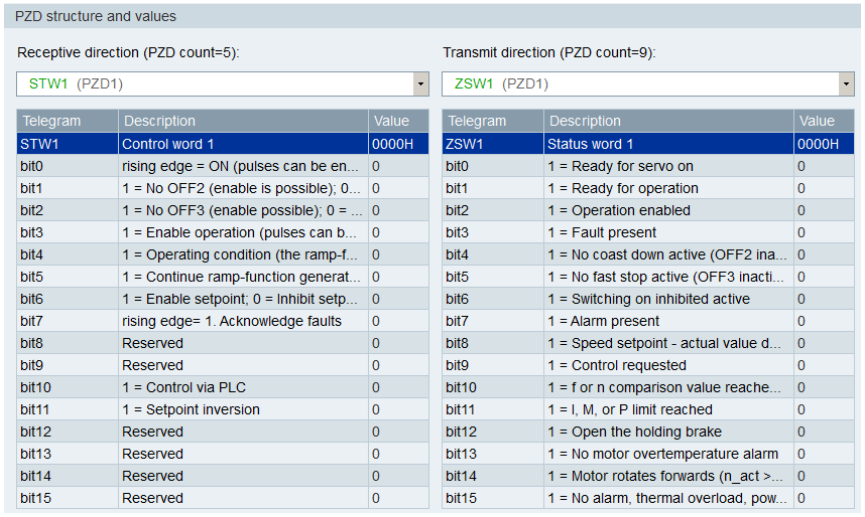
4.2.1 Selecting telegram

In this area, you can see the activated control mode and telegram. If you desire to change the telegram, you can click the drop-down list and select the desired telegram.



After you select a new telegram, the displayed process data changes according to the selected telegram. You can view all the PZDs of the selected telegram with the drop-down list and read their hexadecimal values from the first row of the table.

The PZD in green indicates that it has a bit definition. You can read the binary value of each bit from the table.


PZD structure and values

Receptive direction (PZD count=5):

STW1 (PZD1)

Telegram	Description	Value
STW1	Control word 1	0000H
bit0	rising edge = ON (pulses can be en...	0
bit1	1 = No OFF2 (enable is possible); 0...	0
bit2	1 = No OFF3 (enable possible); 0 = ...	0
bit3	1 = Enable operation (pulses can b...	0
bit4	1 = Operating condition (the ramp-f...	0
bit5	1 = Continue ramp-function generat...	0
bit6	1 = Enable setpoint; 0 = Inhibit setp...	0
bit7	rising edge= 1. Acknowledge faults	0
bit8	Reserved	0
bit9	Reserved	0
bit10	1 = Control via PLC	0
bit11	1 = Setpoint inversion	0
bit12	Reserved	0
bit13	Reserved	0
bit14	Reserved	0
bit15	Reserved	0

Transmit direction (PZD count=9):

ZSW1 (PZD1)

Telegram	Description	Value
ZSW1	Status word 1	0000H
bit0	1 = Ready for servo on	0
bit1	1 = Ready for operation	0
bit2	1 = Operation enabled	0
bit3	1 = Fault present	0
bit4	1 = No coast down active (OFF2 ina...	0
bit5	1 = No fast stop active (OFF3 inacti...	0
bit6	1 = Switching on inhibited active	0
bit7	1 = Alarm present	0
bit8	1 = Speed setpoint - actual value d...	0
bit9	1 = Control requested	0
bit10	1 = f or n comparison value reache...	0
bit11	1 = I, M, or P limit reached	0
bit12	1 = Open the holding brake	0
bit13	1 = No motor overtemperature alarm	0
bit14	1 = Motor rotates forwards (n_act >...	0
bit15	1 = No alarm, thermal overload, pow...	0

Supported telegrams

SINAMICS V90 PN supports standard telegrams and Siemens telegrams for speed control mode. You can select the desired telegram with parameter p0922. See the following table for details.

From the perspective of the drive unit, the received process data represents the receive words and the process data to be sent to the send words.

Telegram	Maximum number of PZD		Description
	Receive word	Send word	
Standard telegram 1	2	2	p0922 = 1
Standard telegram 2	4	4	p0922 = 2
Standard telegram 3	5	9	p0922 = 3
Standard telegram 5	9	9	p0922 = 5
Siemens telegram 102	6	10	p0922 = 102
Siemens telegram 105	10	10	p0922 = 105

One PZD = one word

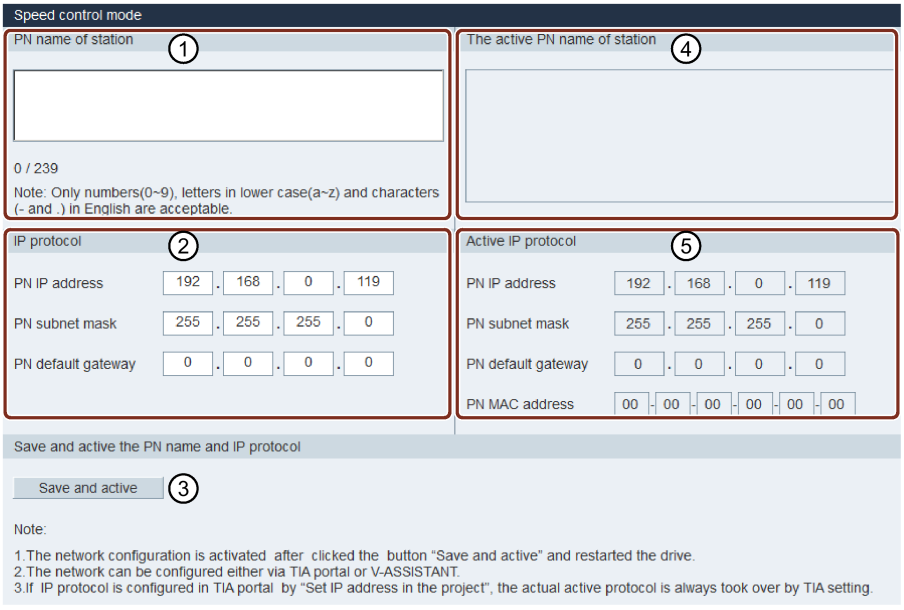
Standard telegram 5 and Siemens telegram 105 can only be used when the V90 PN connects to the SIMATICS S7-1500.

Standard telegrams

Tele-gram	1		2		3		5		102		105	
Appl. class	1		1		1, 4		4		1, 4		4	
PZD1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1
PZD2	NSOLL_A	NIST_A	NSOLL_B	NIST_B	NSOLL_B	NIST_B	NSOLL_B	NIST_B	NSOLL_B	NIST_B	NSOLL_B	NIST_B
PZD3	⇧ Receive telegram from PROFINET	⇩ Send telegram to PROFINET										
PZD4			STW2	ZSW2	STW2	ZSW2	STW2	ZSW2	STW2	ZSW2	STW2	ZSW2
PZD5					G1_STW	G1_ZSW	G1_STW	G1_ZSW	MOMRED	MELDW	MOMRED	MELDW
PZD6						G1_XIST1	XERR	G1_XIST1	G1_STW	G1_ZSW	G1_STW	G1_ZSW
PZD7										G1_XIST1	XERR	G1_XIST1
PZD8						G1_XIST2	KPC	G1_XIST2				
PZD9										G1_XIST2	KPC	G1_XIST2
PZD10												

4.2.2 Configuring network

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



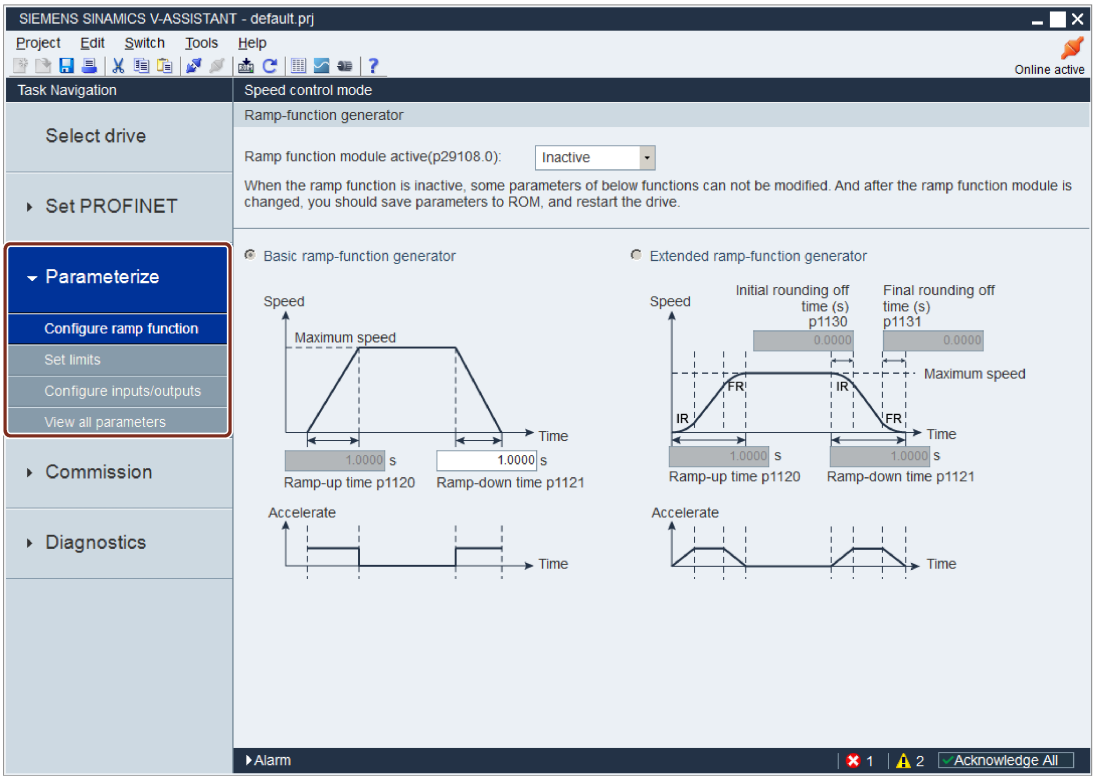
In online mode, the IP address of the connected drive is displayed in area "②" automatically. You can define the PN name of station in area "①". Note that only numbers (0 to 9), lowercase letters ("a" to "z") and characters ("-" and ".") in English are permissible. In addition, you can modify the IP address in area "②" as desired. Click button "③" to save

and activate the settings. Restart the drive and then the PN name and IP address you set become active and appear in areas "④" and "⑤".

Note

If you have also configured the IP protocol in TIA Portal, then the IP protocol set in TIA Portal takes the first priority and displays in area "⑤" as the actual active IP protocol.

4.3 Parameterizing



Totally, there are four functions available in the S control mode:

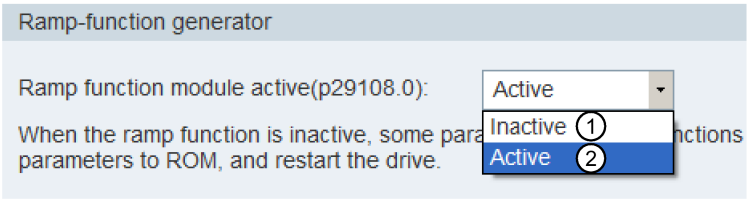
- Configuring ramp function (Page 42)
- Setting limits (Page 43)
- Configuring inputs/outputs (Page 45)
- Viewing all parameters (Page 47)

4.3.1 Configuring ramp function

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.

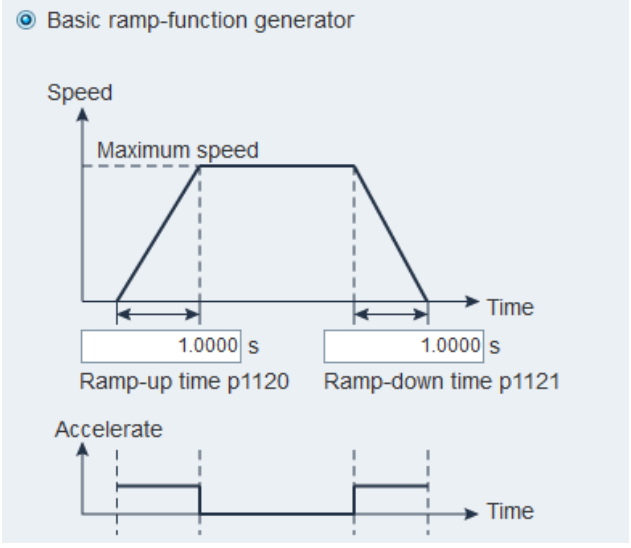
The ramp-up time p1120 and ramp-down time p1121 can be used to set acceleration and deceleration ramps separately. This allows a smoothed transition in the event of setpoint changes.



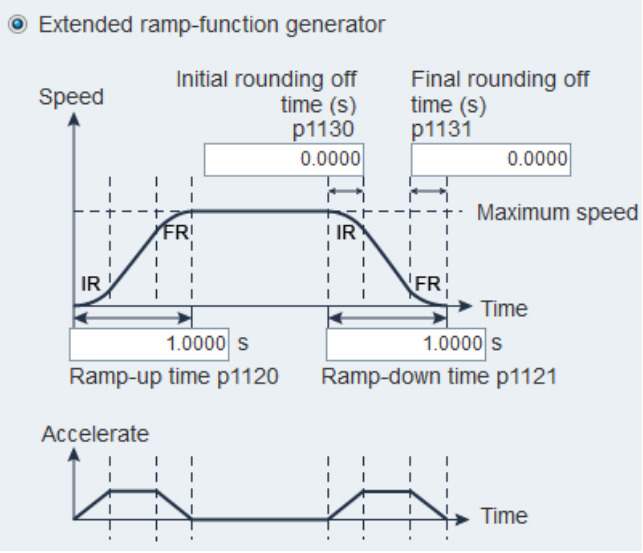
To activate this function, select "②" from the drop-down list in the above window or set bit 0 of p29108 on the BOP first. Make sure you have properly connected the SINAMICS V90 PN drive with the motor and the encoder works normally; otherwise, the ramp function generator is disabled due to faults (for example, F31117 and F52983, etc.) despite that it is displayed active in the above window. To activate the internal configuration of the ramp function generator, you have to re-connect the motor and restart the drive. Then, you can continue with either type of the ramp function generator.

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

- Basic ramp-function generator



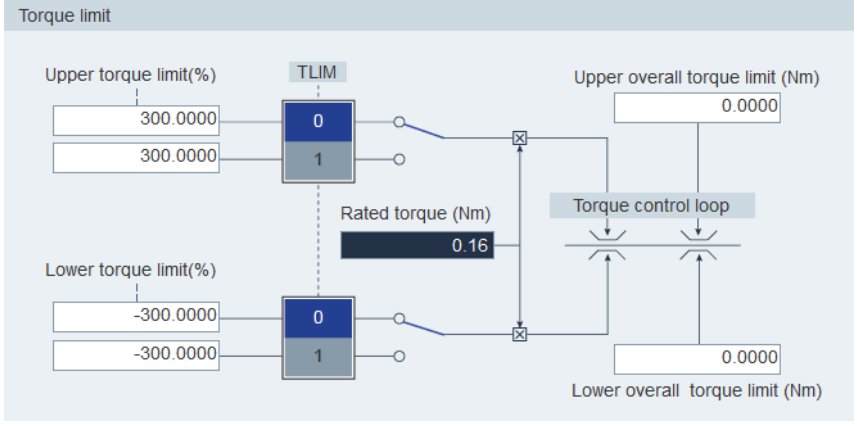
- Extended ramp-function generator



4.3.2 Setting limits

4.3.2.1 Torque limit

You can specify the corresponding parameters on the following panel:



Source of torque limit

Two sources in total are available for torque limit. You can select one of them via the digital input signal TLIM:

Digital input (TLIM)	Torque limit
0	Internal torque limit 1
1	Internal torque limit 2

When the torque setpoint reaches torque limit, the torque is limited to the value selected by TLIM.

Note

You can switch between the two sources and modify their values when the servo drive is running.

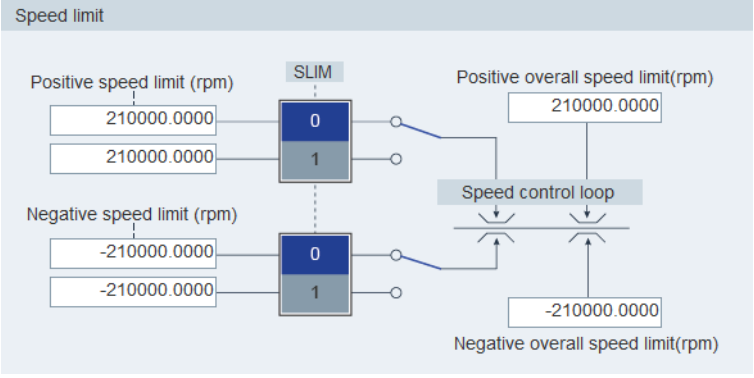
Refer to Section "Digital inputs (DIs) (Page 51)" for more information about the digital input signal TLIM.

Overall torque limit

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

4.3.2.2 Speed limit

You can specify the corresponding parameters on the following panel:



Source of speed limit

Two sources in total are available for speed limit. You can select one of them via the digital input signal SLIM:

Digital input (SLIM)	Speed limit
0	Internal speed limit 1
1	Internal speed limit 2

Note

You can switch between the two sources and modify their values when the servo drive is running.

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

Refer to Section "Digital inputs (DIs) (Page 51)" for more information about the digital input signal SLIM.

Overall speed limit

Besides the above two channels, an overall speed limit is available.

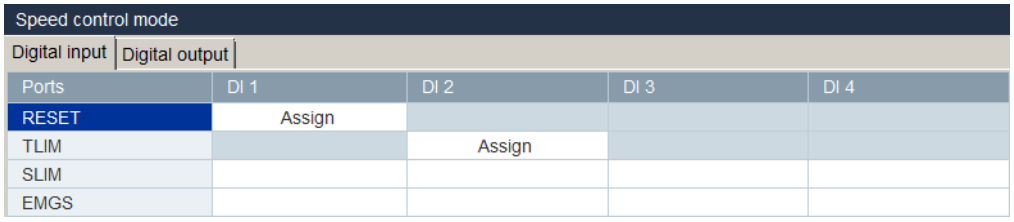
4.3.3 Configuring inputs/outputs

Two sub-functions are available as follows:

- Digital inputs (DIs) (Page 51)
- Digital outputs (DOs) (Page 52)

4.3.3.1 Assigning digital inputs

You can assign digital inputs on the following panel:

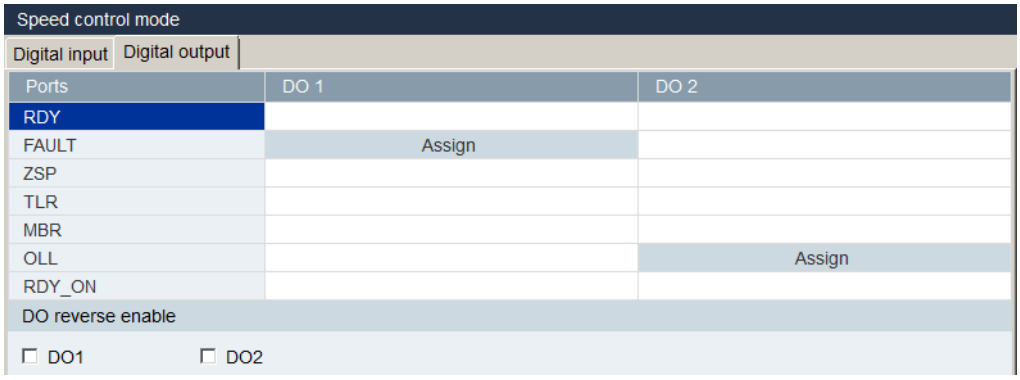


Four signals in total can be freely linked to digital inputs, for more information, refer to Section "Digital inputs (DIs) (Page 51)".

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.

4.3.3.2 Assigning digital outputs

You can assign digital outputs on the following panel:

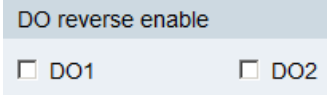


Seven signals in total can be freely linked to digital outputs. For more information, refer to Section "Digital outputs (DOs) (Page 52).

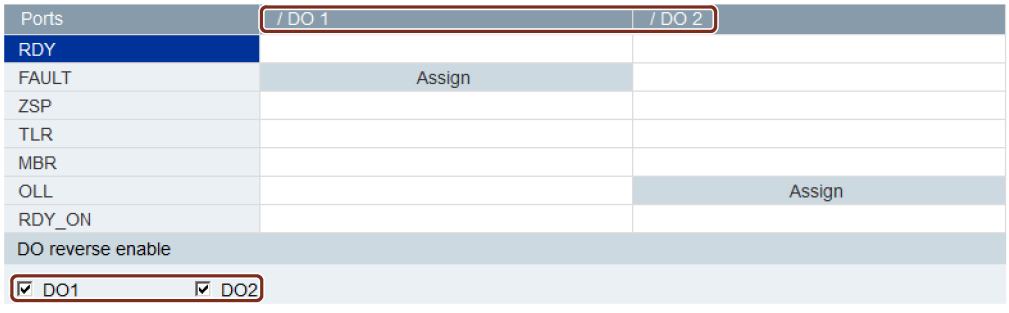
Click the cells with white background in the table. Select **"Assign"** to link the digital input with the corresponding signal. Then the current cell displays grey.

DO signal reverse

You can reverse the logics of DO1 and DO2 by activating the checkboxes in the following function area or setting the bit 0 and bit 1 of parameter p748:

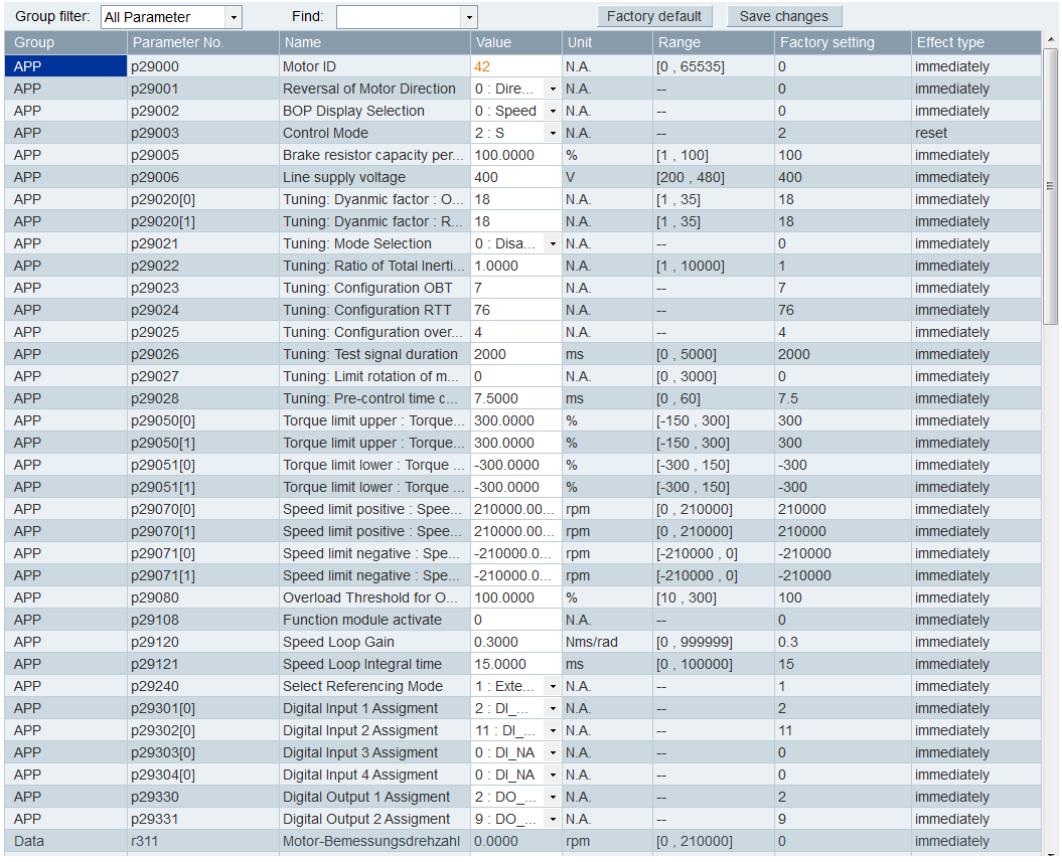


After the DO port is reversed, an "/" appears before the DO port to indicate that the logic of the signal assigned to this port has been reversed.



4.3.4 Viewing all parameters

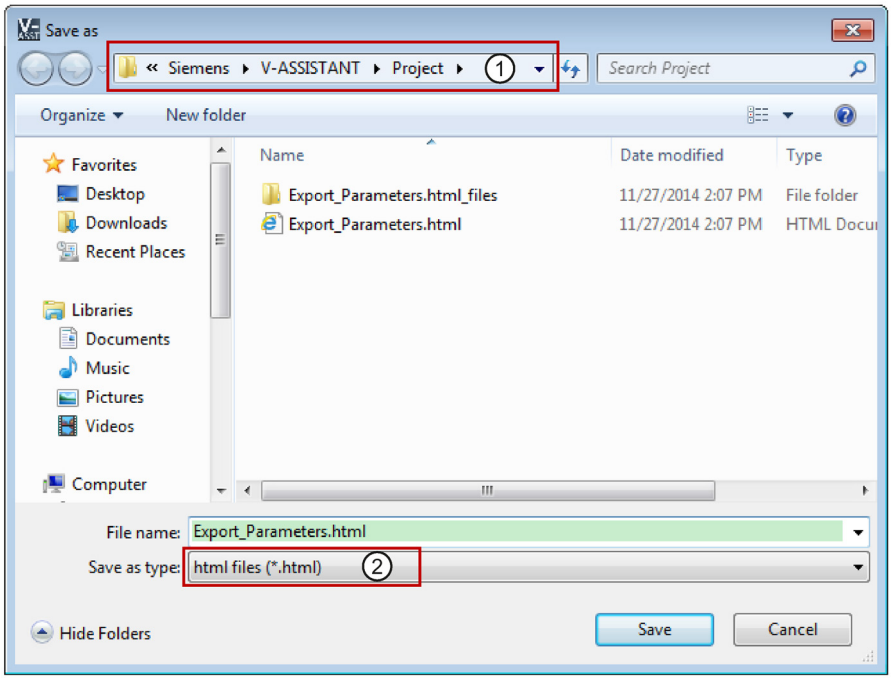
You can configure all editable parameters in this field:



Group filter: All Parameter Find: Factory default Save changes

Group	Parameter No.	Name	Value	Unit	Range	Factory setting	Effect type
APP	p29000	Motor ID	42	N.A.	[0 , 65535]	0	immediately
APP	p29001	Reversal of Motor Direction	0 : Dire...	N.A.	--	0	immediately
APP	p29002	BOP Display Selection	0 : Speed	N.A.	--	0	immediately
APP	p29003	Control Mode	2 : S	N.A.	--	2	reset
APP	p29005	Brake resistor capacity per...	100.0000	%	[1 , 100]	100	immediately
APP	p29006	Line supply voltage	400	V	[200 , 480]	400	immediately
APP	p29020[0]	Tuning: Dyanmic factor : O...	18	N.A.	[1 , 35]	18	immediately
APP	p29020[1]	Tuning: Dyanmic factor : R...	18	N.A.	[1 , 35]	18	immediately
APP	p29021	Tuning: Mode Selection	0 : Disa...	N.A.	--	0	immediately
APP	p29022	Tuning: Ratio of Total Inerti...	1.0000	N.A.	[1 , 10000]	1	immediately
APP	p29023	Tuning: Configuration OBT	7	N.A.	--	7	immediately
APP	p29024	Tuning: Configuration RTT	76	N.A.	--	76	immediately
APP	p29025	Tuning: Configuration over...	4	N.A.	--	4	immediately
APP	p29026	Tuning: Test signal duration	2000	ms	[0 , 5000]	2000	immediately
APP	p29027	Tuning: Limit rotation of m...	0	N.A.	[0 , 3000]	0	immediately
APP	p29028	Tuning: Pre-control time c...	7.5000	ms	[0 , 60]	7.5	immediately
APP	p29050[0]	Torque limit upper : Torque...	300.0000	%	[-150 , 300]	300	immediately
APP	p29050[1]	Torque limit upper : Torque...	300.0000	%	[-150 , 300]	300	immediately
APP	p29051[0]	Torque limit lower : Torque ...	-300.0000	%	[-300 , 150]	-300	immediately
APP	p29051[1]	Torque limit lower : Torque ...	-300.0000	%	[-300 , 150]	-300	immediately
APP	p29070[0]	Speed limit positive : Spee...	210000.00...	rpm	[0 , 210000]	210000	immediately
APP	p29070[1]	Speed limit positive : Spee...	210000.00...	rpm	[0 , 210000]	210000	immediately
APP	p29071[0]	Speed limit negative : Spe...	-210000.0...	rpm	[-210000 , 0]	-210000	immediately
APP	p29071[1]	Speed limit negative : Spe...	-210000.0...	rpm	[-210000 , 0]	-210000	immediately
APP	p29080	Overload Threshold for O...	100.0000	%	[10 , 300]	100	immediately
APP	p29108	Function module activate	0	N.A.	--	0	immediately
APP	p29120	Speed Loop Gain	0.3000	Nms/rad	[0 , 999999]	0.3	immediately
APP	p29121	Speed Loop Integral time	15.0000	ms	[0 , 100000]	15	immediately
APP	p29240	Select Referencing Mode	1 : Exte...	N.A.	--	1	immediately
APP	p29301[0]	Digital Input 1 Assigment	2 : DI_...	N.A.	--	2	immediately
APP	p29302[0]	Digital Input 2 Assigment	11 : DI_...	N.A.	--	11	immediately
APP	p29303[0]	Digital Input 3 Assigment	0 : DI_NA	N.A.	--	0	immediately
APP	p29304[0]	Digital Input 4 Assigment	0 : DI_NA	N.A.	--	0	immediately
APP	p29330	Digital Output 1 Assigment	2 : DO_...	N.A.	--	2	immediately
APP	p29331	Digital Output 2 Assigment	9 : DO_...	N.A.	--	9	immediately
Data	r311	Motor-Bemessungsdrehzahl	0.0000	rpm	[0 , 210000]	0	immediately

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)".

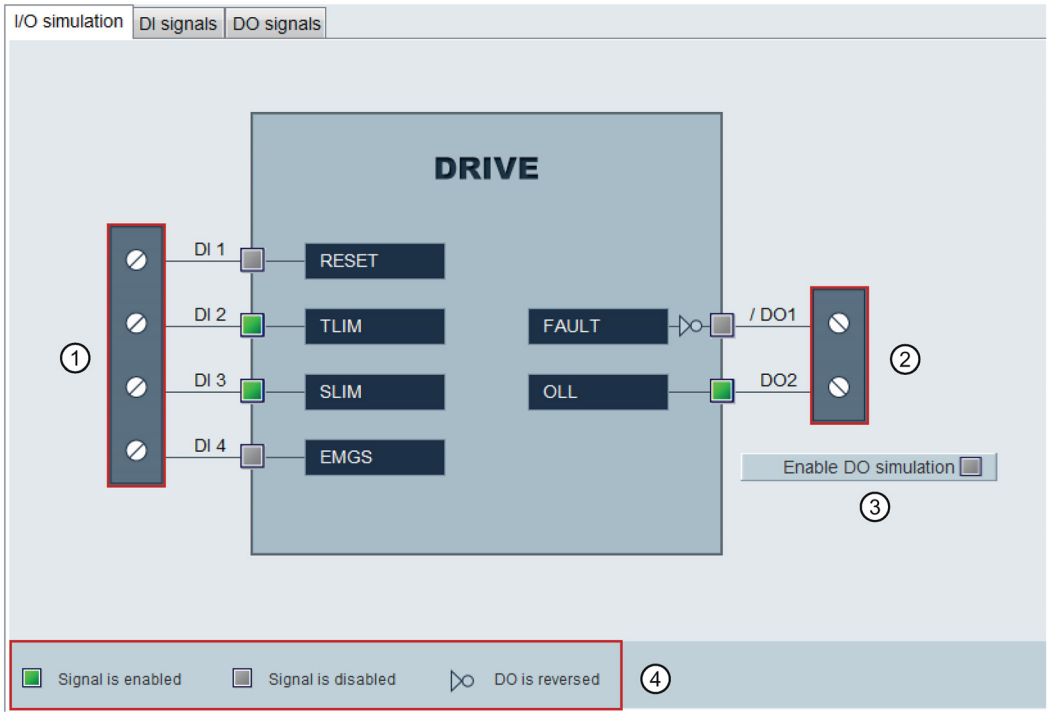
Field	Description
Save changes	You can click the following button to save the changes compared to the defaults/factory settings into an .html file which can be further used for documentation purposes or as an reference for BOP commisioning. Save changes Save in the following window:  ①: The default location 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.

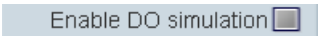
4.4 Commissioning

4.4.1 Testing interface

4.4.1.1 I/O simulation

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



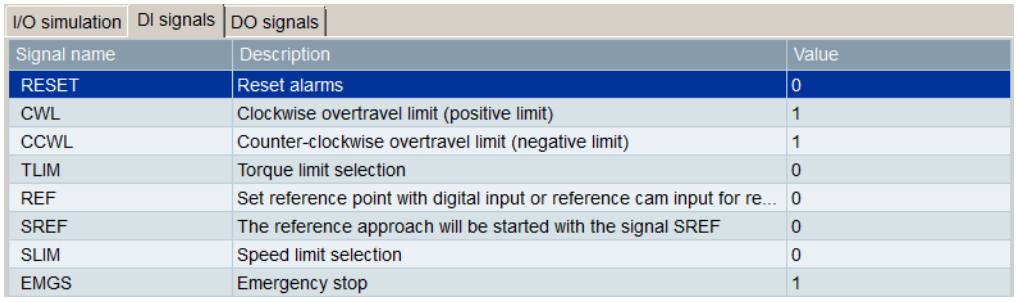
Area	Item		Description
①	DI1~DI4		Every digital input can be linked with either of the four internal signals.
	Note: For more information about the number and definition of signals, refer to Section"Digital inputs (DIs) (Page 51)".		
②	DO1~DO6		Every digital output can be freely linked with either of the seven internal signals.
	Note: DO1 and DO2 can be reversed. For more information about the number and definition of signals, refer to Section"Digital outputs (DOs) (Page 52)".		
③			Clicking this button enables DO simulation. If you desire to disable this function, click the following button: 
④		Signal is enabled	Before DO is reversed: Indicates high-voltage (or logic 1) is on the digital input/output. After DO is reversed: Indicates low-voltage (or logic 0) is on the digital input/output.
		Signal is disabled	Before DO is reversed: Indicates low-voltage (or logic 0) is on the digital input/output. After DO is reversed: Indicates high-voltage (or logic 1) is on the digital input/output.
		DO is reversed	Indicates the logic of the DO is reversed. After the DO is reversed, an "/" appears before the DO port.

Note

- This function is unavailable but can be displayed in offline mode.
- The status of each indicator are updated every 0.5 s.
- You can change the signal link as you desire. For more information, refer to Section "Configuring inputs/outputs (Page 45)".

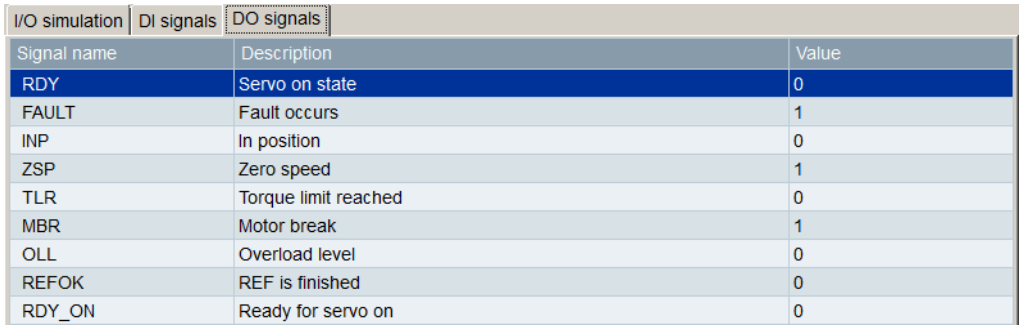
DI signals

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



DO signals

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



4.4.1.2 Digital inputs (DIs)

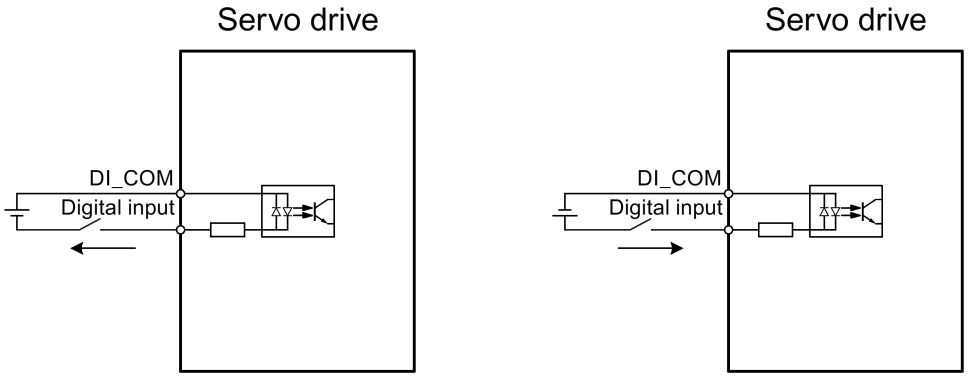
You can assign a maximum of four internal digital input signals to the SINAMICS V90 PN servo drive. For detailed information about these signals, see the table below:

Name	Type	Description
RESET	Edge 0→1	Reset alarms • 0→1: Reset alarms
TLIM	Level	Torque limit selection Two internal torque limit sources can be selected with the digital input signal TLIM. • 0 = internal torque limit 1 • 1 = internal torque limit 2

Name	Type	Description
SLIM	Level	Speed limit selection Two internal speed limit sources can be selected with the digital input signal SLIM. • 0 = internal speed limit 1 • 1 = internal speed limit 2
EMGS	Level	Emergency stop • 0 = Emergency stop • 1 = Servo drive is ready to run

Wiring

The digital inputs support both PNP and NPN types of wirings. You can find detailed information from the following diagrams:



NPN wiring PNP wiring

4.4.1.3 Digital outputs (DOs)

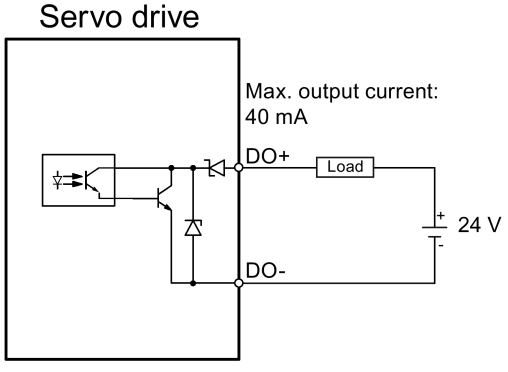
You can assign a maximum of seven internal digital output signals to the SINAMICS V90 PN servo drive. For detailed information about these signals, see the table below:

Name	Description
RDY	Servo ready • 1: ready to operate • 0: drive not ready (alarm occurs or enable signal is missing)
FAULT	Fault • 1: in fault status • 0: no fault

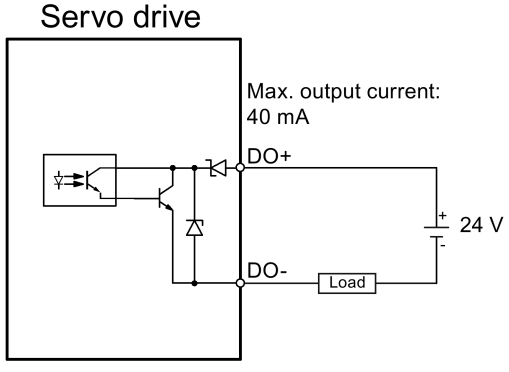
Name	Description
ZSP	Zero speed detection • 1: motor speed is equal with or lower than the zero speed (can be set with parameter p2161). • 0: motor speed is higher than zero speed + hysteresis (10 rpm).
TLR	Torque limit reached • 1: the generated torque has nearly (internal hysteresis) reached the value of the positive torque limit, negative torque limit or analog torque limit • 0: the generated torque has not reached the limit
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.
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
RDY_ON	Ready for servo on • 1: ready to servo on • 0: drive is not ready for servo on (fault occurs, main power supply is missing, or STW1.1 and STW1.2 are not set to 1) **Note:** After the drive is servo on, the signal remains in 1 status unless the above abnormal cases happen.

Wiring

The digital outputs support both PNP and NPN types of wirings. You can find detailed information from the following diagrams:



NPN wiring



PNP wiring

4.4.2 Testing motor

4.4.2.1 Jog

For detailed information about the Jog function, see Section "Jog (Page 36)".

4.4.3 Optimizing drive

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

Auto-tuning modes

SINAMICS V90 PN 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.

4.4.3.1 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.

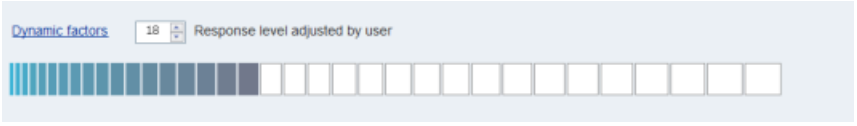
With one-button auto tuning, the servo drive can automatically estimate the ratio of load moment of inertia.

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

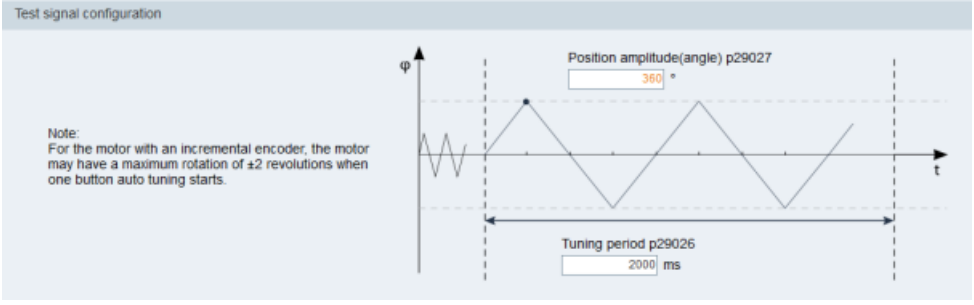
Implement the following steps to use the one-button auto tuning function:

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.

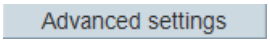
2. Configure the test signal in the following area:



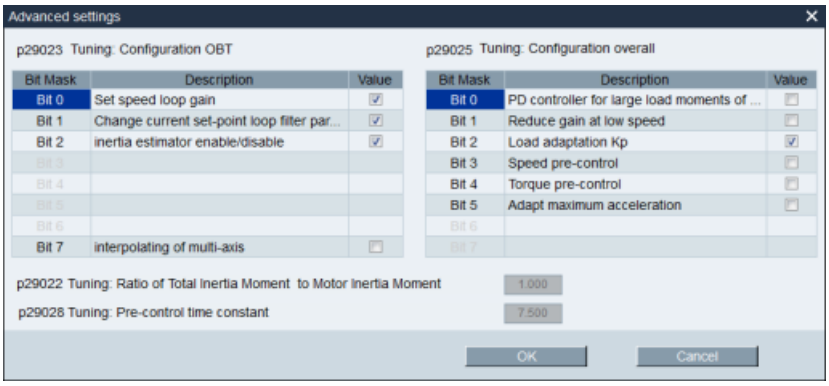
   Note:

   The recommended position amplitude (p29027) is 360°.

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



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 machine 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.

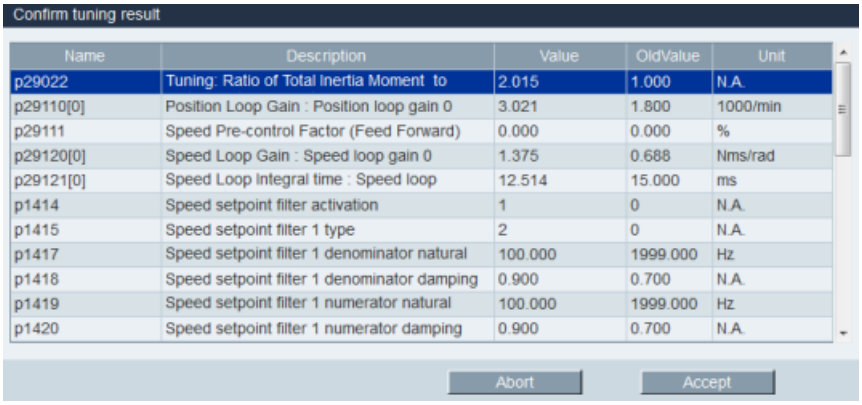
Parameter p29028 is available when the multi-axis interpolation function is activated (p29023.7 = 1). If the axes are used as the interpolation axes, you need to set the same pre-control time constants (p29028) for them.

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.

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.

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.

4.4.3.2 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.

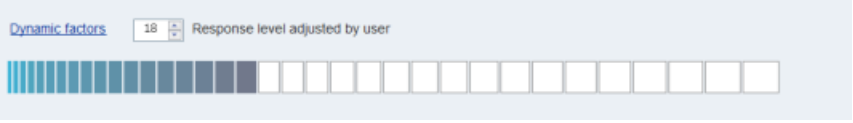
With real-time auto tuning, the servo drive can automatically estimate the ratio of load moment of inertia and set the optimum control parameters.

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.

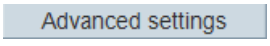
Implement the following steps to use the real-time auto tuning function:

1. Select the dynamic factor in the following area:

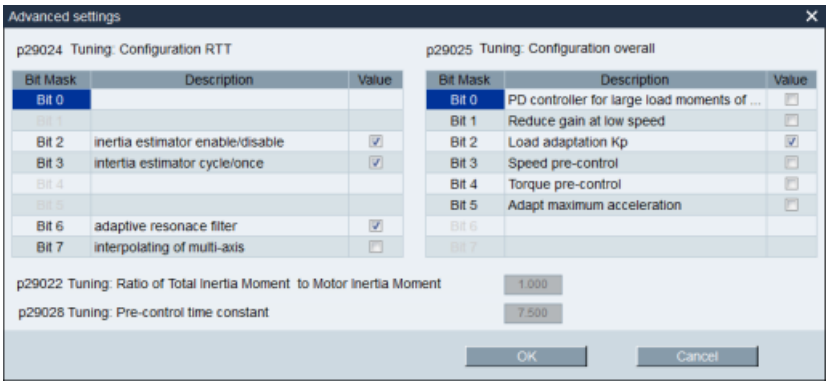


   For more information about selecting the dynamic factor, refer to chapter "Real-time auto tuning" in SINAMICS V90, SIMOTICS S-1FL6 Operating Instructions.

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:

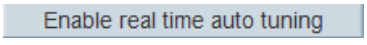
You can set the ratio of machine load moment of inertia (p29022) with the following methods:

- 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.

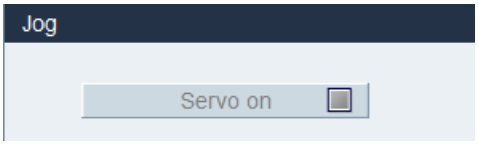
Parameter p29028 is available when the multi-axis interpolation function is activated (p29024.7 = 1). If the axes are used as the interpolation axes, you need to set the same pre-control time constants (p29028) for them.

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:

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.

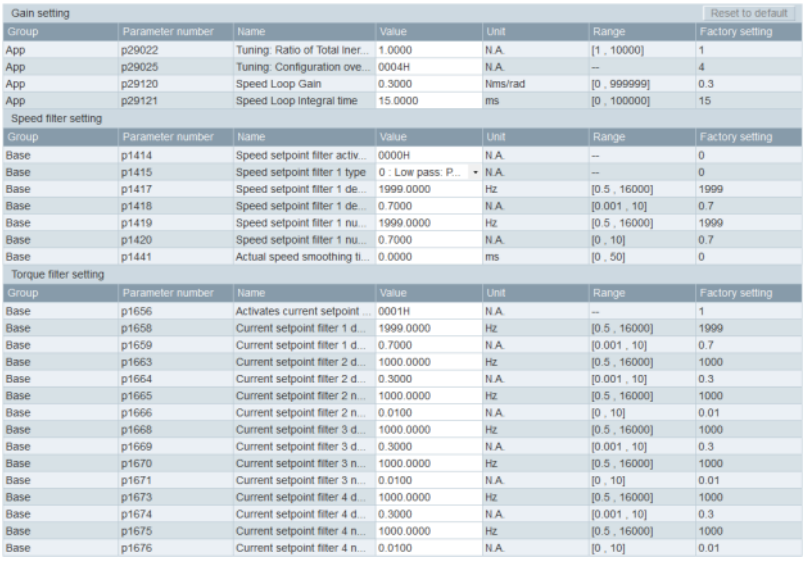
4.4.3.3 Manual tuning

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
App	p29022	Tuning: Ratio of Total Iner...	1.0000	N.A.	[1 , 10000]	1
App	p29025	Tuning: Configuration ove...	0004H	N.A.	--	4
App	p29120	Speed Loop Gain	0.3000	Nms/rad	[0 , 999999]	0.3
App	p29121	Speed Loop Integral time	15.0000	ms	[0 , 100000]	15

Speed filter setting

Group	Parameter number	Name	Value	Unit	Range	Factory setting
Base	p1414	Speed setpoint filter activ...	0000H	N.A.	--	0
Base	p1415	Speed setpoint filter 1 type	0 : Low pass: P...	N.A.	--	0
Base	p1417	Speed setpoint filter 1 de...	1999.0000	Hz	[0.5 , 16000]	1999
Base	p1418	Speed setpoint filter 1 de...	0.7000	N.A.	[0.001 , 10]	0.7
Base	p1419	Speed setpoint filter 1 nu...	1999.0000	Hz	[0.5 , 16000]	1999
Base	p1420	Speed setpoint filter 1 nu...	0.7000	N.A.	[0 , 10]	0.7
Base	p1441	Actual speed smoothing ti...	0.0000	ms	[0 , 50]	0

Torque filter setting

Group	Parameter number	Name	Value	Unit	Range	Factory setting
Base	p1656	Activates current setpoint ...	0001H	N.A.	--	1
Base	p1658	Current setpoint filter 1 d...	1999.0000	Hz	[0.5 , 16000]	1999
Base	p1659	Current setpoint filter 1 d...	0.7000	N.A.	[0.001 , 10]	0.7
Base	p1663	Current setpoint filter 2 d...	1000.0000	Hz	[0.5 , 16000]	1000
Base	p1664	Current setpoint filter 2 d...	0.3000	N.A.	[0.001 , 10]	0.3
Base	p1665	Current setpoint filter 2 n...	1000.0000	Hz	[0.5 , 16000]	1000
Base	p1666	Current setpoint filter 2 n...	0.0100	N.A.	[0 , 10]	0.01
Base	p1668	Current setpoint filter 3 d...	1000.0000	Hz	[0.5 , 16000]	1000
Base	p1669	Current setpoint filter 3 d...	0.3000	N.A.	[0.001 , 10]	0.3
Base	p1670	Current setpoint filter 3 n...	1000.0000	Hz	[0.5 , 16000]	1000
Base	p1671	Current setpoint filter 3 n...	0.0100	N.A.	[0 , 10]	0.01
Base	p1673	Current setpoint filter 4 d...	1000.0000	Hz	[0.5 , 16000]	1000
Base	p1674	Current setpoint filter 4 d...	0.3000	N.A.	[0.001 , 10]	0.3
Base	p1675	Current setpoint filter 4 n...	1000.0000	Hz	[0.5 , 16000]	1000
Base	p1676	Current setpoint filter 4 n...	0.0100	N.A.	[0 , 10]	0.01

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
- p29120
- p29121

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:

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.

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

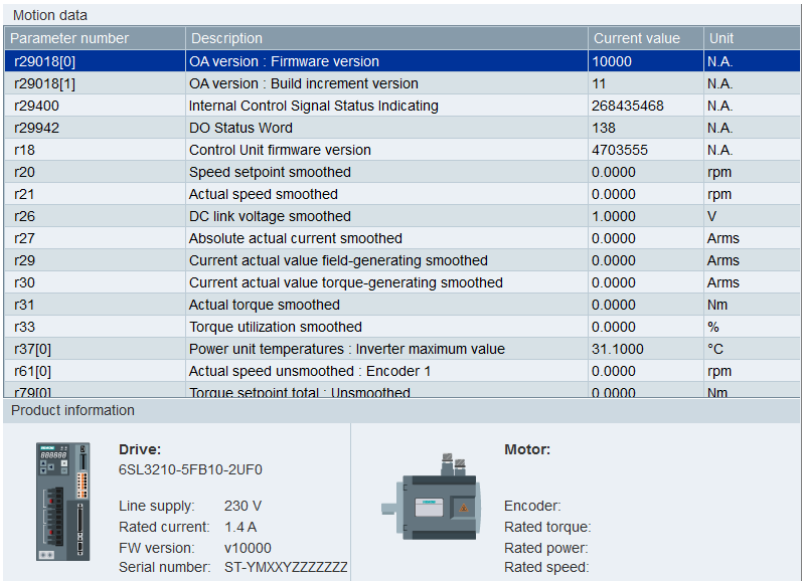
4.5 Diagnostics

4.5.1 Monitoring status

Note

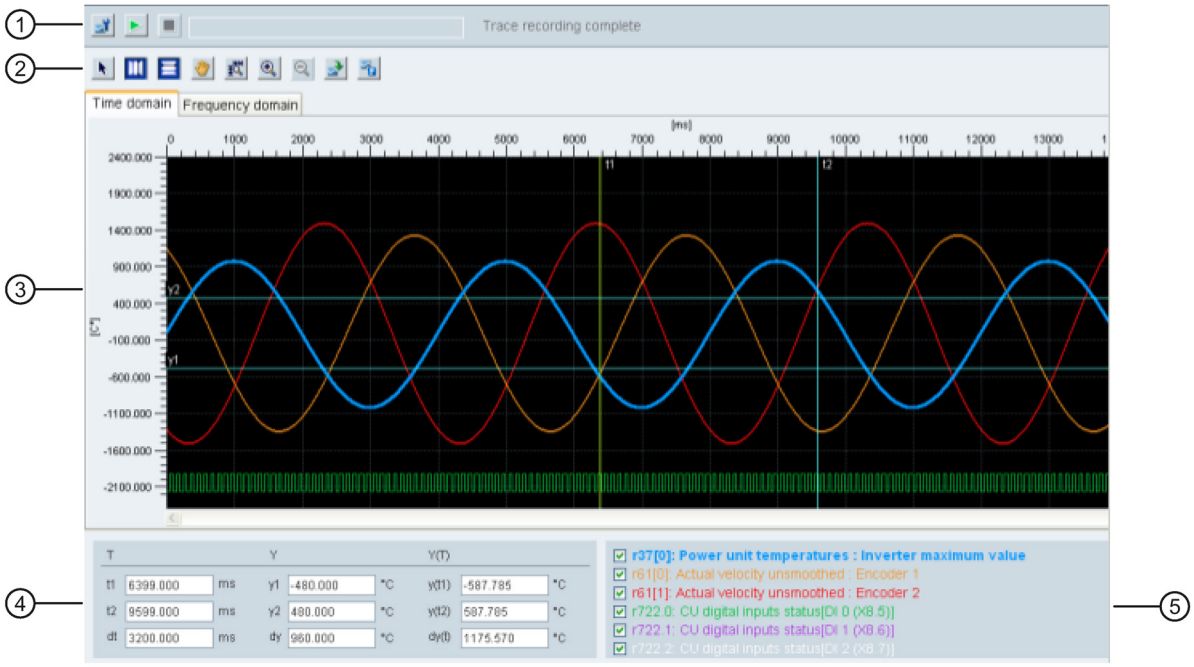
This function can **only** work in online mode.

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



4.5.2 Tracing signals

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

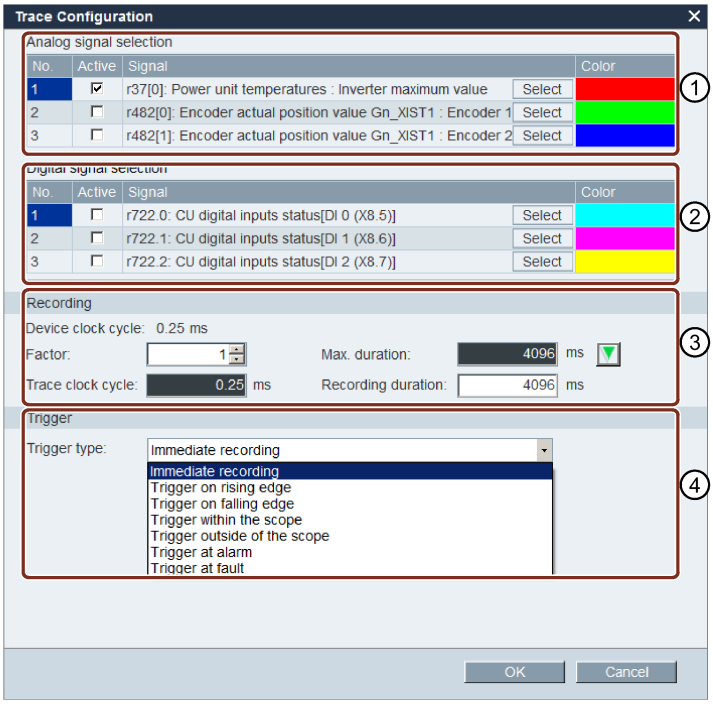


Area	Item		Description
①	Trace configuration		Opens the window of trace configuration. For more information, refer to "Trace configuration (Page 68)".
	Start/stop trace (**Only** available in online mode)		Starts recording the current trace. If you desire to stop the trace process, click the following 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 in the following file formats: • .trc: trace curve files • .png: bode diagrams, time domain charts or frequency domain charts
	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.

4.5.2.1 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. If you desire to set the recording duration to the maximum duration, you can click ▼ to copy the value.

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.

4.5.3 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.

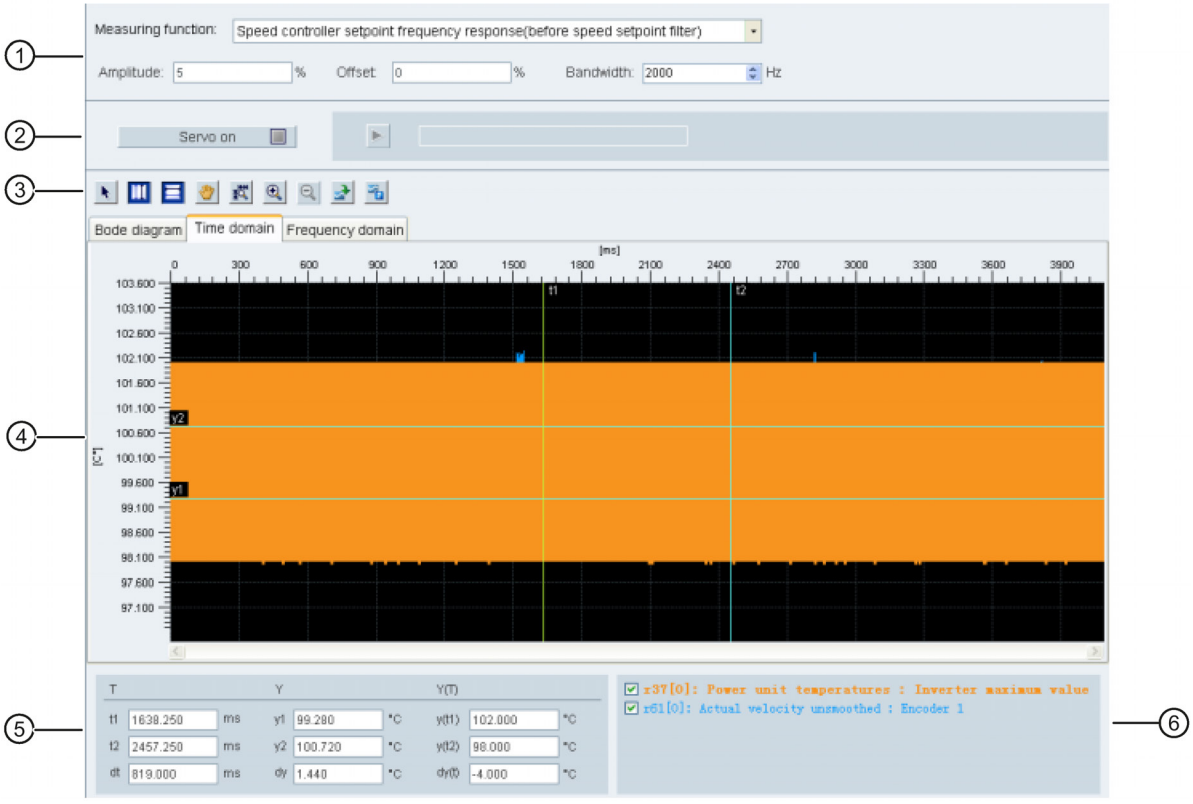
- Current controller setpoint frequency response(after current setpoint filter)

  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.

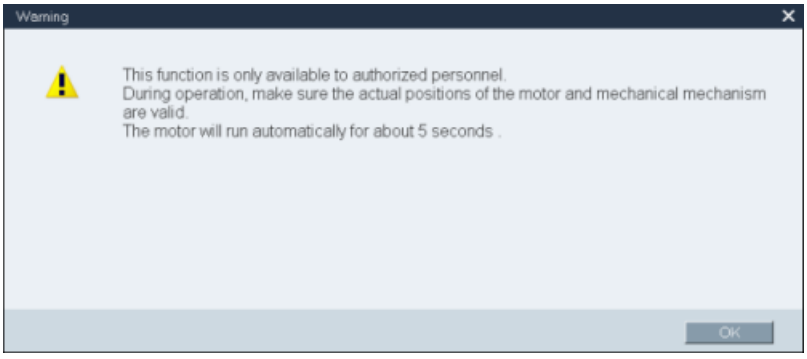
Note

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 in the following file formats: • .trc: trace curve files • .png: time domain charts or frequency domain charts

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.

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