SIEMENS

SINAMICS

SINAMICS V90
SINAMICS V-ASSISTANT Online Help

Operating Manual

Preface

Fundamental safety instructions 1

SINAMICS V-ASSISTANT 2

User interface 3

Task navigation 4

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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:

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

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Disclaimer of Liability

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

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Preface

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Table of contents

Preface **3**

1 Fundamental safety instructions **9**

1.1 General safety instructions 9

1.2 Warranty and liability for application examples 9

1.3 Industrial security 10

2 SINAMICS V-ASSISTANT **11**

2.1 Overview 11

2.2 Device combination 12

2.2.1 Device combination of SINAMICS V90 PN and SIMOTICS S-1FL6 12

2.2.2 Device combination of SINAMICS V90 PTI and SIMOTICS S-1FL6 15

3 User interface **19**

3.1 Working modes 19

3.2 User interface - overview 24

3.3 Menu bar 26

3.3.1 Menu bar - overview 26

3.3.2 Project menu 26

3.3.2.1 Project -> New project 26

3.3.2.2 Project -> Open project 27

3.3.2.3 Project -> Save project 28

3.3.2.4 Project -> Save project as 29

3.3.2.5 Project -> Print 29

3.3.2.6 Project -> Language 30

3.3.2.7 Project -> Exit 30

3.3.3 Edit menu 30

3.3.3.1 Edit -> Cut 30

3.3.3.2 Edit -> Copy 31

3.3.3.3 Edit -> Paste 31

3.3.4 Switch menu 31

3.3.4.1 Switch -> Go offline 31

3.3.4.2 Switch -> Go online 32

3.3.5 Tools menu 32

3.3.5.1 Tools -> Save parameters to ROM 32

3.3.5.2 Tools -> Restart drive 33

3.3.5.3 Tools -> Reset absolute encoder 33

3.3.5.4 Tools -> Factory default 34

3.3.5.5 Tools -> Upload parameters 36

3.3.6 Help menu 36

3.3.6.1 Help -> View help 36

3.3.6.2 Help -> About SINAMICS V-ASSISTANT 37

3.4 Toolbar 37

3.5 Alarm window ... 38
3.6 Function keys and shortcuts ... 39
4 Task navigation ... 41
4.1 Selecting drive ... 43
4.1.1 Selecting drive ... 44
4.1.2 Selecting motor ... 46
4.1.3 Control mode ... 47
4.1.4 Jog ... 49
4.2 Setting PROFINET (V90 PN only) ... 50
4.2.1 Selecting telegram ... 50
4.2.2 Configuring network ... 53
4.3 Parameterizing ... 54
4.3.1 Setting electronic gear ratio (V90 PTI only) ... 56
4.3.1.1 Overview ... 56
4.3.1.2 Mechanical structure ... 57
4.3.2 Setting mechanism ... 59
4.3.3 Setting parameter setpoint ... 59
4.3.3.1 Position setpoint ... 60
4.3.3.2 Speed setpoint ... 69
4.3.3.3 Torque setpoint ... 71
4.3.4 Configuring ramp function (V90 PN only) ... 72
4.3.5 Setting limits ... 74
4.3.5.1 Torque limit ... 74
4.3.5.2 Speed limit ... 76
4.3.6 Configuring inputs/outputs ... 78
4.3.6.1 Assigning digital inputs ... 78
4.3.6.2 Assigning digital outputs ... 79
4.3.6.3 Assigning analog outputs (V90 PTI only) ... 80
4.3.7 Configuring referencing ... 81
4.3.7.1 Setting referencing ... 81
4.3.7.2 Setting software position limit ... 86
4.3.8 Setting encoder pulse output (V90 PTI only) ... 88
4.3.9 Backlash compensation ... 88
4.3.10 Viewing all parameters ... 90
4.4 Commissioning ... 93
4.4.1 Testing interface ... 93
4.4.1.1 I/O simulation ... 93
4.4.1.2 Digital inputs/outputs (DIs/Dos) ... 97
4.4.1.3 Analog inputs (AIs) ... 108
4.4.1.4 Analog outputs (AOs) ... 109
4.4.1.5 Pulse train inputs (PTIs) ... 109
4.4.1.6 Pulse train encoder outputs (PTOs) ... 110
4.4.2 Testing motor ... 110
4.4.2.1 Jog ... 110
4.4.2.2 Position trial run (V90 PTI only) ... 111
4.4.3 Optimizing drive ... 112
4.4.3.1 One-button auto tuning ... 113
4.4.3.2 Real-time auto tuning ... 117
4.4.3.3 Manual tuning ... 120

4.4.3.4 Low frequency vibration suppression 123
4.5 Diagnostics 125
4.5.1 Monitoring status 125
4.5.2 Tracing signals 126
4.5.2.1 Trace configuration 129
4.5.3 Measuring machine 130
4.6 Communicating with the PLC (V90 PTI only) 135
4.6.1 USS communication 135
4.6.2 Modbus communication 137
4.6.2.1 Cyclic communication 143
4.6.2.2 Acyclic communication 150
Index 159

Fundamental safety instructions 1

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

Malfunctions of the machine as a result of incorrect or changed parameter settings

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

- Protect the parameterization (parameter assignments) against unauthorized access.
- Handle possible malfunctions by taking suitable measures, e.g. emergency stop or emergency off.

1.2 Warranty and liability for application examples

The application examples are not binding and do not claim to be complete regarding configuration, equipment or any eventuality which may arise. The application examples do not represent specific customer solutions, but are only intended to provide support for typical tasks. You are responsible for the proper operation of the described products. These application examples do not relieve you of your responsibility for safe handling when using, installing, operating and maintaining the equipment.

1.3 Industrial security

Note

Industrial security

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens products and solutions only represent one component of such a concept.

The customer is responsible for preventing unauthorized access to its plants, systems, machines and networks. Systems, machines and components should only be connected to the enterprise network or the internet if and to the extent necessary and with appropriate security measures (e.g. use of firewalls and network segmentation) in place.

Additionally, Siemens' guidance on appropriate security measures should be taken into account. For more information about industrial security, please visit:

Industrial security (http://www.siemens.com/industrialsecurity).

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends to apply product updates as soon as available and to always use the latest product versions. Use of product versions that are no longer supported, and failure to apply latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed at:

Industrial security (http://www.siemens.com/industrialsecurity).

⚠ WARNING

Unsafe operating states resulting from software manipulation

Software manipulations (e.g. viruses, trojans, malware or worms) can cause unsafe operating states in your system that may lead to death, serious injury, and property damage.

- Keep the software up to date.
- Incorporate the automation and drive components into a holistic, state-of-the-art industrial security concept for the installation or machine.
- Make sure that you include all installed products into the holistic industrial security concept.
- Protect files stored on exchangeable storage media from malicious software by with suitable protection measures, e.g. virus scanners.

SINAMICS V-ASSISTANT 2

2.1 Overview



SINAMICS V90

The SINAMICS V-ASSISTANT engineering tool is designed for faster commissioning and diagnostics for the following SINAMICS V90 drive variants:

- SINAMICS V90 drives with the PROFINET interface (referred to as SINAMICS V90 PN)
- SINAMICS V90 drives with the pulse train, USS/Modbus interface (referred to as SINAMICS V90 PTI)

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 via a USB cable. It can be used to modify parameters and monitor status of SINAMICS V90 drives.

Note

To ensure the stability of online commissioning, Siemens recommends that you use a shielded USB cable of no longer than 3 m with ferrite cores on both ends.

Note

The minimum screen resolution must be 1024 × 768.

2.2 Device combination

2.2.1 Device combination of SINAMICS V90 PN and SIMOTICS S-1FL6

V90 PN 200 V servo system

SIMOTICS S-1FL6 low inertia servo motors							SINAMICS V90 PN 200 V servo drives		MOTION-CONNECT 300 pre-assembled cables			
									Power cable	Brake cable	Encoder cable	
Rated torque (Nm)	Rated power (kW)	Rated speed (rpm)	Shaft height (mm)	Article No. 1FL60			Article No. 6SL3210-5	Frame size	Article No. 6FX3002-5	Article No. 6FX3002-5	Article No. 6FX3002-2	
0.16	0.05	3000	20	22-2AF21-1	❑	❑ 1	FB10-1UF0	FSA	CK01-1AD0 (3 m)	BK02-1AD0 (3 m)	❑❑	20-1AD0 (3 m)
0.32	0.1	3000		24-2AF21-1	❑	❑ 1			CK01-1AF0 (5 m)	BK02-1AF0 (5 m)		20-1AF0 (5 m)
0.64	0.2	3000	30	32-2AF21-1	❑	❑ 1	FB10-2UF0		CK01-1BA0 (10 m)	BK02-1BA0 (10 m)		20-1BA0 (10 m)
1.27	0.4	3000		34-2AF21-1	❑	❑ 1	FB10-4UF1	FSB	CK01-1CA0 (20 m)	BK02-1CA0 (20 m)		20-1CA0 (20 m)
2.39	0.75	3000	40	42-2AF21-1	❑	❑ 1	FB10-8UF0	FSC				
3.18	1	3000		44-2AF21-1	❑	❑ 1	FB11-0UF1	FSD				
4.78	1.5	3000	50	52-2AF21-0	❑	❑ 1	FB11-5UF0		CK31-1AD0 (3 m)	BL02-1AD0 (3 m)	❑❑	10-1AD0 (3 m)
6.37	2	3000		54-2AF21-0	❑	❑ 1	FB12-0UF0		CK31-1AF0 (5 m)	BL02-1AF0 (5 m)		10-1AF0 (5 m)
									CK31-1BA0 (10 m)	BL02-1BA0 (10 m)		10-1BA0 (10 m)
									CK31-1CA0 (20 m)	BL02-1CA0 (20 m)		10-1CA0 (20 m)
Incremental encoder TTL 2500 ppr					A				Incremental encoder TTL 2500 ppr		CT	
Absolute encoder single-turn 21-bit					M				Absolute encoder single-turn 21-bit		DB	

V90 PN 400 V servo system

SIMOTICS S-1FL6 high inertia servo motors with straight connectors							SINAMICS V90 PN 400 V servo drives		MOTION-CONNECT 300 pre-assembled cables			
									Power cable	Brake cable	Encoder cable	
Rated torque (Nm)	Rated power (kW)	Rated speed (rpm)	Shaft height (mm)	Article No. 1FL60			Article No. 6SL3210-5	Frame size	Article No. 6FX3002-5	Article No. 6FX3002-5	Article No. 6FX3002-2	
1.27	0.4	3000	45	42-1AF61-0	❑	❑1	FE10-4UF0	FSAA	CL01-1AD0 (3 m)	BL02-1AD0 (3 m)	❑❑	10-1AD0 (3 m)
2.39	0.75	3000		44-1AF61-0	❑	❑1	FE10-8UF0	FSA	CL01-1AF0 (5 m)	BL02-1AF0 (5 m)		10-1AF0 (5 m)
3.58	0.75	2000	65	61-1AC61-0	❑	❑1	FE11-0UF0		CL01-1AH0 (7 m)	BL02-1AH0 (7 m)		10-1AH0 (7 m)
4.78	1.0	2000		62-1AC61-0	❑	❑1			CL01-1BA0 (10 m)	BL02-1BA0 (10 m)		10-1BA0 (10 m)
									CL01-1BF0 (15 m)	BL02-1BF0 (15 m)		10-1BF0 (15 m)
									CL01-1CA0 (20 m)	BL02-1CA0 (20 m)		10-1CA0 (20 m)
7.16	1.5	2000		64-1AC61-0	❑	❑1	FE11-5UF0	FSB	CL11-1AD0 (3 m)			
8.36	1.75	2000		66-1AC61-0	❑	❑1			CL11-1AF0 (5 m)			
9.55	2.0	2000		67-1AC61-0	❑	❑1	FE12-0UF0		CL11-1AH0 (7 m)			
11.9	2.5	2000	90	90-1AC61-0	❑	❑1			CL11-1BA0 (10 m)			
16.7	3.5	2000		92-1AC61-0	❑	❑1	FE13-5UF0	FSC	CL11-1BF0 (15 m)			
23.9	5.0	2000		94-1AC61-0	❑	❑1	FE15-0UF0		CL11-1CA0 (20 m)			
33.4	7.0	2000		96-1AC61-0	❑	❑1	FE17-0UF0					
Incremental encoder TTL 2500 ppr					A				Incremental encoder TTL 2500 ppr		CT	
Absolute encoder 20-bit + 12-bit multi-turn					L				Absolute encoder 20-bit + 12-bit multi-turn		DB	

SIMOTICS S-1FL6 high inertia servo motors with angular connectors							SINAMICS V90 PN 400 V servo drives		MOTION-CONNECT 300 pre-assembled cables			
									Power cable	Brake cable	Encoder cable	
Rated torque (Nm)	Rated power (kW)	Rated speed (rpm)	Shaft height (mm)	Article No. 1FL60			Article No. 6SL3210-5	Frame size	Article No. 6FX3002-5	Article No. 6FX3002-5	Article No. 6FX3002-2	
1.27	0.4	3000	45	42-1AF61-2	❑	❑ 1	FE10-4UF0	FSAA	CL02-1AD0 (3 m)	BL03-1AD0 (3 m)	❑❑❑ ❑	-1AD0 (3 m)
2.39	0.75	3000		44-1AF61-2	❑	❑ 1	FE10-8UF0	FSA	CL02-1AF0 (5 m)	BL03-1AF0 (5 m)		-1AF0 (5 m)
3.58	0.75	2000	65	61-1AC61-2	❑	❑ 1	FE11-0UF0		CL02-1AH0 (7 m)	BL03-1AH0 (7 m)		-1AH0 (7 m)
4.78	1.0	2000		62-1AC61-2	❑	❑ 1			CL02-1BA0 (10 m)	BL03-1BA0 (10 m)		-1BA0 (10 m)
									CL02-1BF0 (15 m)	BL03-1BF0 (15 m)		-1BF0 (15 m)
									CL02-1CA0 (20 m)	BL03-1CA0 (20 m)		-1CA0 (20 m)
7.16	1.5	2000		64-1AC61-2	❑	❑ 1	FE11-5UF0	FSB	CL12-1AD0 (3 m)			
8.36	1.75	2000		66-1AC61-2	❑	❑ 1			CL12-1AF0 (5 m)			
9.55	2.0	2000		67-1AC61-2	❑	❑ 1	FE12-0UF0		CL12-1AH0 (7 m)			
11.9	2.5	2000	90	90-1AC61-2	❑	❑ 1			CL12-1BA0 (10 m)			
16.7	3.5	2000		92-1AC61-2	❑	❑ 1	FE13-5UF0	FSC	CL12-1BF0 (15 m)			
23.9	5.0	2000		94-1AC61-2	❑	❑ 1	FE15-0UF0		CL12-1CA0 (20 m)			
33.4	7.0	2000		96-1AC61-2	❑	❑ 1	FE17-0UF0					
Incremental encoder TTL 2500 ppr					A				Incremental encoder TTL 2500 ppr		CT12	
Absolute encoder 20-bit + 12-bit multi-turn					L				Absolute encoder 20-bit + 12-bit multi-turn		DB10	

Note

You can select a SINAMICS V90 PN servo drive for all the SIMOTICS S-1FL6 servo motors whose rated power values are equal to or smaller than that specified as matching with this servo drive in the table above.

2.2.2 Device combination of SINAMICS V90 PTI and SIMOTICS S-1FL6

V90 200 V servo system

SIMOTICS S-1FL6 low inertia servo motors							SINAMICS V90 200 V servo drives		MOTION-CONNECT 300 pre-assembled cables			
									Power cable	Brake cable	Encoder cable	
Rated torque (Nm)	Rated power (kW)	Rated speed (rpm)	Shaft height (mm)	Article No. 1FL60			Article No. 6SL3210-5	Frame size	Article No. 6FX3002-5	Article No. 6FX3002-5	Article No. 6FX3002-2	
0.16	0.05	3000	20	22-2AF21-1	❑	❑1	FB10-1UA0	FSA	CK01-1AD0 (3 m)	BK02-1AD0 (3 m)	❑❑	20-1AD0 (3 m)
0.32	0.1	3000		24-2AF21-1	❑	❑1			CK01-1AF0 (5 m)	BK02-1AF0 (5 m)		20-1AF0 (5 m)
0.64	0.2	3000	30	32-2AF21-1	❑	❑1	FB10-2UA0		CK01-1BA0 (10 m)	BK02-1BA0 (10 m)		20-1BA0 (10 m)
1.27	0.4	3000		34-2AF21-1	❑	❑1	FB10-4UA1	FSB	CK01-1CA0 (20 m)	BK02-1CA0 (20 m)		20-1CA0 (20 m)
2.39	0.75	3000	40	42-2AF21-1	❑	❑1	FB10-8UA0	FSC				
3.18	1	3000		44-2AF21-1	❑	❑1	FB11-0UA1	FSD				
4.78	1.5	3000	50	52-2AF21-0	❑	❑1	FB11-5UA0		CK31-1AD0 (3 m)	BL02-1AD0 (3 m)	❑❑	10-1AD0 (3 m)
6.37	2	3000		54-2AF21-0	❑	❑1	FB12-0UA0		CK31-1AF0 (5 m)	BL02-1AF0 (5 m)		10-1AF0 (5 m)
									CK31-1BA0 (10 m)	BL02-1BA0 (10 m)		10-1BA0 (10 m)
									CK31-1CA0 (20 m)	BL02-1CA0 (20 m)		10-1CA0 (20 m)
Incremental encoder TTL 2500 ppr					A				Incremental encoder TTL 2500 ppr		CT	
Absolute encoder single-turn 21-bit					M				Absolute encoder single-turn 21-bit		DB	

V90 400 V servo system

SIMOTICS S-1FL6 high inertia servo motors with straight connectors							SINAMICS V90 400 V servo drives		MOTION-CONNECT 300 pre-assembled cables			
									Power cable	Brake cable	Encoder cable	
Rated torque (Nm)	Rated power (kW)	Rated speed (rpm)	Shaft height (mm)	Article No. 1FL60			Article No. 6SL3210-5	Frame size	Article No. 6FX3002-5	Article No. 6FX3002-5	Article No. 6FX3002-2	
1.27	0.4	3000	45	42-1AF61-0	❑	❑ 1	FE10-4UA0	FSAA	CL01-1AD0 (3 m)	BL02-1AD0 (3 m)	❑❑	10-1AD0 (3 m)
2.39	0.75	3000		44-1AF61-0	❑	❑ 1	FE10-8UA0	FSA	CL01-1AF0 (5 m)	BL02-1AF0 (5 m)		10-1AF0 (5 m)
3.58	0.75	2000	65	61-1AC61-0	❑	❑ 1	FE11-0UA0		CL01-1AH0 (7 m)	BL02-1AH0 (7 m)		10-1AH0 (7 m)
4.78	1.0	2000		62-1AC61-0	❑	❑ 1			CL01-1BA0 (10 m)	BL02-1BA0 (10 m)		10-1BA0 (10 m)
									CL01-1BF0 (15 m)	BL02-1BF0 (15 m)		10-1BF0 (15 m)
									CL01-1CA0 (20 m)	BL02-1CA0 (20 m)		10-1CA0 (20 m)
7.16	1.5	2000		64-1AC61-0	❑	❑ 1	FE11-5UA0	FSB	CL11-1AD0 (3 m)			
8.36	1.75	2000		66-1AC61-0	❑	❑ 1			CL11-1AF0 (5 m)			
9.55	2.0	2000		67-1AC61-0	❑	❑ 1	FE12-0UA0		CL11-1AH0 (7 m)			
11.9	2.5	2000	90	90-1AC61-0	❑	❑ 1			CL11-1BA0 (10 m)			
16.7	3.5	2000		92-1AC61-0	❑	❑ 1	FE13-5UA0	FSC	CL11-1BF0 (15 m)			
23.9	5.0	2000		94-1AC61-0	❑	❑ 1	FE15-0UA0		CL11-1CA0 (20 m)			
33.4	7.0	2000		96-1AC61-0	❑	❑ 1	FE17-0UA0					
Incremental encoder TTL 2500 ppr					A				Incremental encoder TTL 2500 ppr		CT	
Absolute encoder 20-bit + 12-bit multi-turn					L				Absolute encoder 20-bit + 12-bit multi-turn		DB	

SIMOTICS S-1FL6 high inertia servo motors with angular connectors							SINAMICS V90 400 V servo drives		MOTION-CONNECT 300 pre-assembled cables			
									Power cable	Brake cable	Encoder cable	
Rated torque (Nm)	Rated power (kW)	Rated speed (rpm)	Shaft height (mm)	Article No. 1FL60			Article No. 6SL3210-5	Frame size	Article No. 6FX3002-5	Article No. 6FX3002-5	Article No. 6FX3002-2	
1.27	0.4	3000	45	42-1AF61-2	❑	❑ 1	FE10-4UA0	FSAA	CL02-1AD0 (3 m)	BL03-1AD0 (3 m)	❑❑❑ ❑	-1AD0 (3 m)
2.39	0.75	3000		44-1AF61-2	❑	❑ 1	FE10-8UA0	FSA	CL02-1AF0 (5 m)	BL03-1AF0 (5 m)		-1AF0 (5 m)
3.58	0.75	2000	65	61-1AC61-2	❑	❑ 1	FE11-0UA0		CL02-1AH0 (7 m)	BL03-1AH0 (7 m)		-1AH0 (7 m)
4.78	1.0	2000		62-1AC61-2	❑	❑ 1			CL02-1BA0 (10 m)	BL03-1BA0 (10 m)		-1BA0 (10 m)
									CL02-1BF0 (15 m)	BL03-1BF0 (15 m)		-1BF0 (15 m)
									CL02-1CA0 (20 m)	BL03-1CA0 (20 m)		-1CA0 (20 m)
7.16	1.5	2000		64-1AC61-2	❑	❑ 1	FE11-5UA0	FSB	CL12-1AD0 (3 m)			
8.36	1.75	2000		66-1AC61-2	❑	❑ 1			CL12-1AF0 (5 m)			
9.55	2.0	2000		67-1AC61-2	❑	❑ 1	FE12-0UA0		CL12-1AH0 (7 m)			
11.9	2.5	2000	90	90-1AC61-2	❑	❑ 1			CL12-1BA0 (10 m)			
16.7	3.5	2000		92-1AC61-2	❑	❑ 1	FE13-5UA0	FSC	CL12-1BF0 (15 m)			
23.9	5.0	2000		94-1AC61-2	❑	❑ 1	FE15-0UA0		CL12-1CA0 (20 m)			
33.4	7.0	2000		96-1AC61-2	❑	❑ 1	FE17-0UA0					
Incremental encoder TTL 2500 ppr					A				Incremental encoder TTL 2500 ppr		CT12	
Absolute encoder 20-bit + 12-bit multi-turn					L				Absolute encoder 20-bit + 12-bit multi-turn		DB10	

Note

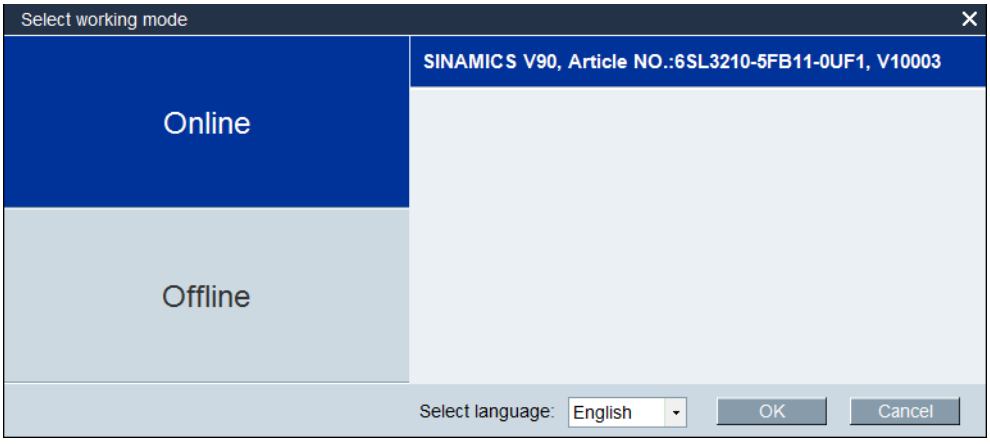
You can select a SINAMICS V90 servo drive for all the SIMOTICS S-1FL6 servo motors whose rated power values are equal to or smaller than that specified as matching with this servo drive in the table above.

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 according to the working modes.

Online mode

SINAMICS V-ASSISTANT communicates with the target drive. The drive connects to a PC by a USB cable.

If you select the online mode, a list of connected drives are displayed. Select the target drive and click the following button.

OK

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

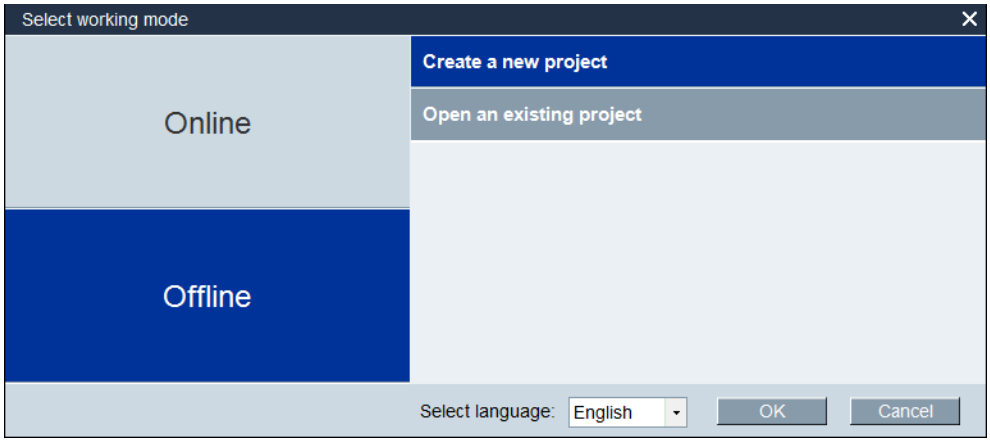
Note

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

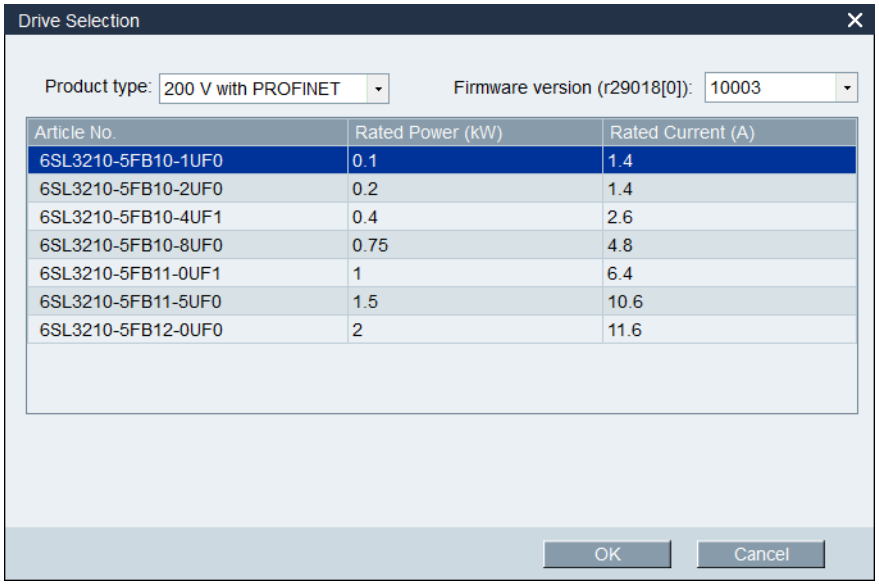
Offline mode

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

In this mode, you can choose the following options:



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

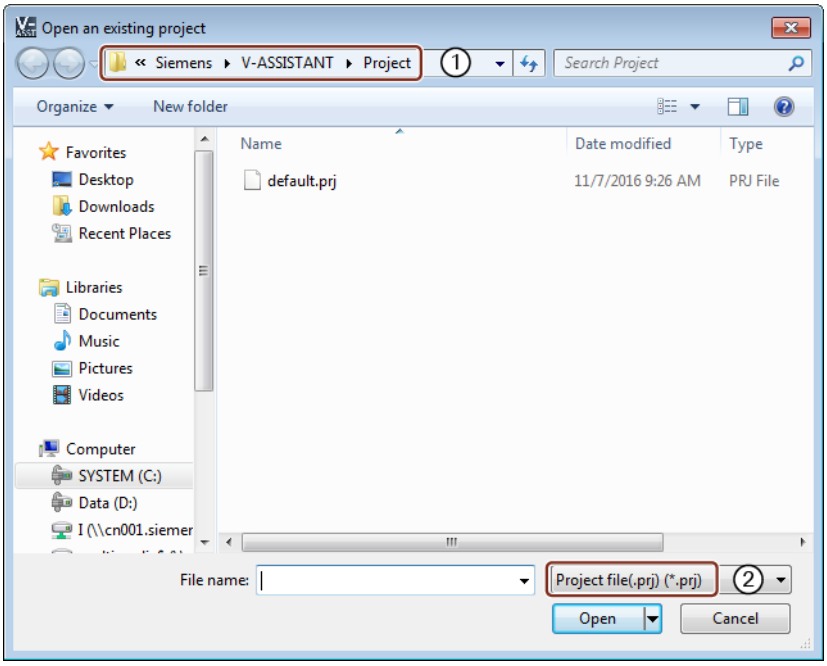


Select the product type and firmware version from the drop-down lists respectively. Then select the article number of your desired drive. Click OK to save the factory settings of the selected drive to the new project and enter the main window; otherwise, click Cancel to return to the last step.

Note

To obtain the firmware version, you can view r29108 on BOP (Basic Operator Panel). For more information, see the 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 Default location: xxx/Siemens/V-ASSISTANT/Project
xxx: SINAMICS V-ASSISTANT setup root directory

② Only .prj format is available.

Status indicators

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

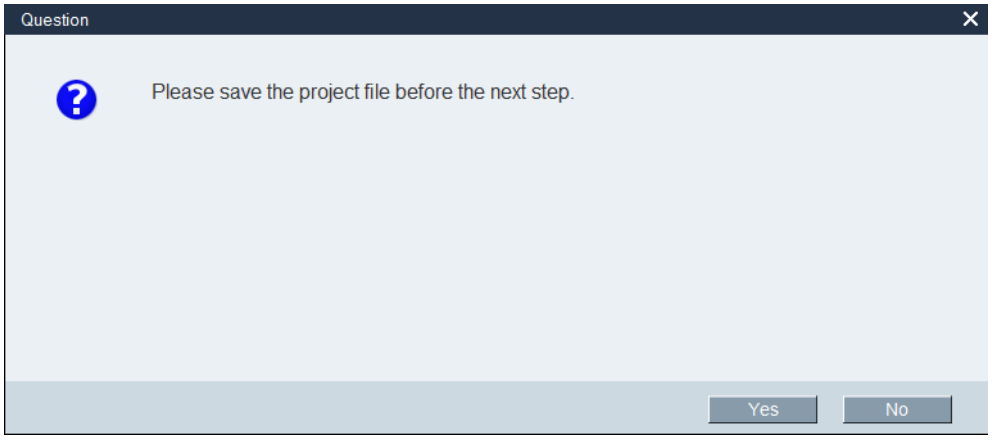
 Online

 Offline

You can switch the working mode between the two modes. For more information, see Section "Switch menu (Page 31)".

Compare parameters

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

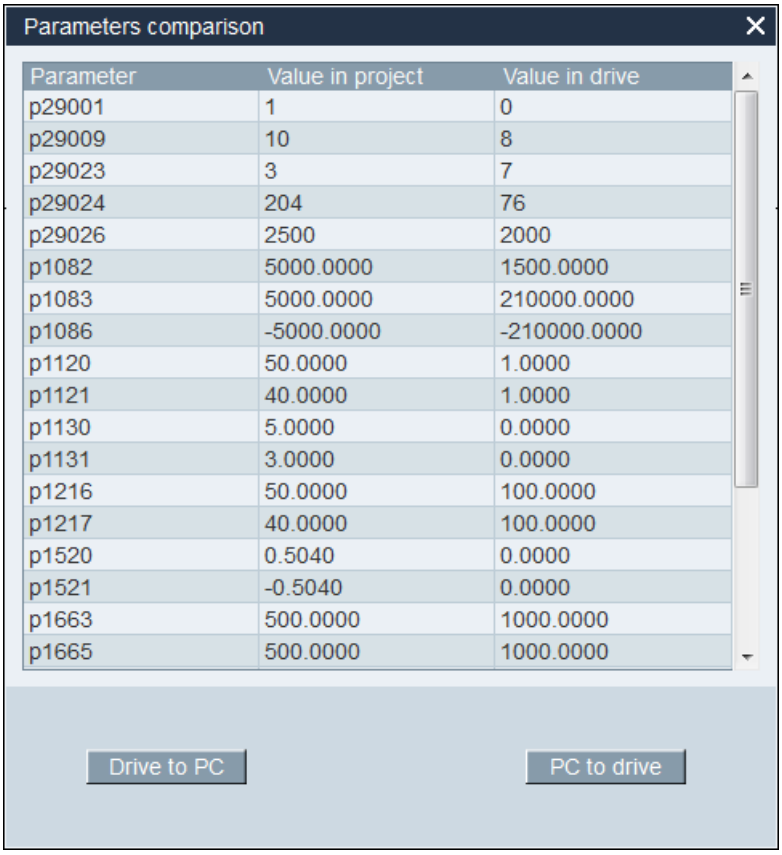


You can click Yes to save the project; otherwise, you can click No to abort saving.

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

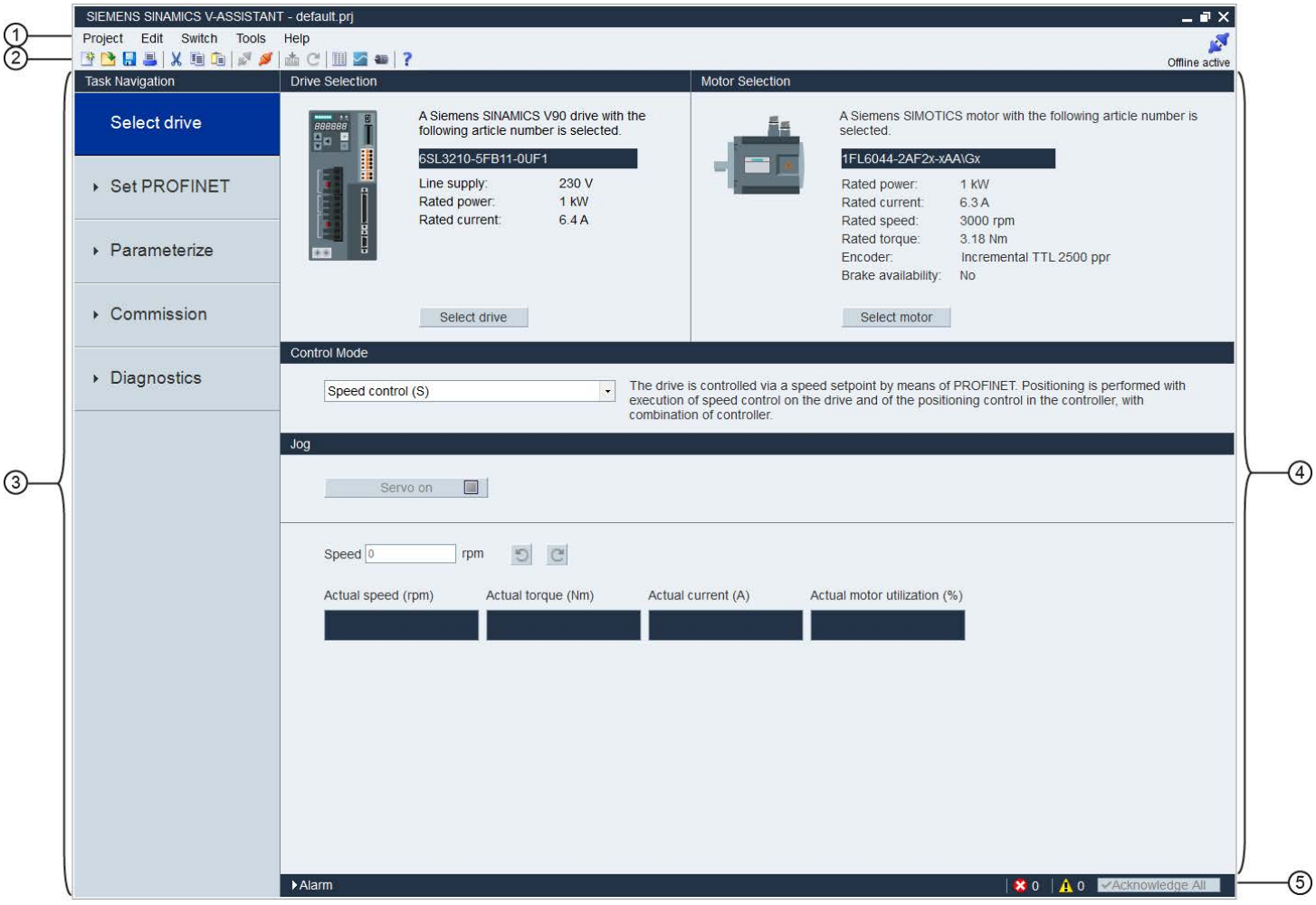


If any inconsistency is detected, the following window appears:



Click the first button to upload all parameter values of the connected drive to the current project; 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 pane
⑤ Alarm window

Note

The user interface screenshot of SINAMICS V-ASSISTANT for V90 PN is used as an example here.

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 26)".

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 37)".

Task navigation

The task navigation mask contains tasks for users to fulfill. Each task consists of various 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 41)".

Function pane

The function pane provides the user interface of each task to implement related functions.

Alarm window

In online mode, the currently active faults and alarms are displayed in a list with their types, numbers and names; in offline mode, the alarm window is disabled. For more information, see Section "Alarm window (Page 38)".

3.3 Menu bar

3.3.1 Menu bar - overview

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

- Project menu (Page 26)
- Edit menu (Page 30)
- Switch menu (Page 31)
- Tools menu (Page 32)
- Help menu (Page 36)

3.3.2 Project menu

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

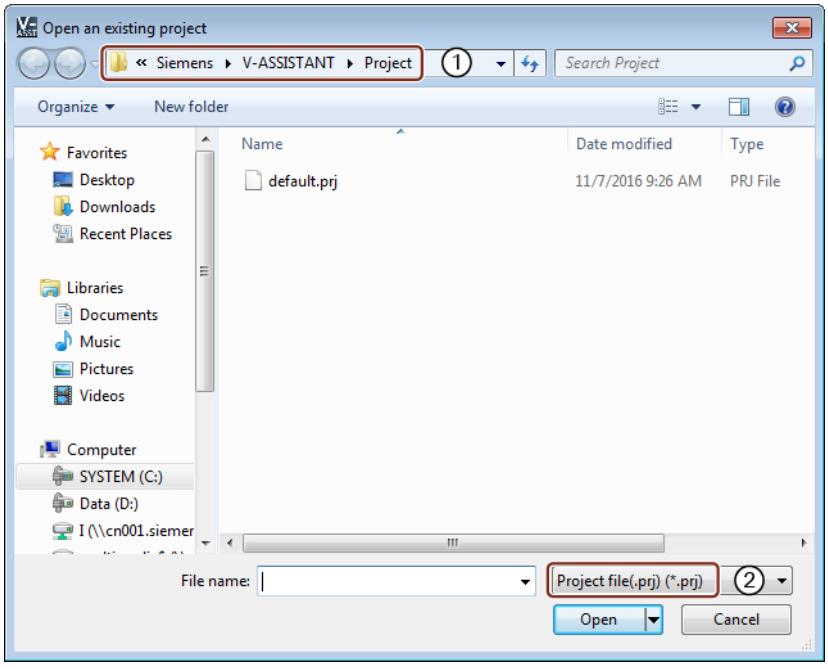
- New project (Page 26)
- Open project (Page 27)
- Save project (Page 28)
- Save project as (Page 29)
- Print (Page 29)
- Language (Page 30)
- Exit (Page 30)

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, see Section "Selecting drive (Page 44)".

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:



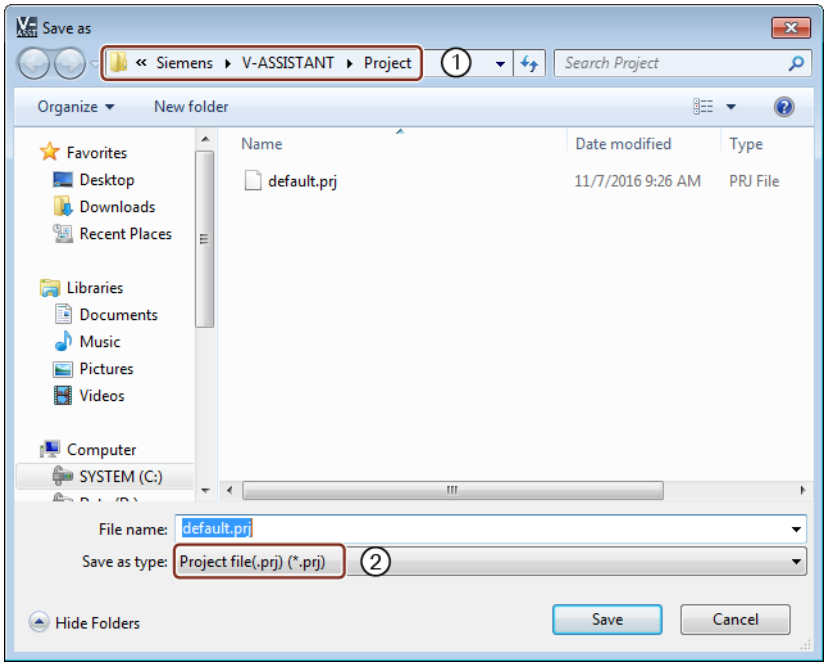
① Default location: xxx/Siemens/V-ASSISTANT/Project
xxx: SINAMICS V-ASSISTANT setup root directory

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 29)". You can specify the file name and directory in the following window:



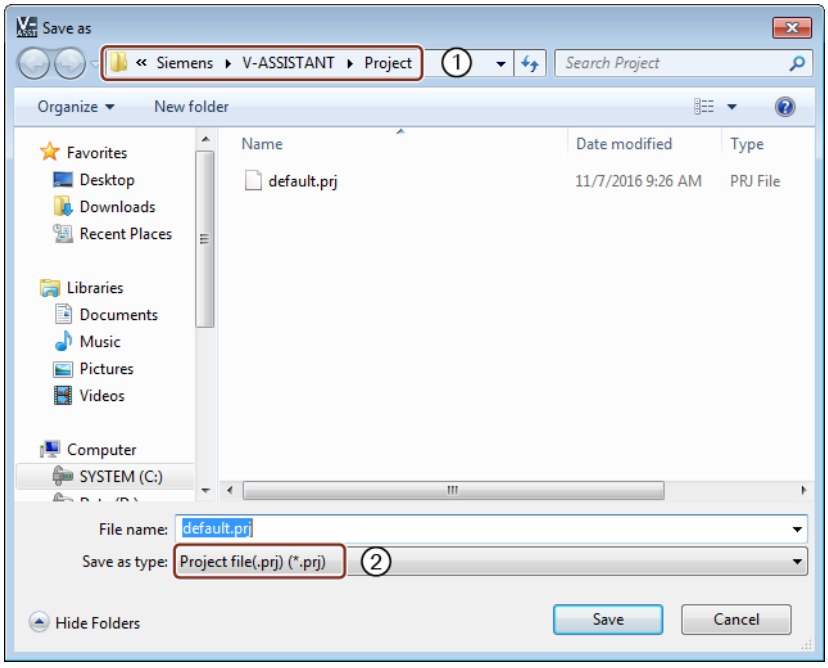
① Default location: xxx/Siemens/V-ASSISTANT/Project
xxx: SINAMICS V-ASSISTANT setup root directory

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 Default location: 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 41)".

3.3.2.6 Project -> Language

Online mode/offline mode

You can use this menu command to switch the user interface language as desired. The default languages of SINAMICS V-ASSISTANT are English and Chinese. For installation packages of additional 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 one.

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 parameter values or technical data of the motor and drive.

- Cut (Page 30)
- Copy (Page 31)
- Paste (Page 31)

3.3.3.1 Edit -> Cut

This command deletes the selected objects, for example, the parameter values from the user interface, and then 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 90)".

3.3.3.2 Edit -> Copy

The command copies the selected objects, such as parameter values, article 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 panes:

- Selecting drive (Page 44)
- Selecting motor (Page 46)
- Viewing all parameters (Page 90)
- Signal (Page 93)

3.3.3.3 Edit -> Paste

This menu command copies the clipboard content to the input field. The copied content can be inserted at 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 90).

3.3.4 Switch menu

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

-  Go offline (Page 31)
-  Go online (Page 32)

3.3.4.1 Switch -> Go offline

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

Alternatively, you can use  from the toolbar.

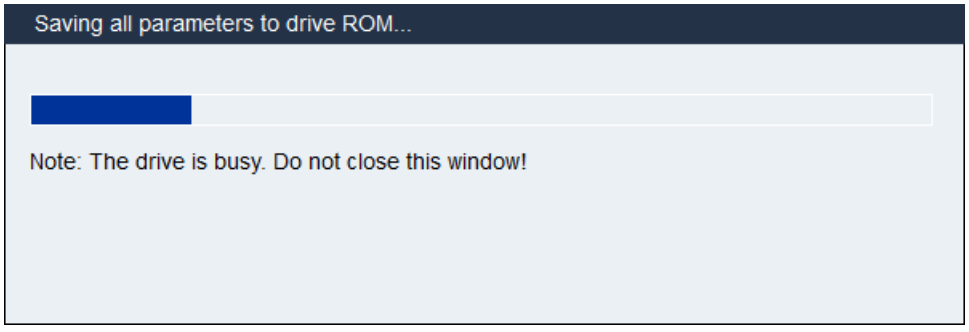
3.3.5 Tools menu

This menu contains the following menu commands:

- Tools -> Save parameters to ROM (Page 32)
- Tools -> Restart drive (Page 33)
- Tools -> Reset absolute encoder (Page 33)
- Tools -> Factory default (Page 34)
- Tools -> Upload parameters (Page 36)

3.3.5.1 Tools -> Save parameters to ROM

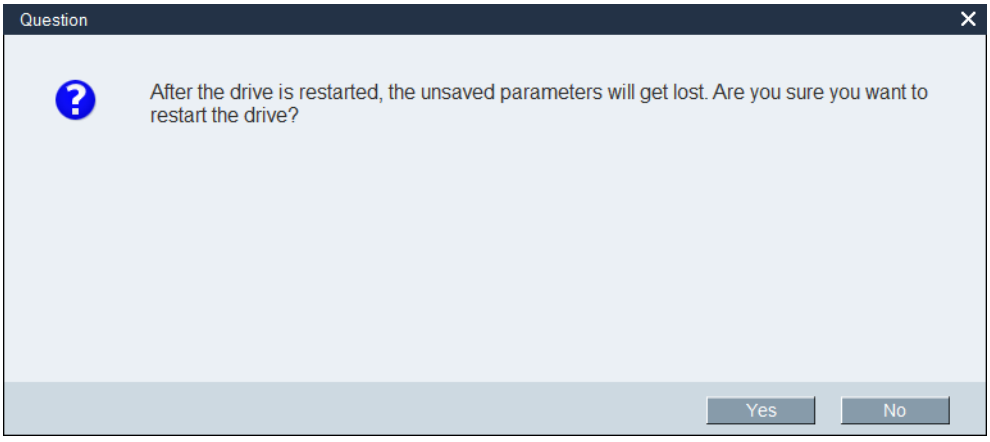
You can use this menu command to save parameters from RAM to ROM in the drive. The following window appears to display the saving process:



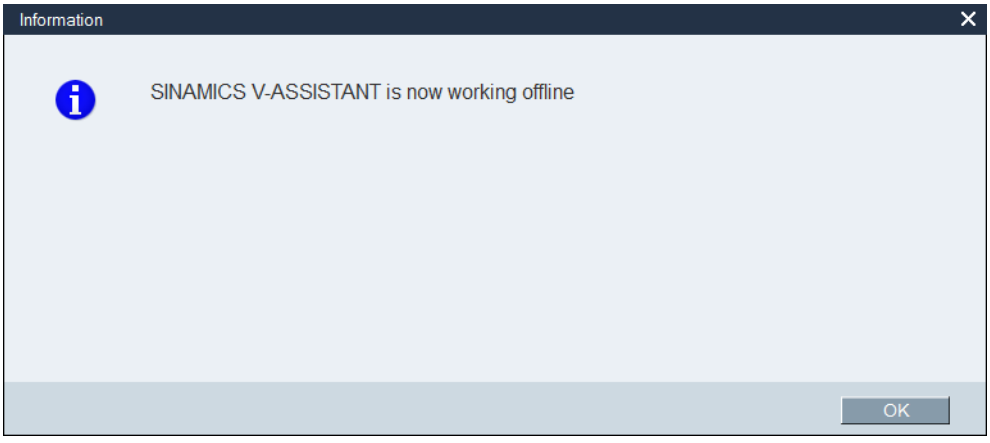
Alternatively, you can use  from the toolbar.

3.3.5.2 Tools -> Restart drive

You can use this menu command to restart the drive. After you select this menu command, the following reminder appears:



If you click Yes, then the following information window appears:



Click OK and the drive is restarted successfully.

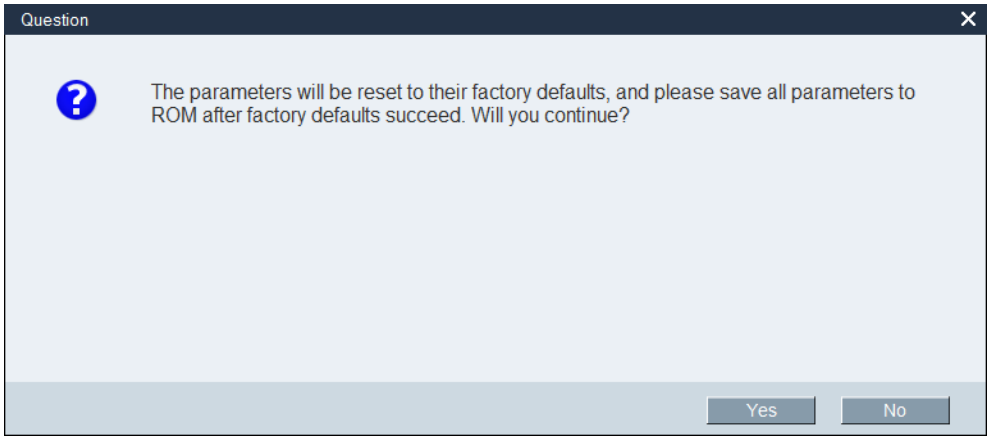
3.3.5.3 Tools -> Reset absolute encoder

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

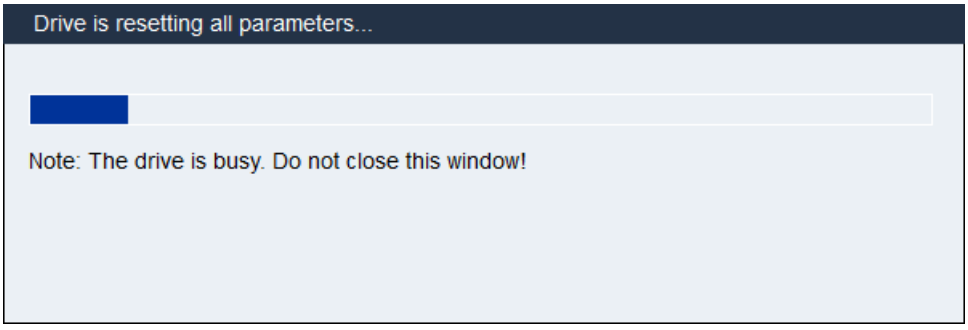
3.3.5.4 Tools -> Factory default

Online

Select this menu command and the following reminder appears:



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

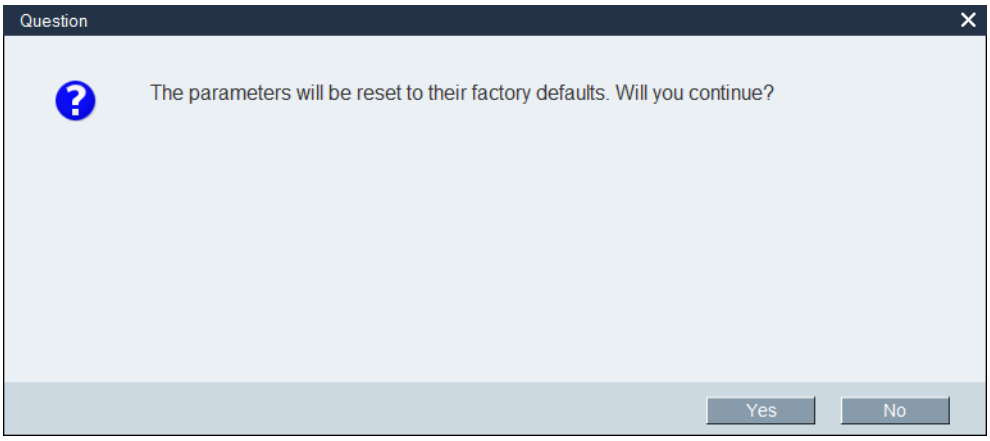


When the process completes, this window disappears automatically.

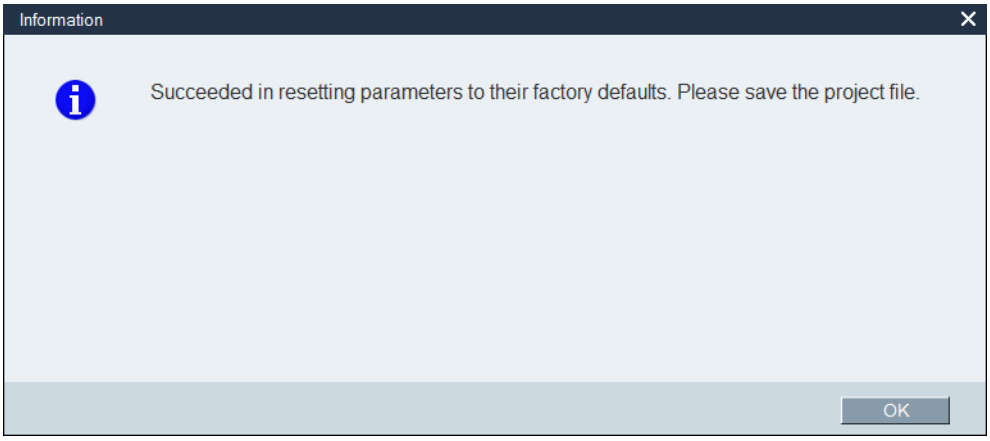
- If you click No, this operation can be aborted.

Offline

Select this menu command and the following reminder appears:



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

  Click OK to close the information window. To save the project, see Section "Project -> Save project (Page 28)".

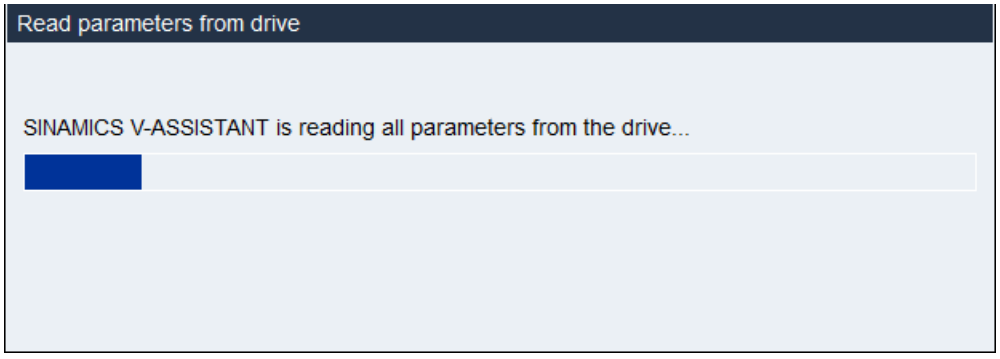
- If you click No, this operation can be aborted.

3.3.5.5 Tools -> Upload parameters

Note

This menu command is only available in online mode.

You can use this menu command to upload parameters from the drive to SINAMICS V-ASSISTANT. After you select this menu command, the following window appears to show the process:



After the process is complete, the values of the same parameters in SINAMICS V-ASSISTANT are overwritten 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 36)
- Help -> About SINAMICS V-ASSISTANT... (Page 37)

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. You can read or download the legal notices, software installation packages, and user manuals by clicking the links.



3.4 Toolbar

The icons of the toolbar provide quick access to the commands in the menu bar or functions from Task navigation (Page 41).



- New project (Page 26)
- Open project (Page 27)
- Save project (Page 28)
- Print (Page 29)
- Cut (Page 30)
- Copy (Page 31)
- Paste (Page 31)
- Go offline (Page 31)
- Go online (Page 32)
- Save parameters to ROM (Page 32)
- Upload parameters (Page 36)

Viewing all parameters (Page 90)

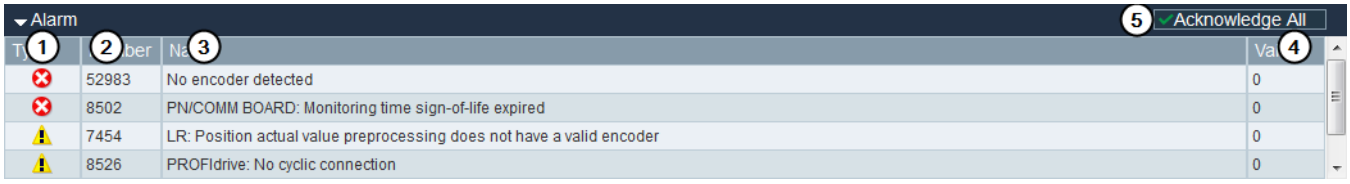
Trace (Page 126)

Test motor (Page 110)

Help (Page 36)

3.5 Alarm window

Alarm window overview



①	**Alarm type** [1] • : Fault • : Alarm	④	**Alarm value**
②	**Alarm number**	⑤	**Acknowledge All** Clears the faults in the buffer area of the drive
③	**Alarm name and description**		

[1] Faults are displayed in prior to alarms.

Note

To view the detailed information of an active fault/alarm, press F1 to call the corresponding online help.

3.6 Function keys and shortcuts

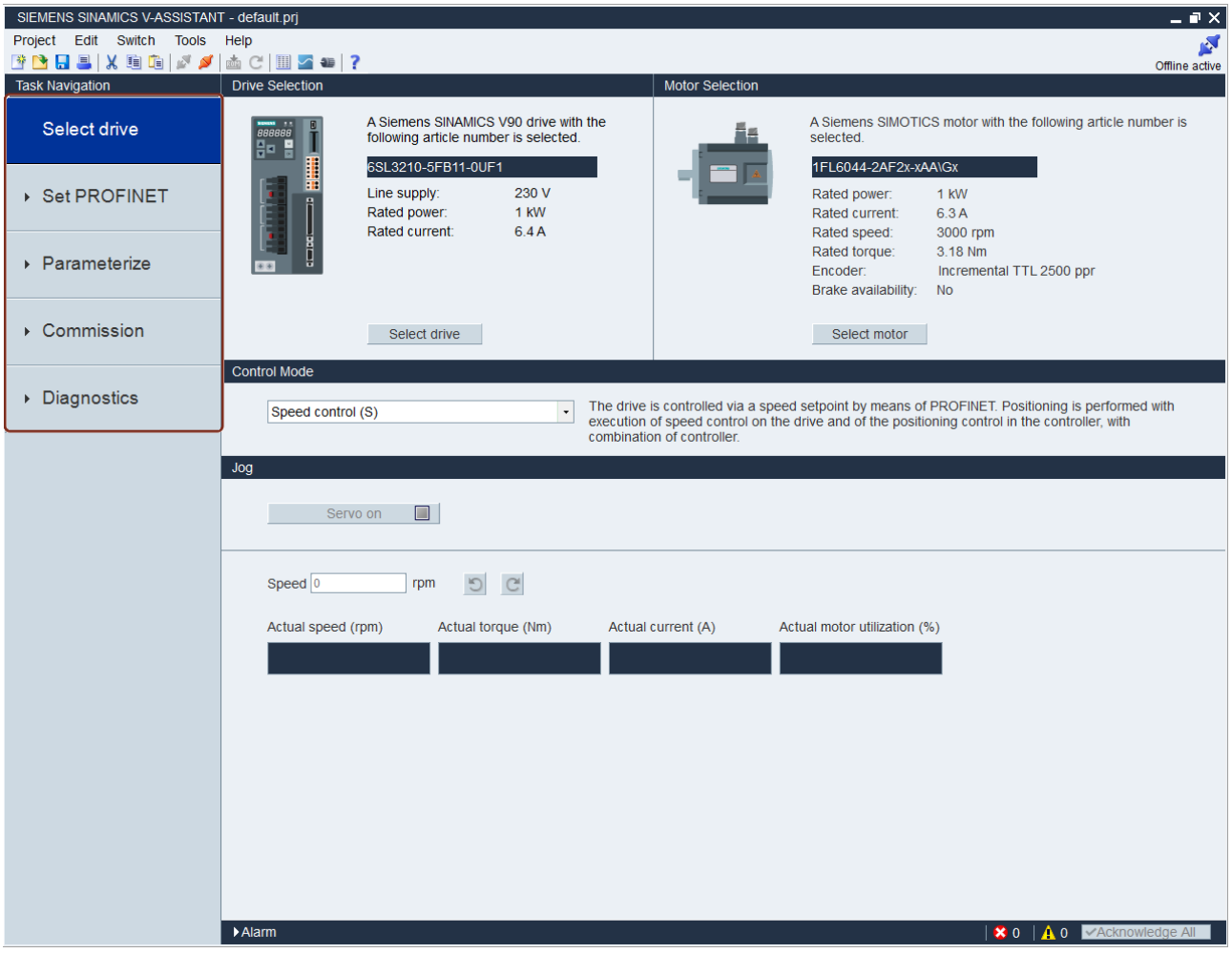
SINAMICS V-ASSISTANT provides function keys and shortcuts for frequently called functions.

Function keys in SINAMICS V-ASSISTANT

[F1]	→ Calls the context sensitive online help
[Ctrl+X]	→ Edit -> Cut (Page 30)
[Ctrl+C]	→ Edit -> Copy (Page 31)
[Ctrl+V]	→ Edit -> Paste (Page 31)

Task navigation

4

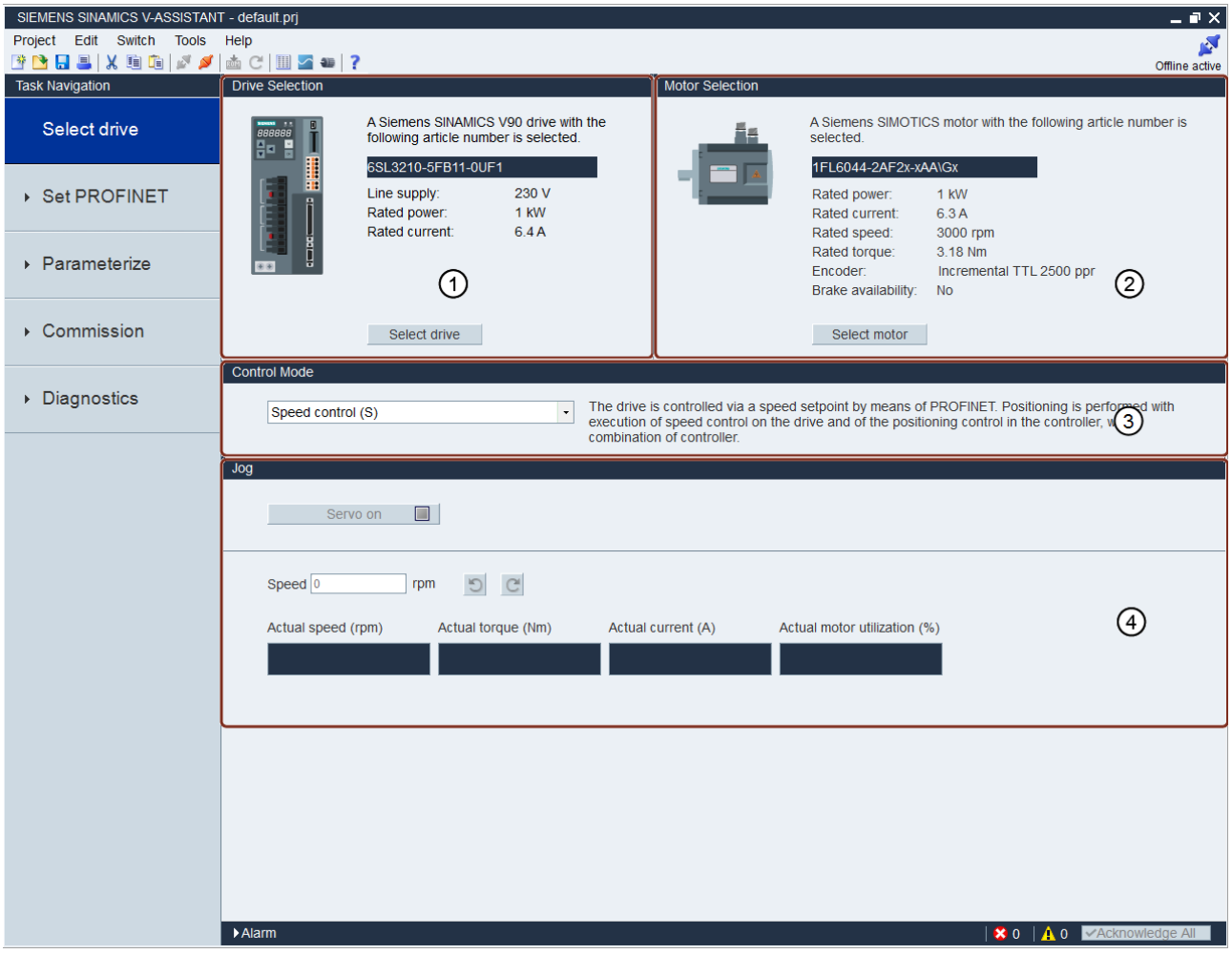


Note

The task navigation mask screenshot of SINAMICS V-ASSISTANT for V90 PN is used as an example here.

Task	Sub-functions	
	SINAMICS V90 PN	SINAMICS V90 PTI
Selecting drive (Page 43)	• Selecting drive (Page 44) • Selecting motor (Page 46) • Control mode (Page 47) • Jog (Page 49)	
Setting PROFINET (V90 PN only) (Page 50)	• Selecting telegram (Page 50) • Configuring network (Page 53)	-
Parameterizing (Page 54)	• Setting electronic gear ratio (V90 PTI only) (Page 56) • Setting mechanism (Page 59) • Setting parameter setpoint (Page 59) • Configuring ramp function (V90 PN only) (Page 72) • Setting limits (Page 74) • Configuring inputs/outputs (Page 78) • Configuring referencing (Page 81) • Setting encoder pulse output (V90 PTI only) (Page 88) • Backlash compensation (Page 88) • Viewing all parameters (Page 90)	
Commissioning (Page 93)	• Testing interface (Page 93) • Testing motor (Page 110) • Optimizing drive (Page 112)	
Diagnostics (Page 125)	• Monitoring status (Page 125) • Tracing signals (Page 126) • Measuring machine (Page 130)	

4.1 Selecting drive



Note

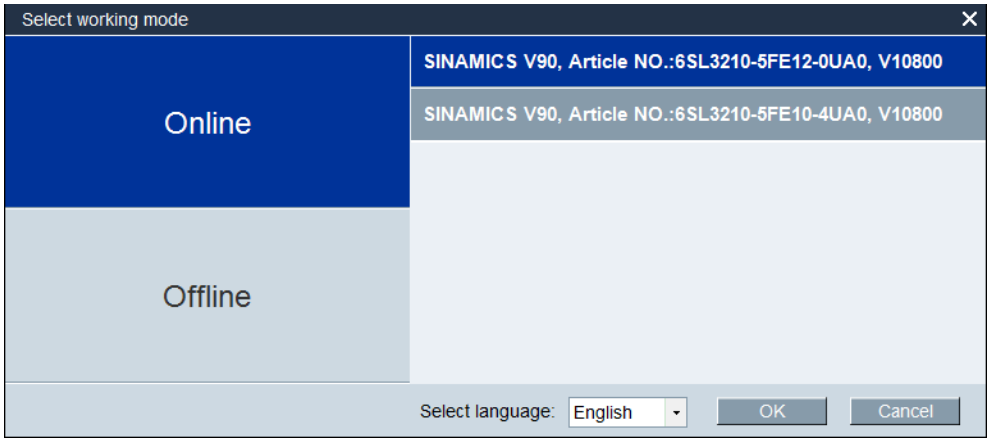
The task navigation mask of SINAMICS V-ASSISTANT for V90 PN is used as an example here.

Area	Function	Description	See also
①	Drive selection	Selects a drive in this field	"Selecting drive (Page 44)"
②	Motor selection	Selects a motor in this field	"Selecting motor (Page 46)"
③	Control mode	Selects a control mode in this field	"Control mode (Page 47)"
④	Jog	Tests the Jog function in this field	"Jog (Page 49)"

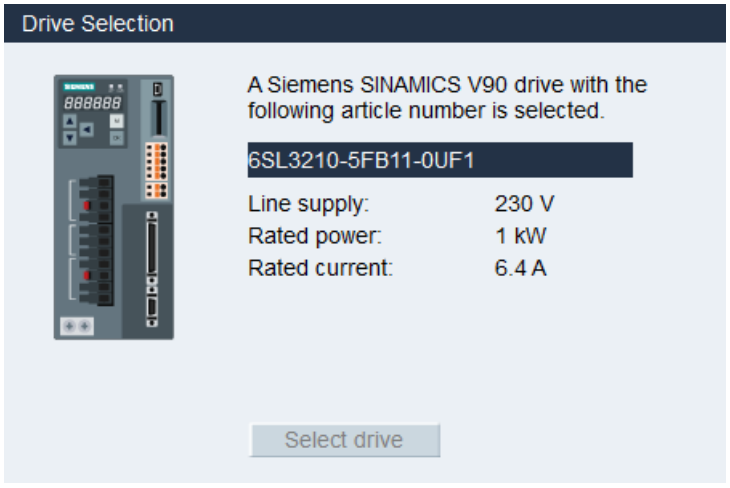
4.1.1 Selecting drive

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:

- Article number
- Line supply

- Rated power
- Rated current

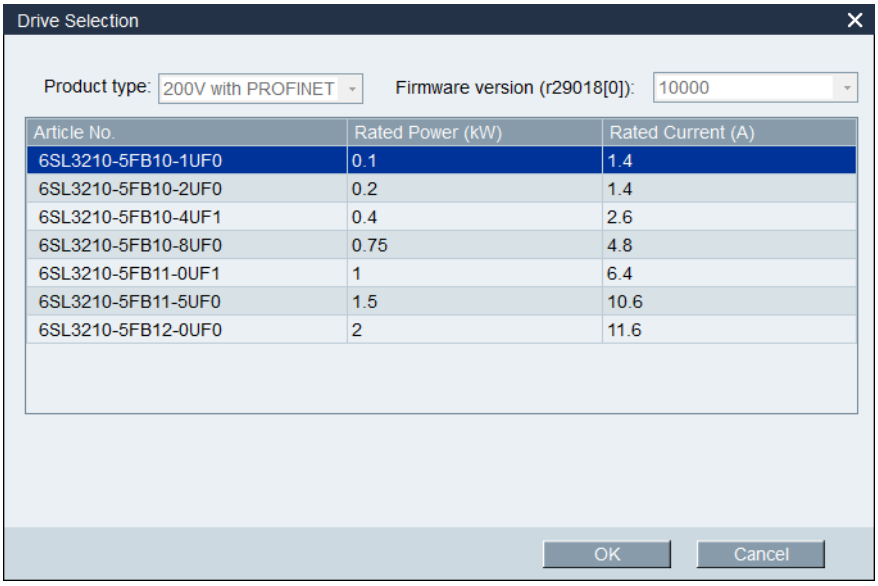
Note

Select drive is disabled in online mode.

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:

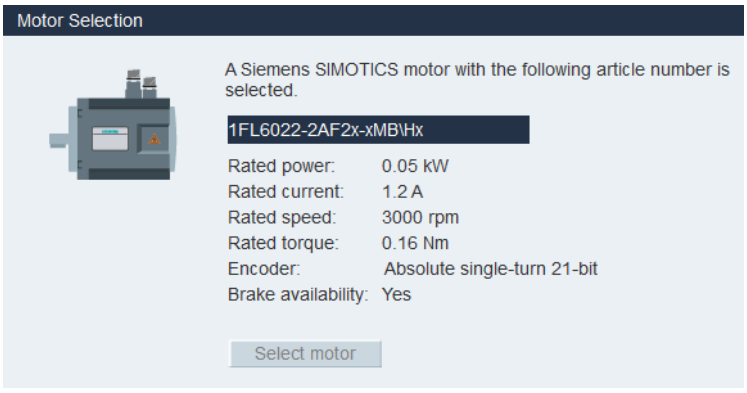


Select the article number of the target drive. Click OK to save the factory settings of the selected drive to the new project and enter the main window; or otherwise, click Cancel to exit.

4.1.2 Selecting motor

Online mode

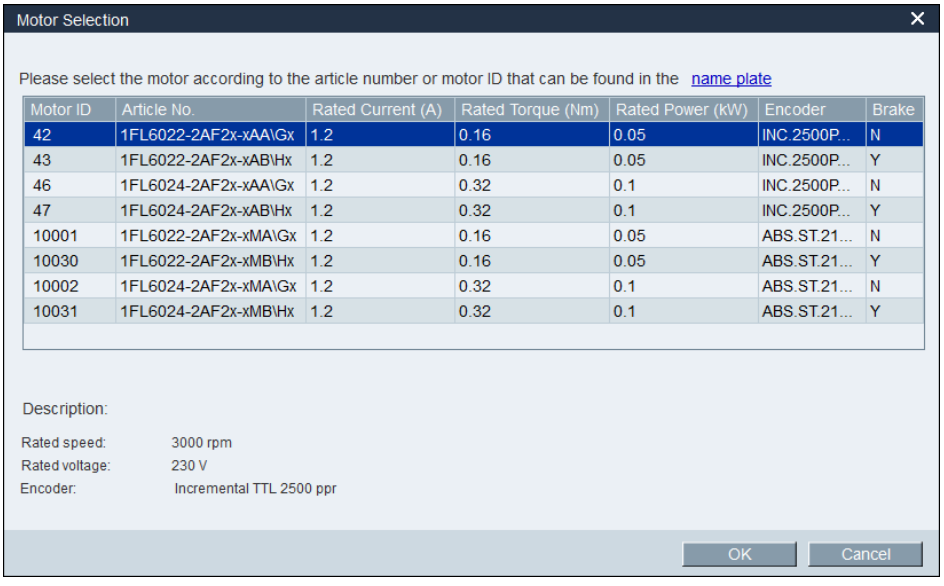
- If the connected motor is equipped with an absolute encoder, Select motor is disabled.



Note

In the article number, "x" is a wildcard; for more information about "A\G", see the 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

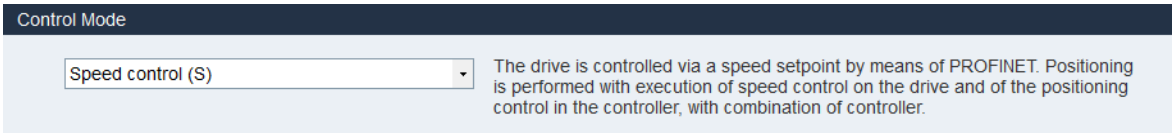
You can click "name plate" in the above window to see the specific location of the name plate on the motor.

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, eleven control modes are available for V90 drives:

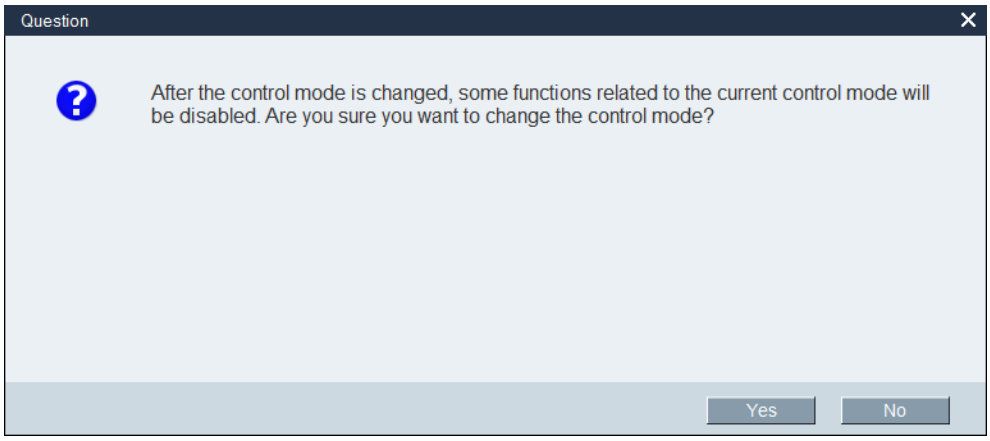
Control mode	V90 PN	V90 PTI
Basic control mode	• Speed control mode (S) [1] • Basic positioner control mode (EPOS)	• Pulse train input position control mode (PTI) [2] • Internal position control mode (IPos) • Speed control mode (S) • Torque control mode (T)
Compound control mode	-	• Control change mode: PTI/S • Control change mode: IPos/S • Control change mode: PTI/T • Control change mode: IPos/T • Control change mode: S/T

[1] Default control mode for V90 PN, different from S control mode for V90 PTI

[2] Default control mode for V90 PTI

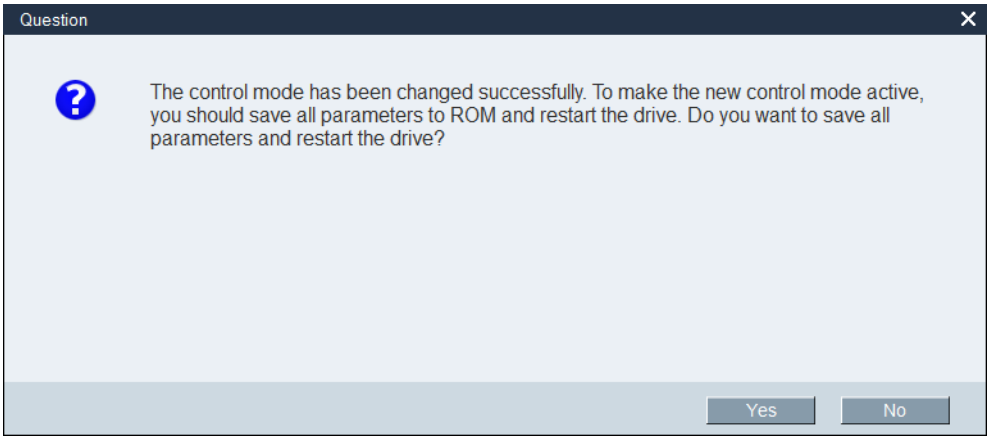
Apply a control mode

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



- **Online mode**

  Click Yes and the following message appears:

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

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

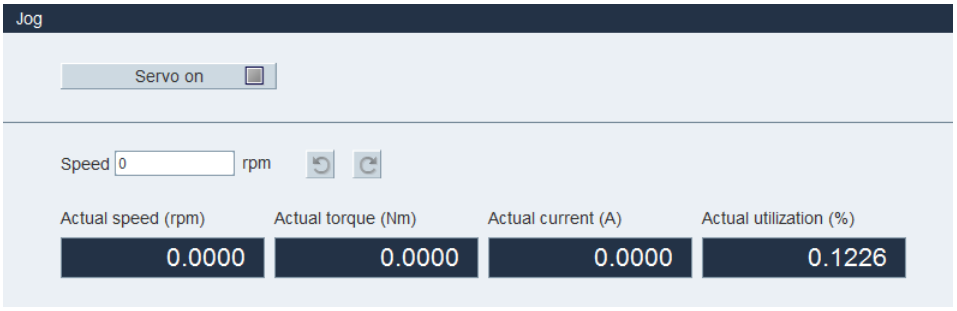
  No

- **Offline mode**

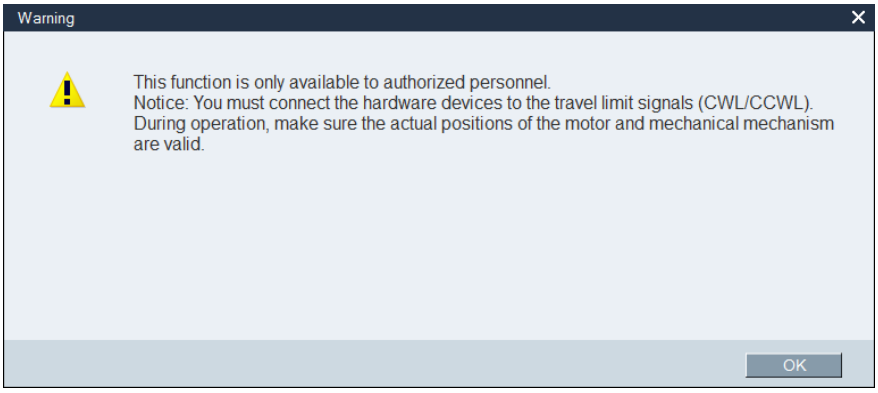
  Click Yes and the control mode is changed.

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, enter the Jog speed first. Click Servo on, then the following warning appears:



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 are displayed.

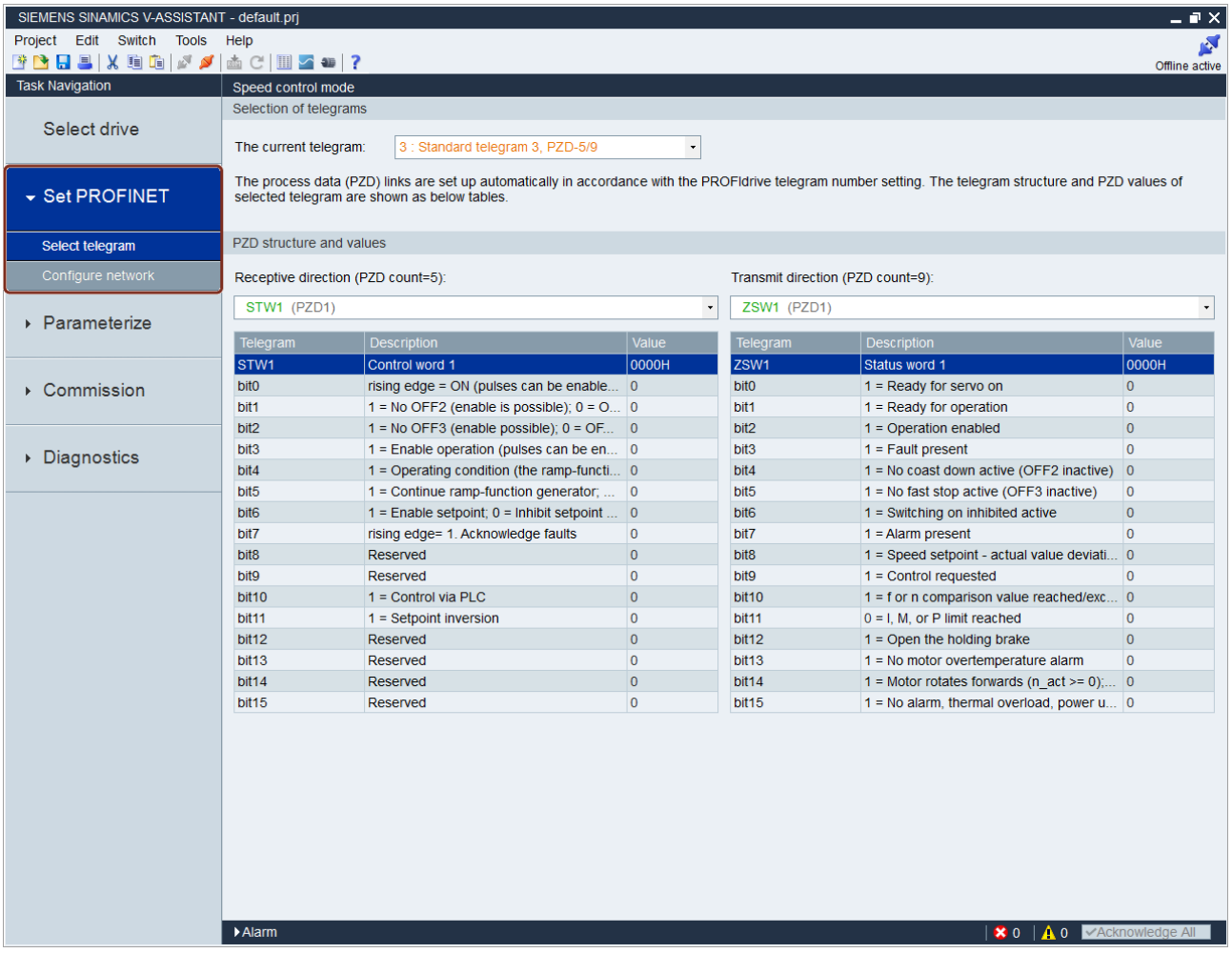
- To stop the Jog function, click Servo off in the following window and SINAMICS V-ASSISTANT releases the control priority.



Note

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

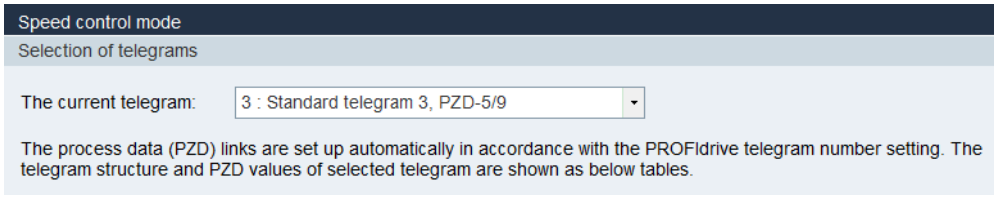
4.2 Setting PROFINET (V90 PN only)



You can select the desired telegram and configure the network with this function.

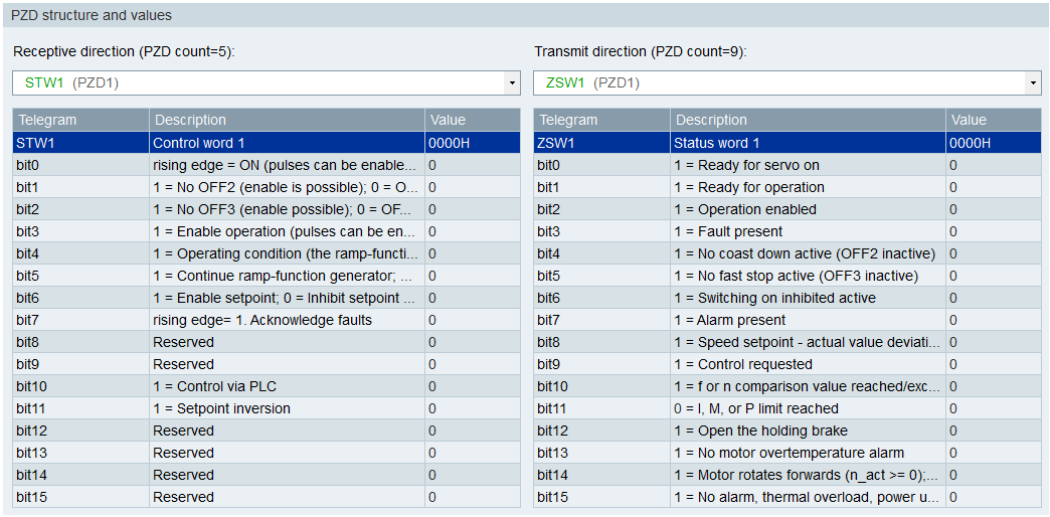
4.2.1 Selecting telegram

In the following 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 PZDs of the selected telegram by clicking 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 enable...	0
bit1	1 = No OFF2 (enable is possible); 0 = O...	0
bit2	1 = No OFF3 (enable possible); 0 = OF...	0
bit3	1 = Enable operation (pulses can be en...	0
bit4	1 = Operating condition (the ramp-functi...	0
bit5	1 = Continue ramp-function generator; ...	0
bit6	1 = Enable setpoint; 0 = Inhibit setpoint ...	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 inactive)	0
bit5	1 = No fast stop active (OFF3 inactive)	0
bit6	1 = Switching on inhibited active	0
bit7	1 = Alarm present	0
bit8	1 = Speed setpoint - actual value deviati...	0
bit9	1 = Control requested	0
bit10	1 = f or n comparison value reached/exc...	0
bit11	0 = 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);...	0
bit15	1 = No alarm, thermal overload, power u...	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
Standard telegram 7	2	2	p0922 = 7
Standard telegram 9	10	5	p0922 = 9
Siemens telegram 102	6	10	p0922 = 102
Siemens telegram 105	10	10	p0922 = 105
Standard telegram 110	12	7	p0922 = 110
Standard telegram 111	12	12	p0922 = 111

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 and the TIA Portal version is V14 or higher.

Telegrams used for speed control mode

Telegram	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												

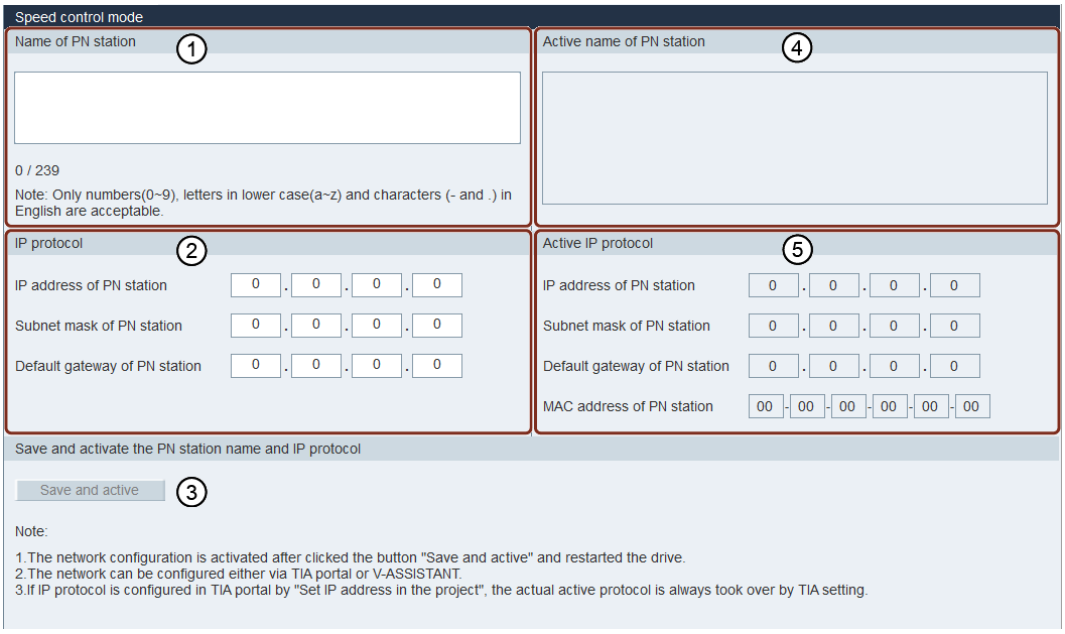
Telegrams used for basic positioner control mode

Telegram	7		9		110		111	
Appl. class	3		3		3		3	
PZD1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1
PZD2	SATZANW	AKTSATZ	SATZANW	AKTSATZ	SATZANW	AKTSATZ	POS_STW1	POS_ZSW1
PZD3	⇧ Receive telegram from PROFINET	⇩ Send telegram to PROFINET	STW2	ZSW2	POS_STW	POS_ZSW	POS_STW2	POS_ZSW2
PZD4			MDI_TARPOS	XIST_A	STW2	ZSW2	STW2	ZSW2
PZD5					OVERRIDE	MELDW	OVERRIDE	MELDW
PZD6			MDI_VELOCITY		MDI_TARPOS	XIST_A	MDI_TARPOS	XIST_A
PZD7								
PZD8			MDI_ACC		MDI_VELOCITY		MDI_VELOCITY	NIST_B
PZD9			MDI_DEC					
PZD10			MDI_MOD		MDI_ACC		MDI_ACC	FAULT_CODE
PZD11					MDI_DEC		MDI_DEC	WARN_CODE
PZD12					MDI_MODE		user [1]	user [1]

[1] PZD12 of telegram 111 is used to configure the user-defined function.

4.2.2 Configuring network

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

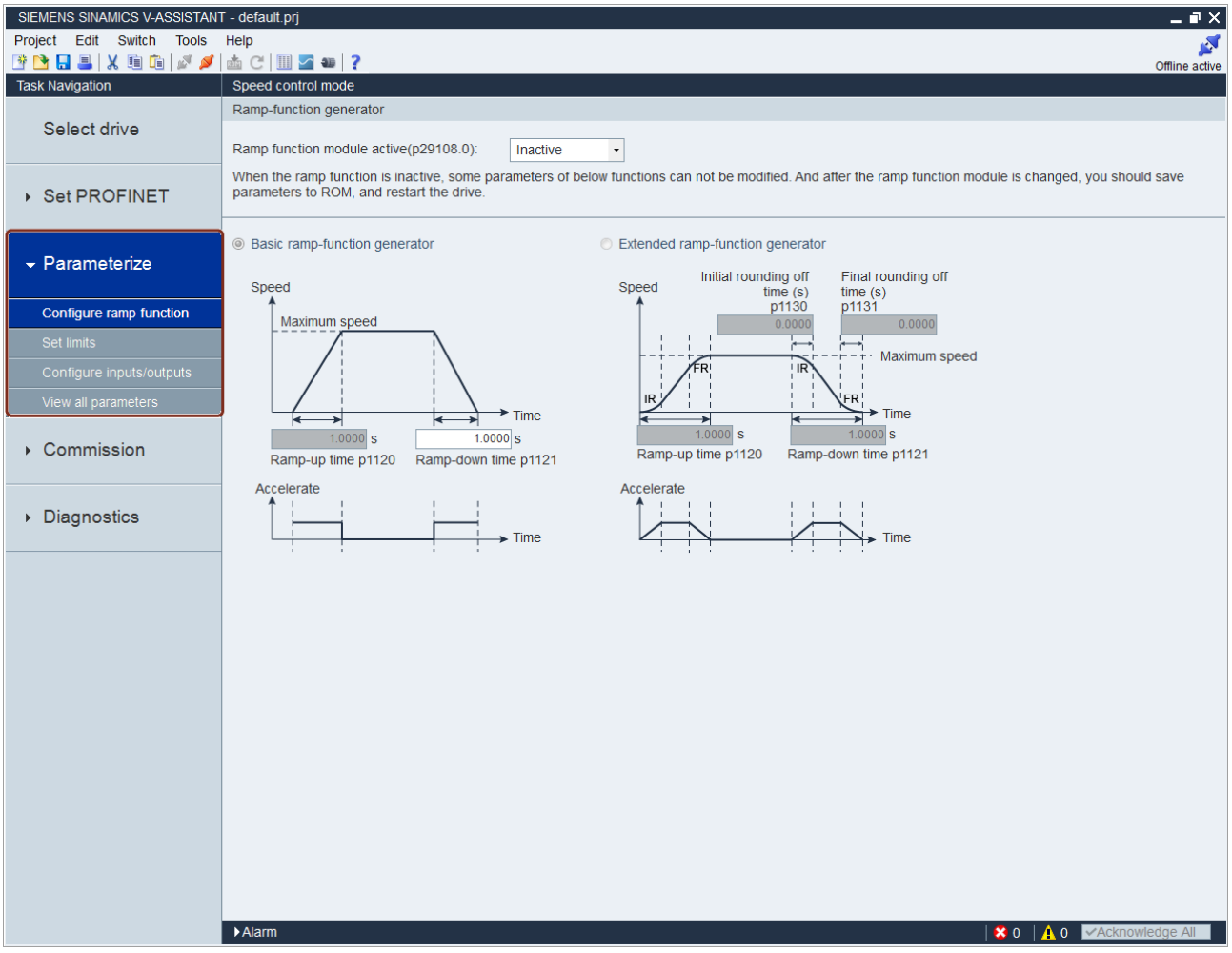


In online mode, the IP address of the connected drive is displayed in area "②" automatically. You can define the PN name of station in area "①". Note that only numbers (0 to 9), lowercase letters ("a" to "z") and characters ("-" and ".") in English are permissible. In addition, you can modify the IP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



Note

The parameterizing panel screenshot of SINAMICS V-ASSISTANT for V90 PN is used as an example here.

Totally, ten sub-functions are available. The sub-function combinations vary with the drive variant and control modes:

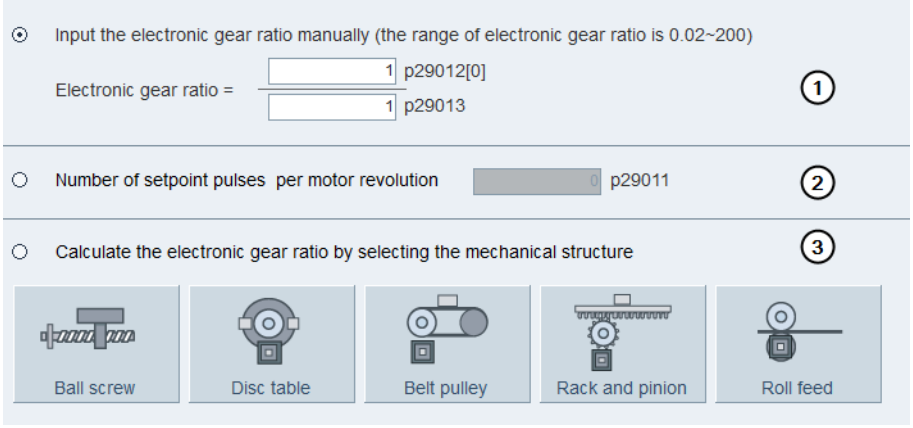
Sub-function	Control mode					
	V90 PN		V90 PTI			
	EPOS	S	PTI	IPos	S	T
Setting electronic gear ratio (V90 PTI only) (Page 56)			✓			
Setting mechanism (Page 59)	✓			✓		
Setting parameter set-point (Page 59)	✓		✓	✓	✓	✓
Configuring ramp function (V90 PN only) (Page 72)	✓	✓				
Setting limits (Page 74)	✓	✓	✓	✓	✓	✓
Configuring inputs/outputs (Page 78)	✓	✓	✓	✓	✓	✓
Configuring referencing (Page 81)	✓			✓		
Setting encoder pulse output (V90 PTI only) (Page 88)			✓	✓		
Backlash compensation (Page 88)	✓			✓		
Viewing all parameters (Page 90)	✓	✓	✓	✓	✓	✓

4.3.1 Setting electronic gear ratio (V90 PTI only)

4.3.1.1 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:

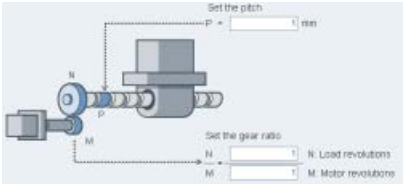
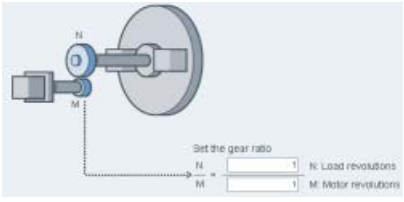
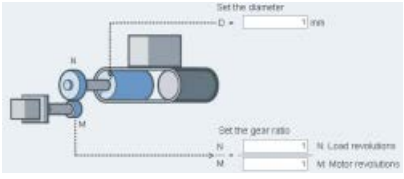
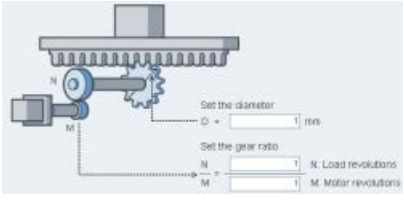
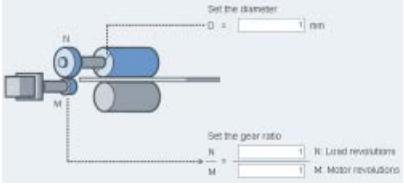


Options	Description
①	When number of setpoint pulses per motor revolution (p29011) is 0, configure electronic gear ratio by setting numerator (p29012) and denominator (p29013).
②	When number of setpoint pulses per motor revolution is not 0, enter the number of set-point pulses per motor revolution here.
③	Calculate the electronic gear ratio according to different mechanical structures. Totally, five mechanical structures are available: • Ball screw • Disc table • Belt pulley • Rack and pinion • Roll feed For more information, see Section "Mechanical structure (Page 57)". Enter the pitch value and gear ratio, select a display unit and click Calculate. Then the electronic gear ratio can be calculated automatically.

4.3.1.2 Mechanical structure

Variables

Configure variables according to the selected mechanical structure:

Mechanical structure	Graphical view	Variable setting	
		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:

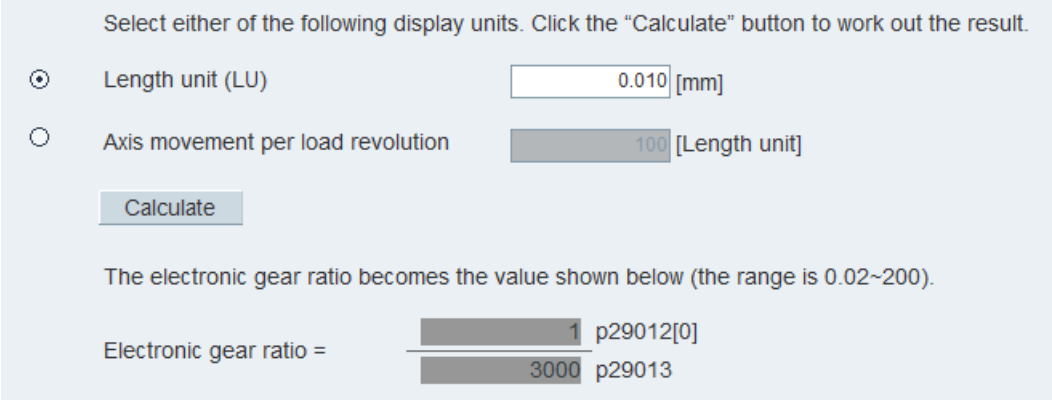
- Length unit

  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:

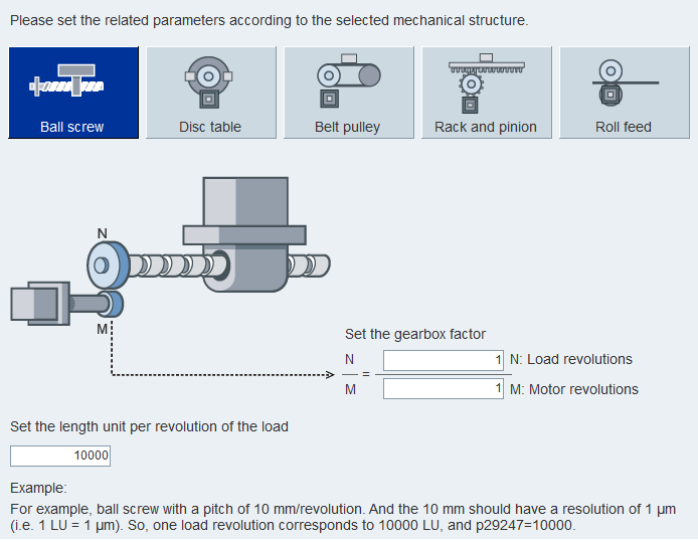


Note

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

4.3.2 Setting mechanism

By parameterizing the mechanical system, you can establish the link between the physical moving part and the length unit (LU). Select the mechanical structure and then set the gearbox factor as well as 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 take LU as their unit in IPos control mode.

Take a ball screw system as an example. If the system has a pitch of 10 mm/revolution, then the resolution of the length unit is 1 µm (1 LU = 1 µm). Therefore, one load revolution corresponds to 10000 LU (p29247 = 10000).

4.3.3 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 following sub-functions:

Function	Control mode					
	V90 PN		V90 PTI			
	EPOS	S	PTI	IPos	S	T
Signal form selection (Page 60)			✓			
Position setpoint smoothing time setting (Page 60)	✓		✓	✓		
Position reached window setting (Page 60)	✓		✓	✓		

Function	Control mode					
	V90 PN		V90 PTI			
	EPOS	S	PTI	IPos	S	T
Fixed position setpoint (Page 60)				✓		
Speed setpoint (Page 69)					✓	
Ramp-function generator (Page 69)	✓	✓			✓	
Speed reached window (Page 69)					✓	
Torque setpoint (Page 71)						✓
EPOS setpoint settings	✓					

When SINAMICS V-ASSISTANT is in compound control modes, for how to set the parameter setpoint, refer to the settings in basic control modes .

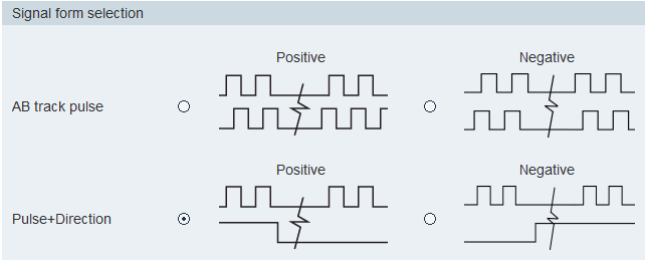
4.3.3.1 Position setpoint

Position setpoint

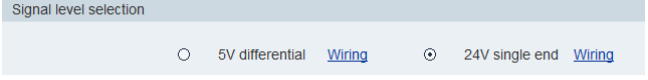
The position setpoint function varies with the control modes. You can set the position setpoint on the corresponding panels in each control mode.

Setting the position setpoint in PTI control mode

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



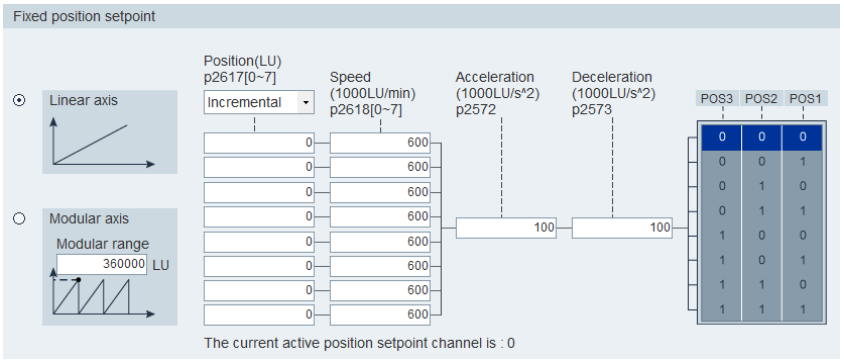
Select the signal level on the following panels:



For more information, see Section "Pulse train inputs (PTIs) (Page 109)".

Setting the position setpoint in IPos control mode

In IPos control mode, you must specify the 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:

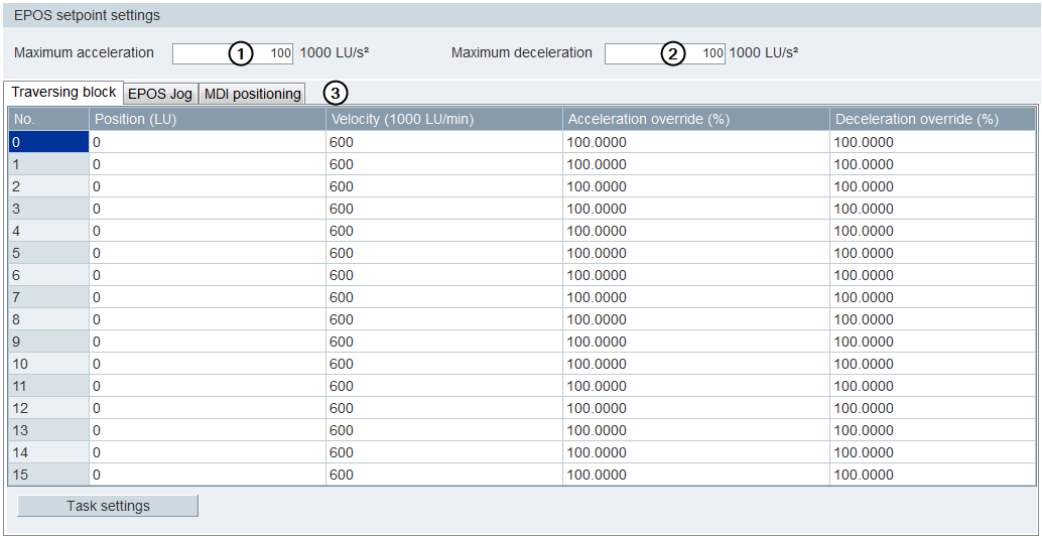
Position setpoint channel	Index of p2617	Index of p2618
0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7

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 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

Setting the position setpoint in EPOS control mode

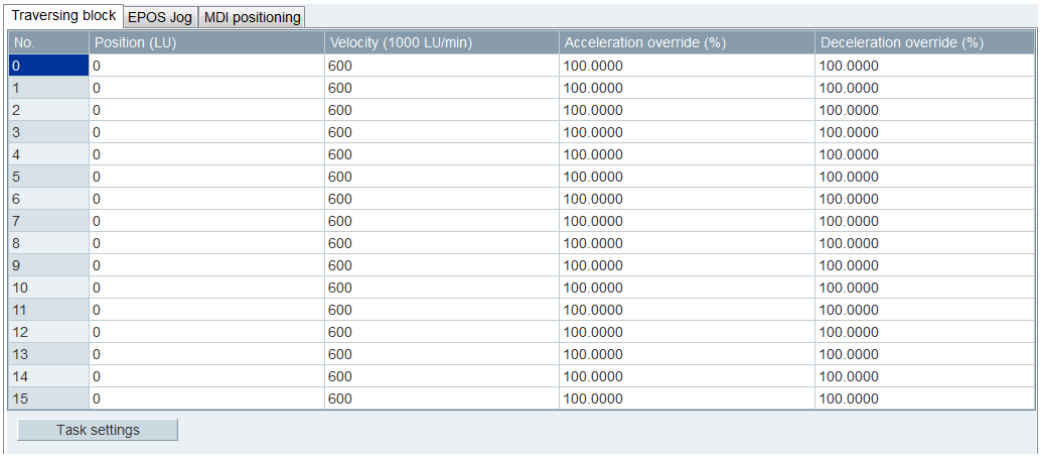


Legend	Description
①	Maximum acceleration in 1000 LU/s² (default value: 100)
②	Maximum deceleration in 1000 LU/s² (default value: 100)
③	Working mode overview for EPOS setpoint settings

Three working modes are available for your selection. Whatever mode you select, the actual velocity is affected by the maximum acceleration and deceleration. You can enter the desired maximum acceleration and deceleration in areas ① and ② respectively.

Configure your desired working mode on the corresponding panel:

- Traversing block



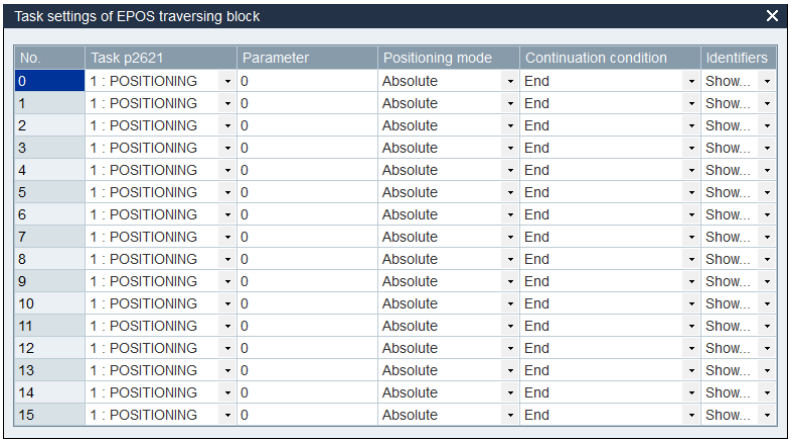
A total of 16 position setpoints are available. Each position setpoint comes from one group of position data:

Basic position setpoint	Corresponding parameters	
	Parameter	Description
Basic position setpoint 1	p2617[0]	EPOS traversing block position
	p2618[0]	EPOS traversing block velocity
	p2619[0]	EPOS traversing block acceleration override
	p2620[0]	EPOS traversing deceleration override
	p2621[0]	EPOS traversing block task
	p2622[0]	EPOS traversing block task parameter
	p2623[0]	EPOS traversing block task mode
Basic position setpoint 2	p2617[1]	EPOS traversing block position
	p2618[1]	EPOS traversing block velocity
	p2619[1]	EPOS traversing block acceleration override
	p2620[1]	EPOS traversing deceleration override
	p2621[1]	EPOS traversing block task
	p2622[1]	EPOS traversing block task parameter
	p2623[1]	EPOS traversing block task mode
Basic position setpoint 3	p2617[2]	EPOS traversing block position
	p2618[2]	EPOS traversing block velocity
	p2619[2]	EPOS traversing block acceleration override
	p2620[2]	EPOS traversing deceleration override
	p2621[2]	EPOS traversing block task
	p2622[2]	EPOS traversing block task parameter
	p2623[2]	EPOS traversing block task mode
Basic position setpoint 4	p2617[3]	EPOS traversing block position
	p2618[3]	EPOS traversing block velocity
	p2619[3]	EPOS traversing block acceleration override
	p2620[3]	EPOS traversing deceleration override
	p2621[3]	EPOS traversing block task
	p2622[3]	EPOS traversing block task parameter
	p2623[3]	EPOS traversing block task mode
Basic position setpoint 5	p2617[4]	EPOS traversing block position
	p2618[4]	EPOS traversing block velocity
	p2619[4]	EPOS traversing block acceleration override
	p2620[4]	EPOS traversing deceleration override
	p2621[4]	EPOS traversing block task
	p2622[4]	EPOS traversing block task parameter
	p2623[4]	EPOS traversing block task mode

Basic position setpoint	Corresponding parameters	
	Parameter	Description
Basic position setpoint 6	p2617[5]	EPOS traversing block position
	p2618[5]	EPOS traversing block velocity
	p2619[5]	EPOS traversing block acceleration override
	p2620[5]	EPOS traversing deceleration override
	p2621[5]	EPOS traversing block task
	p2622[5]	EPOS traversing block task parameter
	p2623[5]	EPOS traversing block task mode
Basic position setpoint 7	p2617[6]	EPOS traversing block position
	p2618[6]	EPOS traversing block velocity
	p2619[6]	EPOS traversing block acceleration override
	p2620[6]	EPOS traversing deceleration override
	p2621[6]	EPOS traversing block task
	p2622[6]	EPOS traversing block task parameter
	p2623[6]	EPOS traversing block task mode
Basic position setpoint 8	p2617[7]	EPOS traversing block position
	p2618[7]	EPOS traversing block velocity
	p2619[7]	EPOS traversing block acceleration override
	p2620[7]	EPOS traversing deceleration override
	p2621[7]	EPOS traversing block task
	p2622[7]	EPOS traversing block task parameter
	p2623[7]	EPOS traversing block task mode
Basic position setpoint 9	p2617[8]	EPOS traversing block position
	p2618[8]	EPOS traversing block velocity
	p2619[8]	EPOS traversing block acceleration override
	p2620[8]	EPOS traversing deceleration override
	p2621[8]	EPOS traversing block task
	p2622[8]	EPOS traversing block task parameter
	p2623[8]	EPOS traversing block task mode
Basic position setpoint 10	p2617[9]	EPOS traversing block position
	p2618[9]	EPOS traversing block velocity
	p2619[9]	EPOS traversing block acceleration override
	p2620[9]	EPOS traversing deceleration override
	p2621[9]	EPOS traversing block task
	p2622[9]	EPOS traversing block task parameter
	p2623[9]	EPOS traversing block task mode
Basic position setpoint 11	p2617[10]	EPOS traversing block position
	p2618[10]	EPOS traversing block velocity
	p2619[10]	EPOS traversing block acceleration override
	p2620[10]	EPOS traversing deceleration override
	p2621[10]	EPOS traversing block task
	p2622[10]	EPOS traversing block task parameter
	p2623[10]	EPOS traversing block task mode

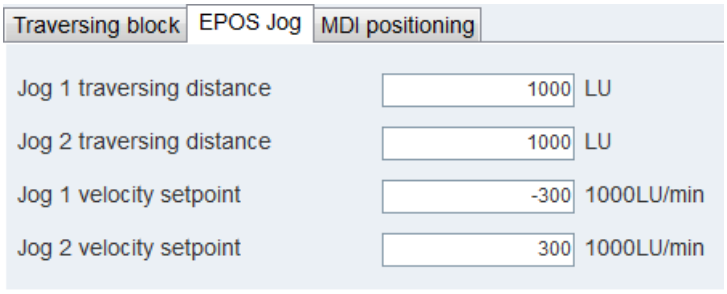
Basic position setpoint	Corresponding parameters	
	Parameter	Description
Basic position setpoint 12	p2617[11]	EPOS traversing block position
	p2618[11]	EPOS traversing block velocity
	p2619[11]	EPOS traversing block acceleration override
	p2620[11]	EPOS traversing deceleration override
	p2621[11]	EPOS traversing block task
	p2622[11]	EPOS traversing block task parameter
	p2623[11]	EPOS traversing block task mode
Basic position setpoint 13	p2617[12]	EPOS traversing block position
	p2618[12]	EPOS traversing block velocity
	p2619[12]	EPOS traversing block acceleration override
	p2620[12]	EPOS traversing deceleration override
	p2621[12]	EPOS traversing block task
	p2622[12]	EPOS traversing block task parameter
	p2623[12]	EPOS traversing block task mode
Basic position setpoint 14	p2617[13]	EPOS traversing block position
	p2618[13]	EPOS traversing block velocity
	p2619[13]	EPOS traversing block acceleration override
	p2620[13]	EPOS traversing deceleration override
	p2621[13]	EPOS traversing block task
	p2622[13]	EPOS traversing block task parameter
	p2623[13]	EPOS traversing block task mode
Basic position setpoint 15	p2617[14]	EPOS traversing block position
	p2618[14]	EPOS traversing block velocity
	p2619[14]	EPOS traversing block acceleration override
	p2620[14]	EPOS traversing deceleration override
	p2621[14]	EPOS traversing block task
	p2622[14]	EPOS traversing block task parameter
	p2623[14]	EPOS traversing block task mode
Basic position setpoint 16	p2617[15]	EPOS traversing block position
	p2618[15]	EPOS traversing block velocity
	p2619[15]	EPOS traversing block acceleration override
	p2620[15]	EPOS traversing deceleration override
	p2621[15]	EPOS traversing block task
	p2622[15]	EPOS traversing block task parameter
	p2623[15]	EPOS traversing block task mode

If you desire to configure the task settings of the traversing block, you can click Task settings to open the following window:



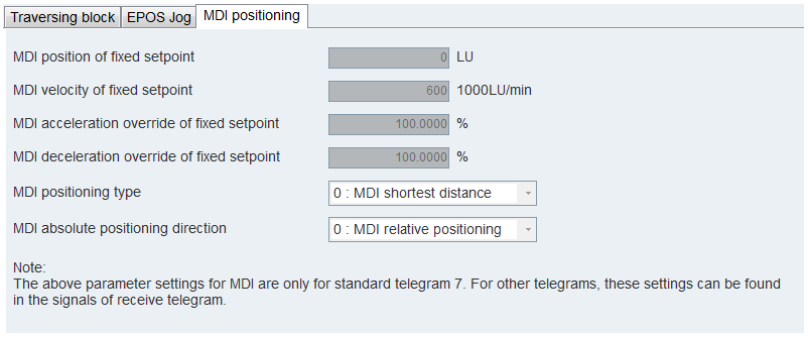
Click ▾ to expand the drop-down lists. Select your desired type of 2621, positioning mode, continuation condition as well as IDs and then close the window.

- EPOS Jog



Enter the desired traversing distance and velocity setpoint for Jog 1 or Jog 2 in the above window.

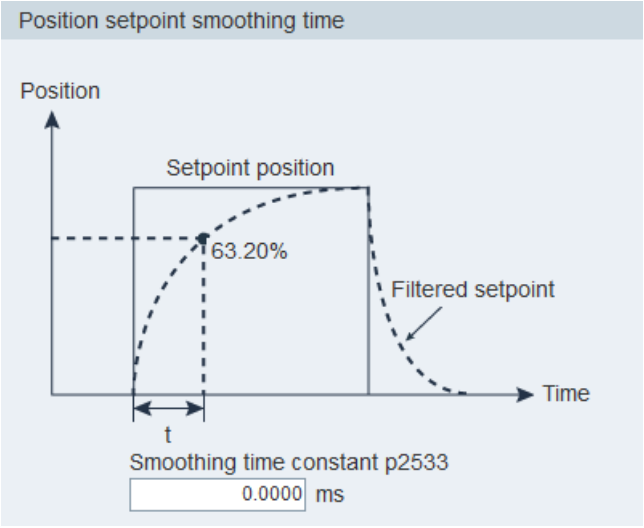
- MDI Positioning



Enter the desired MDI position, MDI velocity, MDI acceleration override and MDI deceleration override of the fixed setpoint. Click ▾ to expand the drop-down lists of the MDI positioning type and absolute positioning direction. Select your desired settings and close the window.

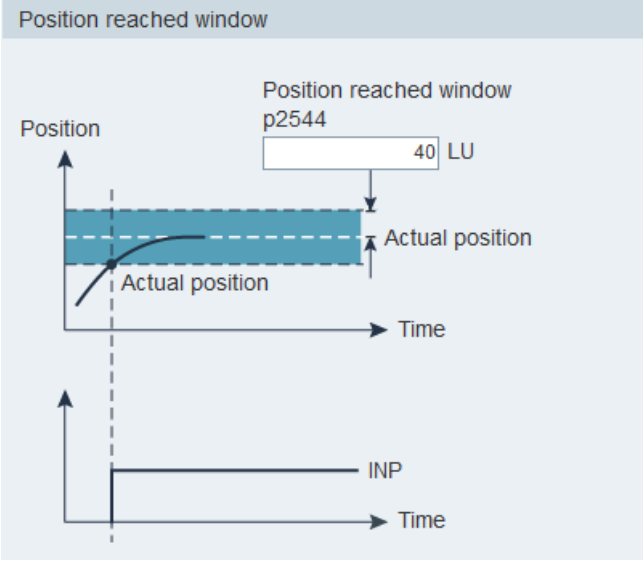
Position setpoint smoothing time setting

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.



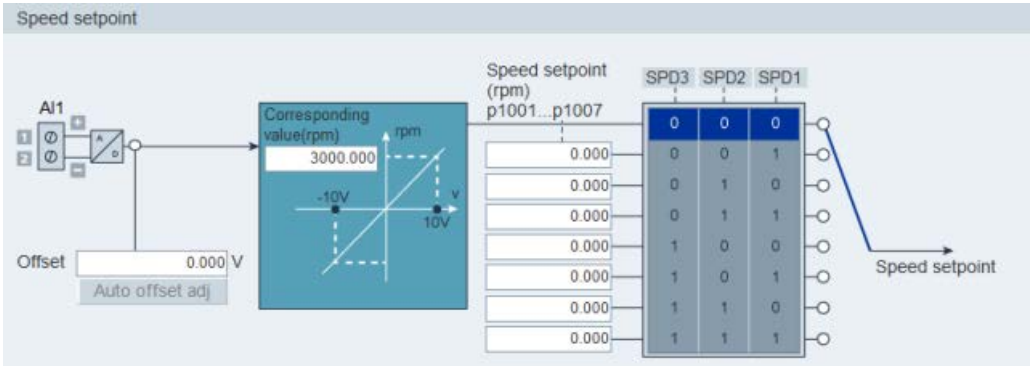
Position reached window setting

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



For more information about signal INP, see Section "Digital inputs/outputs (DIs/Dos) (Page 97)".

4.3.3.2 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)

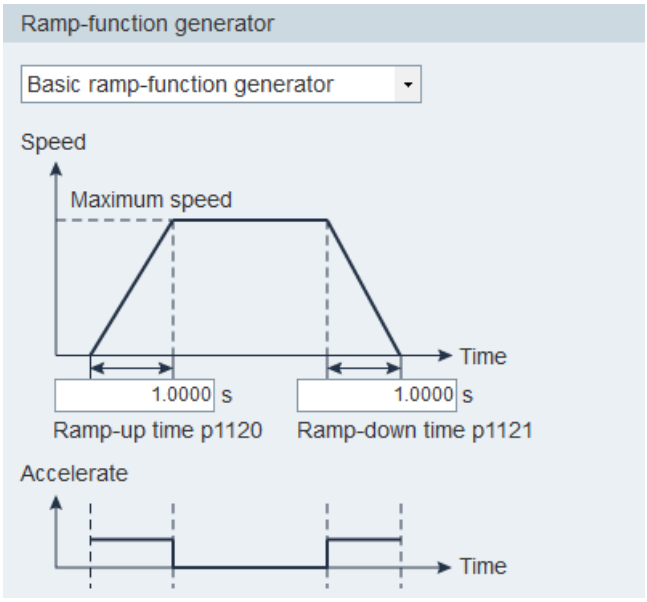
Ramp-function generator

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.

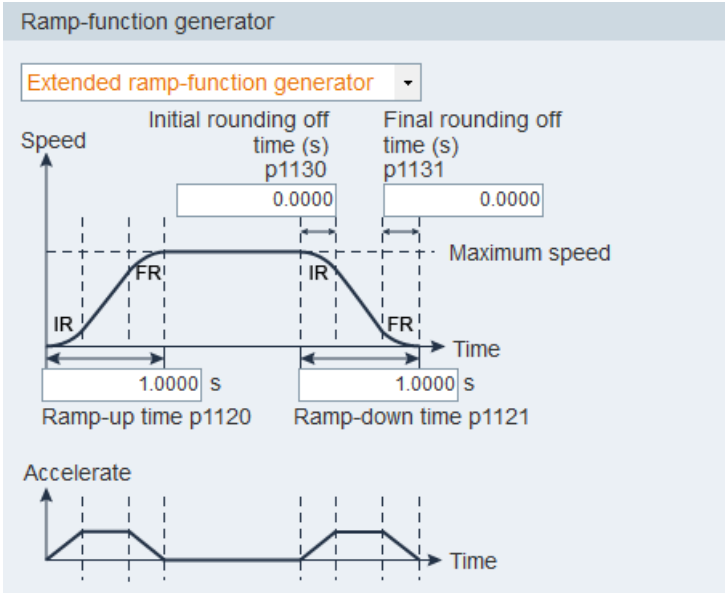
The ramp-up time p1120 and ramp-down time p1121 can be used to set acceleration and deceleration ramps separately. This allows a smoothed transition in the event of setpoint changes.

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

- Basic ramp-function generator

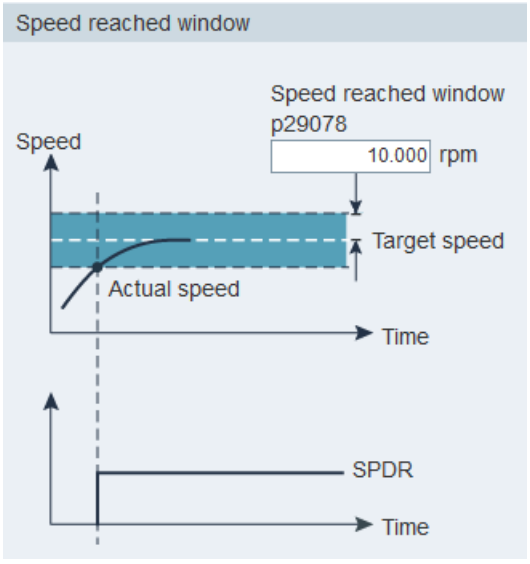


- Extended ramp-function generator

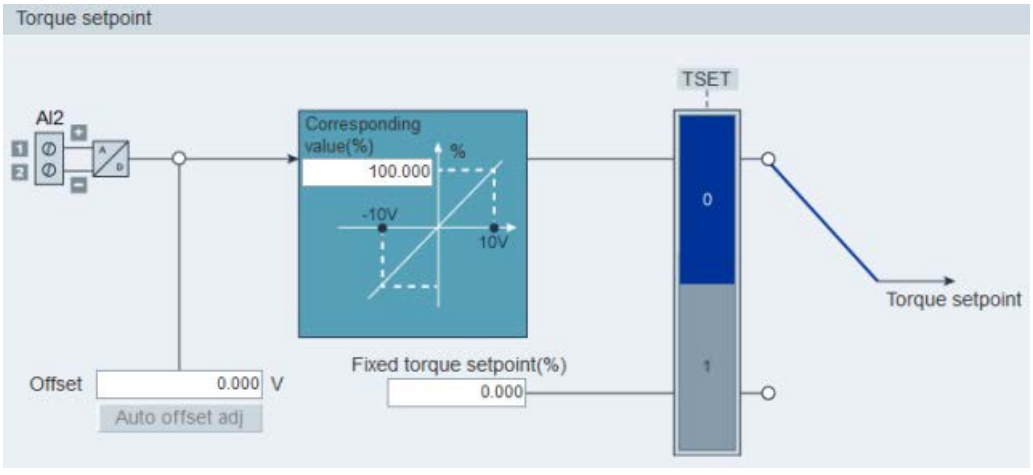


Speed reached window

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



4.3.3.3 Torque setpoint



Source of torque setpoint

Two sources are available for torque setpoint:

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

You can select these two sources with the digital input signal TSET:

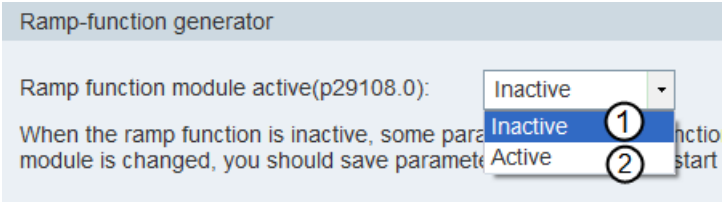
Signal	Level	Source of torque setpoint
TSET	0 (default)	Analog torque setpoint (analog input 2)
	1	Fixed torque setpoint (p29043)

4.3.4 Configuring ramp function (V90 PN only)

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.

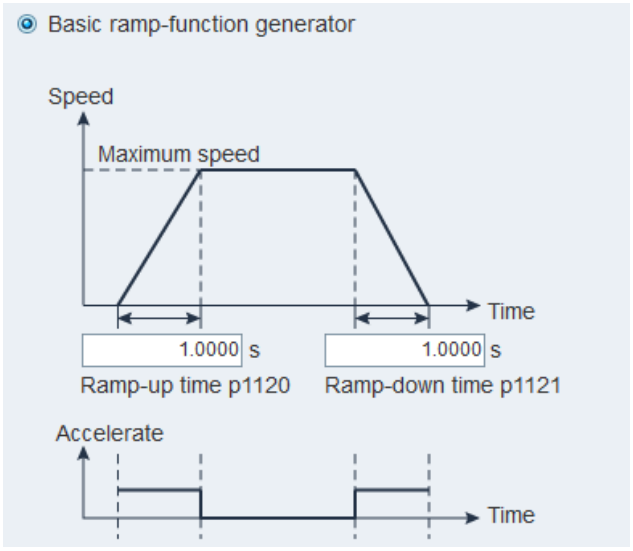
The ramp-up time p1120 and ramp-down time p1121 can be used to set acceleration and deceleration ramps separately. This allows a smoothed transition in the event of setpoint changes.



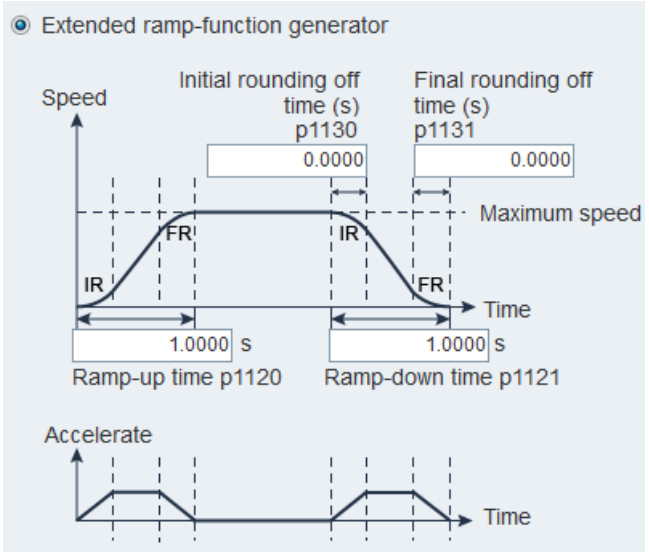
To activate this function, select "②" from the drop-down list in the above window or set bit 0 of p29108 on the BOP first. Make sure you have properly connected the SINAMICS V90 PN drive to the motor and the encoder works normally; otherwise, the ramp function generator is disabled due to faults (such as 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



4.3.5 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:

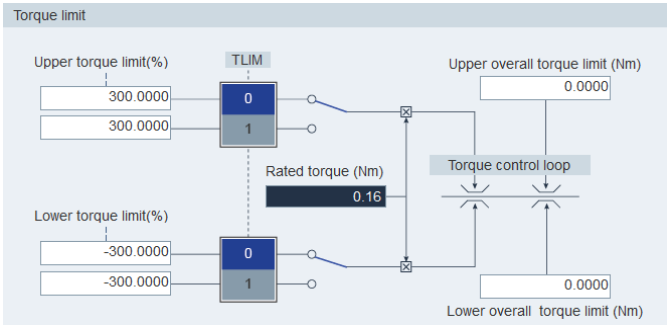
Function	Control mode					
	V90 PN		V90 PTI			
	EPOS	S	PTI	IPos	S	T
Torque limit (Page 74)	✓	✓	✓	✓	✓	
Overall torque limit	✓	✓	✓	✓	✓	✓
Speed limit (Page 76)	✓	✓	✓	✓	✓	✓
Overall speed limit	✓	✓	✓	✓	✓	✓
Software Position limit (Page 86)	✓			✓		

4.3.5.1 Torque limit

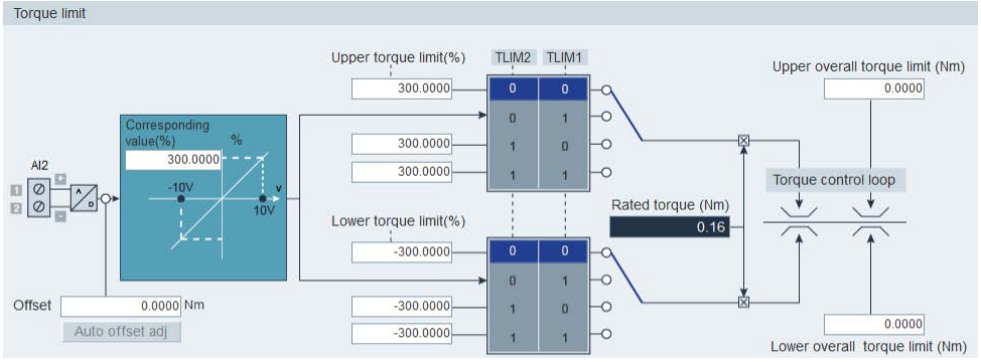
Torque limit is available in PTI, IPos, S and EPOS control modes.

You can specify the corresponding parameters on the following panels:

- In S (V90 PN) and EPOS control modes:



- In S (V90 PTI), PTI and IPos control modes:



Source of torque limit

- SINAMICS V90 PN

  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.

  For more information about the digital input signal TLIM, see Section "DIs (Page 97)".

- SINAMICS V90 PTI

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

  Note

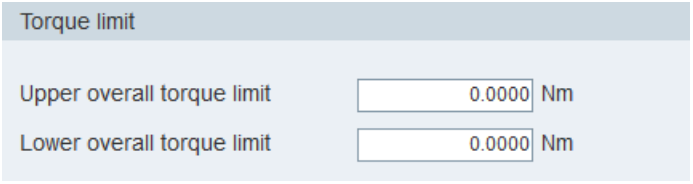
  These four sources are valid in control modes PTI, IPos, and S. You can switch among them when the servo drive is running.

  For more information about the digital input signals TLIM1 and TLIM2, see Section "DIs (Page 100)".

Overall torque limit

Besides the above sources, an overall torque limit is available in **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.

In T mode, you can set the overall torque limit on the following panel:

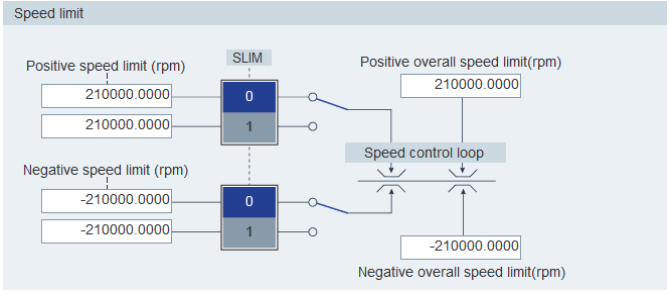


4.3.5.2 Speed limit

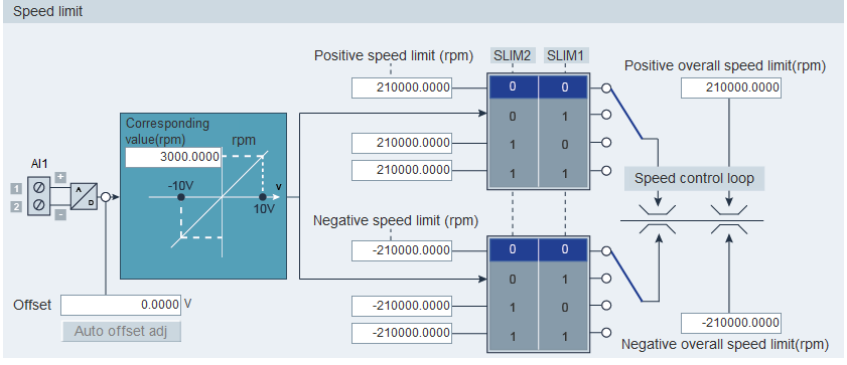
Speed limit is available in PTI, IPos, S, T and EPOS control modes.

You can specify the corresponding parameters on the following panels:

- In S (V90 PN) and EPOS control modes:



- In S (V90 PTI), PTI, IPos and T control modes:



Source of speed Limit

- SINAMICS V90 PN

  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.

For more information about the digital input signal SLIM, see Section "DIs (Page 97)".

- SINAMICS V90 PTI

  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 for V90 PTI. You can switch among them when the servo drive is running.

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

For more information about the digital input signals SLIM1 and SLIM2, see Section "DIs (Page 100)".

Overall speed limit

Besides the above sources, an overall speed limit is available in all control modes.

4.3.6 Configuring inputs/outputs

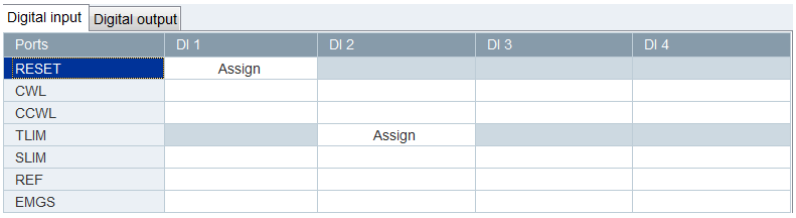
Three sub-functions are available as follows:

- Assigning digital inputs (Page 78)
- Assigning digital outputs (Page 79)
- Assigning analog outputs (V90 PTI only) (Page 80)

4.3.6.1 Assigning digital inputs

You can assign digital inputs on the following panels:

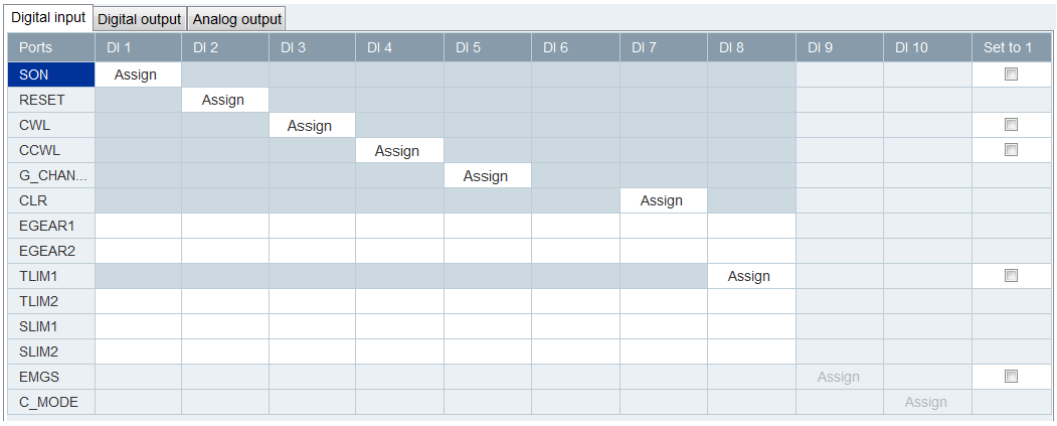
- Assigning digital inputs for V90 PN



A total of four signals can be freely linked to digital inputs, for more information, see Section "DIs (Page 97)".

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 then displays white.

- Assigning digital inputs for V90 PTI



A total of 28 signals can be freely linked to digital inputs except for DI9 and DI10 linked with E_Stop and C_Mode signals. For more information, see Section "DIs (Page 100)".

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 then displays 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 V1.04.00 or higher.

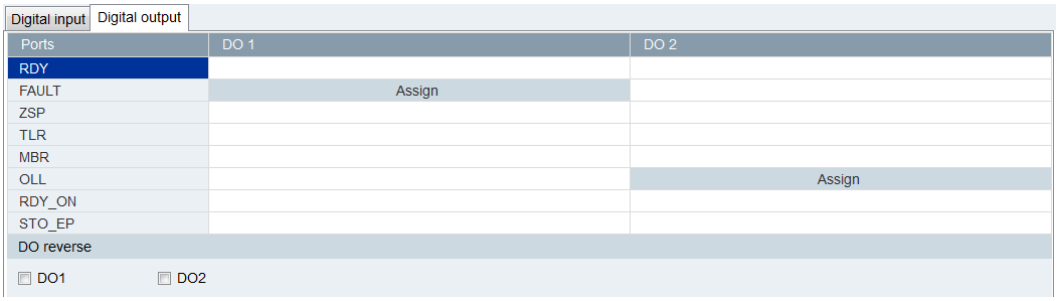
Note

Signal P_TRG in PTI mode is reserved for future use.

4.3.6.2 Assigning digital outputs

You can assign digital outputs on the following panels:

- Assigning digital outputs for V90 PN

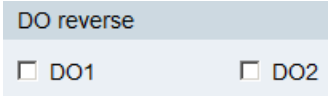


A total of seven signals can be freely linked to digital outputs. For more information, see Section "DOs (Page 98)".

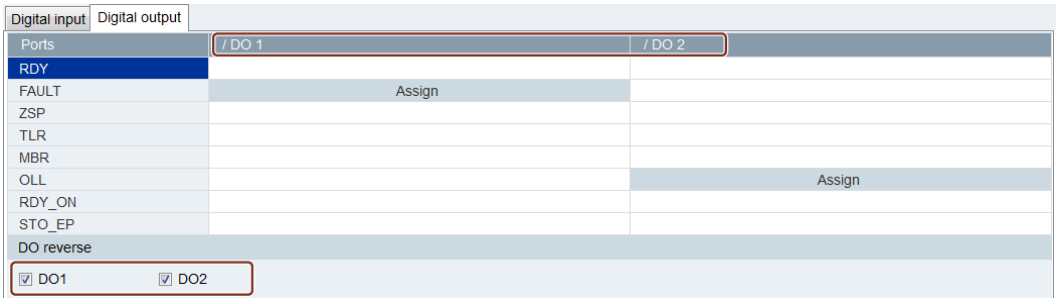
Click the cells with white background in the table. Select **"Assign"** to link the digital input with the corresponding signal. Then the current cell displays grey.

DO signal reverse

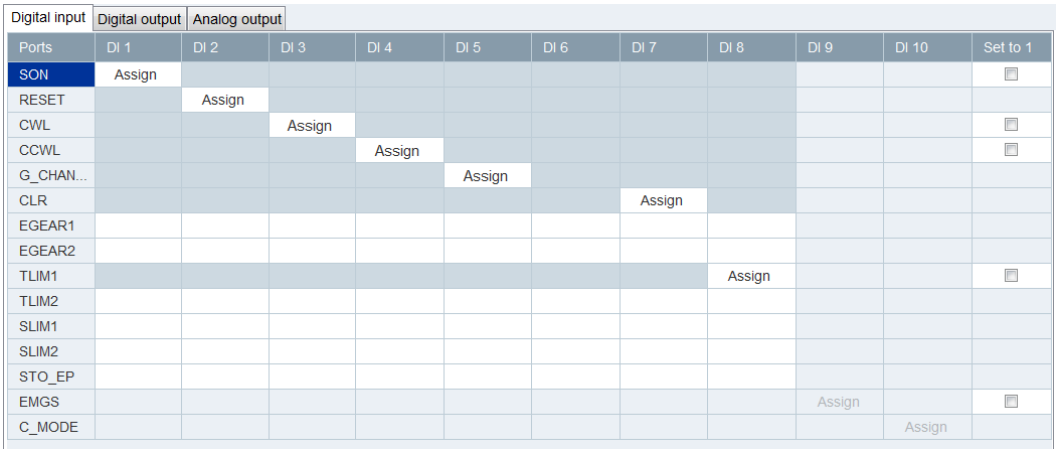
You can reverse the logics of DO1 and DO2 by activating the checkboxes in the following function area or setting the bit 0 and bit 1 of parameter p748:



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



- Assigning digital outputs for V90 PTI



A total of 14 signals can be freely linked to digital outputs. For more information, see Section "DOs (Page 105)".

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.

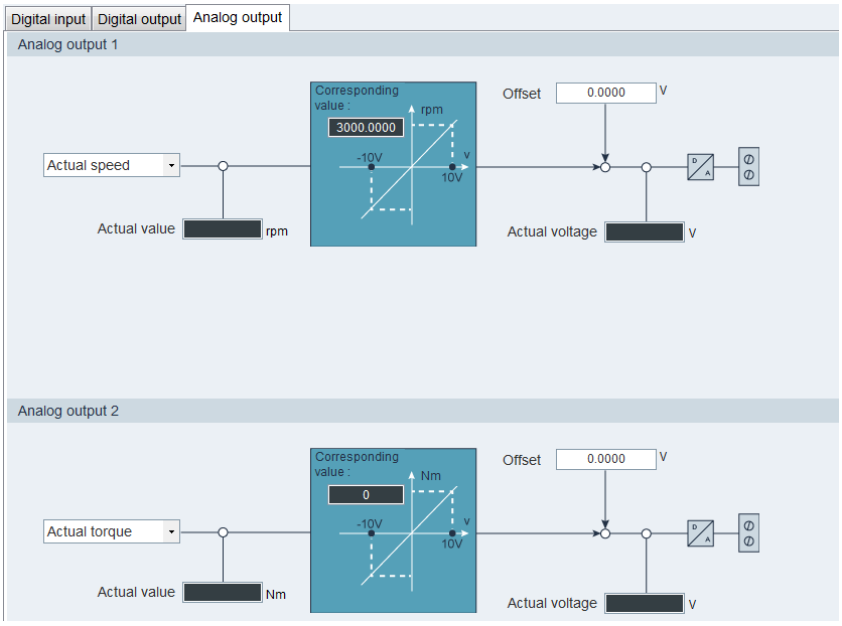
Note

DO signal inverse

The logics of digital output signals DO1 to DO6 can be reversed. You can inverse the logics of DO1 to DO6 by setting the bit 0 to bit 5 of parameter p0748.

4.3.6.3 Assigning analog outputs (V90 PTI only)

You can assign analog outputs on the panel below:



Seven signals in total can be linked with either analog output. For more information, see Section "Analog outputs (AOs) (Page 109)".

By default, analog output 1 and 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.

4.3.7 Configuring referencing

Referencing is only available in IPos and EPOS control modes.

Two sub-functions are available:

- Setting referencing (Page 81)
- Setting software position limit (Page 86)

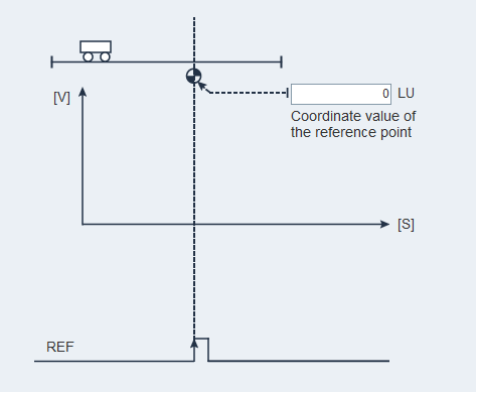
4.3.7.1 Setting referencing

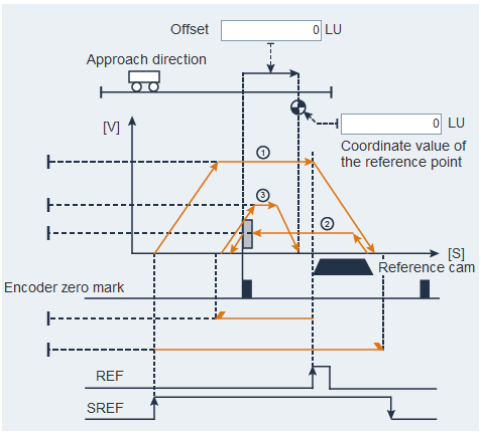
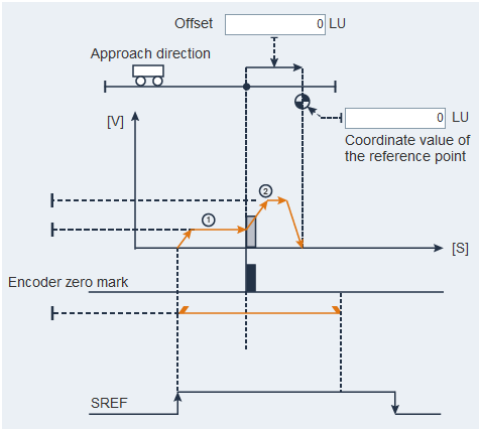
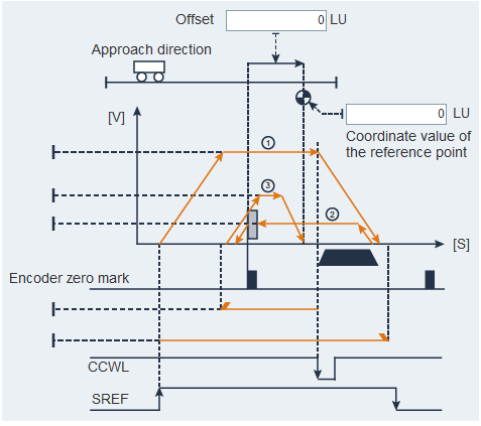
Setting referencing is **only** available in online mode.

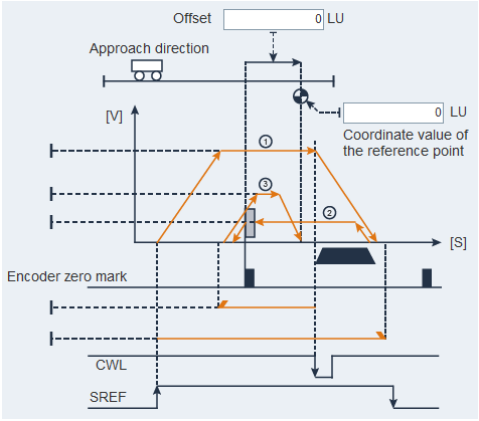
Setting referencing (in IPos control mode)

- **Incremental encoder**

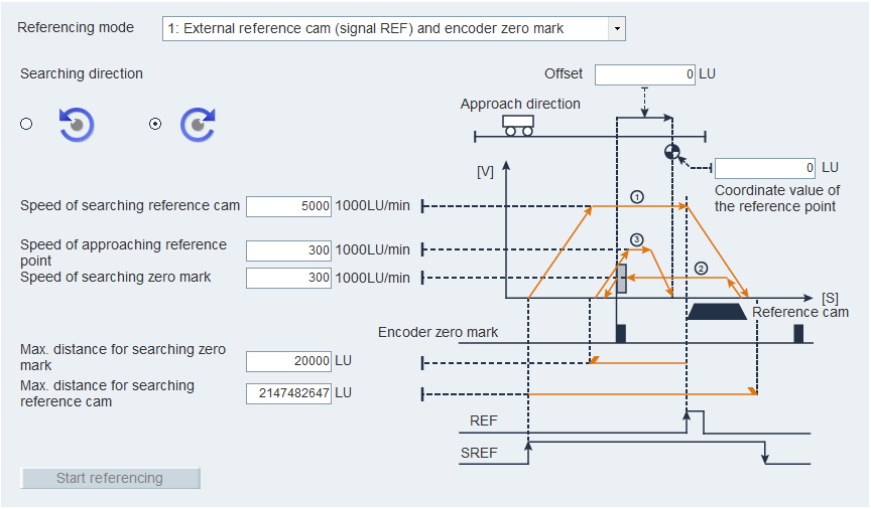
  If the motor is equipped with an incremental encoder, five referencing modes in total are available:

Parameter	Value	Referencing mode	Illustration
p29240	0	Setting the reference point via digital input (signal REF)	

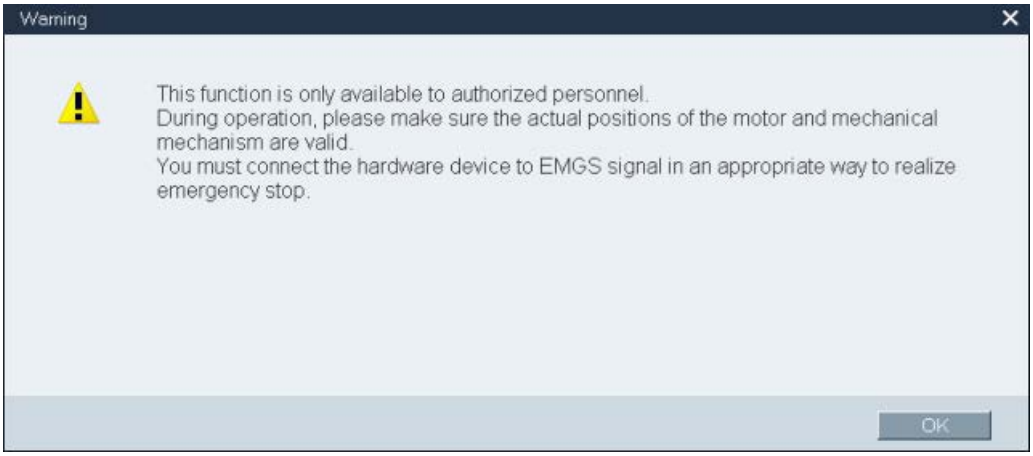
Parameter	Value	Referencing mode	Illustration
	1	External reference cam (signal REF) and encoder zero mark	
	2	Encoder zero mark only	
	3	External reference cam (CCWL signal) and encoder zero mark	

Parameter	Value	Referencing mode	Illustration
	4	External reference cam (CWL signal) and encoder zero mark	

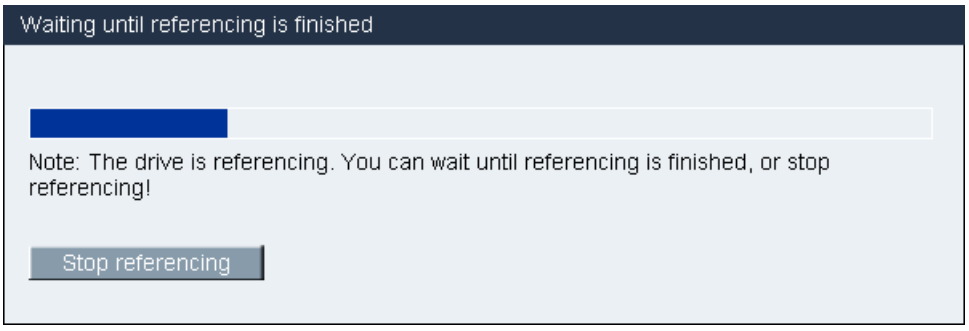
Taking the second referencing mode as an example, you can configure relevant parameters on the following panel:



Assign signals REF and SREF(for more information, see Section "Configuring inputs/outputs (Page 78)"). Click Start referencing and the following warning appears:



Click OK to start referencing and the following window appears:



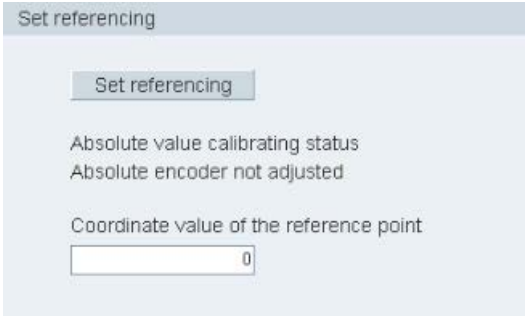
To stop the referencing process, click the following button:

Stop referencing

- **Absolute encoder**

  If the motor is equipped with an absolute encoder, the five referencing modes are available. You can implement the referencing process via the Modbus or external DI terminals rather than the V-ASSISTANT.

  If the motor is equipped with an absolute encoder, you can adjust the absolute encoder by clicking Set referencing on the following panel to configure referencing:



Note

Referencing mode for the absolute encoder

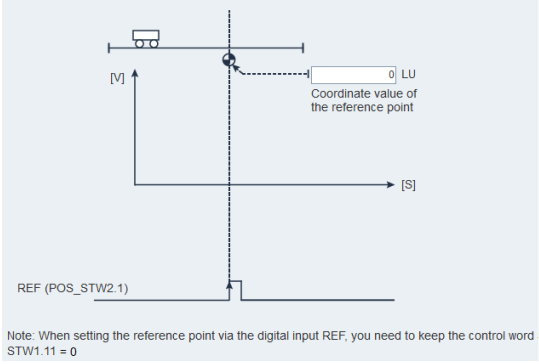
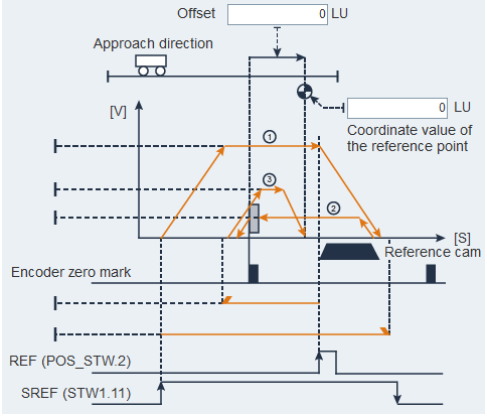
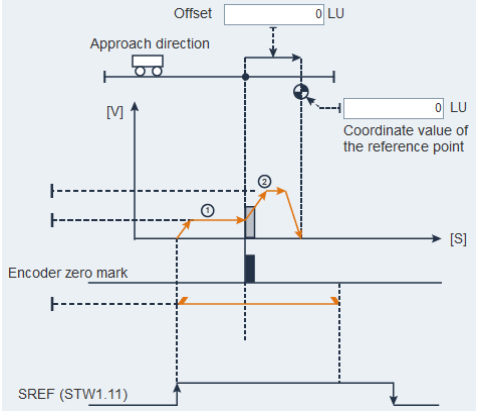
If an absolute encoder is connected, the five referencing modes are also available. You can select different referencing modes with the parameter p29240. When p29240 = 1 to 4, the referencing process can only be implemented before you set the current position as the zero position. Once the zero position is set, the four referencing modes are not available any more.

Setting referencing (in EPOS control mode)

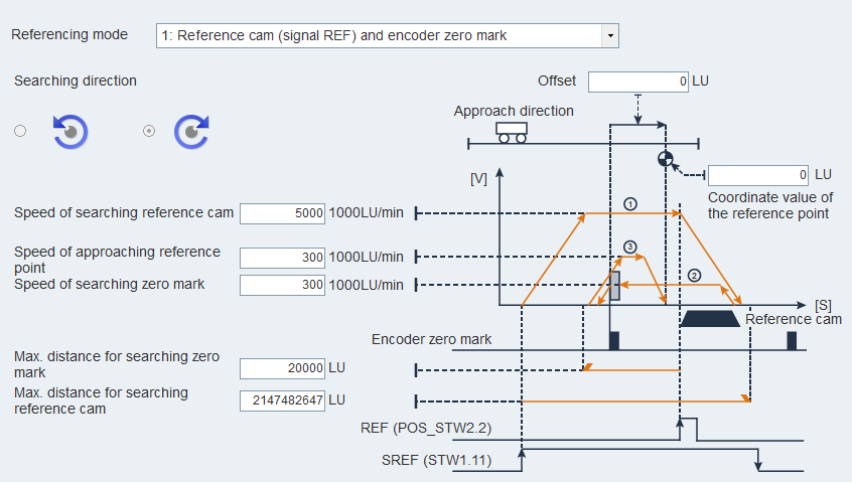
You can view the current telegram in the header of this function mask.

- **Incremental encoder**

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

Parameter	Value	Referencing mode	Illustration
p29240	0	Setting the reference point via digital input (signal REF)	 **Note** When setting the reference point via the digital input REF, you need to keep the control word STW1.11 = 0.
	1	External reference cam (signal REF) and encoder zero mark	
	2	Encoder zero mark only	

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



Before starting referencing, check the sources of signals REF and SREF in the above illustration respectively. In this example, the source of signal REF is DI. See Section "Assigning digital inputs (Page 78)" for information on how to assign signal REF.

- **Absolute encoder**

  See the relevant description in Section "Setting referencing (in IPos control mode) (Page 81)".

4.3.7.2 Setting software position limit

Prerequisites

- You have implemented the referencing function successfully.
- You have selected the linear axis working mode.

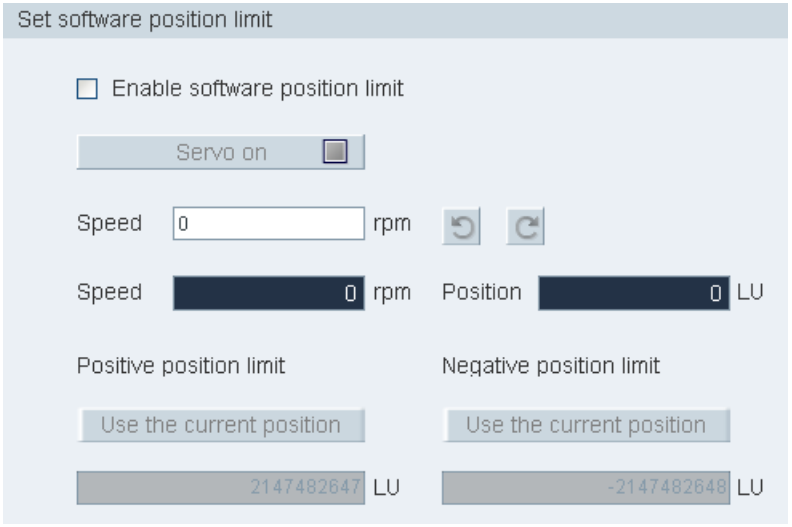
Setting software position limit

The following two software position limits are available in IPos and EPOS control modes:

- positive position limit
- negative position limit

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

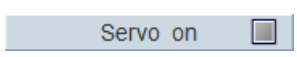
Click on the checkbox to enable the software position limit. Enter the desired position values in the bottom input fields directly.

Method 2: Setting through the Jog function

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

   Note:

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



3. Click this button to execute servo-on function and a warning message appears. Confirm your selection by clicking 

in the message window.



4. Click this button to rotate the motor clockwisely and set a proper limit position.



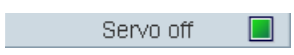
5. Obtain the current position by clicking this button.



6. Click this button to rotate the motor counter-clockwisely and set a proper limit position.



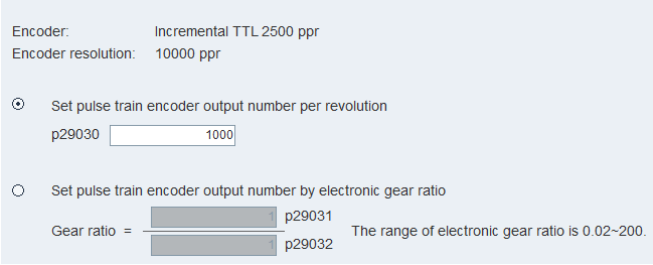
7. Obtain the current position by clicking this button.



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

4.3.8 Setting encoder pulse output (V90 PTI only)

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 available for you to configure PTO relevant parameters:

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

4.3.9 Backlash compensation

Note

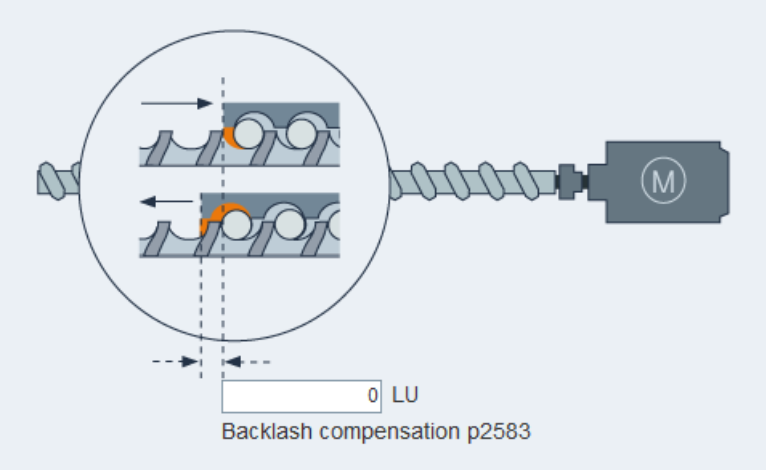
Prerequisites for backlash compensation

- The axis has been referenced for incremental measuring system. For more information about referencing, see Section "Setting referencing (in IPos control mode) (Page 81)" .
- The axis has been adjusted for absolute measuring system.

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 the backlash compensation for V90 PTI 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.

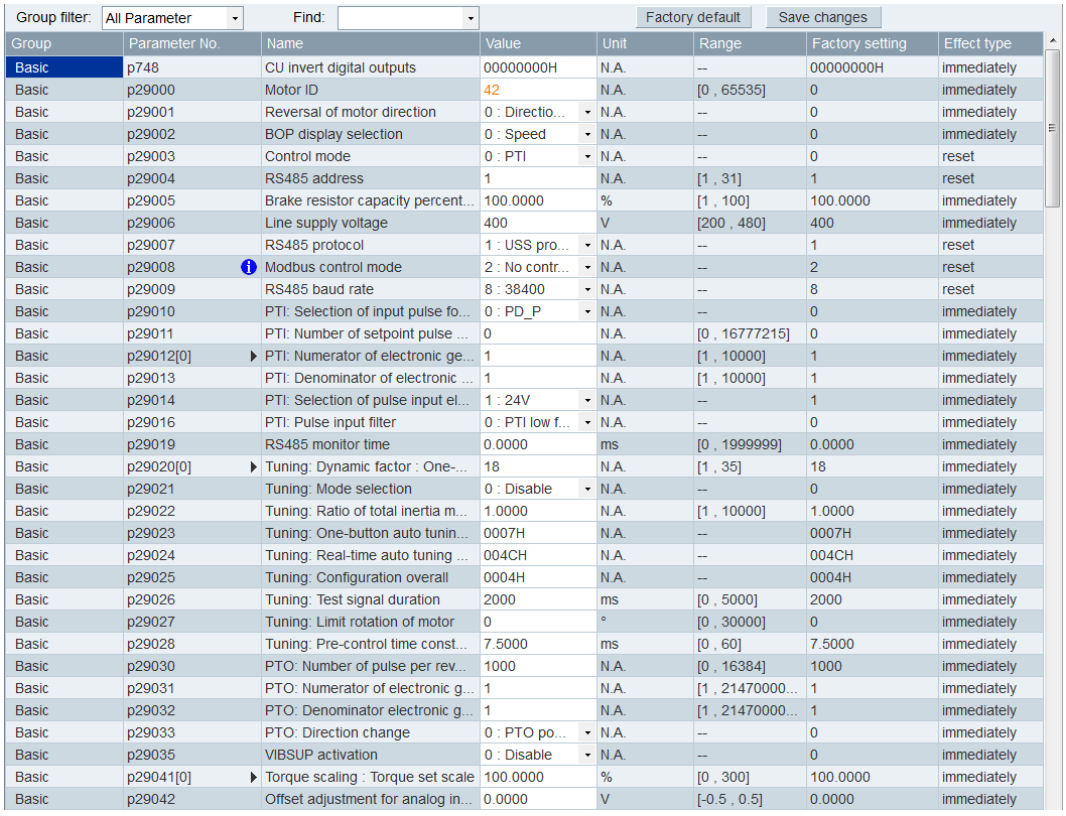
Note

Backlash compensation for V90 PN

The backlash compensation pane for V90 PN is included in the function pane of "Set mechanism".

4.3.10 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
Basic	p748	CU invert digital outputs	00000000H	N.A.	--	00000000H	immediately
Basic	p29000	Motor ID	42	N.A.	[0 , 65535]	0	immediately
Basic	p29001	Reversal of motor direction	0 : Directio...	N.A.	--	0	immediately
Basic	p29002	BOP display selection	0 : Speed	N.A.	--	0	immediately
Basic	p29003	Control mode	0 : PTI	N.A.	--	0	reset
Basic	p29004	RS485 address	1	N.A.	[1 , 31]	1	reset
Basic	p29005	Brake resistor capacity percent...	100.0000	%	[1 , 100]	100.0000	immediately
Basic	p29006	Line supply voltage	400	V	[200 , 480]	400	immediately
Basic	p29007	RS485 protocol	1 : USS pro...	N.A.	--	1	reset
Basic	p29008	Modbus control mode	2 : No contr...	N.A.	--	2	reset
Basic	p29009	RS485 baud rate	8 : 38400	N.A.	--	8	reset
Basic	p29010	PTI: Selection of input pulse fo...	0 : PD_P	N.A.	--	0	immediately
Basic	p29011	PTI: Number of setpoint pulse ...	0	N.A.	[0 , 16777215]	0	immediately
Basic	p29012[0]	PTI: Numerator of electronic ge...	1	N.A.	[1 , 10000]	1	immediately
Basic	p29013	PTI: Denominator of electronic ...	1	N.A.	[1 , 10000]	1	immediately
Basic	p29014	PTI: Selection of pulse input el...	1 : 24V	N.A.	--	1	immediately
Basic	p29016	PTI: Pulse input filter	0 : PTI low f...	N.A.	--	0	immediately
Basic	p29019	RS485 monitor time	0.0000	ms	[0 , 1999999]	0.0000	immediately
Basic	p29020[0]	Tuning: Dynamic factor : One-...	18	N.A.	[1 , 35]	18	immediately
Basic	p29021	Tuning: Mode selection	0 : Disable	N.A.	--	0	immediately
Basic	p29022	Tuning: Ratio of total inertia m...	1.0000	N.A.	[1 , 10000]	1.0000	immediately
Basic	p29023	Tuning: One-button auto tunin...	0007H	N.A.	--	0007H	immediately
Basic	p29024	Tuning: Real-time auto tuning ...	004CH	N.A.	--	004CH	immediately
Basic	p29025	Tuning: Configuration overall	0004H	N.A.	--	0004H	immediately
Basic	p29026	Tuning: Test signal duration	2000	ms	[0 , 5000]	2000	immediately
Basic	p29027	Tuning: Limit rotation of motor	0	°	[0 , 30000]	0	immediately
Basic	p29028	Tuning: Pre-control time const...	7.5000	ms	[0 , 60]	7.5000	immediately
Basic	p29030	PTO: Number of pulse per rev...	1000	N.A.	[0 , 16384]	1000	immediately
Basic	p29031	PTO: Numerator of electronic g...	1	N.A.	[1 , 21470000...	1	immediately
Basic	p29032	PTO: Denominator electronic g...	1	N.A.	[1 , 21470000...	1	immediately
Basic	p29033	PTO: Direction change	0 : PTO po...	N.A.	--	0	immediately
Basic	p29035	VIBSUP activation	0 : Disable	N.A.	--	0	immediately
Basic	p29041[0]	Torque scaling : Torque set scale	100.0000	%	[0 , 300]	100.0000	immediately
Basic	p29042	Offset adjustment for analog in...	0.0000	V	[-0.5 , 0.5]	0.0000	immediately

Note

Icons

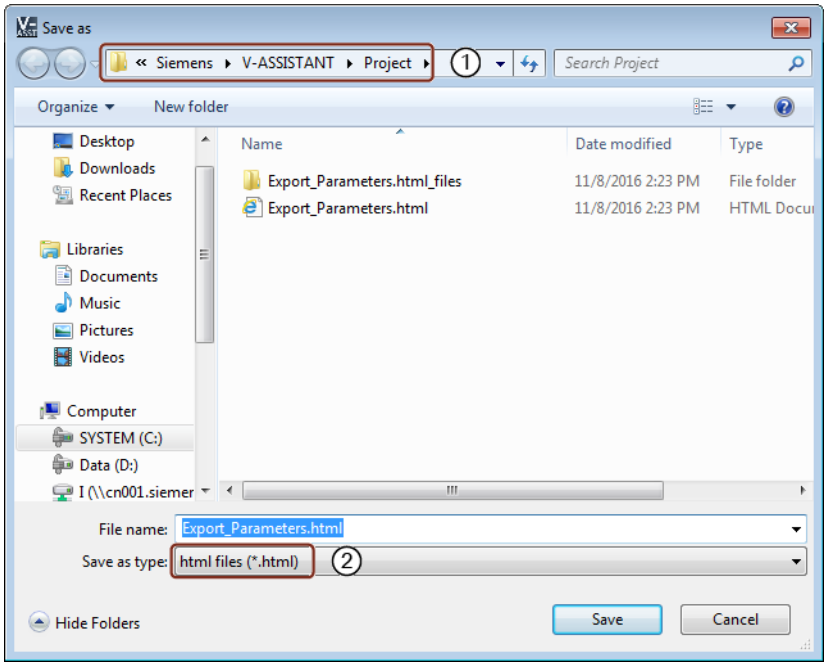
- this icon is only available for V90 PTI. A parameter with this icon in the above list indicates that it is related to Modbus communication. You can click on this icon to call the online help for Modbus communication.
- parameters with this icon in the above list indicate they are indexed parameters. By default, the first index of each indexed parameter is displayed. To view all indices of an indexed parameter, click on this icon.

Note

Can be changed

The parameters can be changed in two states. You can see the attribute of each parameter in Section "Parameter list" in the online help. The online help can be called by pressing F1 key.

- U (Run): Can be changed in the "Running" state when the drive is in "S ON" state.
- T (Ready to run): Can be changed in the "Ready" state when the drive is in "S OFF" state.

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. **Note:** If you enter the parameter number of an indexed parameter in the input field, all its indices can be displayed. To return to the view of all parameters, you only need to clear the entered text.
Factory default	You can click the following button to reset all parameters to their factory settings: Factory default For more information, see Section "Tools -> Factory default (Page 34)".
Save changes	You can click the following button to save the changes compared to the defaults/factory settings into an .html file and use the file for future documentation purposes or as an reference for BOP commissioning. Save changes Window for saving the changes:  ①: Default location: xxx/Siemens/V-ASSISTANT/Project. xxx: SINAMICS V-ASSISTANT setup root directory ②: Only .html format is available.

Field	Description
Table	All parameters are displayed with the following information: • Group • Parameter number • Name • Value • Unit • Range • Factory setting • Effect type **Note:** In the value relevant column, values with white background are editable.

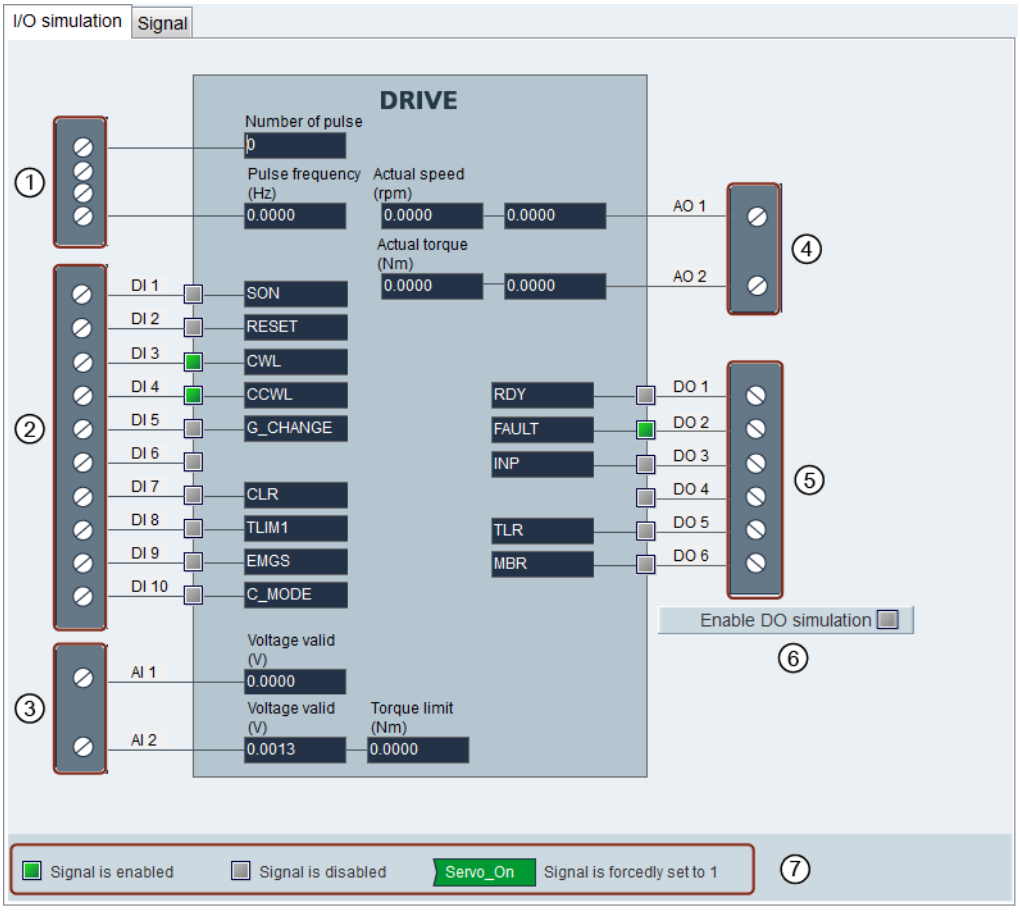
4.4 Commissioning

4.4.1 Testing interface

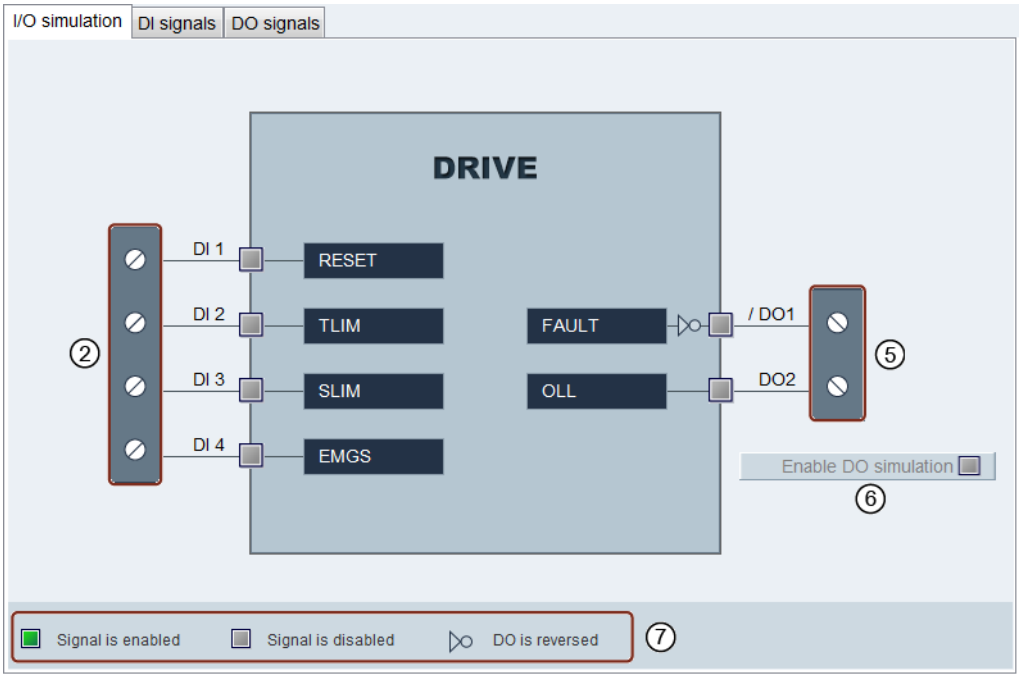
4.4.1.1 I/O simulation

When SINAMICS V-ASSISTANT is working in online mode, you can view the I/O status on the following panel for V90 PTI and V90 PN respectively:

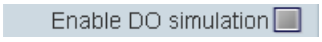
- SINAMICS V90 PTI:



- SINAMICS V90 PN:



Area	Item	Description
①	Pulse train input	Information about pulse train input: • Received number of pulses • Pulse frequency For more information, see Section "Pulse train inputs (PTIs) (Page 109)".
②	**SINAMICS V90 PTI**	
	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
	SINAMICS V90 PN	
	DI1~DI4	Every digital input can be linked with either of the seven internal signals.
	Note: For more information about the number and definition of signals, see Section "DIs (Page 97)".	
③	AI1	Linked with speed related signals
	AI2	Linked with torque related signals
	Note: For more information about analog inputs, see Section "Analog inputs (AIs) (Page 108)".	
④	AO1	Linked with actual speed signal by default
	AO2	Linked with actual torque signal by default
	Note: For more information, see Section "Analog outputs (AOs) (Page 109)".	

⑤	**SINAMICS V90 PTI**		
	DO1~DO6		Every digital output can be freely linked with either of the 15 internal signals.
	SINAMICS V90 PN		
	DO1~DO2		Every digital output can be freely linked with either of the ten internal signals.
	Note: For more information, see Section "Digital inputs/outputs (DIs/Dos) (Page 97)".		
⑥			Clicking this button enables DO simulation. If you desire to disable this function, click the following button: 
⑦		Signal is enabled	Indicates that high-voltage (or logic 1) is on the digital input/output.
		Signal is disabled	Indicates that low-voltage (or logic 0) is on the digital input/output.
		Signal is forcedly set to 1	Indicates that the status of the assigned signal is forcedly set to 1.
		DO is reversed	Indicates that the logic of the DO is reversed. After the DO is reversed, a "/" appears in front of the DO port.

Note

- This function is unavailable but can be displayed in offline mode.
- The status of each indicator and analog value is updated every 0.5 s.
- Signal P_TRG in PTI control mode is reserved for future use.
- You can change the signal link as desired. For more information, see Section "Configuring inputs/outputs (Page 78)".

Status of signals

You can view the name, description, value and status of individual signals on the following panels for V90 PTI and V90 PN respectively:

- SINAMICS V90 PTI:

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 re...	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
EMGS	Emergency stop	0	0
C_MODE	Change mode	0	0

- SINAMICS V90 PN:
  - Status of DI signals:

I/O simulation | DI signals | DO signals

Signal name	Description	Value
RESET	Reset alarms	0
CWL	Clockwise overtravel limit (positive limit)	0
CCWL	Counter-clockwise overtravel limit (negative limit)	0
TLIM	Torque limit selection	0
SLIM	Speed limit selection	0
REF	Set reference point with digital input or reference cam input for re...	0
EMGS	Emergency stop	0

  - Status of DO signals:

I/O simulation | DI signals | DO signals

Signal name	Description	Value
RDY	Servo ready	0
FAULT	Fault	0
INP	In-position signal	0
ZSP	Zero speed detection	0
TLR	Torque limit reached	0
MBR	Motor holding brake	0
OLL	Overload level reached	0
REFOK	Referenced	0
RDY_ON	Ready for servo on	0
STO_EP	STO active	0

4.4.1.2 Digital inputs/outputs (DIs/Dos)

DIs/Dos for SINAMICS V90 PN

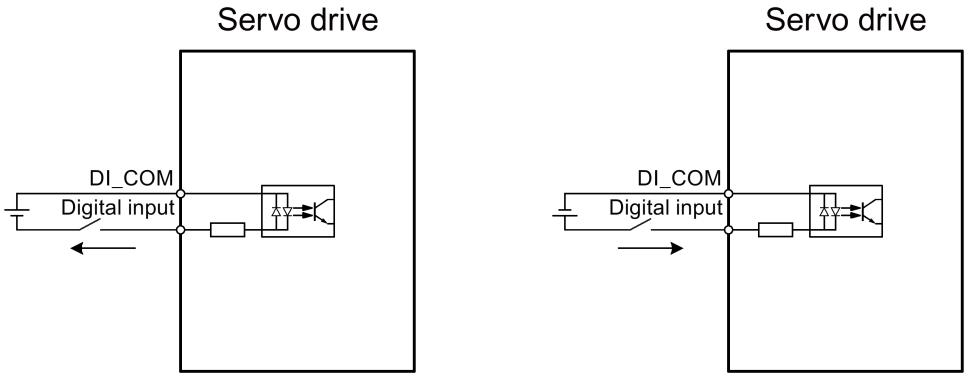
DIs

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

Name	Type	Description	Control mode	
			S	EPOS
RESET	Edge 0→1	Reset alarms • 0→1: reset alarms	✓	✓
TLIM	Level	Torque limit selection You can select two internal torque limit sources with the digital input signal TLIM. • 0: internal torque limit 1 • 1: internal torque limit 2	✓	✓
SLIM	Level	Speed limit selection You can select two internal speed limit sources 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	✓	✓
REF	Edge 0→1	Setting the reference point with a digital input or reference cam input for reference approaching mode • 0→1: reference input	X	✓
CWL	Edge 1→0	Clockwise over-travel limit (positive limit) • 1: condition for operation • 1→0: emergency stop (OFF3)	X	✓
CCWL	Edge 1→0	Counter-clockwise over-travel limit (negative limit) • 1: condition for operation • 1→0: emergency stop (OFF3)	X	✓

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

DOs

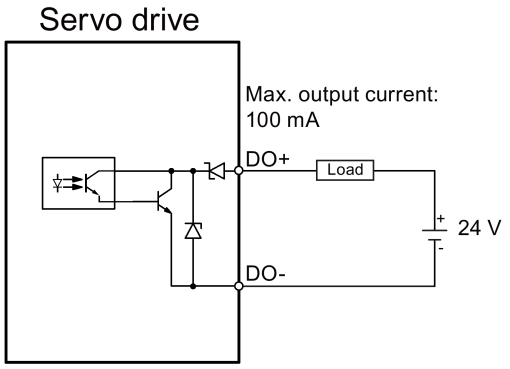
You can assign a maximum of ten internal digital output signals to the SINAMICS V90 PN servo drive. For detailed information about these signals, see the table below:

Name	Descriptions	Control mode	
		S	EPOS
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	✓	✓
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	✓	✓

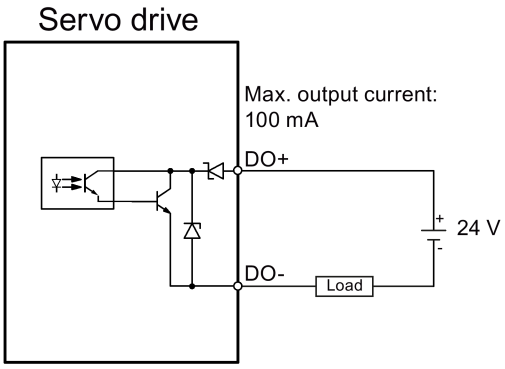
Name	Descriptions	Control mode	
		S	EPOS
MBR	Motor holding brake • 1: motor holding brake is closed • 0: motor holding brake is released **Note**: MBR is only status signal because the control and the power supply of the motor holding brake is realized with separate terminals.	✓	✓
OLL	Overload level 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.	✓	✓
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	✓
REFOK	Referenced • 1: referenced • 0: not referenced	X	✓
STO_EP	STO active • 1: the enable signal is missing, indicating that STO is active. • 0: the enable signal is available, indicating that STO is inactive. **Note:** STO_EP is only a status signal for STO input terminals but not a safe DO for the Safety Integrated function.	✓	✓

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

DIs/Dos for SINAMICS V90 PTI

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 set. • 0: the first gain parameter set • 1: the second gain parameter set	✓	✓	✓	X

No.	Name	Type	Description	Control mode			
				PTI	IPos	S	T
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 clear • 1: clear the droop pulses based on the selected clear mode by p29242	✓	X	X	X
8	EGEAR1	Level	Electronic gear. 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	X
9	EGEAR2	Level		✓	X	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 setpoints). 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 3	✓	✓	✓	✓
20	SLIM2	Level					
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					

No.	Name	Type	Description	Control mode			
				PTI	IPos	S	T
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 can 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 the drive is working in the torque control mode, the torque setpoint equals to 0 if CWE and CCWE are at the same status. For more information, see the direction and stop relevant section in the 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:

- DI signal SREF is invalid during referencing via SINAMICS V-ASSISTANT.
- DI signal SON is invalid during a trial run test; meanwhile, DI7 and DI8 are occupied by SINAMICS V-ASSISTANT.

Direct signal map

You can set the following six signals to logical "1" forcedly 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 forcedly set the signal SON to a logical high signal, DI1 can then be assigned to other desired signals.

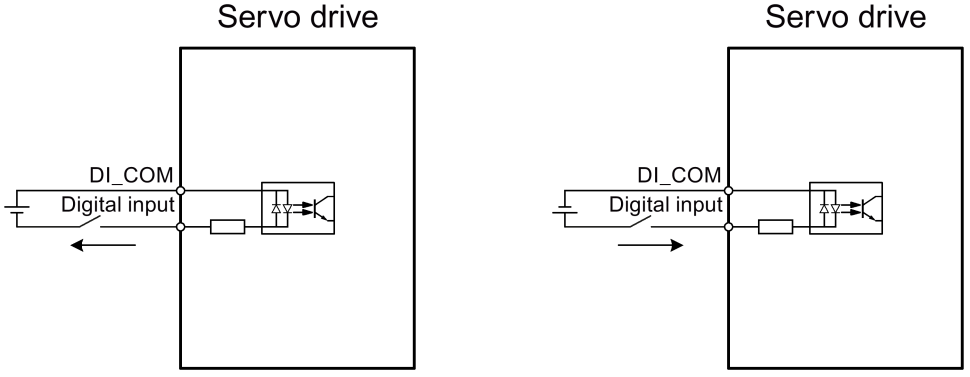
Note

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 "S ON" state.

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

DOs

You can assign a maximum of 15 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
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.	✓	✓	✓	✓

No.	Name	Descriptions	Control mode			
			PTI	IPos	S	T
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)	✓	✓	✓	✓
14	RDY_ON	Ready for servo on • 1: ready to servo on • 0: drive is not ready for servo on (a fault occurs or the main power supply is missing) **Note:** after the drive is in "S ON" state, the signal remains at high level (1) unless the above abnormal cases happen.	✓	✓	✓	✓
15	STO_EP	STO active • 1: the enable signal is missing, indicating that STO is active. • 0: the enable signal is available, indicating that STO is inactive. **Note:** STO_EP is only a status signal for STO input terminals but not a safe DO for the Safety Integrated function.	✓	✓	✓	✓

Assigning warning signals to digital outputs

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

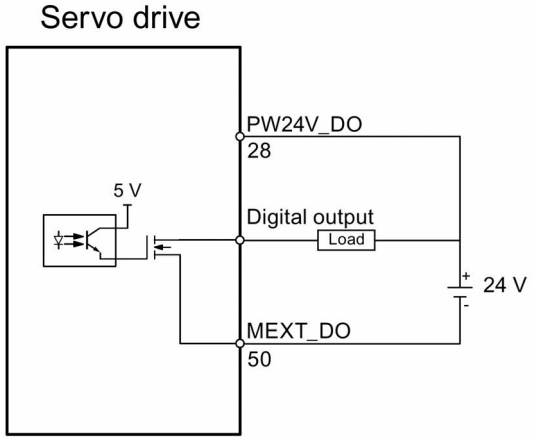
Setting (p29340/p29341)	Warning conditions
1	Overload protection: load factor is 85% of or above the motor utilization.
2	Braking resistor: capacity of the braking resistor is 85% of or above the resistor power rating.
3	Fan alarm: fan has stopped for 1 second or longer.
4	Encoder alarm
5	Motor overheat: 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.

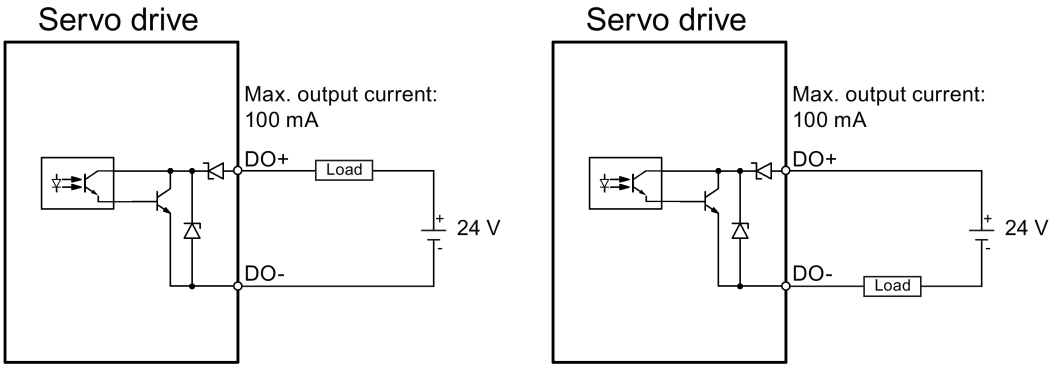
If warning condition assigned to p29341 occurs, WARNING2 becomes ON.

Wiring

The digital outputs 1 to 3 only support the wiring of the NPN type as illustrated below:



The digital outputs 4 to 6 support the wiring of both the NPN and PNP types as illustrated below:



NPN wiring PNP wiring

4.4.1.3 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

4.4.1.4 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:

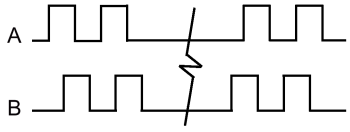
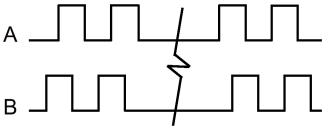
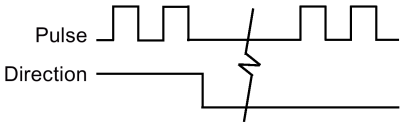
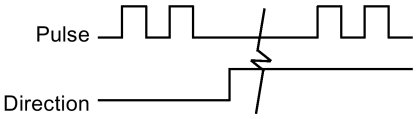
Parameter	Value	Source	Value	Source
p29350	0 (default)	Actual speed (reference p29060)	7	Pulse input frequency (reference 100 k)
	1	Actual torque (reference 3 × r0333)	8	Pulse input frequency (reference 1000 k)
	2	Speed setpoint (reference p29060)	9	Remaining number of pulses (reference 1 k)
	3	Torque 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)		

4.4.1.5 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 (CW)	Reverse (CCW)
AB track pulse				
Pulse + Direction				

4.4.1.6 Pulse train encoder outputs (PTOs)

Function

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

4.4.2 Testing motor

Two sub-functions are available:

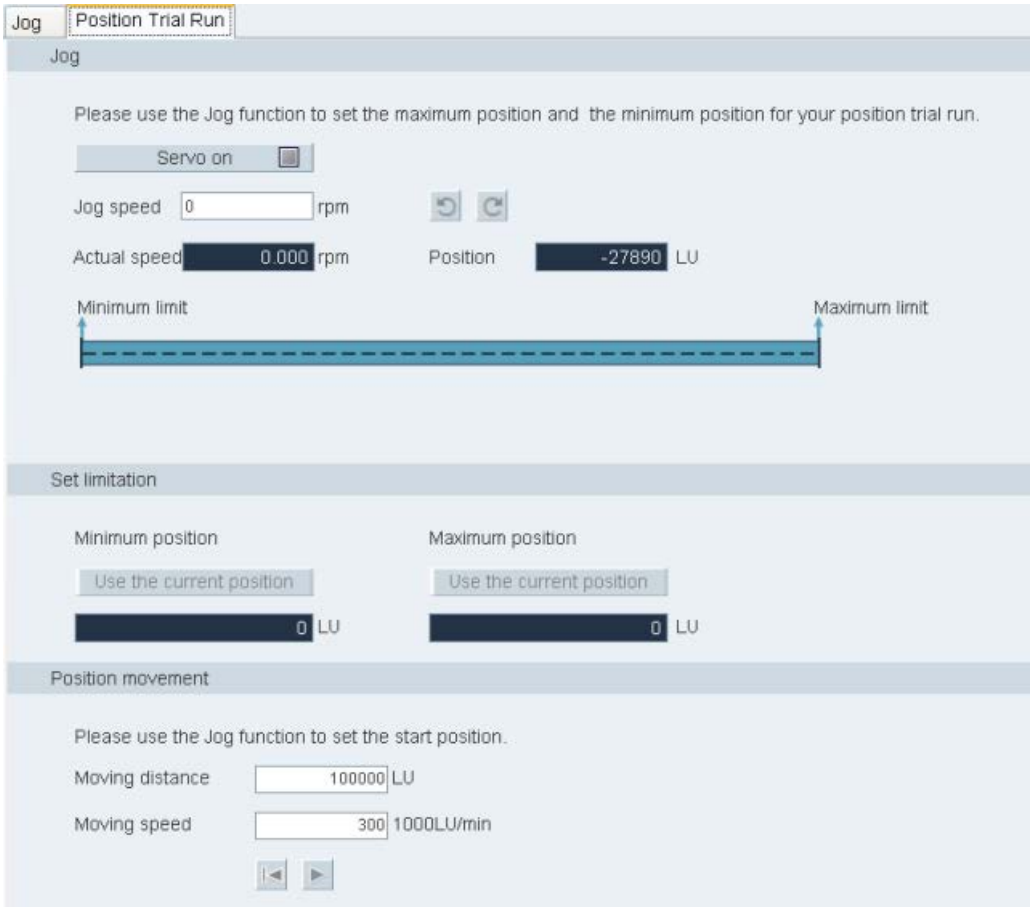
- Jog (Page 110)
- Position trial run (V90 PTI only) (Page 111)

4.4.2.1 Jog

For detailed information about the Jog function, see Section "Jog (Page 49)".

4.4.2.2 Position trial run (V90 PTI only)

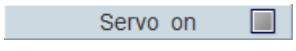
In online mode, you can configure this function on the following panel:



Note

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

Operating sequence

1. Enter the Jog speed.
2. 

Use this button to enable the Jog function.

   Note:

   After clicking this button, a warning message appears. Click OK in the message window to confirm executing servo-on.
3. 
Click this button to rotate the motor clockwise and set a proper limit position.
4. 

Obtain the current position by clicking this button.



5. Click this button to rotate the motor counter-clockwise and set a proper limit position.



6. Obtain the current position by clicking this button.

   Note:

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

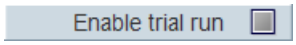


7. Use this button to disable the Jog function.

   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:

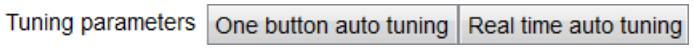
    



11. If necessary, click this button to move back to the previous position.

4.4.3 Optimizing drive

You can select the desired tuning mode by clicking 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.

The one-button auto tuning function allows the servo drive to automatically estimate the ratio of load moment of inertia.

Prerequisites 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

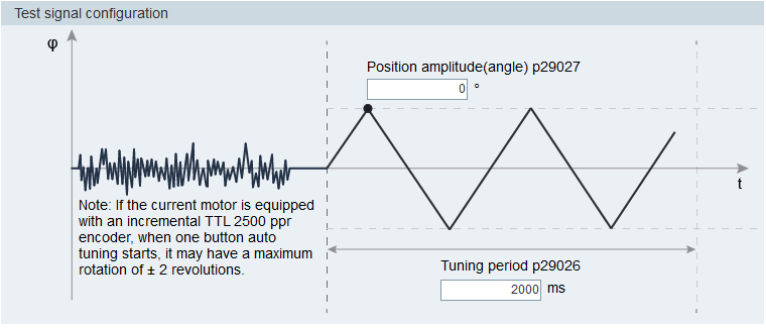
Implement the following steps to use the one-button auto tuning function:

1. Select the dynamic factor in the following area:



   For more information about selecting the dynamic factor, see the SINAMICS V90, SIMOTICS S-1FL6 Operating Instructions.

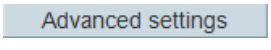
2. Configure the test signal in the following area:



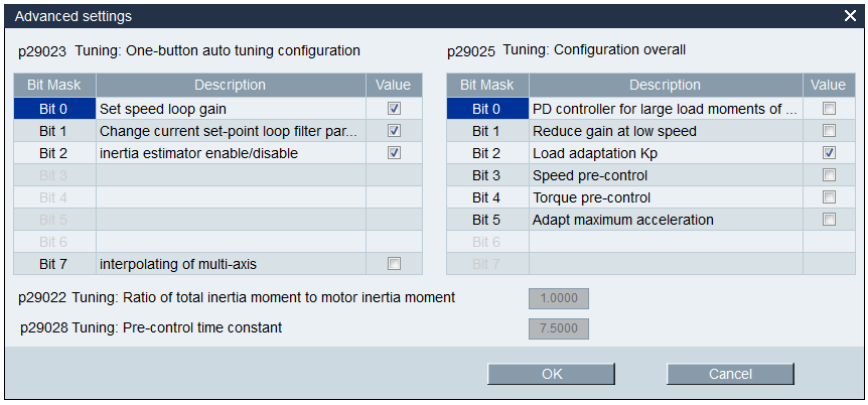
   Note:

   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.

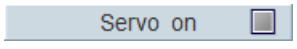
Parameter p29028 is available when the multi-axis interpolation function is activated (p29023.7 = 1). If several axes are used as interpolation axes, you need to set the same pre-control time constants (p29028) for them.

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

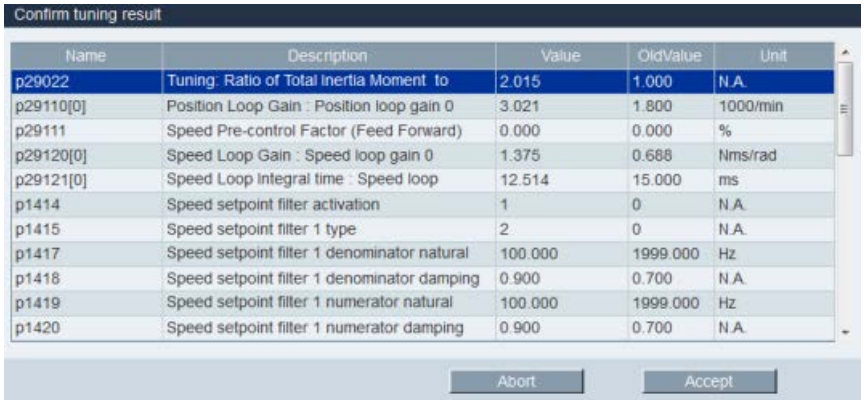
5. Click the following button to enable the function after the parameters are set.



6. Click this button to start tuning.



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



Click Accept to apply the tuning result; otherwise, click Abort to abort the tuning result.

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

Note

After you set the drive to the servo-on state, the motor runs with the test signal.

After the one-button auto tuning process is complete successfully, the value of the parameter p29021 is set to 0 automatically. You can also set the value of the parameter p29021 to 0 before setting the derive to the servo-on state to interrupt the one-button auto tuning. Before saving the parameters on the drive, you need to make sure that p29021 has been changed to 0.

Note

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

Note

After the one-button tuning function is activated, you are not allowed to perform any operation except servo off and emergency stop.

Note

After activating one-button auto tuning, do not change other auto tuning related control/filter parameters since these parameters can be set automatically and your changes can 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 a long time to realize 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 enabled 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.

The real-time auto tuning function allows the servo drive to automatically estimate the ratio of load moment of inertia and set the optimum control parameters.

Prerequisites for real-time auto tuning

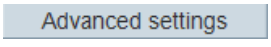
- The drive must be controlled by the host controller.
- The machine actual load moment of inertia is different when the machine moves to the different positions.
- Make sure that the motor has multiple accelerations and decelerations. Step command is recommended.
- Machine resonance frequency changes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

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

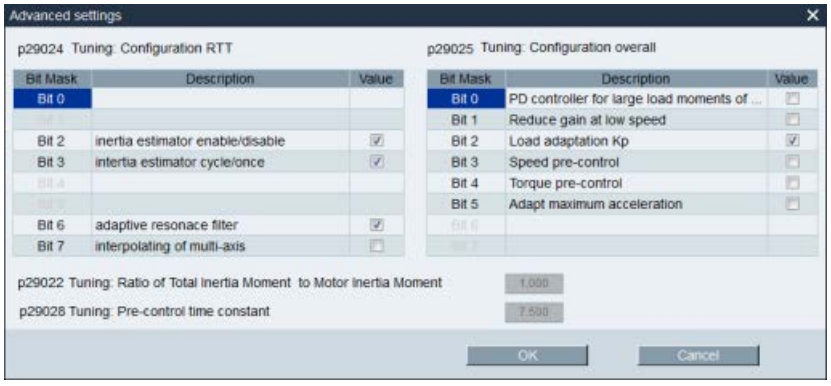
1. Select the dynamic factor in the following area:

   For more information about selecting the dynamic factor, see the 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:

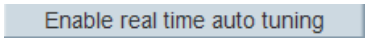
You can set the ratio of machine load moment of inertia (p29022) with the following methods:

- 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.

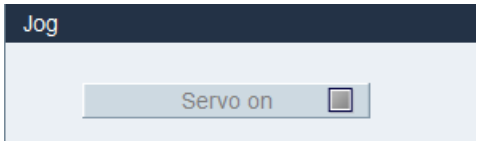
Parameter p29028 is available when the multi-axis interpolation function is activated (p29024.7 = 1). If the axes are used as the interpolation axes, you need to set the same pre-control time constants (p29028) for them.

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:

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.

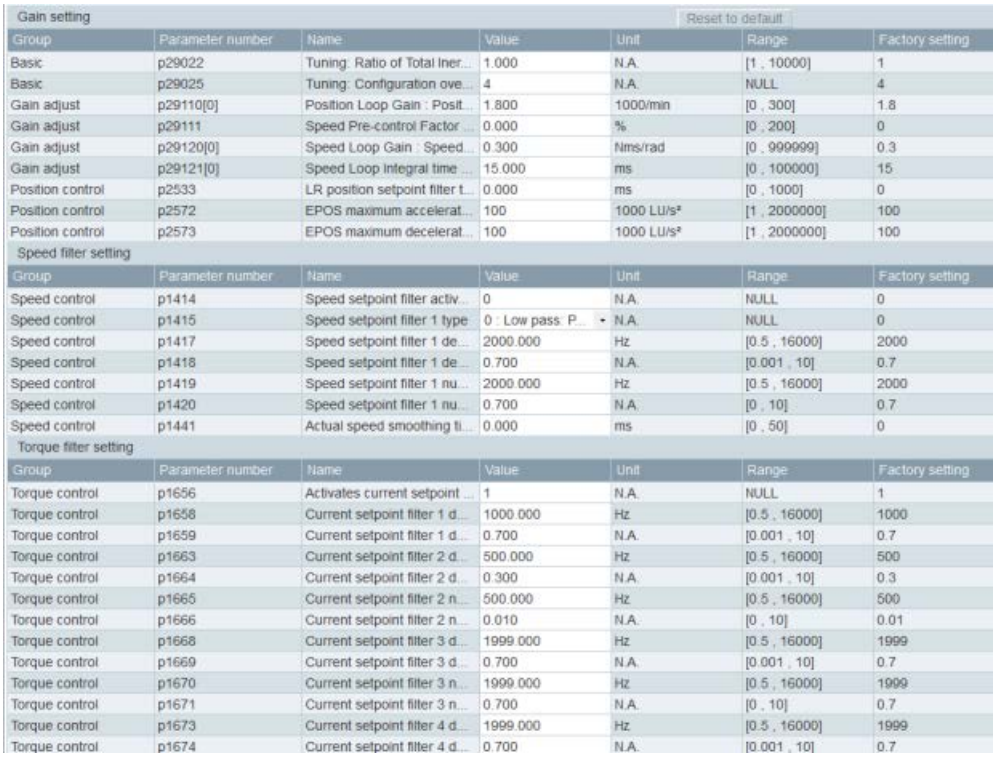
4.4.3.3 Manual tuning

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
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:

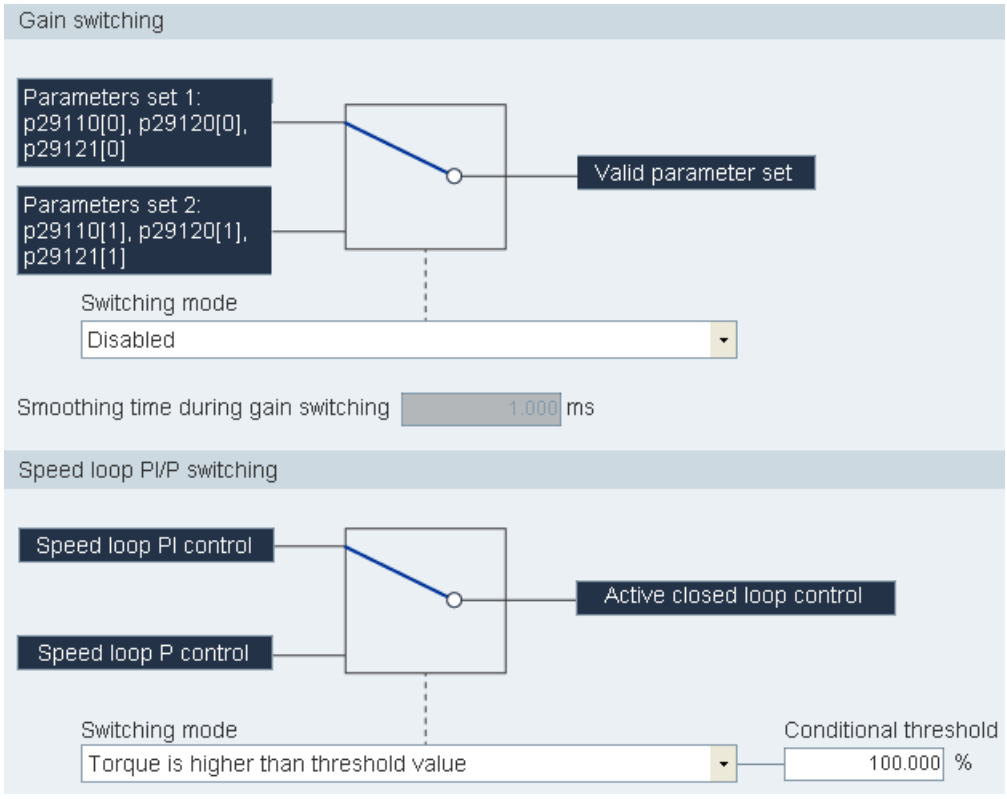
p1663=p1665=f_{sp}

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

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

Switching modes

The following two switching modes are only available for V90 PTI:



These two switching modes cannot be used at the same time. Once one mode is enabled, the other one becomes 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 can 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 as shown in the above screenshot.

Note

PI/P switching

This function is **not** available in **T** mode and responds with a delay of several milliseconds.

4.4.3.4 Low frequency vibration suppression

Low frequency vibration suppression is a position setpoint filter function. It can suppress the vibration frequency within 0.5 Hz to 62.5 Hz.

This function is only available in IPos and EPOS control modes.

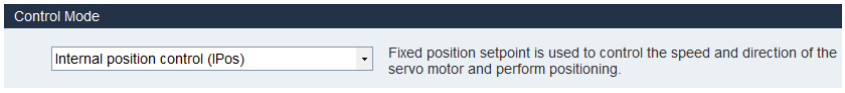
Parameter settings

To 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: disable = 1: enable
p31581	0 to 1	0	-	Vibration suppression filter type = 0: rugged = 1: sensitive
p31585	0.5 to 62.5	1	Hz	Vibration suppression filter frequency
p31586	0 to 0.99	0.03	-	Vibration suppression filter damping

Operating sequence

1. Set the drive to servo off status.
2. Set relevant parameters on the "Viewing all parameters (Page 90)" panel.
   - Select the filter type by setting p31581:
     – p31581 = 0: rugged
     – p31581 = 1: sensitive
   - Define the suppression frequency by setting p31585 (value range: 0.5 Hz to 62.5 Hz).
   - Set the filter damping by p31586 (value range: 0 to 0.99).
3. Select the desired control mode for the drive on the following panel.



4. Enable the vibration suppression function by setting p29035 = 1 on the "Viewing all parameters (Page 90)" panel.
5. Set the drive to servo on status.

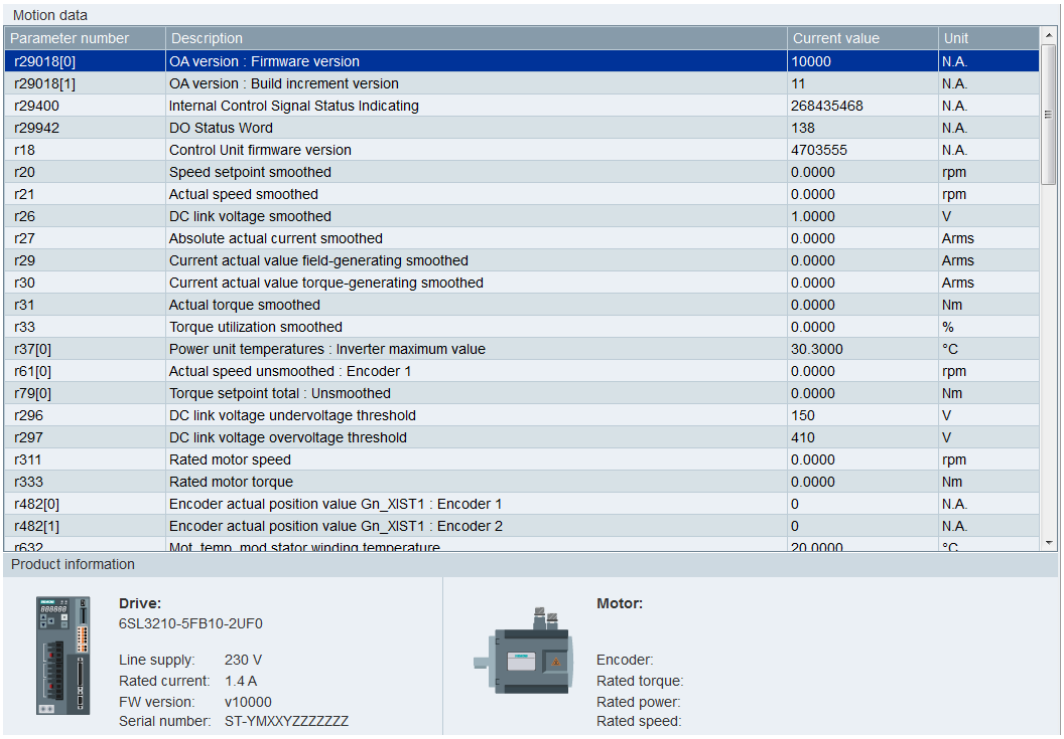
4.5 Diagnostics

4.5.1 Monitoring status

Note

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

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

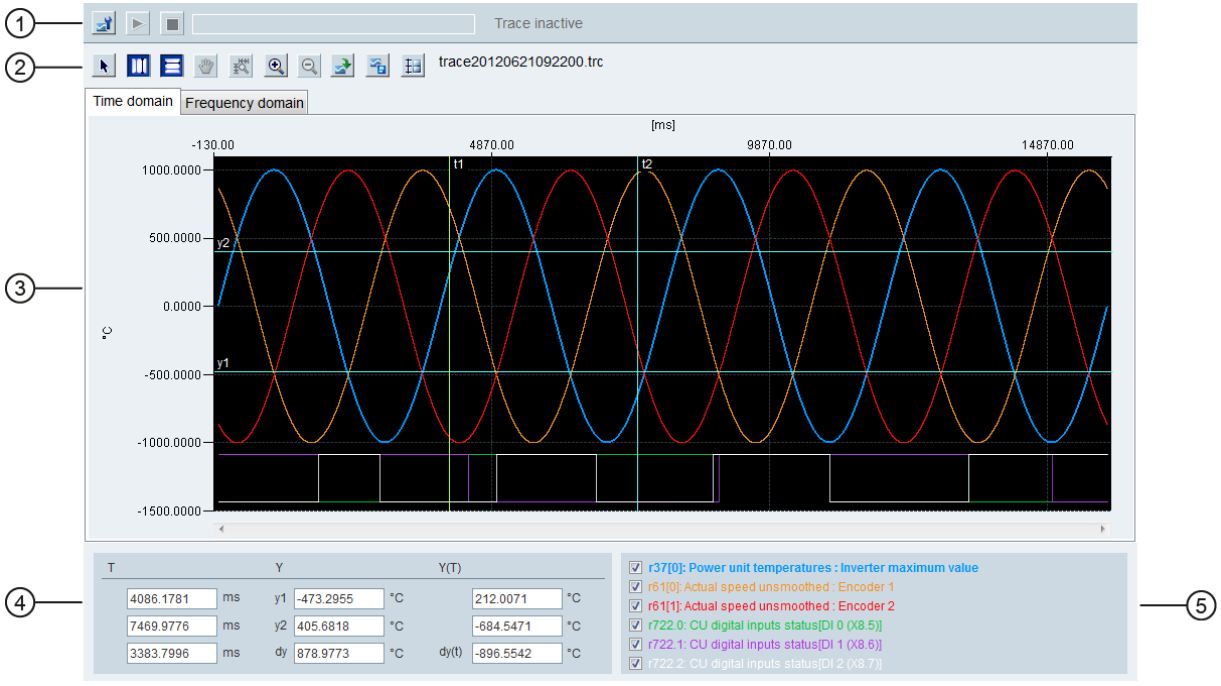


Note

The above screenshot takes the user interface of SINAMICS V-ASSISTANT for V90 PN for example.

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:

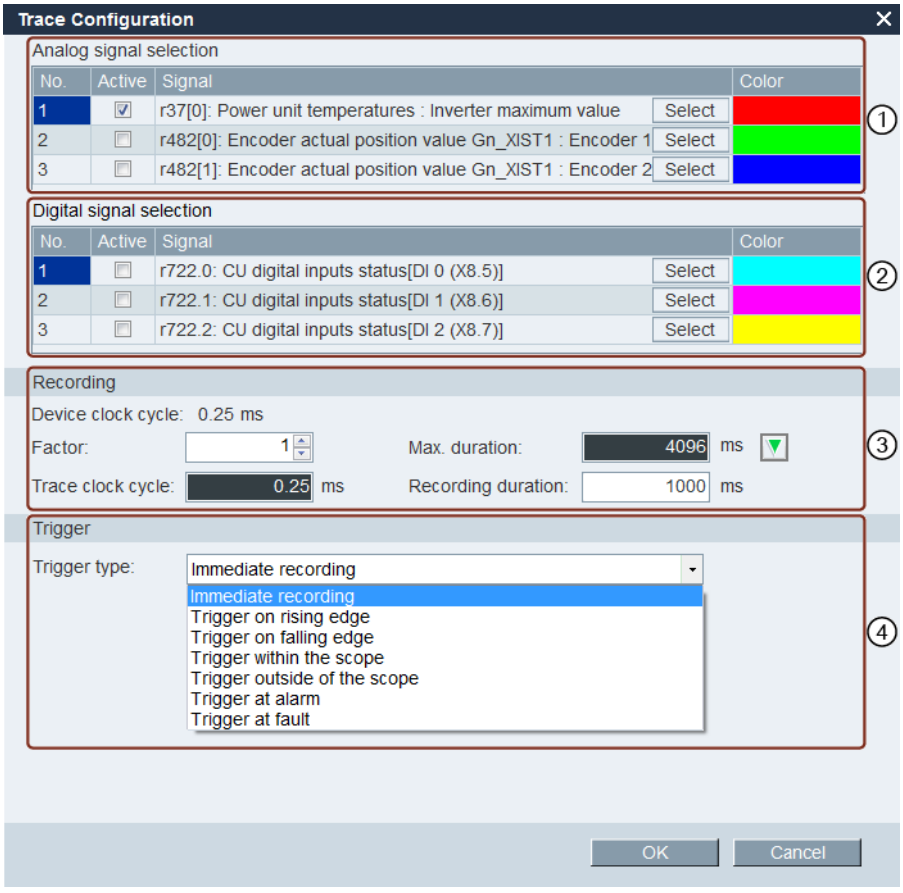


Area	Item		Description
①	Trace configuration		Opens the window of trace configuration For more information, see Section "Trace configuration (Page 129)".
	Start/stop trace (**Only** available in online mode)		Starts recording the current trace If you desire to stop the trace process, click the following button: 
②	Cursors		Changes the cursor shape from cross to arrow When the cursor appears as an arrow, you can directly select a curve and use it for variable calculation. **Note:** The selected curve is displayed 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 the 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 the 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 the frequency domain chart, the button is unavailable.
	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
	Reset scaling		Displays the selected curves with the same scale, that is, the biggest scale of all selected curves
	Note: In the 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. Formula: 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 Formula: dy = y2 - y1
	Y(T)	Coordinate 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 Formula: dy(t) = y(t2) - y(t1)
	Note: You can select a coordinate by clicking its designation, then the selected coordinate is displayed 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 appear 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 abort your selection. 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 abort your selection. 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 as the 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.

4.5.3 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.

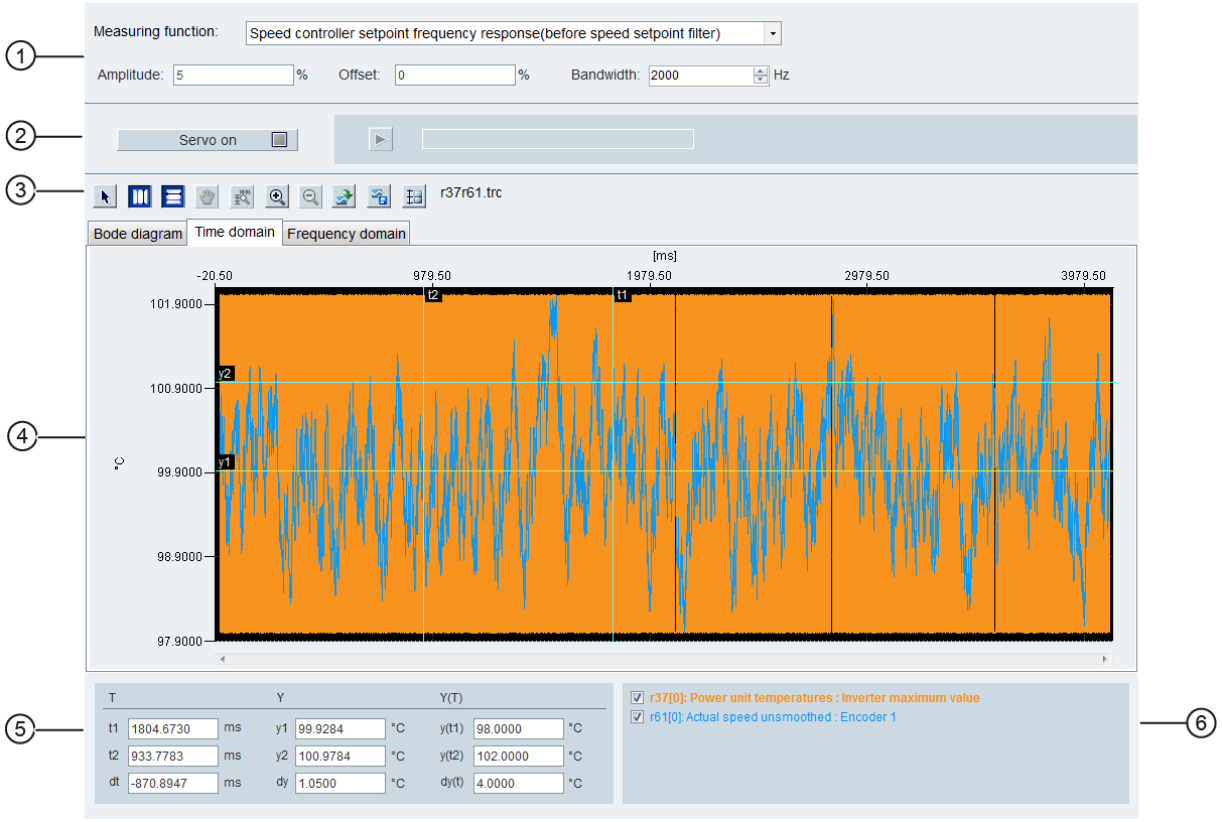
- Current controller setpoint frequency response(after current setpoint filter)

  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.

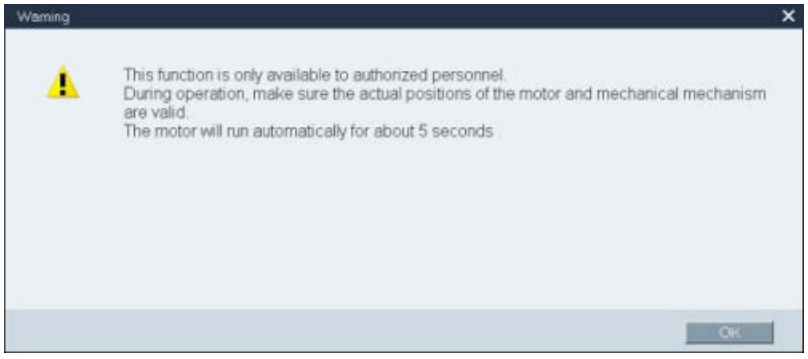
Note

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.

Area	Item		Description
	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.
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 completed.
③	Cursor		Changes the cursor shape from cross to arrow When the cursor appears as an arrow, you can directly select a curve and use it for variable calculation. **Note:** The selected curve is displayed 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 the 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 the 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 the 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 the frequency domain chart, the button is not available.

Area	Item		Description
	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
	Reset scaling		Displays the selected curves with the same scale, that is, the biggest scale of all selected curves
	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 Formula: 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 Formula: 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 Formula: dy(t) = y(t2) - y(t1)
	Note: You can select a coordinate by clicking its designation, then the selected coordinate is displayed yellow.		

Area	Item	Description
	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 appear in the chart.

4.6 Communicating with the PLC (V90 PTI only)

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

4.6.1 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.

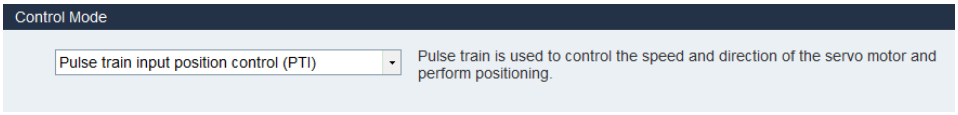
Parameter	Description	Parameter	Description
p1001	Fixed speed setpoint 1	r0020	Speed setpoint smoothed
p1002	Fixed speed setpoint 2	r0021	Actual speed smoothed
p1003	Fixed speed setpoint 3	r0026	DC link voltage smoothed
p1004	Fixed speed setpoint 4	r0027	Absolute actual current smoothed
p1005	Fixed speed 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 value
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 on 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 parameters 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.

4.6.2 Modbus communication

The SINAMICS V90 servo drive can communicate with the PLC through an RS485 cable by using the standard Modbus communication protocol. There are two ways of sending a message to a slave.

- Unicast mode (addresses 1 to 31): The master sends a message to a sepcific slave directly.
- Broadcast mode (address 0): The master sends a message to all slaves at the same time.

The broadcast mode cannot be used for an error request because all slaves cannot respond at once.

For the 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 Modbus function code FC6 (single register) or FC16 (multiple registers).

Supported function codes

The SINAMICS V90 supports only three function codes. If a request with an unknown function code is received, an error message is returned.

FC3 - Read holding registers

When a message with FC = 0x03 is received, then four bytes of data are expected, that is, FC3 has four bytes of data:

- Two bytes for the starting address
- Two bytes for the number of registers

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Address	FC (0x03)	Start address		Number of registers		CRC	
		High	Low	High	Low	High	Low

FC6 - Write single register

When a message with FC = 0x06 is received, then four bytes of data are expected, that is, FC6 has four bytes of data:

- Two bytes for the register address
- Two bytes for the register value

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
Address	FC (0x06)	Start address		New register value		CRC	
		High	Low	High	Low	High	Low

FC16 - Write multiple registers

When a message with FC = 0x10 is received, then 5 + N bytes of data are expected, that is, FC16 has 5 + N bytes of data:

- Two bytes for the starting address
- Two bytes for the number of registers
- One byte for the byte count
- N bytes for the register values

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 7 + N	Byte 8 + N	Byte 9 + N	Byte 10 + N
Address	FC (0x10)	Start address		Number of registers		Number of bytes	Register N value		CRC	
		High	Low	High	Low		High	Low	High	Low

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	MDI position setpoint high word (IPos)	R/W	LU	1	-2147482648 to 2147482647	Process data 3, receive word, PZD3
40103	MDI position setpoint low word (IPos)	R/W	LU	1		Process data 4, receive word, PZD4
40104	MDI speed setpoint high word (IPos)	R/W	1000 LU/min	1	1 to 40000000	Process data 5, receive word, PZD5
40105	MDI speed setpoint low word (IPos)	R/W	1000 LU/min	1		Process data 6, receive word, PZD6
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
40114	Actual speed high word (PTI, IPos)	R	1000 LU/min	1	1 to 40000000	Process data 5, send word, PZD5

Modbus register number	Description	Modbus access	Unit	Scaling factor	Range or On/Off text	Data/parameter
40115	Actual speed low word (PTI, IPos)	R	1000 LU/min	1		Process data 6, send word, PZD6
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	-
40280/40281	Enable DI simulation (high part/low part)	R/W	-	1	HIGH/LOW	p0795
40282/40283	Setpoint DI simulation (high part/low part)	R/W	-	1	HIGH/LOW	p0796
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]/100
40320	Rated power of the power unit	R	kW	100	0.00 to 327.67	-
40321	Current limit	R/W	A	1	0.0 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
40326	Reference mode	R/W	-	1	0 to 4	p29240
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

Modbus register number	Description	Modbus access	Unit	Scaling factor	Range or On/Off text	Data/parameter
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 65535	-
40401	Failure number, index 1	R	-	1	0 to 65535	-
40402	Failure number, index 2	R	-	1	0 to 65535	-
40403	Failure number, index 3	R	-	1	0 to 65535	-
40404	Failure number, index 4	R	-	1	0 to 65535	-
40405	Failure number, index 5	R	-	1	0 to 65535	-
40406	Failure number, index 6	R	-	1	0 to 65535	-
40407	Failure number, index 7	R	-	1	0 to 65535	-
40408	Alarm number	R	-	1	0 to 65535	-
40601	DS47 Control	R/W	-	-	-	-
40602	DS47 header	R/W	-	-	-	-
40603	DS47 data 1	R/W	-	-	-	-
...	...					
40722	DS47 data 120	R/W	-	-	-	-
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]

Modbus register number	Description	Modbus access	Unit	Scaling factor	Range or On/Off text	Data/parameter
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	IPos jerk limiting	R/W	1000 LU/s^3	1	1 to 100000000	p2574
40886/40887	IPos reference point coordinate value	R/W	LU	1	-2147482648 to 2147482647	p2599
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
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
40934	MDI acceleration override	R/W	%	100	0.1 to 100	p2692
40935	MDI deceleration override	R/W	%	100	0.1 to 100	p2693
40950	Fixed torque setpoint	R/W	%	100	-100 to 100	p29043

Modbus register number	Description	Modbus access	Unit	Scaling factor	Range or On/Off text	Data/parameter
40960/40961	Number of pulses per revolution	R/W	-	1	0 to 16777215	p29011
40962/40963	Numerator of electronic gear 0	R/W	-	1	1 to 10000	p29012[0]
40964/40965	Numerator of electronic gear 1	R/W	-	1	1 to 10000	p29012[1]
40966/40967	Numerator of electronic gear 2	R/W	-	1	1 to 10000	p29012[2]
40968/40969	Numerator of electronic gear 3	R/W	-	1	1 to 10000	p29012[3]
40970/40971	Denominator of the electronic gear	R/W	-	1	1 to 10000	p29013

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.

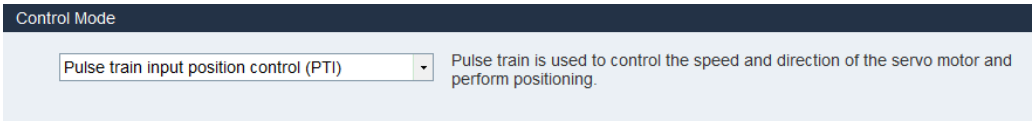
4.6.2.1 Cyclic communication

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.
   - Set the monitor time for Modbus by parameter p29019.

     Sets the monitoring time to monitor the process data received via the RS485 interface. If no process data is received within this time, then F1910 is output.

     The default vaule of p29019 is 0. If p29019 = 0, monitoring is deactivated.
3. Select the control mode for the drive on 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. Set a way for PLC to send the message to slaves.

   Note:

   For broadcast mode, you need to set the slave address to 0 on the PLC side.

   For unicast mode, you need to set the desired target slave address on the PLC side. For example, if you want to send the message to slave 1, you need to set the slave address to 1 on the PLC side.
7. Write the control word via the PLC.

   Note:

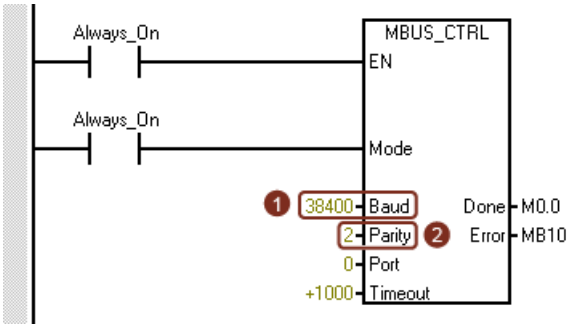
   Bit 10 of the register 40100 must be set to 1 to allow the PLC to control the drive.

   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.
8. Write the setpoint and read the status word via PLC.

Example

This example shows the operating procedures when we use the setpoint and control word from Modbus (p29008 = 1) 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. Set the drive work mode to S control mode.
6. Save the parameters and restart the drive.
7. Configure the PLC parameters.

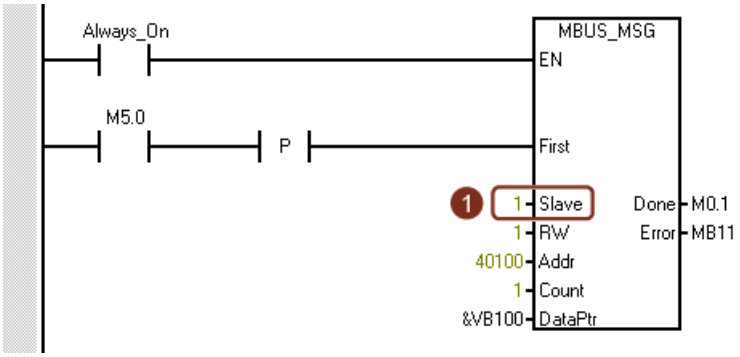


Note:

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

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

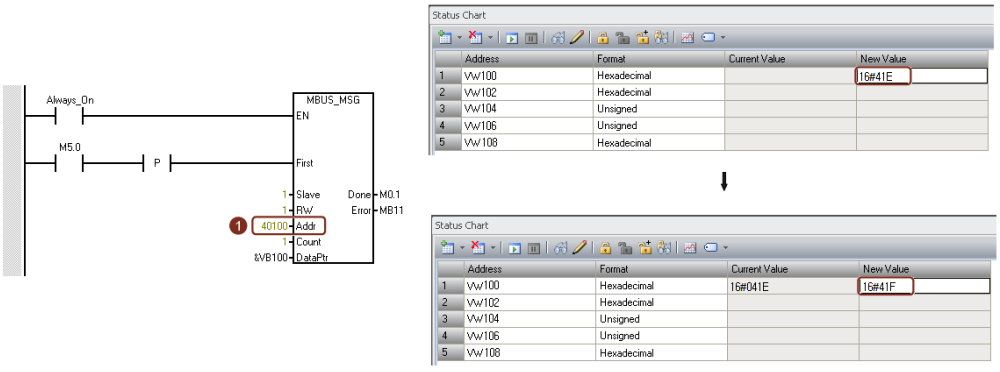
8. Set a way for PLC sending message to slaves. Here we use the unicast mode and we only want to send the message to slave 1.



Note:

If you want to send the message to all slaves, you need to set the slave address to 0 to use the broadcast mode.

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



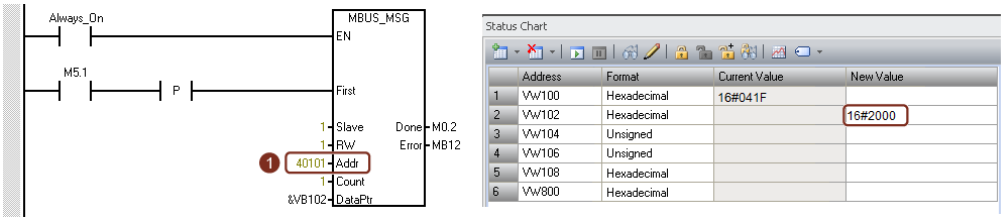
Note:

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".

10. 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.

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	-

Bit	PTI control mode		IPos control mode	
	Signals	Description	Signals	Description
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)
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_RAMP	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 external 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

In IPos control mode, when the relative positioning mode is selected, the method for accepting MDI setpoint must be a rising edge (bit 5 = 0); otherwise, fault F7488 occurs.

Note

In IPos control mode, when you implement the absolute positioning for the modular axis with Modbus, you can select the MDI direction with parameter p29230.

Note

In T control mode, the motor cannot be stopped with OFF1 via Modbus.

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	-

DI simulation

The digital input signals can be simulated by Modbus with registers 40281 and 40283.

Digital input	DI1	DI2	DI3	DI4	DI5	DI6	DI7	DI8	DI9	DI10
Register 40281 (p0795)	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Bit 8	Bit 9
Register 40283 (p0796)	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Bit 8	Bit 9

- Set the simulation mode for DIs with register 40281

  Bit 0 to bit 9 of register 40281 can be used to set the simulation mode for DI1 to DI 10. For example, if you want to simulate DI1 with Modbus, you need to set bit 0 = 1 for register 40281.

- Set the setpoint for DIs with register 40283

  Bit 0 to bit 9 of register 40283 can be used to set the setpoint for the simulated DI signals. After the DI simulation mode is set, you can set the setpoint for a DI signal with register 40283 to enable the DI signal. For example, if you have set bit 0 = 1 for register 40281, to enable signal DI1, you need to set the trigger condition (rising edge or high level) for bit 0 of register 40283.

DI simulation example in S control mode

In S control mode, the default digital input signal assignment is as follows:

Digital input	DI1	DI2	DI3	DI4	DI5	DI6	DI7	DI8	DI9	DI10
Signal	SON	REST	CWL	CCWL	CWE	CCWE	SPD1	SPD2	EMGS	C-MODE
Register 40281 (p0795)	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Bit 8	Bit 9
Register 40283 (p0796)	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Bit 8	Bit 9

For more information about the DI assignment, see Section "Digital inputs/outputs (DIs/Dos) (Page 97)".

- Set the simulation mode for DI1

  To simulate DI1 with Modbus, you need to set bit 0 = 1 for register 40281.

- Set the setpoint for DI1

  After the simulation mode of DI1 is set, you can set the setpoint for DI1 with register 40283 to enable the DI signal.

  In S control mode, DI1 is assigned with SON by default, so we need to trigger a rising edge to enable the SON signal. Set bit 0 = 0 for register 40283 and then set the bit to 1. A rising edge is triggered. The motor is now in "S ON" state.

4.6.2.2 Acyclic communication

The SINAMICS V90 servo drive supports acyclic communication via data set 47.

The maximum data length per request is 240 bytes.

Note

Values in italics

Values in italics in the following tables mean that you have to adjust these values for a specific request.

Data block setting

Reading parameter values

The table below formats a request to read parameters.

Data block	Byte n	Bytes n + 1	n
Header	**Reference** *00 hex ... FF hex*	**01 hex**: Read job	0
	02 hex (ID of drive objects, at V90 always = 2)	**Number of parameters (m)**	2
Address, parameter 1	**Attribute** *10 hex:* Parameter value	**Number of the indices** *00 hex ... EA hex* (For parameters without index: 00 hex)	4
	Parameter number *0001 hex ... FFFF hex*		6
	Number of the 1st Index *0000 hex ... FFFF hex* (for parameters without index: 0000 hex)		8
	…		…
Address, parameter 2	…		…
…	…		…
Address, parameter m	…		…

The table below formats the drive response to a read request.

Data block	Byte n	Bytes n + 1	n
Header	**Reference** (identical to a read request)	**01 hex**: Drive has executed the read request. **81 hex**: Drive was not able to completely execute the read request.	0
	02 hex (ID of drive objects, at V90 always = 2)	**Number of parameters (m)** (identical to the read request)	2

Data block	Byte n	Bytes n + 1	n
Values, parameter 1	**Format** *02 hex*: Integer8 *03 hex*: Integer16 *04 hex*: Integer32 *05 hex*: Unsigned8 *06 hex*: Unsigned16 *07 hex*: Unsigned32 *08 hex*: FloatingPoint *0A hex*: OctetString *0D hex*: TimeDifference *34 hex*: TimeOfDay without date indication *35 hex*: TimeDifference with date indication *36 hex*: TimeDifference without date indication *41 hex*: Byte *42 hex*: Word *43 hex*: Double word *44 hex*: Error	**Number of index values** or - for a negative response - **number of error values**	4
	Value of the 1st Index or - for a negative response- **Error value 1** You can find the error values in the table at the end of this section.		6
	…		…
Values, parameter 2	…		
…	…		
Values, parameter m	…		

Changing parameter values

The table below formats a request to change parameters.

Data block	Byte n	Bytes n + 1	n
Header	**Reference** *00 hex ... FF hex*	**02 hex**: Change request	0
	02 hex (ID of drive objects, at V90 always = 2)	**Number of parameters (m)** *01 hex ... 27 hex*	2
Address, parameter 1	**10 hex**: Parameter value	**Number of indices** *00 hex ... EA hex* (00 hex and 01 hex are equivalents)	4
	Parameter number *0001 hex ... FFFF hex*		6
	Number of the 1st Index *0001 hex ... FFFF hex*		8
	…		…
Address, parameter 2	…		
…	…		…
Address, parameter m	…		

Data block	Byte n	Bytes n + 1	n
Values, parameter 1	**Format** *02 hex:* Integer 8 *03 hex:* Integer 16 *04 hex:* Integer 32 *05 hex:* Unsigned 8 *06 hex:* Unsigned 16 *07 hex:* Unsigned 32 *08 hex:* Floating Point *0A hex:* Octet String *0D hex:* Time Difference *34 hex*: TimeOfDay without date indication *35 hex*: TimeDifference with date indication *36 hex*: TimeDifference without date indication *41 hex:* Byte *42 hex:* Word *43 hex:* Double word	**Number of index values** *00 hex ... EA hex*	
	Value of the 1st Index		
	…		
Values, parameter 2	…		
…	…		
Values, parameter m	…		

The table below formats the response when the drive has executed the change request.

Data block	Byte n	Bytes n + 1	n
Header	**Reference** (identical to a change request)	**02 hex** (change request successful)	0
	02 hex (ID of drive objects, at V90 always = 2)	**Number of parameters** (identical to a change request)	2

The table below formats the response when the drive was not able to completely execute the change request.

Data block	Byte n	Bytes n + 1	n
Header	**Reference** (identical to a change request)	**82 hex:** (Drive was not able to completely execute the write request)	0
	02 hex (ID of drive objects, at V90 always = 2)	**Number of parameters** (identical to a change request)	2
Values, parameter 1	**Format** 40 hex: Zero (change request for this data block executed) 44 hex: Error (change request for this data block not executed)	**Number of error values** 00 hex 01 hex or 02 hex	4
	Only for "Error" - **error value 1** You can find the error values in the table at the end of this section.		6
	Only for "Error" - **error value 2** Error value 2 is either zero, or it contains the number of the first index where the error occurred.		8
Values, parameter 2	...		
...	…		…
Values, parameter m	...		

Error values

See the table below for error values in the parameter response.

Error value 1	Meaning
00 hex	**Illegal parameter number** (access to a parameter that does not exist)
01 hex	**Parameter value cannot be changed** (change request for a parameter value that cannot be changed)
02 hex	**Lower or upper value limit exceeded** (change request with a value outside the value limits)
03 hex	**Incorrect subindex** (access to a parameter index that does not exist)
04 hex	**No array** (access with a subindex to non-indexed parameters)
05 hex	**Incorrect data type** (change request with a value that does not match the data type of the parameter)
06 hex	**Setting not permitted, only resetting** (change request with a value not equal to 0 without permission)
07 hex	**Descriptive element cannot be changed** (change request to a descriptive element that cannot be changed)
09 hex	**Description data not available** (access to a description that does not exist, parameter value is available)
0B hex	**No master control** (change request but with no master control)
0F hex	**Text array does not exist** (although the parameter value is available, the request is made to a text array that does not exist)
11 hex	**Request cannot be executed due to the operating state** (access is not possible for temporary reasons that are not specified)
14 hex	**Inadmissible value** (change request with a value that is within the limits but which is illegal for other permanent reasons, i.e. a parameter with defined individual values)
15 hex	**Response too long** (the length of the actual response exceeds the maximum transfer length)
16 hex	**Illegal parameter address** (illegal or unsupported value for attribute, number of elements, parameter number, subindex or a combination of these)
17 hex	**Illegal format** (change request for an illegal or unsupported format)
18 hex	**Number of values not consistent** (number of values of the parameter data to not match the number of elements in the parameter address)
19 hex	**Drive object does not exist** (access to a drive object that does not exist)
20 hex	**Parameter text cannot be changed**
21 hex	**Service is not supported** (illegal or not support request ID).
6B hex	**A change request for a controller that has been enabled is not possible**. (The drive rejects the change request because the motor is switched on. Please observe the "Can be changed" parameter attribute (U, T) as given in the parameter list relevant section in the SINAMICS V90, SIMOTICS S-1FL6 Operating Instructions.
6C hex	**Unknown unit**.
77 hex	**Change request is not possible during download.**
81 hex	**Change request is not possible during download.**
82 hex	**Accepting the master control is inhibited.**
83 hex	**Desired interconnection is not possible** (the connector output does not supply a float value although the connector input requires a float value)
84 hex	**Inverter does not accept a change request**(inverter is busy with internal calculations.
85 hex	**No access methods defined**.
87 hex	**Know-how protection active, access locked**
C8 hex	**Change request below the currently valid limit** (change request to a value that lies within the "absolute" limits, but is however below the currently valid lower limit)
C9 hex	**Change request above the currently valid limit** (example: a parameter value is too large for the drive power)
CC hex	**Change request not permitted** (change is not permitted as the access code is not available)

Examples

Via FC 16, with one request, up to 122 registers can be written to directly one after the other.

Header

In addition to the slave address, enter the transfer type, the start address and the number of the following registers in the header.

User data

You control the access in the user data via register 40601.

In register 40602, you define the acyclic access as well as the length of the request data.

Register 40603 contains the request reference, which is defined by the user, and the access type reading or writing.

From register 40603 and higher, the request aligns acyclic communication via data set 47.

Register 40604 contains the number of the drive object (for V90 always 2) and the number of parameters that are read out or written to.

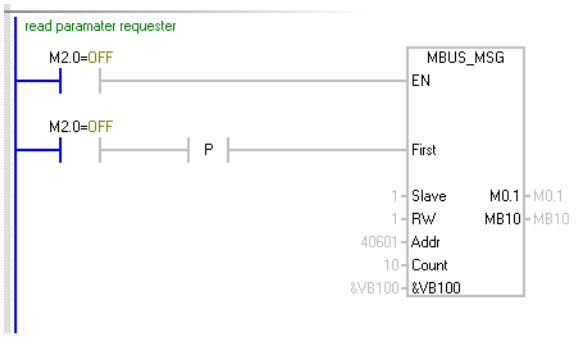
Register 40605 contains the attribute (for V90 always 0x10). In the number of elements you specify how many indices are read.

Example: p1215 and p1120 read acyclically

The table below formats a request to read the parameter values of p1215 and p1120 from slave number 1.

	Byte	Description
Header		
01 h	0	Slave address
10 h	1	Function code (write multiple)
0258 h	2,3	Register start address
000A h	4,5	Number of registers to be read (40601 … 40610)
14 h	6	Number of data bytes (10 registers, each 2 bytes = 20 bytes)
User data		
0001 h	7,8	40601: DS47 Control = 1 (activate request)
2F10 h	9,10	40602: Function 2F h (47), request length 16 bytes (10 h)
8001 h	11,12	40603: Request reference = 80 h, request identifier = 1 h
0202 h	13,14	40604: V90 = 2 h, number of parameters = 2
1001 h	15,16	40605: Attribute, number of elements of the first parameter
04BF h	17,18	
0000 h	19,20	40606: First parameter number = p1215
1001 h	21,22	40607: First parameter subindex = 0
0460 h	23,24	40608: Attribute, number of elements of the second parameter
0000 h	25,26	
		40609: Second parameter number = p1120
		40610: Second parameter subindex = 0

Write the PLC command from registers 40601 to 40610:



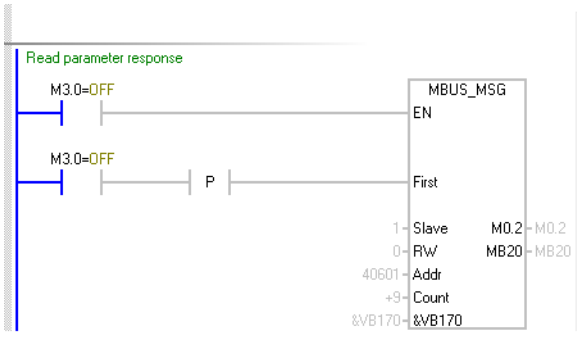
Status Chart

	Address	Format	Current Value
1	H40601	Hexadecimal	16#0001
2	H40602	Hexadecimal	16#2F10
3	H40603	Hexadecimal	16#8001
4	H40604	Hexadecimal	16#0202
5	H40605	Hexadecimal	16#1001
6	H40606	Signed	+1215
7	H40607	Hexadecimal	16#0000
8	H40608	Hexadecimal	16#1001
9	H40609	Unsigned	1120
10	H40610	Hexadecimal	16#0000

The table below formats a response for successful read operation.

	Byte	Description
Header		
01 h	0	Slave address
03 h	1	Function code (read)
20 h	2	Number of following data bytes (20 h: 32 bytes ≙ 16 registers)
User data		
0002 h	3,4	40601: DS47 Control = 2 (the request was executed)
2F0E h	5,6	40602: Function code 2F h (47), response lengths 14 bytes (0e h)
8001 h	7,8	40603: Request reference mirrored = 80 h, response identifier = 1 (request parameter)
0202 h	9,10	40604: V90 = 2 h, number of parameters = 2
0301 h	11,12	40605: Format, number of elements of the first parameter
0001 h	13,14	40606: First parameter value = 1
0801 h	15,16	40607: Format, number of elements of the second parameter
4142 h	17,18	40608: Second parameter value = 12.15 (41426666 h)
6666 h	19,20	40609: Second parameter value

Write the PLC command from registers 40601 to 40609:



Status Chart

	Address	Format	Current Value
11	R40601	Hexadecimal	16#0002
12	R40602	Hexadecimal	16#2F0E
13	R40603	Hexadecimal	16#8001
14	R40604	Hexadecimal	16#0202
15	R40605	Hexadecimal	16#0301
16	R40606	Signed	+1
17	R40607	Hexadecimal	16#0801
18	R40608	Hexadecimal	16#4142
19	R40609	Hexadecimal	16#6666

The table below formats a response for unsuccessful read operation (read request still not completed).

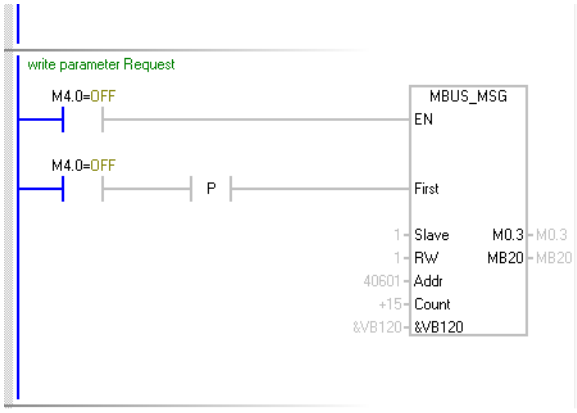
	Byte	Description
Header		
01 h	0	Slave address
03 h	1	Function code (read)
20 h	2	Number of following data bytes (20 h: 32 bytes ≙ 16 registers)
User data		
0001 h	3,4	40601: Check value 1 = request is processed
2F00 h	5,6	40602: Function 2F h(47), response length 0 (fault)
0004 h	7,8	40603: Error code: 0004 Response Not Ready (response has still not been issued)

Example: Set p1121 = 11.28 and p29130 = 2

The table below formats a request to write the parameter values of p1121 and p29130 from slave number 1.

	Byte	Description
Header		
01 h	0	Slave address
10 h	1	Function code (write multiple)
0258 h	2,3	Register start address
000A h	4,5	Number of registers to be written to (40601 … 40615)
1E h	6	Number of data bytes (15 registers, each 2 bytes = 30 bytes)
User data		
0001 h	7,8	40601: ds47=1 (activate request)
2F1A h	9,10	40602: Function 2F h (47), request length 16 bytes (10 h)
8002 h	11,12	40603: Request reference = 80 h, request identifier = 2 h (write)
0202 h	13,14	40604: V90 = 2 h, number of parameters = 2
1001 h	15,16	40605: Attribute, number of elements of the first parameter
0461 h	17,18	40606: First parameter number = p1121
0000 h	19,20	40607: First parameter subindex = 0
1001 h	21,22	40608: Attribute, number of elements of the second parameter
71CA h	23,24	40609: Second parameter number = p29130
0000 h	25,26	40610: Second parameter subindex = 0
0801 h	27,28	40611: Format, number of values of the first parameter
4134 h	29,30	40612: First parameter value 11.28 (41347AE1 h)
7AE1 h	31,32	40613: First parameter value
0301 h	33,34	40614: Format, number of values of the second parameter
0002 h	35,36	40615: Second parameter value 2

Write the PLC command from registers 40601 to 40615:



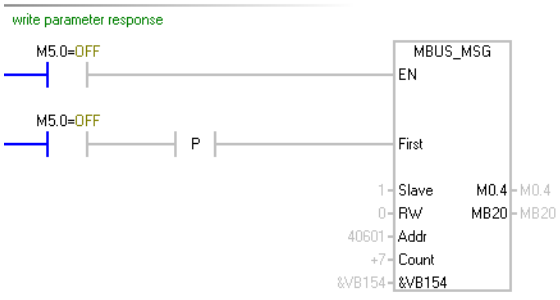
	Address	Format	Current Value
1	reW40601	Hexadecimal	16#0001
2	reW40602	Hexadecimal	16#2F1A
3	reW40603	Hexadecimal	16#8002
4	reW40604	Hexadecimal	16#0202
5	reW40605	Hexadecimal	16#1001
6	reW40606	Unsigned	1121
7	reW40607	Hexadecimal	16#0000
8	reW40608	Hexadecimal	16#1001
9	reW40609	Unsigned	29130
10	reW40610	Hexadecimal	16#0000
11	reW40611	Hexadecimal	16#0801
12	reW40612	Hexadecimal	16#4134
13	reW40613	Hexadecimal	16#7AE1
14	reW40614	Hexadecimal	16#0301
15	reW40615	Hexadecimal	16#0002

The table below formats a response for successful write operation.

Table 4- 1 Response for successful write operation

	Byte	Description
Header		
01 h	0	Slave address
03 h	1	Function code (read)
20 h	2	Number of following data bytes (20 h: 32 bytes ≙ 16 registers)
User data		
0002 h	3,4	40601: DS47 Control = 2 (request was executed)
2F04 h	5,6	40602: Function code 2F h (47), response length 4 bytes
8002 h	7,8	40603: Request reference mirrored = 80 h, response identifier = 2 (change parameter)
0202 h	9,10	40604: V90 = 2 h, number of parameters = 2

Write the PLC command from registers 40601 to 40604:



Status Chart

	Address	Format	Current Value
16	Rpw40601	Hexadecimal	16#0002
17	Rpw40602	Hexadecimal	16#2F04
18	Rpw40603	Hexadecimal	16#8002
19	Rpw40604	Hexadecimal	16#0202
20	Rpw40605	Hexadecimal	16#0000
21	Rpw40606	Hexadecimal	16#0000
22	Rpw40607	Hexadecimal	16#0000

The table below formats a response for unsuccessful write operation (write request still not completed).

	Byte	Description
Header		
01 h	0	Slave address
03 h	1	Function code (read)
20 h	2	Number of following data bytes (20 h: 32 bytes ≙ 16 registers)
User data		
0001 h	3,4	40601: DS47 Control = 1 (request is processed)
2F00 h	5,6	40602: Function 2F h(47), response length 0 (fault)
0004 h	7,8	40603: Error code: 0004 Response Not Ready (response has still not been issued)

4.7

4.8

Index

A

Alarm window, 38
Analog inputs, 108
Analog outputs, 109

C

Configure inputs/outputs, 78
  analog outputs assignment, 80
  digital inputs assignment, 78
  digital outputs assignment, 79
Configure referencing
  set referencing, 81
  set software position limit, 86

D

Diagnostics
  measure machine, 130
  monitor status, 125
  trace signals, 126
Digital inputs
  Direct signal map, 103
  Wiring, 98, 104
Digital inputs/outputs
  DIs for V90 PN, 97
  DIs for V90 PTI, 100
  DOs for V90 PN, 98
  DOs for V90 PTI, 105
Digital outputs
  Assigning warning signals to digital outputs, 107
  Wiring, 100

E

Edit
  Copy, 31
  Cut, 30
  Paste, 31

F

Function keys and shortcuts, 39

H

Help
  About SINAMICS V-ASSISTANT, 37
  View help, 36

I

IO simulation, 93

M

Mechanical structure, 57

O

Optimize drive
  low frequency vibration suppression, 123
  manual tuning, 120
  one-button auto tuning, 113
  real-time auto tuning, 117

P

Parameter value, 150
Parameterize
  backlash compensation, 88
  configure referencing, 81
  Set electronic gear ratio, 56
  set encoder pulse output, 88
  set mechanism, 59
  view all parameters, 90
PI/P switching, 123
Position setpoint, 60
Position trial run, 111
Preface
  Technical support, 3
Project
  Exit, 30
  Language, 30
  New project, 26
  Open project, 27
  Print, 29
  Save project, 28
  Save project as, 29

Pulse train encoder outputs, 110
Pulse train inputs, 109

S

Select drive
  Control mode, 47
  Drive selection, 44
  Jog, 49
  Motor selection, 46
Set limits, 74
Set parameter setpoint, 59
Set PROFINET
  Configure network, 53
  Select telegram, 50
Speed limit, 76
Switch
  Go offline, 31
  Go online, 32

T

Test motor, 110
Toolbar, 37
Tools
  Factory default, 34
  Reset absolute encoder, 33
  Restart drive, 33
  Save parameters to ROM, 32
  Upload parameters, 36
Torque control mode
  Torque setpoint, 71
Torque limit, 74
Trace configuration, 129

U

User interface, 25

W

Working modes, 19