SIEMENS
SINAMICS/SIMOTICS

SINAMICS V90, SIMOTICS S-1FL6
Getting Started

Table of contents

A5E32100920, 08/2013

1 Safety instructions

1.1 General safety instructions

DANGER

Danger to life when live parts are touched

Death or serious injury can result when live parts are touched.

- Only work on electrical devices when you are qualified for this job.
- Always observe the country-specific safety rules.

Generally, six steps apply when establishing safety:

1. Prepare for shutdown and notify all those who will be affected by the procedure.
2. Disconnect the machine from the supply.
   - Switch off the machine.
   - Wait until the discharge time specified on the warning labels has elapsed.
   - Check that it really is in a no-voltage condition, from phase conductor to phase conductor and phase conductor to protective conductor.
   - Check whether the existing auxiliary supply circuits are de-energized.
   - Ensure that the motors cannot move.
3. Identify all other hazardous energy sources, e.g. compressed air, hydraulic systems, water.
4. Isolate or neutralize all hazardous energy sources, e.g. by closing switches, grounding or short-circuiting or closing valves.
5. Secure the energy sources against switching on again.
6. Make sure that the machine is completely locked ... and that you have the right machine. After you have completed the work, restore the operational readiness in the inverse sequence.

WARNING

Danger to life through a hazardous voltage when connecting an unsuitable power supply

Death or serious injury can result when live parts are touched in the event of a fault.

- Only use power supplies that provide SELV (Safety Extra Low Voltage) or PELV- (Protective Extra Low Voltage) output voltages for all connections and terminals of the electronics modules.

WARNING

Danger to life when live parts are touched on damaged devices

Improper handling of devices can cause damage.

Hazardous voltages can be present at the housing or exposed components on damaged devices.

- Ensure compliance with the limit values specified in the technical data during transport, storage and operation.
- Do not use any damaged devices.
- Protect the components against conductive pollution, e.g., by installing them in a control cabinet with IP54 degree of protection according to IEC 60529 or NEMA 12. Provided conductive pollution can be prevented at the installation site, the degree of protection for the cabinet can be decreased accordingly.

WARNING

Danger of fire spreading due to inadequate housing

Fire and smoke development can cause severe personal injury or material damage.

- Install devices without a protective housing in a metal control cabinet (or protect the device by another equivalent measure) in such a way that contact with fire inside and outside the device is prevented.
- Additionally, select the installation site so that an uncontrolled spreading of smoke can be avoided in the case of a fire.
- Ensure that smoke can escape via designated paths.

WARNING

Danger to life through unexpected movement of machines when using mobile wireless devices or mobile phones

Using mobile wireless devices or mobile phones with a transmitter power > 1 W closer than approx. 2 m to the components may cause the devices to malfunction and influence the functional safety of machines, therefore putting people at risk or causing material damage.

- Switch the wireless devices or mobile phones off in the immediate vicinity of the components.

WARNING

Fire hazard for the motor due to overload of the insulation

There is a greater load on the motor insulation through a ground fault in an IT system. A possible result is the failure of the insulation with a risk for personnel through smoke development and fire.

- Use a monitoring device that signals an insulation fault.
- Correct the fault as quickly as possible so the motor insulation is not overloaded.

WARNING

Fire hazard due to overheating because of inadequate ventilation clearances

Inadequate ventilation clearances can cause overheating with a risk for personnel through smoke development and fire. This can also result in increased downtime and reduced service lives for devices / systems.

- Ensure compliance with the specified minimum clearance as ventilation clearance for the respective component. They can be found in the dimension drawings or in the "Product-specific safety instructions" at the start of the respective section.

WARNING

Danger to life through electric shock due to unconnected cable shields

Hazardous touch voltages can occur through capacitive cross-coupling due to unconnected cable shields.

- Connect cable shields and unused conductors of power cables (e.g., brake conductors) at least on one side to the grounded housing potential.

WARNING

Danger to life when safety functions are inactive

Safety functions that are inactive or that have not been adjusted accordingly can cause operational faults on machines that could lead to serious injury or death.

- Observe the information in the appropriate product documentation before commissioning.
- Carry out a safety inspection for functions relevant to safety on the entire system, including all safety-related components.
- Ensure that the safety functions used in your drives and automation tasks are adjusted and activated through appropriate parameterizing.
- Run a function test.
- Only put your plant into live operation once you have guaranteed that the functions relevant to safety are running correctly.

Note

Important safety notices for safety functions

If you want to use safety functions, you must observe the safety notices in the safety manuals.

1.2 Safety instructions for electromagnetic fields (EMF)

⚠ WARNING

Danger to life from electromagnetic fields

Electromagnetic fields (EMF) are generated by the operation of electrical power equipment such as transformers, converters or motors.

People with pacemakers or implants are at a special risk in the immediate vicinity of these devices/systems.

- Keep a distance of at least 2 m.

1.3 Handling electrostatic sensitive devices (ESD)

Electrostatic sensitive devices (ESD) are individual components, integrated circuits, modules or devices that may be damaged by either electric fields or electrostatic discharge.

NOTICE

Damage through electric fields or electrostatic discharge

Electric fields or electrostatic discharge can cause malfunctions through damaged individual components, integrated circuits, modules or devices.

- Only pack, store, transport and send electronic components, modules or devices in their original packaging or in other suitable materials, e.g conductive foam rubber of aluminum foil.
- Only touch components, modules and devices when you are grounded by one of the following methods:
  - Wearing an ESD wrist strap
  - Wearing ESD shoes or ESD grounding straps in ESD areas with conductive flooring
- Only place electronic components, modules or devices on conductive surfaces (table with ESD surface, conductive ESD foam, ESD packaging, ESD transport container).

1.4 Residual risks of power drive systems

Residual risks of power drive systems

The control and drive components of a drive system are approved for industrial and commercial use in industrial line supplies. Their use in public line supplies requires a different configuration and/or additional measures.

These components may only be operated in closed housings or in higher-level control cabinets with protective covers that are closed, and when all of the protective devices are used.

These components may only be handled by qualified and trained technical personnel who are knowledgeable and observe all of the safety instructions on the components and in the associated technical user documentation.

When assessing the machine's risk in accordance with the respective local regulations (e.g., EC Machinery Directive), the machine manufacturer must take into account the following residual risks emanating from the control and drive components of a drive system:

1. Unintentional movements of driven machine components during commissioning, operation, maintenance, and repairs caused by, for example:
   - Hardware defects and/or software errors in the sensors, controllers, actuators, and connection technology
   - Response times of the controller and drive
   - Operating and/or ambient conditions outside of the specification
   - Condensation / conductive contamination
   - Parameterization, programming, cabling, and installation errors
   - Use of radio devices / cellular phones in the immediate vicinity of the controller
   - External influences / damage
2. In the event of a fault, exceptionally high temperatures, including an open fire, as well as emissions of light, noise, particles, gases, etc. can occur inside and outside the inverter, e.g.:
   - Component malfunctions
   - Software errors
   - Operating and/or ambient conditions outside of the specification

- External influences / damage

Inverters of the Open Type / IP20 degree of protection must be installed in a metal control cabinet (or protected by another equivalent measure) such that the contact with fire inside and outside the inverter is not possible.

3. Hazardous shock voltages caused by, for example:
   - Component malfunctions
   - Influence of electrostatic charging
   - Induction of voltages in moving motors
   - Operating and/or ambient conditions outside of the specification
   - Condensation / conductive contamination
   - External influences / damage
4. Electrical, magnetic and electromagnetic fields generated in operation that can pose a risk to people with a pacemaker, implants or metal replacement joints, etc. if they are too close.
5. Release of environmental pollutants or emissions as a result of improper operation of the system and/or failure to dispose of components safely and correctly.

Note

The components must be protected against conductive contamination (e.g. by installing them in a control cabinet with degree of protection IP54 according to IEC 60529 or NEMA 12).

Assuming that conductive contamination at the installation site can definitely be excluded, a lower degree of cabinet protection may be permitted.

For more information about residual risks of the components in a drive system, see the relevant sections in the technical user documentation.

1.5 Additional safety instructions

Delivery check

Note

Intact deliverables

Deliverables received must be intact. It's not permissible to put a damaged unit into use.

Transport and storage

NOTICE

Property loss

Notify Siemens service personnel immediately of any damage discovered after delivery. If the equipment is put into storage, keep it in a dry, dust-free, and low-vibration environment. The storage temperature ranges from -40 °C to +70 °C.

Otherwise you will suffer property loss.

Mechanical installation

⚠ WARNING

Death or severe personal injury from harsh installation environment

A harsh installation environment will jeopardize personal safety and equipment. Therefore,

- Do not install the drive and the motor in an area subject to inflammables or combustibles, water or corrosion hazards.
- Do not install the drive and the motor in an area where it is likely to be exposed to constant vibrations or physical shocks.
- Do not keep the drive exposed to strong electro-magnetic interference.
- Make sure that no foreign body (e.g., chips of wood or metal, dust, paper, etc.) can be seen inside the drive or on the heat sink of the drive.
- Make sure that the drive is installed in an electrical cabinet with an adequate degree of protection.

Note

Mounting clearance

To guarantee good heat dissipation and ease of cabling, keep sufficient clearance between drives, one drive and another device/inner wall of the cabinet.

Note

Screw tightening

Make sure you fix the screw to the terminal door of the drive after you have completed the installation work.

Electrical installation

⚠ DANGER

Death or severe personal injury from electrical shock

The earth leakage current for the drive can be greater than AC 3.5 mA, which may cause death or severe personal injury due to electrical shock.

A fixed earth connection is required to eliminate the dangerous leakage current. In addition, the minimum size of the protective earth conductor shall comply with the local safety regulations for high leakage current equipment.

⚠ WARNING

Personal injury and damage to property from improper connections

Improper connections have high risks of electrical shock and short circuit, which will jeopardize personal safety and equipment.

- The drive must be directly connected with the motor. It is not permissible to connect a capacitor, inductor or filter between them.
- Make sure that all connections are correct and reliable, the drive and the motor are well grounded.
- The line supply voltage must be within the allowable range (refer to the drive rating plate). Never connect the line supply cable to the motor terminals U, V, W or connect the motor power cable to the line input terminals L1, L2, L3.
- Never wire up the U, V, W terminals in an interchanged phase sequence.
- If the CE marking for cables is mandatory in some cases, the motor power cable, line supply cable and brake cable used must all be shielded cables.
- For terminal box connection, make sure that the clearances in air between non-insulated live parts are at least 5.5 mm.
- Route signal cables and power cables separately in different cable conduits. The signal cables shall be at least 10 cm away from the power cables.
- Cables connected may not come into contact with rotating mechanical parts.

⚠ CAUTION

Personal injury and damage to property from inadequate protection

Inadequate protection may cause minor personal injury or damage to property.

- The drive must have been disconnected from the power supply for at least five minutes before you perform any wiring to it.
- Check that the equipment is dead!
- Make sure that the drive and the motor are properly grounded.
- Route a second PE conductor with the cross section of the supply system lead in parallel to the protective earth via separate terminals or use a copper protective earth conductor with a cross section of 10 mm^2.
- Terminals for equipotential bondings that exist in addition to terminals for PE conductors must not be used for looping-through the PE conductors.
- To ensure protective separation, an isolating transformer must be used for the 380 V AC line supply system.

NOTICE

Damage to property from incorrect input voltage

Incorrect input voltage will cause severe damage to the drive.

It is recommended that the actual input voltage should not be greater than 110% of the rated voltage or smaller than 75%.

Note

STO wiring

The safe torque off (STO) function can stop a motor using safety relays without involving any upper level control. It is disabled in the factory configuration by short-circuiting the STO terminals. The safety function of the servo drive is SIL 2 (EN61800-5-2).
Connect the STO terminals as the actual requirements.

Commissioning/Operation

⚠ CAUTION

Burns from hot surface

The operating temperature of drive base-plate and heat sink is higher than 65°C, and the surface temperature of the motor may reach up to 80°C. The hot surface may burn your hands.

Do not touch the motor or the heat sink of the drive during operation or within a certain period since power disconnection.

NOTICE

Shortening the service life of motor brake

The motor brake is used for holding purpose only. Frequent emergency stops with the motor brake will shorten its service life.

Unless absolutely necessary, do not apply the motor brake as an emergency stop or deceleration mechanism.

NOTICE

Damage to the equipment from frequent power-on/off

Frequent power-on/off will cause damage to the drive.

Do not switch on/off the power frequently.

Note

Voltage requirement

Before switching the power on, make sure that the drive system has been reliably installed and connected, and the line supply voltage is within the allowable range.

Note

Drive functioning interfered by use of radio devices

Some environmental factors may result in power derating, e.g. altitude and ambient temperature. In this case, the drive cannot work normally.

Environmental factors must be taken into account during commissioning or operation.

Troubleshooting

⚠ WARNING

Drive remaining charged

The drive may remain charged in a short period after it is powered off.

Touching terminals or disassembling cables may cause minor injury due to electrical shock.

Do not touch terminals or disassemble cables until the drive system has been disconnected for at least five minutes.

⚠ WARNING

Personal injury due to unexpected restart

The machine might unexpectedly restart after the power supply that was suddenly switched off is switched on again. Touching the machine at this time may cause personal injury.

Do not approach the machine after the power supply is switched on again.

Disposal

Note

Equipment disposal

Disposal of the equipment must be made in accordance with the regulations of the competent environmental protection administration on the disposal of electronic wastes.

Certification

WARNING

Requirements for United States / Canadian installations (UL/cUL)

Suitable for use on a circuit capable of delivering not more than 65000 rms Symmetrical Amperes, 480 VAC maximum, when protected by UL/cUL-certified Class J fuses only. For each frame size AA, A, B, and C, use class 1 75 °C copper wire only.
This equipment is capable of providing internal motor overload protection according to UL508C.
For Canadian (cUL) installations the drive mains supply must be fitted with any external recommended suppressor with the following features:
• Surge-protective devices; device shall be a Listed Surge-protective device (Category code VZCA and VZCA7)
• Rated nominal voltage 480/277 VAC, 50/60 Hz, 3-phase
• Clamping voltage VPR = 2000 V, IN = 3 kA min, MCOV = 508 VAC, SCCR = 65 kA
• Suitable for Type 2 SPD application
• Clamping shall be provided between phases and also between phase and ground

WARNING

Harms to human health from electromagnetic radiation

This product may cause high-frequency electromagnetic radiation, which will affect human health. Therefore, in a residential environment, make sure that necessary suppression measures are taken.

Note

EMC instructions

- All products of SINAMICS V90 meet the EMC standards of CE, with the use of shielded motors, and line input cables (shielded between a line filter and the drive).
- For a radiated emission test, the drive will be installed inside the shielded chamber, other parts of the motion control system (including the PLC, DC power supply, spindle drive, motor) will be put outside the shielded chamber.
- For a conductive emission test, an external AC filter (between the 380 V AC power supply and the drive) will be used to meet the EMC requirement.
- The operational environment of drives is the industrial area, and therefore the limit class C3 is applicable to SINAMICS V90 according to EN61800-3.
- In a residential environment, this product can cause high-frequency interferences that may necessitate suppression measures.

Information regarding non-Siemens products

Note

Non-Siemens products

This document contains recommendations relating to non-Siemens products. Non-Siemens products whose fundamental suitability is familiar to us. It goes without saying that equivalent products from other manufacturers may be used. Our recommendations are to be seen as helpful information, not as requirements or dictates. We cannot accept any liability for the quality and properties/features of non-Siemens products.

Warning labels

Warning labels attached to the motor or drive have the following meanings:

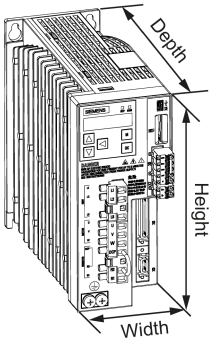
Symbol	Description
	**Risk of electric shock** Do not touch any terminals or disassemble cables until the drive has been disconnected from power for at least five minutes.
	**Caution** Pay attention to the information given on the rating plate and operating instructions. For more information, refer to this manual.
	**Hot surface** Do not touch the heatsink of the drive during operation or within a certain period since power disconnection because its surface temperature may reach up to 65 °C.
	**No knocking at the shaft** Do not exert any shock at the shaft end; otherwise, the shaft may be damaged.
	**Protective conductor terminal**

2 General information

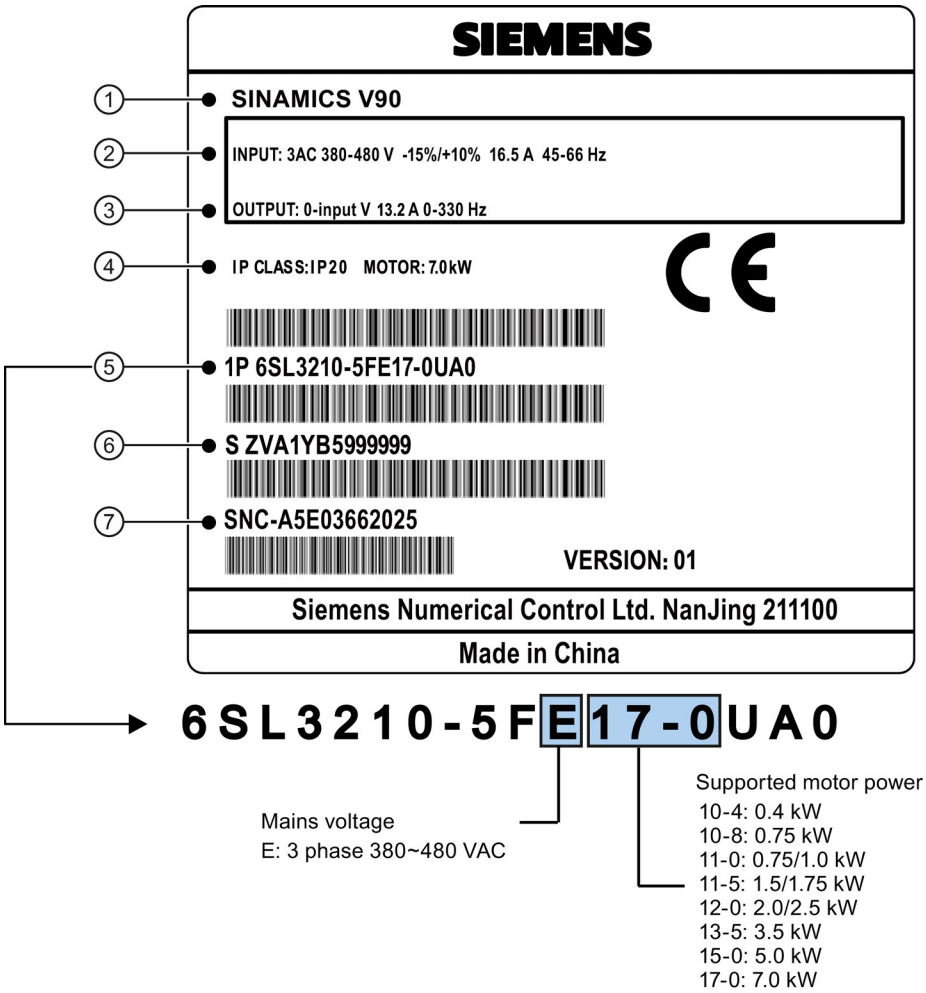
2.1 Deliverables

2.1.1 Drive components

When unpacking the drive package, check whether the following components are included.

Component	Illustration	Rated motor power (kW)	Outline dimension (Width x Height x Depth, mm)	Frame size
SINAMICS V90 servo drive		• 0.4	60 x 180 x 200	FSAA
		• 0.75 • 0.75/1.0	80 x 180 x 200	FSA
		• 1.5/1.75 • 2.0/2.5	100 x 180 x 220	FSB
		• 3.5 • 5.0 • 7.0	140 x 260 x 240	FSC
Connectors		FSAA and FSA: 4 pieces FSB and FSC: 2 pieces		
Shielding plate	 (for FSAA / FSA) or  (for FSB / FSC)	1 piece		
Cable clamp		FSAA and FSA: None FSB and FSC: 1 piece		
User documentation	Getting Started	English-Chinese bilingual version		

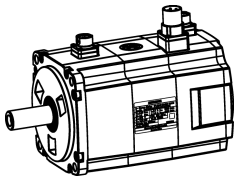
Drive rating plate



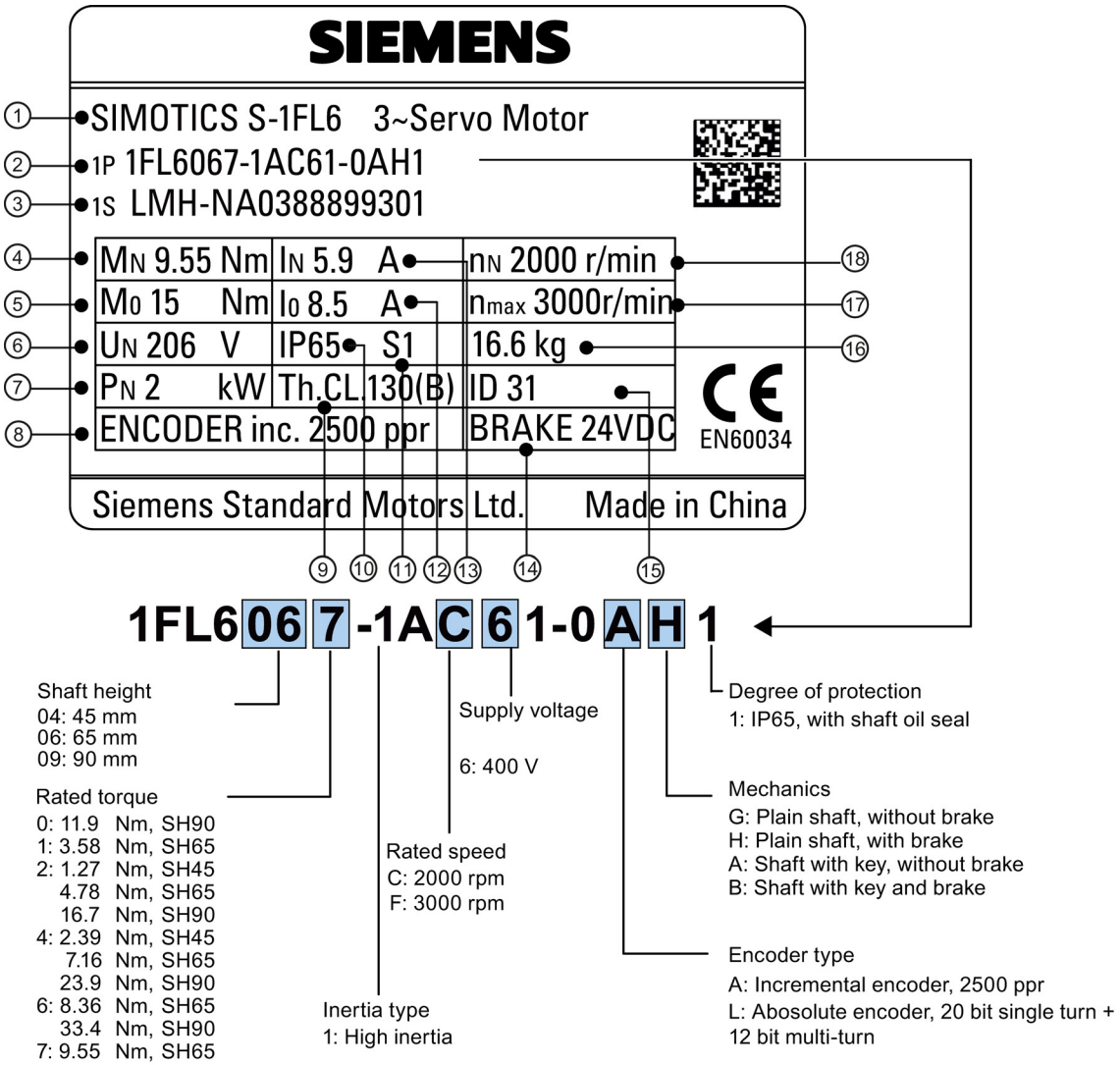
①	Drive name	⑤	Order number
②	Power input	⑥	Product serial number
③	Power output	⑦	Part number
④	Rated motor power		

2.1.2 Motor components

When unpacking the motor package, check whether the following components are included.

Component	Illustration	Rated torque (Nm)	Shaft height (mm)
SIMOTICS S-1FL6 servo motor		• 1.27 • 2.39	45
		• 3.58 • 4.78 • 7.16 • 8.36 • 9.55	65
		• 11.90 • 16.70 • 23.90 • 33.40	90
User documentation	SIMOTICS S-1FL6 Servo Motors Installation Guide		

Motor rating plate



①	Motor type	⑦	Rated power	⑬	Rated current
②	Order number	⑧	Encoder type and resolution	⑭	Holding brake
③	Serial number	⑨	Thermal class	⑮	Motor ID
④	Rated torque	⑩	Degree of protection	⑯	Weight
⑤	Stall torque	⑪	Motor operating mode	⑰	Maximum speed
⑥	Rated voltage	⑫	Stall current	⑱	Rated speed

2.2 Function list

Function	Description	Control mode
Pulse train input position control (PTI)	Implements accurate positioning through two pulse train input channels: 5 V differential or 24 V single end signal. In addition, it supports S-curve position smoothing function.	PTI
Internal position control (IPos)	Implements accurate positioning through internal position commands (up to eight groups) and allows to specify the acceleration/speed for positioning	IPos
Speed control (S)	Flexibly controls motor speed and direction through external analog speed commands (0 to ±10 VDC) or internal speed commands (up to seven groups)	S
Torque control (T)	Flexibly controls motor output torque through external analog torque commands (0 to ±10 VDC) or internal torque commands. In addition, it supports speed limit function to prevent overspeed when a motor has no loads	T
Compound controls	Supports flexible switches among position control mode, speed control mode, and torque control mode	PTI/S, IPos/S, PTI/T, IPos/T, S/T
Absolute position system	Allows to implement motion control tasks immediately after the servo system with an absolute encoder is powered on, needless of carrying out referencing or zero position operation beforehand	PTI, IPos, S, T
Gain switching	Switches between gains during motor rotation or stop with an external signal or internal parameters to reduce noise and positioning time, or improve the operation stability of a servo system	PTI, IPos, S
PI/P switching	Switches from PI control to P control with an external signal or internal parameters to suppress overshooting during acceleration or deceleration (for speed control) or to suppress undershooting during positioning and reduce the settling time (for position control)	PTI, IPos, S
Safe Torque Off (STO)	Safely disconnects torque-generating motor power supply to prevent an unintentional motor restart	PTI, IPos, S, T
Zero speed clamp	Stops motor and clamps the motor shaft when motor speed setpoint is below a parameterized threshold level	S
Real-time auto tuning	Estimates the machine characteristic and sets the closed loop control parameters (position loop gain, speed loop gain, speed integral compensation, filter if necessary, and so on) continuously in real time without any user intervention	PTI, IPos, S
Resonance suppression	Suppresses the mechanical resonance, such as workpiece vibration and base shake	PTI, IPos, S, T
Speed limit	Limits motor speed through external analog speed limit commands (0 to ±10 VDC) or internal speed limit commands (up to three groups)	PTI, IPos, S, T
Torque limit	Limits motor torque through external analog torque limit commands (0 to ±10 VDC) or internal torque limit commands (up to three groups)	PTI, IPos, S
Electronic gear ratio	Defines a multiplier factor for input pulses	PTI, IPos
Basic operator panel (BOP)	Displays servo status on a 6-digit 7-segment LED display	PTI, IPos, S, T
External braking resistor	An external braking resistor can be used when the internal braking resistor is insufficient for regenerative energy.	PTI, IPos, S, T
Digital inputs/outputs (DIs/DOs)	Control signals and status signals can be assigned to eight programmable digital inputs and six digital outputs.	PTI, IPos, S, T
Smoothing function	Transforms position characteristics from the pulse train input setpoint into an S-curve profile with a parameterized time constant	PTI
SINAMICS V-ASSISTANT	You can perform parameter settings, test operation, adjustment and other operations with a PC.	PTI, IPos, S, T

2.3 Device combination

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

SIMOTICS S-1FL6 servo motor					SINAMICS V90 servo drive	
Rated torque (Nm)	Rated power (kW)	Rated speed (rpm)	Shaft height (mm)	Order number[1)]	Order number	Frame size
1.27	0.4	3000	45	1FL6042-1AF61-0❑❑1	6SL3210-5FE10-4UA0	FSAA
2.39	0.75	3000	45	1FL6044-1AF61-0❑❑1	6SL3210-5FE10-8UA0	FSA
3.58	0.75	2000	65	1FL6061-1AC61-0❑❑1	6SL3210-5FE11-0UA0	
4.78	1.0	2000	65	1FL6062-1AC61-0❑❑1		
7.16	1.5	2000	65	1FL6064-1AC61-0❑❑1	6SL3210-5FE11-5UA0	FSB
8.36	1.75	2000	65	1FL6066-1AC61-0❑❑1		
9.55	2.0	2000	65	1FL6067-1AC61-0❑❑1	6SL3210-5FE12-0UA0	
11.9	2.5	2000	90	1FL6090-1AC61-0❑❑1		
16.7	3.5	2000	90	1FL6092-1AC61-0❑❑1	6SL3210-5FE13-5UA0	FSC
23.9	5.0	2000	90	1FL6094-1AC61-0❑❑1	6SL3210-5FE15-0UA0	
33.4	7.0	2000	90	1FL6096-1AC61-0❑❑1	6SL3210-5FE17-0UA0	

[1)] The symbol ❑❑ in the motor order numbers is for optional configurations (encoder type and mechanics). Refer to the motor rating plate explanation in Technical data - servo motors (Page 16) for detailed information.

2.4 Technical data

2.4.1 Technical data - servo drives

Order No.	6SL3210-5FE...		10-4UA0	10-8UA0	11-0UA0	11-5UA0	12-0UA0	13-5UA0	15-0UA0	17-0UA0
Frame size			**FSAA**	**FSA**	**FSA**	**FSB**	**FSB**	**FSC**	**FSC**	**FSC**
Rated output current (A)			1.2	2.1	3.0	5.3	7.8	11.0	12.6	13.2
Max. output current (A)			3.6	6.3	9.0	13.8	23.4	33.0	37.8	39.6
Max. supported motor power (kW)			0.4	0.75	1.0	1.75	2.5	3.5	5.0	7.0
Output frequency (Hz)			0 to 330							
Power supply	Voltage/frequency		3-phase 380 VAC to 480 VAC, 50/60 Hz							
	Permissible voltage fluctuation		-15% to +10%							
	Permissible frequency fluctuation		-10% to +10%							
	Rated input current (A)		1.5	2.6	3.8	5.8	9.8	13.8	15.8	16.5
	Power supply capacity (kVA)		1.7	3.0	4.3	6.6	11.1	15.7	18.0	18.9
	Inrush current (A)		8.0	8.0	8.0	4.0	4.0	2.5	2.5	2.5
24 VDC power supply	Voltage (V) [1]		24 (-15% to +20%)							
	Maximum current (A)		1.6 A (when using a motor without a brake) 3.6 A (when using a motor with a brake)							
Overload capability			300% × rated current for 0.3s within 10s							
Control system			Servo control							
Dynamic brake			Built-in							
Protective functions			Earthing fault protection, output short-circuit protection [2], overvoltage/undervoltage protection, I^2t detection, IGBT overtemperature protection [3]							
Speed control mode	Speed control range		Analog speed command 1:2000, internal speed command 1:5000							
	Analog speed command input		-10 VDC to +10 VDC/rated speed							
	Torque limit		Set through a parameter or the analog input command (0 V - +10 VDC/max. torque)							
Position control mode	Max. input pulse frequency		1 M (differential input), 200 kpps (open collector input)							
	Command pulse multiplying factor		Electronic gear ratio (A/B) A: 1 - 65535 • 131072, B: 1 - 65535 1/50 < A/B < 500							
	In-position range setting		0 - ±10000 pulse (command pulse unit)							
	Error excessive		±10 revolutions							
	Torque limit		Set through a parameter or the analog input command							
Torque control mode	Analog torque command input		-10 V to +10 VDC/max. torque (input impedance 10 kΩ - 12 kΩ)							
	Speed limit		Set through a parameter or the analog input command							
Cooling method			Self-cooled		Fan-cooled					
Environmental conditions	Surrounding air temperature	Operation	0 °C to 45 °C: without power derating 45 °C to 55 °C: with power derating Note: For more information, refer to the SINAMICS V90, SIMOTICS S-1FL6 Operating Instructions.							
		Storage	-40 °C to +70 °C							

Order No.	6SL3210-5FE...		10-4UA0	10-8UA0	11-0UA0	11-5UA0	12-0UA0	13-5UA0	15-0UA0	17-0UA0
Frame size			FSAA	FSA	FSA	FSB	FSB	FSC	FSC	FSC
	Ambient humidity	Operation	< 90% (non-condensing)							
		Storage	90% (non-condensing)							
	Operating environment		Indoors (without direct sunlight), free from corrosive gas, combustible gas, oil gas, or dust							
	Altitude		≤ 1000 m (without power derating)							
	Degree of protection		IP20							
	Degree of pollution		Class 2							
	Vibration	Operation	Shock:	Operational area II Peak acceleration: 5 g Duration of shock: 30 ms						
			Vibration:	Operational area II 10 Hz to 58 Hz: 0.075 mm deflection 58 Hz to 200 Hz: 1g vibration						
		Transport & storage	Vibration:	5 Hz to 9 Hz: 7.5 mm deflection 9 Hz to 200 Hz: 2 g vibration Vibration class: 2M3 transportation						
Certifications	CE									
Mechanical design	Outline dimensions (W x H x D, mm)		60 x 180 x 200	80 x 180 x 200		100 x 180 x 220		140 x 260 x 240		
Weight (kg)			1.800	2.500	2.510	3.055	3.130	6.515	6.615	6.615

1) When SINAMICS V90 works with a motor with a brake, the voltage tolerance of 24 VDC power supply must be -10% to +10% to meet the voltage requirement of the brake.

2) Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes.

3) SINAMICS V90 does not support motor overtemperature protection. Motor overtemperature is calculated by I^2t and protected by the output current from the drive.

2.4.2 Technical data - servo motors

General technical data

Parameter		Description		
Cooling		Self-cooled		
Operating temperature [°C]		0 to 40 (without power derating)		
Storage temperature [°C]		-15 to +65		
Relative humidity [RH]		90% (non-condensing at 30°C)		
Installation altitude [m]		≤ 1000 (without power derating)		
Maximum noise level [dB]		1FL604❑: 65	1FL606❑ :70	1FL609❑: 70
Vibration severity grade		A (according to IEC 60034-14)		
Shock resistance [m/s²]		25 (continuous in axial direction); 50 (continuous in radial direction); 250 (in a short time of 6 ms)		
	Rated voltage (V)	24 ± 10%		
	Rated current (A)	1FL604❑: 0.88	1FL606❑ : 1.44	1FL609❑: 1.88
	Holding brake torque [Nm]	1FL604❑: 3.5	1FL606❑ : 12	1FL609❑: 30
	Maximum brake opening time [ms]	1FL604❑: 60	1FL606❑ : 180	1FL609❑: 220

Parameter		Description		
Holding brake	Maximum brake closing time [ms]	1FL604❑: 45	1FL606❑ : 60	1FL609❑: 115
	Maximum number of emergency stops	2000 [1]		
Bearing lifetime [h]		> 20000 [2]		
Oil seal lifetime [h]		5000		
Encoder lifetime [h]		20000 - 30000 (when load factor ≤ 80% and at 30 °C)		
Degree of protection		IP65, with shaft oil seal		
Type of construction		IM B5, IM V1 and IM V3		
Certification		CE		

[1] Restricted emergency stop operation is permissible. Up to 2000 braking operations can be executed with 300% rotor moment of inertia as external moment of inertia from a speed of 3000 RPM without the brake being subject to an inadmissible amount of wear.

[2] This lifetime is only for reference. When a motor keeps running at rated speed under rated load, replace its bearing after 20,000 to 30,000 hours of service time. Even if the time is not reached, the bearing must be replaced when unusual noise, vibration, or faults are found.

Specific technical data

Order No.	1FL60...	42	44	61	62	64	66	67	90	92	94	96
Rated power [kW]		0.40	0.75	0.75	1.00	1.50	1.75	2.00	2.5	3.5	5.0	7.0 [1]
Rated torque [Nm]		1.27	2.39	3.58	4.78	7.16	8.36	9.55	11.9	16.7	23.9	33.4
Maximum torque [Nm]		3.8	7.2	10.7	14.3	21.5	25.1	28.7	35.7	50.0	70.0	90.0
Rated speed [rpm]		3000		2000					2000			
Maximum speed [rpm]		4000		3000					3000		2500	2000
Rated frequency [Hz]		200		133					133			
Rated current [A]		1.2	2.1	2.5	3.0	4.6	5.3	5.9	7.8	11.0	12.6	13.2
Maximum current [A]		3.6	6.3	7.5	9.0	13.8	15.9	17.7	23.4	33.0	36.9	35.6
Moment of inertia [10^{-4} kgm^2]		2.8	5.3	8.2	15.7	15.7	23.2	30.7	50.2	73.0	96.4	145.6
Moment of inertia (with brake) [10^{-4} kgm^2]		3.4	5.9	9.4	16.9	16.9	24.4	31.9	56.4	79.2	102.6	151.8
Recommended load to motor inertia ration		< 1000%		< 500%					< 500%			
Weight of incremental encoder motor [kg]	With brake	4.6	6.4	8.6	11.3	11.3	14.0	16.6	21.3	25.7	30.3	39.1
	Without brake	3.3	5.1	5.6	8.3	8.3	11.0	13.6	15.3	19.7	24.3	33.2
Weight of absolute encoder motor [kg]	With brake	4.4	6.2	8.3	11.0	11.0	13.6	16.3	20.9	25.3	29.9	38.7
	Without brake	3.1	4.9	5.3	8.0	8.0	10.7	13.3	14.8	19.3	23.9	32.7

[1] When the ambient temperature is higher than 30 °C, the 1FL6096 motors will have a power derating of 10%.

Note

The data of rated torque, rated power, maximum torque, and armature resistance in the above table allow a tolerance of 10%.

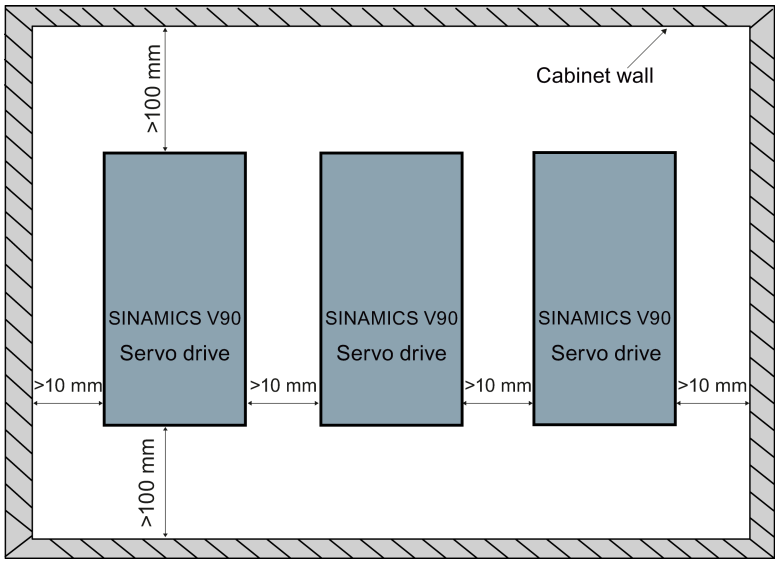
3 Mounting

3.1 Mounting the drive

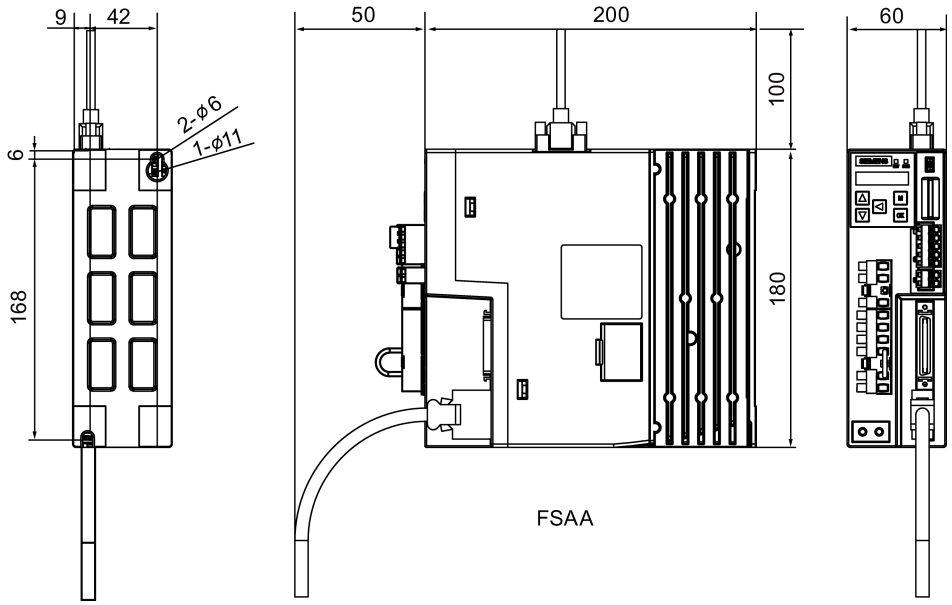
For mounting conditions, see Technical data - servo drives (Page 15).

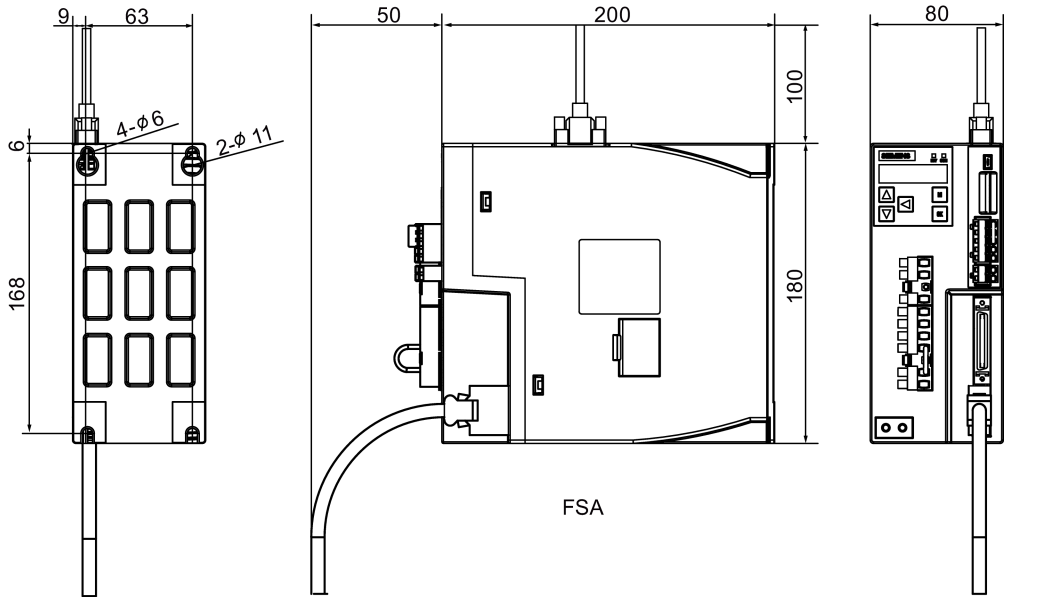
Mounting orientation and clearance

Mount the drive vertically in a shielded cabinet and observe the mounting clearances specified in the illustration below:

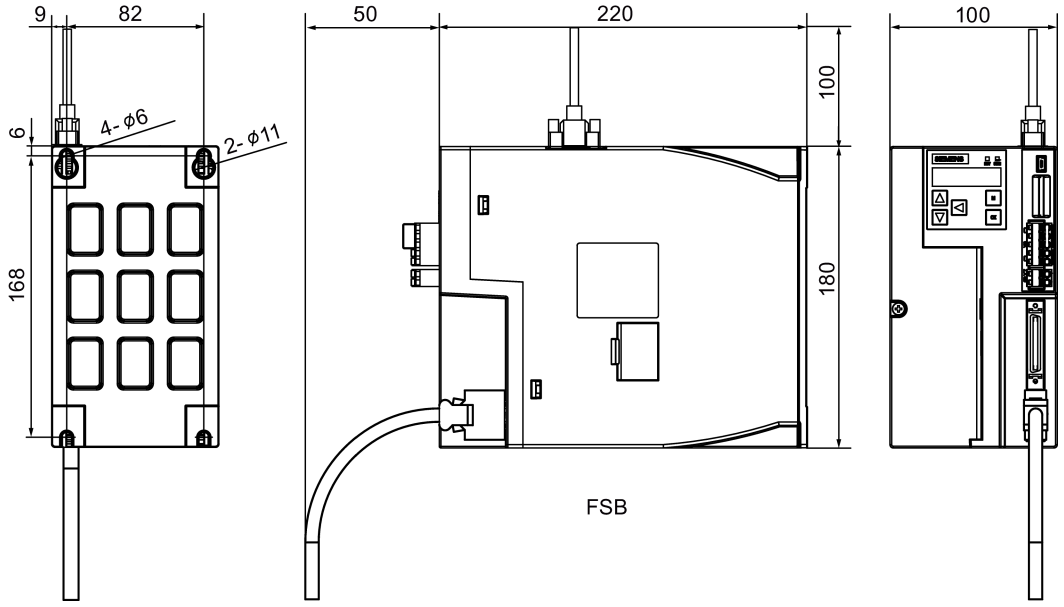


Drill patterns and outline dimensions

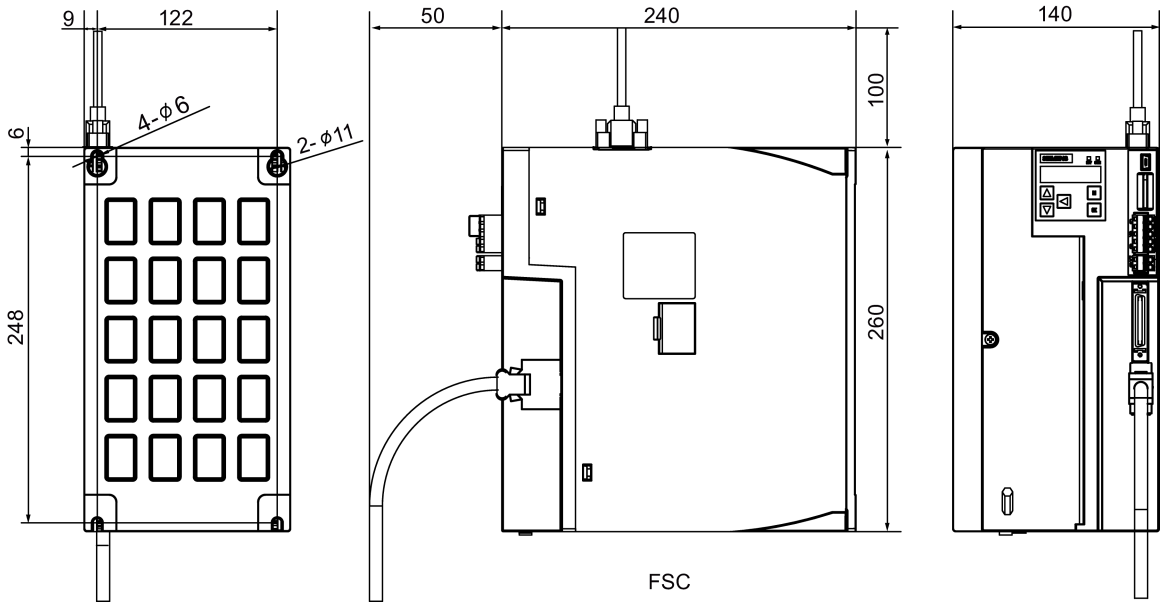



9
63
50
200
80
100
4-φ6
2-φ 11
6
168
180

FSA


9
82
50
220
100
100
4-φ6
2-φ11
6
168
180

FSB



Mounting the drive

Use two M5 screws to mount the FSAA drive and four M5 screws to mount the FSA, FSB, and FSC drives. The recommended tightening torque is 2.0 Nm.

Note

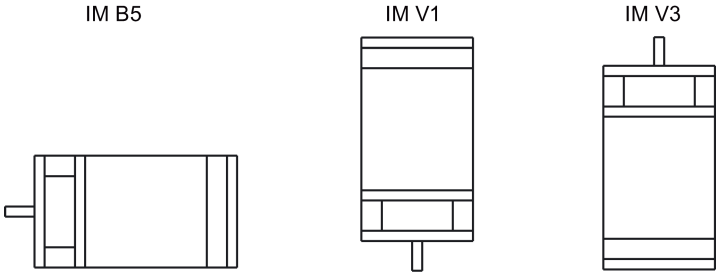
Taking EMC factors into account, you are recommended to mount the drive in a shielded cabinet.

3.2 Mounting the motor

For mounting conditions, see Technical data - servo motors (Page 16).

Mounting orientation

SIMOTICS S-1FL6 supports flange mounting only and three types of constructions.

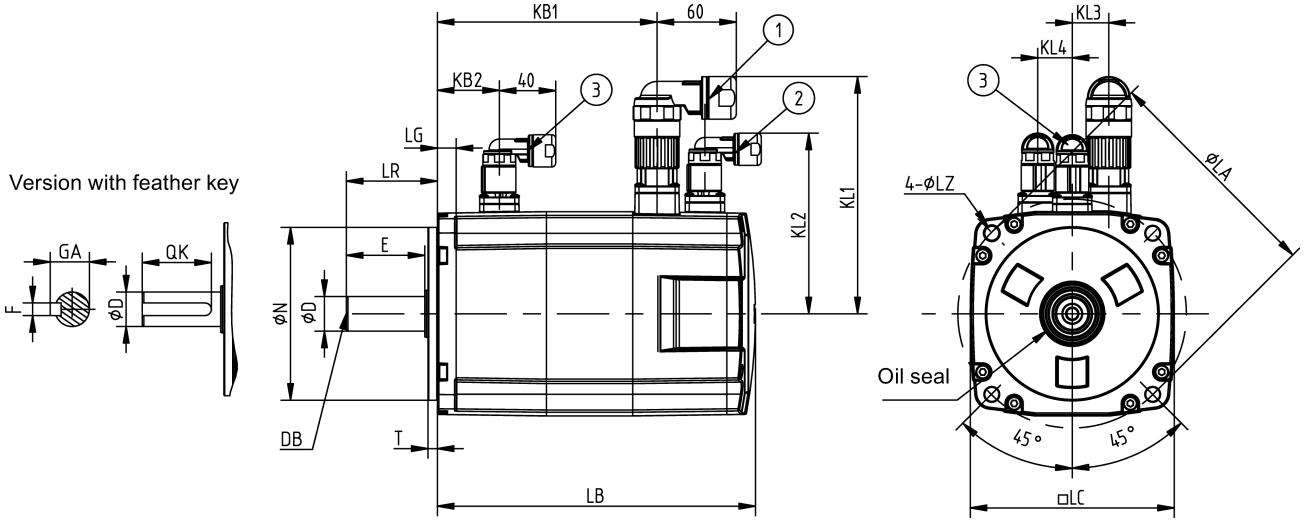


Note

When configuring the IM V3 type of construction, pay particular attention to the permissible axial force (weight force of the drive elements) and the necessary degree of protection.

Motor dimensions

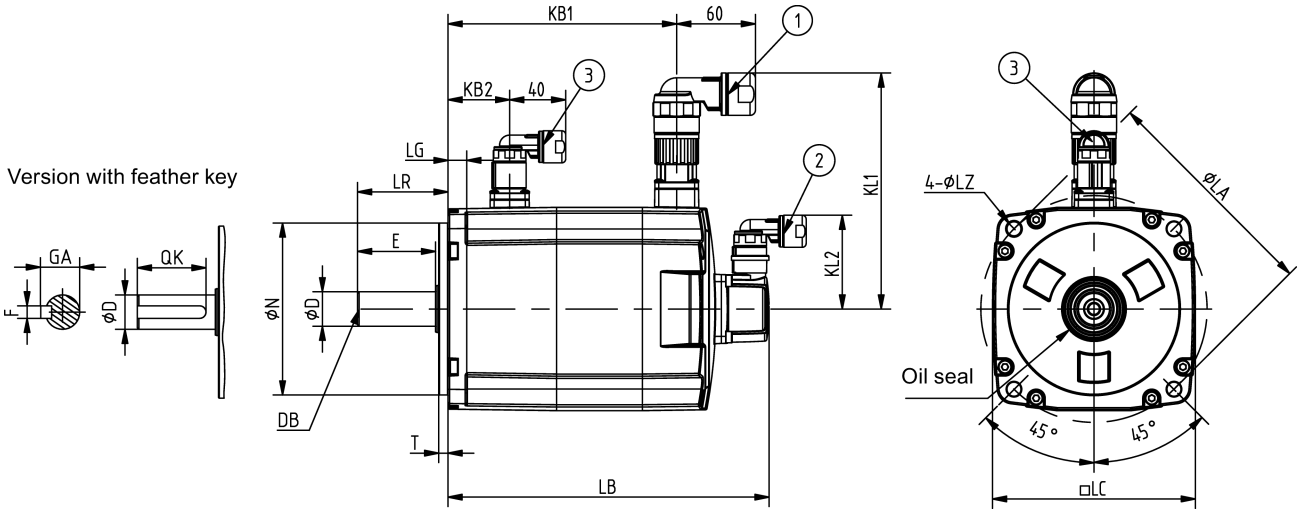
1FL6 motor with incremental encoder (unit: mm)



Shaft height	Type	LC	LA	LZ	N	L R	T	LG	D	DB	E	Q K	GA	F	Without brake			With brake			KL 1	KL2	K L3	K L4
															LB	KB 1	K B2	LB	KB1	KB 2				
45	1FL60 42	90	100	7	80	35	4	10	19	M6x 16	30	25	22	6- 0.03	155	94	-	201	140	32	129	92	-	-
	1FL60 44	90	100	7	80	35	4	10	19	M6x 16	30	25	22	6- 0.03	202	141	-	248	187	32	129	92	-	-
65	1FL60 61	130	145	9	110	58	6	12	22	M8x 16	50	44	25	8- 0.036	148	86	-	203	140	40	151	115	23	22
	1FL60 62	130	145	9	110	58	6	12	22	M8x 16	50	44	25	8- 0.036	181	119	-	236	173	40	151	115	23	22
	1FL60 64	130	145	9	110	58	6	12	22	M8x 16	50	44	25	8- 0.036	181	119	-	236	173	40	151	115	23	22
	1FL60 66	130	145	9	110	58	6	12	22	M8x 16	50	44	25	8- 0.036	214	152	-	269	206	40	151	115	23	22
	1FL60 67	130	145	9	110	58	6	12	22	M8x 16	50	44	25	8- 0.036	247	185	-	302	239	40	151	115	23	22
90	1FL60 90	180	200	14	114	80	3	18	35	M8x 16	75	60	38	10- 0.036	190	140	-	255	206	45	177	149	34	34
	1FL60 92	180	200	14	114	80	3	18	35	M8x 16	75	60	38	10- 0.036	212	162	-	281	232	45	177	149	34	34
	1FL60 94	180	200	14	114	80	3	18	35	M8x 16	75	60	38	10- 0.036	238	188	-	307	258	45	177	149	34	34
	1FL60 96	180	200	14	114	80	3	18	35	M8x 16	75	60	38	10- 0.036	290	240	-	359	310	45	177	149	34	34

- ①−Power cable connector, ②−Incremental encoder cable connector, ③−Brake cable connector. These connectors should be ordered separately. For the ordering information refer to Operating Instructions.
- The boundary dimension of encoder connector−② and brake connector−③ are the same.
- Shaft height 90 mm motor has two M8 screws hole for eyebolts

1FL6 motor with absolute encoder (unit: mm)



Shaft height	Type	LC	LA	LZ	N	LR	T	LG	D	DB	E	QK	GA	F	Without brake			With brake			KL1	KL2	KL3	KL4
															LB	KB1	KB2	LB	KB1	KB2				
45	1FL6042	90	100	7	80	35	4	10	19	M6x16	30	25	22	6-0.03	157	100	-	204	147	32	129	60	-	-
	1FL6044	90	100	7	80	35	4	10	19	M6x16	30	25	22	6-0.03	204	147	-	251	194	32	129	60	-	-
65	1FL6061	130	145	9	110	58	6	12	22	M8x16	50	44	25	8-0.036	151	92	-	206	147	40	151	60	-	-
	1FL6062	130	145	9	110	58	6	12	22	M8x16	50	44	25	8-0.036	184	125	-	239	180	40	151	60	-	-
	1FL6064	130	145	9	110	58	6	12	22	M8x16	50	44	25	8-0.036	184	125	-	239	180	40	151	60	-	-
	1FL6066	130	145	9	110	58	6	12	22	M8x16	50	44	25	8-0.036	217	158	-	272	213	40	151	60	-	-
	1FL6067	130	145	9	110	58	6	12	22	M8x16	50	44	25	8-0.036	250	191	-	305	246	40	151	60	-	-
90	1FL6090	180	200	14	114	80	3	18	35	M8x16	75	60	38	10-0.036	197	135	-	263	201	45	177	60	-	-
	1FL6092	180	200	14	114	80	3	18	35	M8x16	75	60	38	10-0.036	223	161	-	289	227	45	177	60	-	-
	1FL6094	180	200	14	114	80	3	18	35	M8x16	75	60	38	10-0.036	249	187	-	315	253	45	177	60	-	-
	1FL6096	180	200	14	114	80	3	18	35	M8x16	75	60	38	10-0.036	301	239	-	367	305	45	177	60	-	-

- ①-Power cable connector, ②−Absolute encoder cable connector, ③−Brake cable connector. These connectors should be ordered separately. For the ordering information refer to Operating Instructions.
- The boundary dimension of encoder connector−② and brake connector−③ are the same.
- Shaft height 90 mm motor has two M8 screws hole for eyebolts

Mounting the motor

⚠ WARNING

Personal injury and material damage

Some motors, especially the 1FL609❑ are heavy. The excessive weight of the motor should be considered and any necessary assistance required for mounting should be sought.

Otherwise, the motor can fall down during mounting. This can result in serious personal injury or material damage.

NOTICE

Damage to the motor

If the liquid enters the motor, the motor may be damaged

During motor installation or operation, make sure that no liquid (water, oil, etc.) can penetrate into the motor. Besides, when installing the motor horizontally, make sure that the cable outlet faces downward to protect the motor from ingress of oil or water.

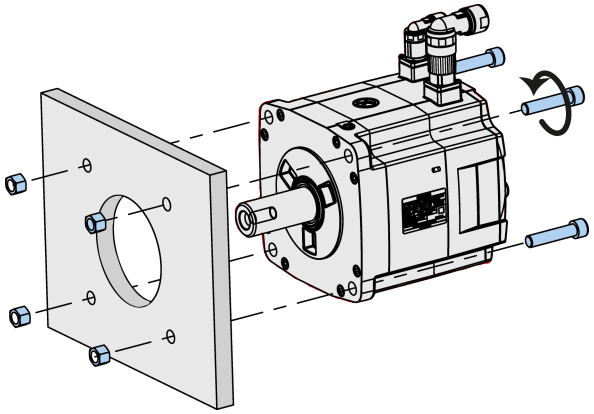
Note

Using the eyebolts

The 1FL609❑ motor (90 mm shaft height) has two M8 screw holes for screwing in two eyebolts. Lift the 1FL609❑ motor only at the eyebolts.

Eyebolts that have been screwed in must be either tightened or removed after mounting.

To ensure better heat dissipation, install a flange between the machine and the motor. You can install the motor onto the flange with 4 screws as shown in the following figure.



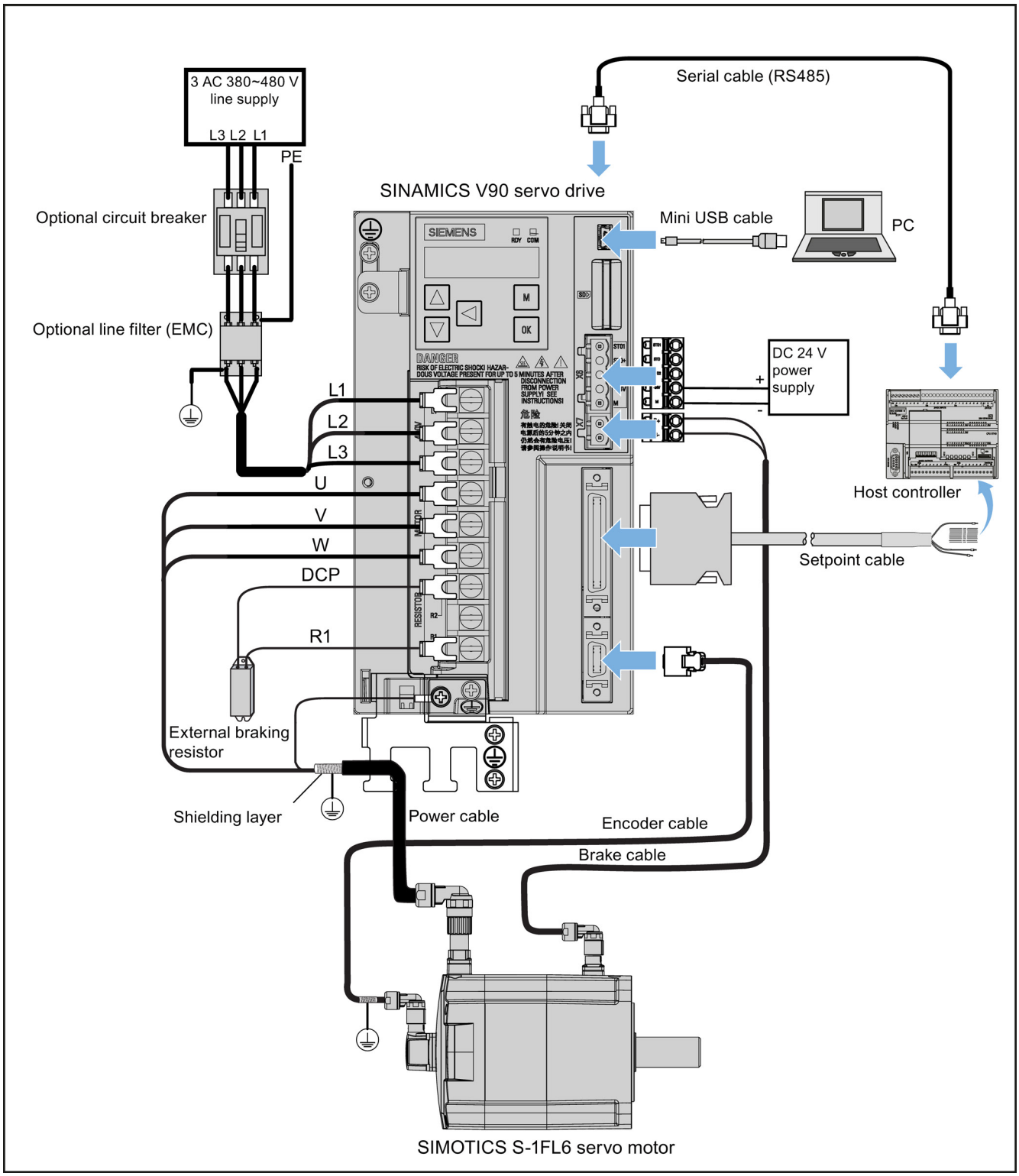
The information about the screws and the flange is as follows:

Motor	Screw	Recommended flange size	Tightening torque	Flange material
1FL604❑	4 x M6	210 x 210 x 10 (mm)	8 Nm	Aluminum alloy
1FL606❑	4 x M8	350 x 350 x 20 (mm)	20 Nm	
1FL609❑	4 x M12	400 x 400 x 25 (mm)	85 Nm	

4 Connecting

4.1 System connection

The SINAMICS V90 servo system is connected as follows:

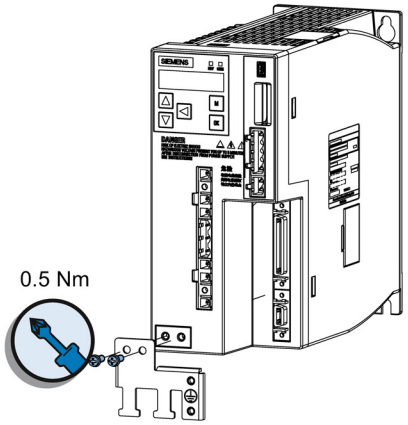


NOTICE
Important wiring information In order to meet **EMC** requirements, all cables must be shielded cables. The cable shields of shielded twisted-pair cables should be connected to the shielding plate or the cable clamp of the servo drive.

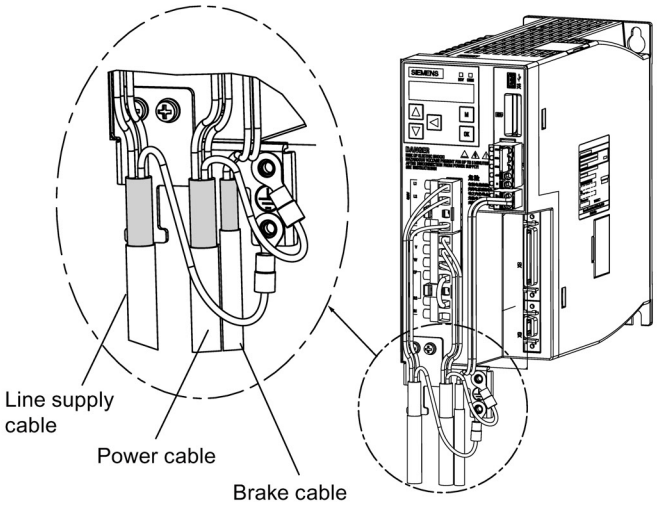
Connecting the cable shields with the shielding plate

To achieve EMC-compliant installation of the drive, use the shielding plate that is shipped with the drive to connect the cable shields. See the following example for steps to connect cable shields with the shielding plate:

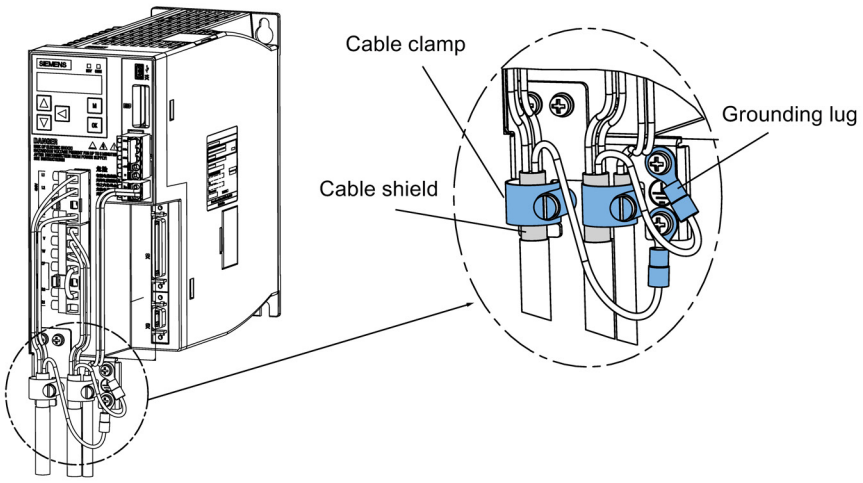
① Mount the shielding plate with two M4 screws.



② Connect the line supply cable, the power cable and the brake cable.

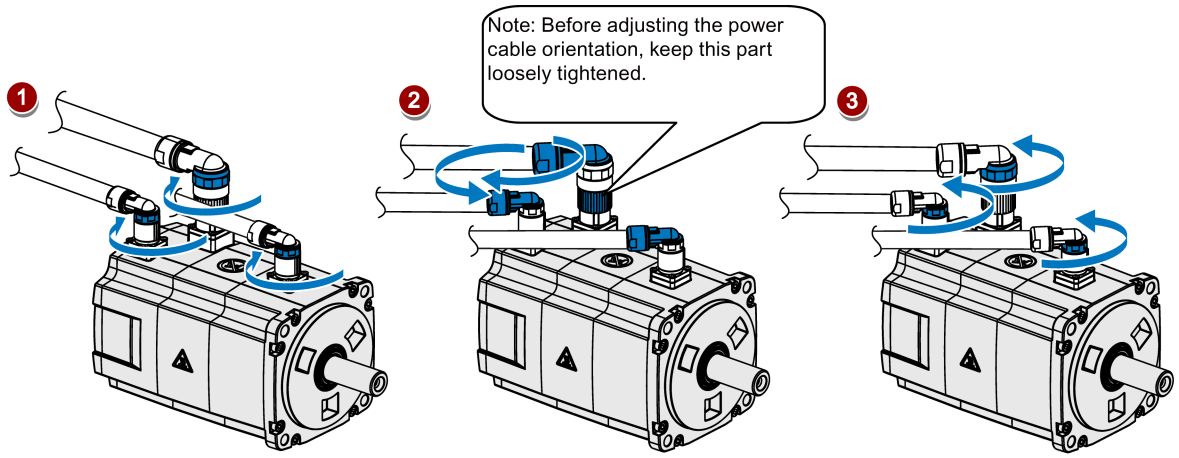


③ Fix the cables.



Adjusting cable orientations from the motor side

From the motor side, you can adjust the orientation of the power cable, encoder cable, and brake cable to facilitate cable connection.



Rotate the screw rings clockwise to loosen the connectors.

Rotate the connectors to adjust the cable orientations.

Rotate the screw rings counter-clockwise to tighten the connectors.

Note

Rotating the connectors

All the three motor-side connectors can be rotated only within 360°.

4.2 Main circuit wirings

4.2.1 Line supply - L1, L2, L3

Maximum conductor cross-section:

FSAA and FSA: 1.5 mm^2 (M2.5 screws, 0.5 Nm)

FSB and FSC: 2.5 mm^2 (M4 screws, 2.25 Nm)

4.2.2 Motor power - U, V, W

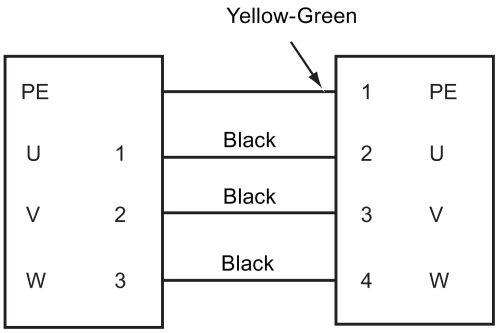
Motor output - drive side

Maximum conductor cross-section:

FSAA and FSA: 1.5 mm2 (M2.5 screws, 0.5 Nm)

FSB and FSC: 2.5 mm2 (M4 screws, 2.25 Nm)

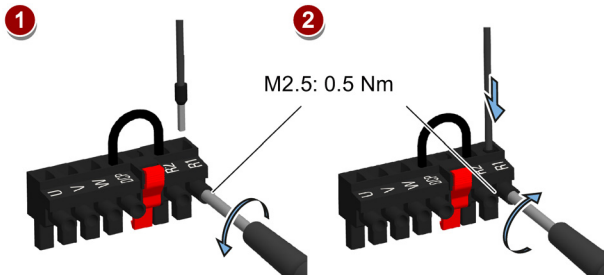
Wiring



Drive side
(Terminal strip)

Motor side
(Socket connector)

Plugging the motor power cable (FSAA and FSA)

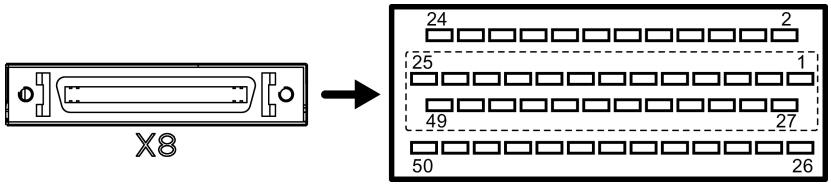


Note

The FSB and FSC servo drives are equipped with barrier terminals for motor power connection. You can fix the motor power cable using the M4 screws on the servo drives.

4.3 Control/Status interface - X8

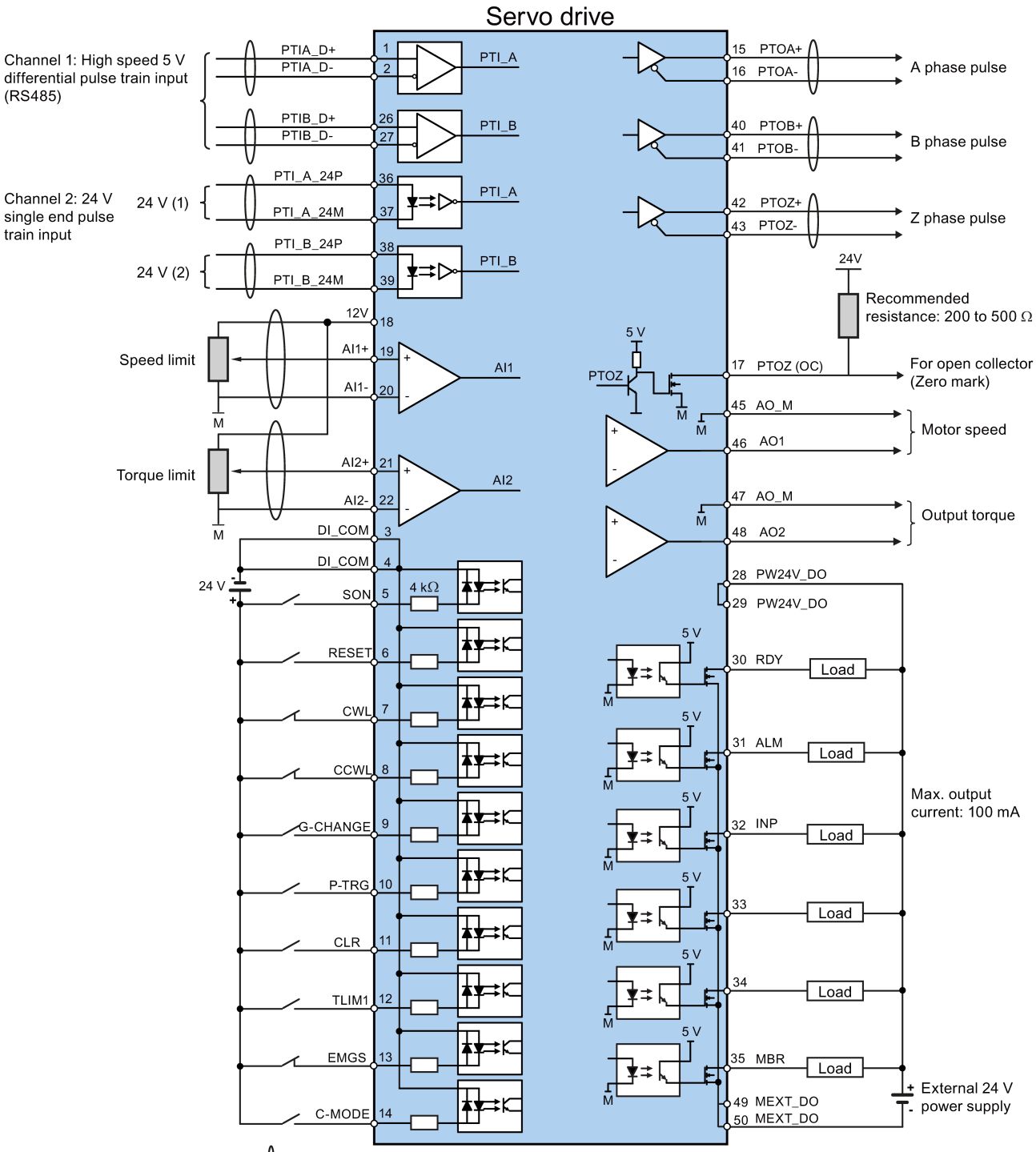
Interface definition

Signal type	Pin No.	Signal	Description	Pin No.	Signal	Description
 Type: 50-pin Sub-D socket						
Pulse train inputs/outputs	1, 2, 26, 27	Position setpoint with pulse train input. Exclusive for high speed 5 V differential pulse train input (RS485) Maximum frequency: 1M Hz Signal transmission of this channel has better noise immunity.		36, 37, 38, 39	Position setpoint with pulse train input. 24 V single end pulse train input Maximum frequency: 200K Hz	
	15, 16, 40, 41	Encoder emulation pulse output with high speed 5 V differential signals (A+/A-, B+/B)		42, 43	Encoder Zero phase pulse output with high speed 5 V differential signals	
	17	Encoder Zero phase pulse output with open collector				
	1	PTIA_D+	High-speed differential pulse train input A (+)	15	PTOA+	Pulse train output A, positive
	2	PTIA_D-	High-speed differential pulse train input A (-)	16	PTOA-	Pulse train output A, negative
	26	PTIB_D+	High-speed differential pulse train input B (+)	40	PTOB+	Pulse train output B, positive
	27	PTIB_D-	High-speed differential pulse train input B (-)	41	PTOB-	Pulse train output B, negative
	36	PTI_A_24P	Pulse train input A, +24 V	42	PTOZ+	Pulse train output Z, positive
	37	PTI_A_24M	Pulse train input A, ground	43	PTOZ-	Pulse train output Z, negative
	38	PTI_B_24P	Pulse train input B, +24 V	17	PTOZ (OC)	Pulse train output Z signal (open collector output)
	39	PTI_B_24M	Pulse train input B, ground			

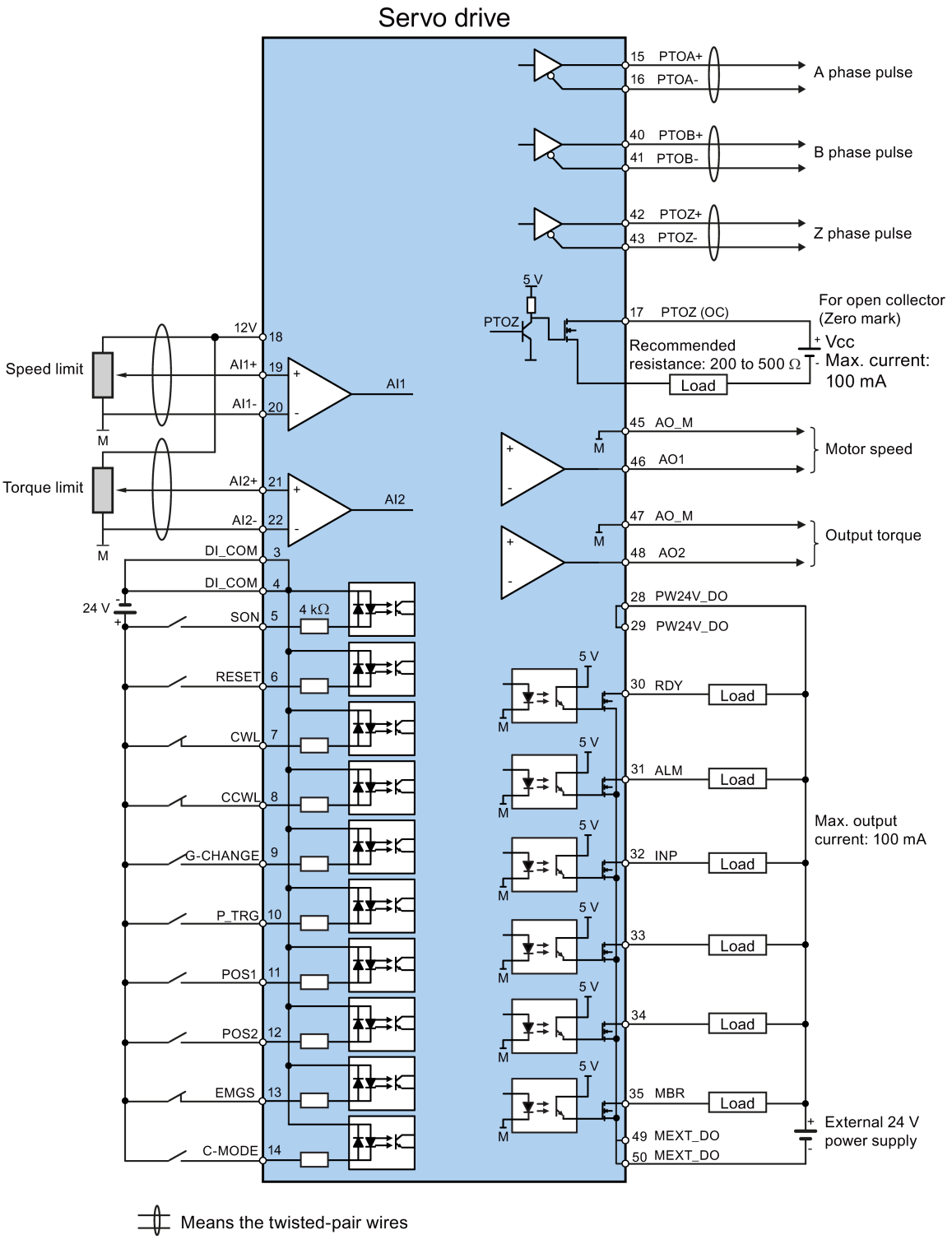
Signal type	Pin No.	Signal	Description	Pin No.	Signal	Description
Digital inputs/outputs	3	DI_COM	Common terminal for digital inputs	14	DI10	Digital input 10
	4	DI_COM	Common terminal for digital inputs	28	PW24V_DO	External 24 V supply for digital outputs
	5	DI1	Digital input 1	29	PW24V_DO	External 24 V supply for digital outputs
	6	DI2	Digital input 2	30	DO1	Digital output 1
	7	DI3	Digital input 3	31	DO2	Digital output 2
	8	DI4	Digital input 4	32	DO3	Digital output 3
	9	DI5	Digital input 5	33	DO4	Digital output 4
	10	DI6	Digital input 6	34	DO5	Digital output 5
	11	DI7	Digital input 7	35	DO6	Digital output 6
	12	DI8	Digital input 8	49	MEXT_DO	External 24 V ground for digital outputs
	13	DI9	Digital input 9	50	MEXT_DO	External 24 V ground for digital outputs
Analog inputs/outputs	18	P12OPVADC	12 V power output	45	AO_M	Analog output ground
	19	AI1+	Analog input channel 1, positive	46	AO1	Analog output channel 1
	20	AI1-	Analog input channel 1, negative	47	AO_M	Analog output ground
	21	AI2+	Analog input channel 2, positive	48	AO2	Analog output channel 2
	22	AI2-	Analog input channel 2, negative			
None	23	-	Reserved	25	-	Reserved
	24	-	Reserved	44	-	Reserved

Standard wiring (four modes)

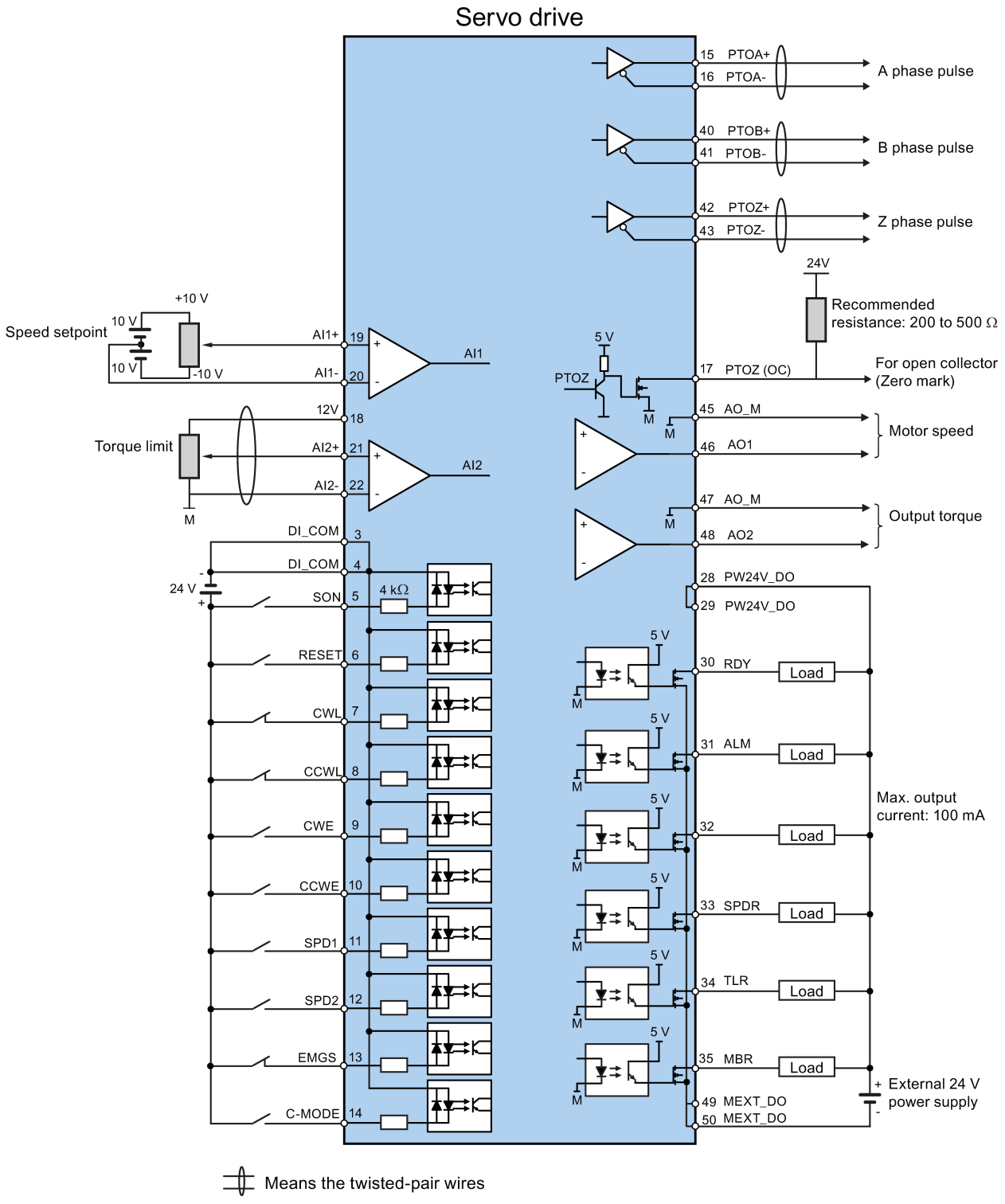
- Pulse train input position control (PTI)



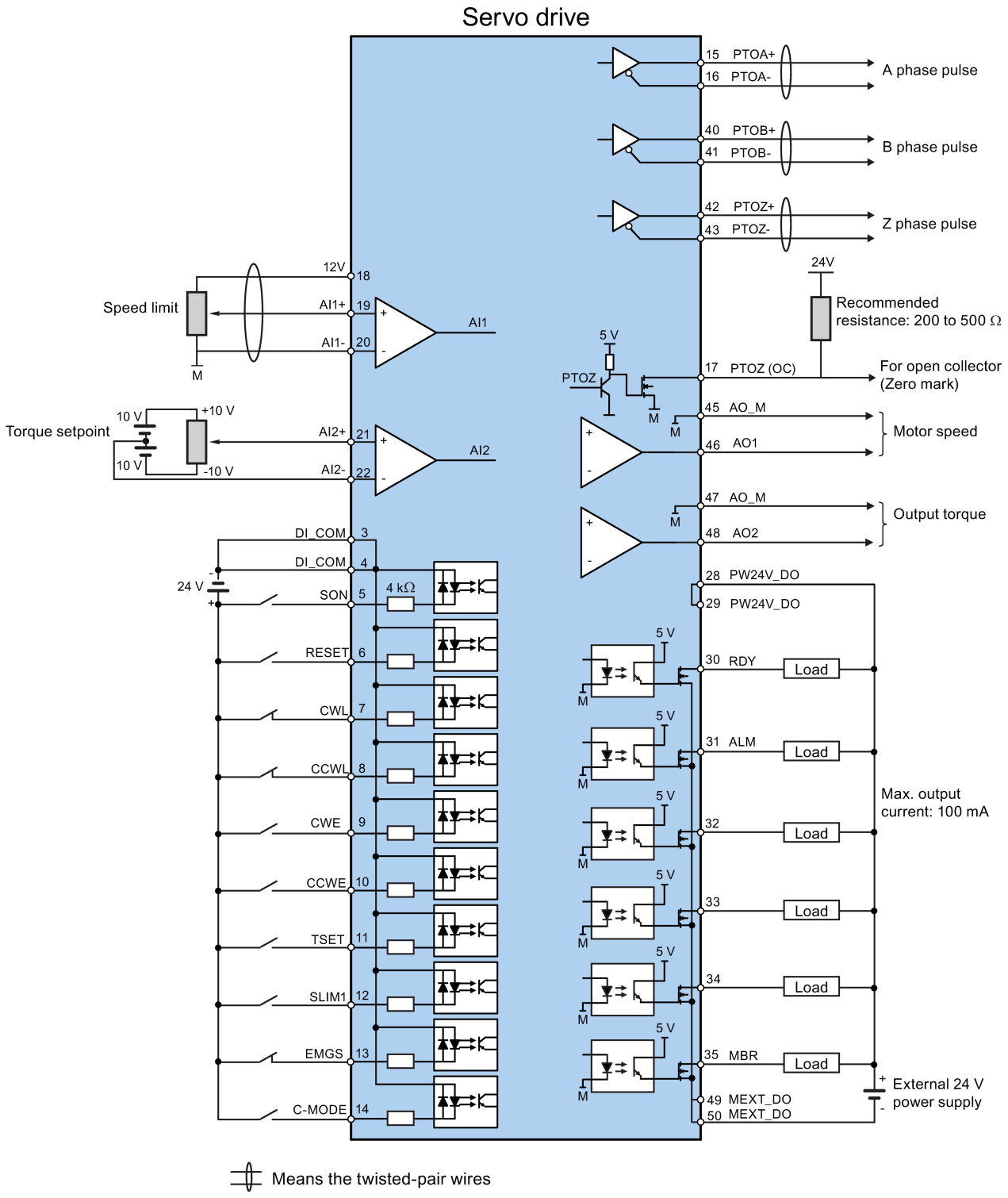
- Internal position control (IPos)



- Speed control (S)

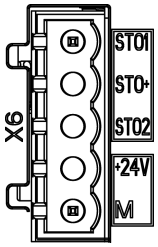


- Torque control (T)



4.4 24 V power supply/STO - X6

The pin assignment for the X6 interface is shown as follows:

Interface	Signal name	Description
	STO 1	Safe torque off channel 1
	STO +	Specific power supply for safe torque off
	STO 2	Safe torque off channel 2
	+24 V	Power supply, 24 VDC
	M	Power supply, 0 VDC
	Maximum conductor cross-section: 1.5 mm^2	

Wiring

WARNING

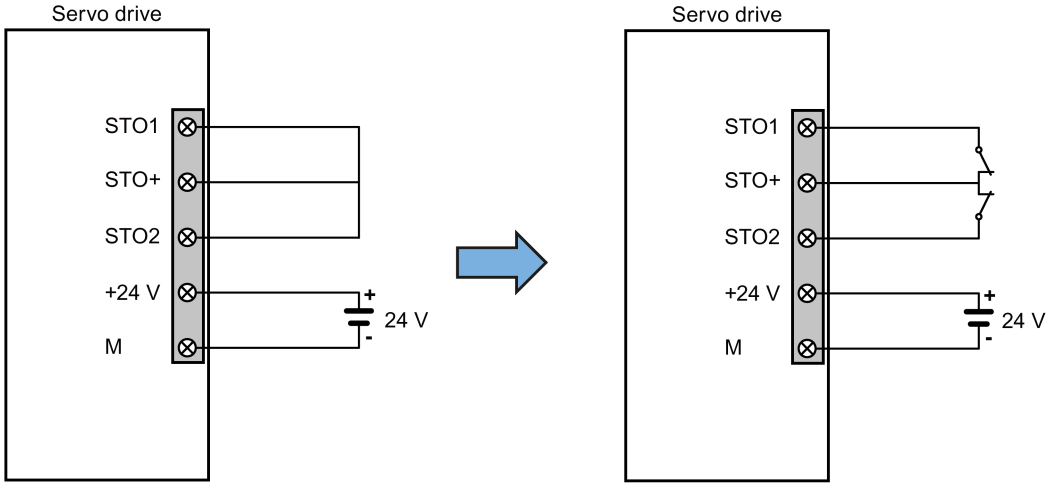
Material damages and personal injuries by the drop of a vertical axis

When the servo system is used as a vertical axis, the axis will drop if the positive and negative poles of the 24 V power supply are connected inversely. Unexpected drop of the vertical axis may cause material damages and personal injuries.

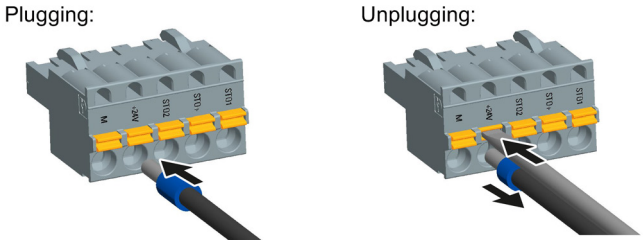
Make sure that the 24 V power supply is correctly connected.

Note

The STO1, STO+ and STO2 are short-circuited at the factory. You must remove the short-circuit stick when you need to use the STO function.



Plugging the 24 V power supply and STO cables



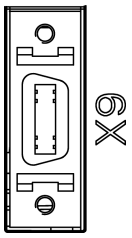
4.5 Encoder interface - X9

The SINAMICS V90 servo drive supports two kinds of encoders:

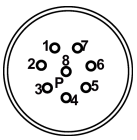
- Incremental encoder
- Absolute encoder

NOTICE
Cable shielding The encoder cable **must** be shielded to meet the EMC requirements.

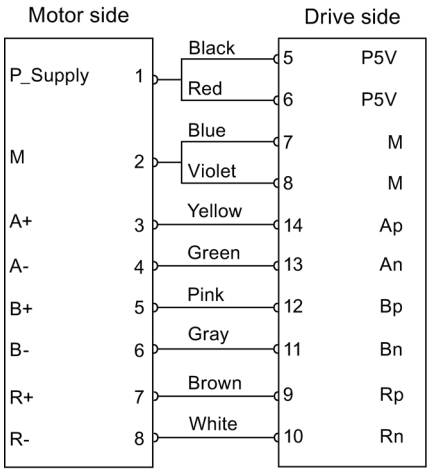
Encoder interface - drive side

Illustration	Pin	Signal name	Description
	1	Biss_DataP	Absolute encoder data signal, positive
	2	Biss_DataN	Absolute encoder data signal, negative
	3	Biss_ClockN	Absolute encoder clock signal, negative
	4	Biss_ClockP	Absolute encoder clock signal, positive
	5	P5V	Encoder power supply, +5V
	6	P5V	Encoder power supply, +5V
	7	M	Encoder power supply, grounding
	8	M	Encoder power supply, grounding
	9	Rp	Encoder R phase positive signal
	10	Rn	Encoder R phase negative signal
	11	Bn	Encoder B phase negative signal
	12	Bp	Encoder B phase positive signal
	13	An	Encoder A phase negative signal
	14	Ap	Encoder A phase positive signal
	Screw type: UNC 4-40 (plug-in terminal block) Tightening torque: 0.5 - 0.6 Nm		

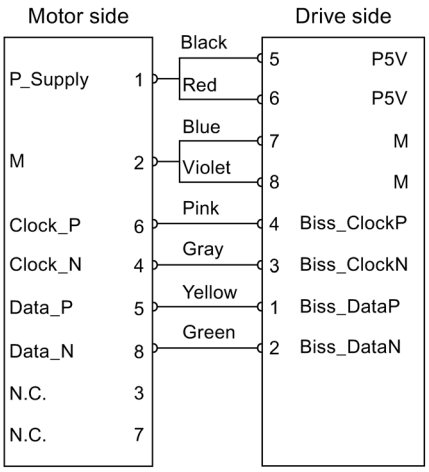
Encoder connector - motor side

Illustration	Pin No.	Incremental encoder		Absolute encoder	
		Signal	Description	Signal	Description
	1	P_Supply	Power supply 5 V	P_Supply	Power supply 5 V
	2	M	Power supply 0 V	M	Power supply 0 V
	3	A+	Phase A+	n. c.	Not connected
	4	A-	Phase A-	Clock_N	Inverted clock
	5	B+	Phase B+	Data_P	Data
	6	B-	Phase B-	Clock_P	Clock
	7	R+	Phase R+	n. c.	Not connected
	8	R-	Phase R-	Data_N	Inverted data

Wiring



Incremental encoder

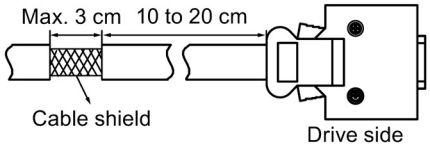


Absolute encoder

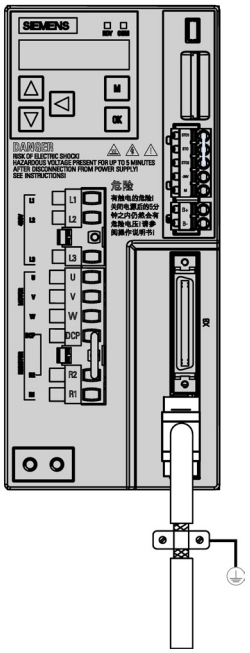
Grounding

To ensure better EMC effects, you are recommended to strip the encoder cable and connect the cable shield to earth, as shown in the following figure:

1



2



4.6 External braking resistor - DCP, R1

The SINAMICS V90 has been designed with an internal braking resistor to absorb regenerative energy from the motor. When the internal braking resistor cannot meet the braking requirements (e.g. the alarm A52901 is generated), you can connect an external braking resistor. For the selection of braking resistors, refer to chapter accessories of the SINAMICS V90, SIMOTICS S-1FL6 operating Instructions.

Connecting an external braking resistor

⚠ WARNING
Damage to the drive Before connecting an external resistor to DCP and R1, remove the short-circuit stick on the connectors. Otherwise, the drive may be damaged.

For the connection of the external braking resistor, refer to Connecting (Page 24).

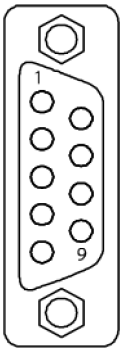
4.7 Motor holding brake - X7

You can connect the SINAMICS V90 servo drive to a servo motor with brake to use the function of motor holding brake.

4.8 RS485 interface - X12

The SINAMICS V90 servo drives support communication with the PLCs through the RS485 interface (X12) over the USS protocol.

Pin assignment

Illustration	Pin	Signal name	Description
	1	Reserved	Do not use
	2	Reserved	Do not use
	3	1RS_DP	RS485 differential signal
	4	Reserved	Do not use
	5	M	Ground to internal 3.3 V
	6	3.3 V	3.3 V power supply for internal signal
	7	Reserved	Do not use
	8	1XRS_DP	RS485 differential signal
	9	Reserved	Do not use
Type: 9-pin, Sub-D, female			

5 Commissioning

Prior to commissioning, read "Introduction to the BOP (Page 38)" for more information about the BOP operations. In case of any faults or alarms during commissioning, refer to Chapter "Diagnostics (Page 76)" for detailed description.

⚠ CAUTION

Carefully read the safety instructions

Before your commissioning or operation, read Section "General safety instructions (Page 2)" and the safety instructions on "**Commissioning/Operation**" in Section "Additional safety instructions (Page 5)" carefully. Failure to observe the instructions may cause serious effects.

⚠ WARNING

Material damages and personal injuries by the drop of a hanging axis

When the servo system is used as a hanging axis, the axis will drop if the positive and negative poles of the 24 V power supply are connected inversely. Unexpected drop of the hanging axis may cause material damages and personal injuries.

Before commissioning, a crosstie must be used to hold the hanging axis in prevention of an unexpected drop. In addition, make sure that the 24 V power supply is correctly connected.

NOTICE

Plugging or unplugging the SD card will cause startup failure.

Do not plug or unplug the SD card during startup; otherwise, the drive will fail to start up.

NOTICE

Existing setting data may be overwritten by the setting data on the SD card during startup.

- When a drive is switched on with an SD card containing user setting data, the existing setting data on the drive will be overwritten.
- When a drive is switched on with an SD card containing no user setting data, the drive will automatically save the existing user setting data onto the SD card.

Before starting up the drive with an SD card, check whether the SD card contains user setting data. Otherwise, the existing data on the drive may be overwritten.

Engineering tool - SINAMICS V-ASSISTANT

You can choose to use the engineering tool SINAMICS V-ASSISTANT to perform the trial operation.

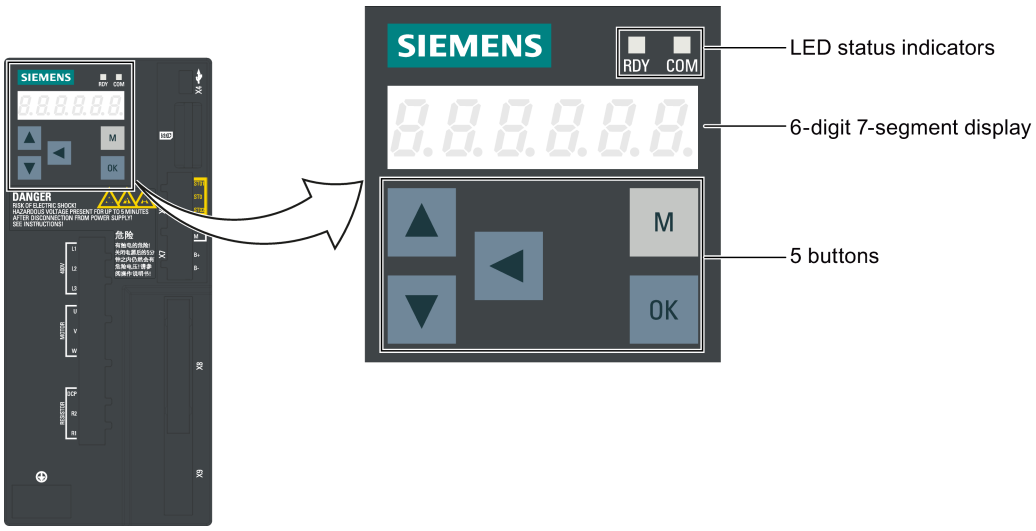
SINAMICS V-ASSISTANT is a software tool that can be installed on a PC and runs on the Windows operating system. It communicates with the SINAMICS V90 servo drive with a USB cable. With SINAMICS V-ASSISTANT, you can change drive parameters and monitor drive working states in online mode.

For more information, refer to SINAMICS V-ASSISTANT Online Help. You can search and download SINAMICS V-ASSISTANT from Technical support website (http://support.automation.siemens.com).

5.1 Introduction to the BOP

Overview

The SINAMICS V90 servo drive has been designed with a Basic Operator Panel (BOP) located on the front of the servo drive.

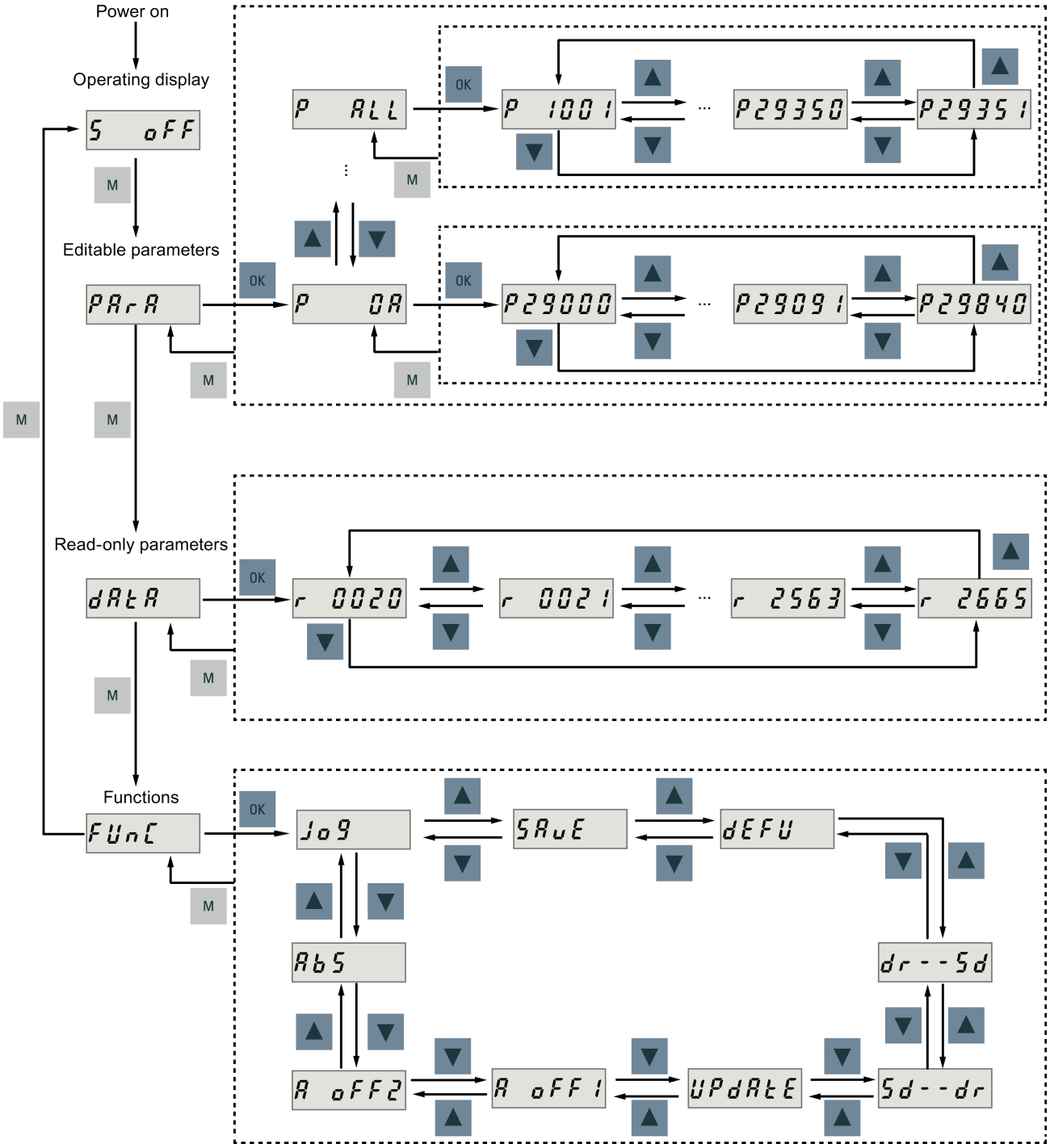


Button functions

Button	Description	Functions
Basic buttons		
M	M button	• Exits from the current menu • Switches between operating modes in the top level menu
OK	OK button	• Confirms selection or input • Enters sub menu • Acknowledges faults
▲	UP button	• Navigates to the next item • Increases a value • JOG in CW (clockwise)
▼	DOWN button	• Navigates to the previous item • Decreases a value • JOG in CCW (counter-clockwise)
◀	SHIFT button	Moves the cursor from digit to digit for single digit editing, including the digit of positive/negative signs
Button combinations		
OK	Long-press OK button	Activates an auxiliary function
OK + M	Press M + OK buttons for four seconds	Restarts the drive
▲ + ◀	Press UP + SHIFT buttons	Moves current display to the left page when ⌜ is displayed at the upper right corner, for example 00.000⌜.
▼ + ◀	Press DOWN + SHIFT buttons	Moves current display to the right page when ⌟ is displayed at the lower right corner, for example 00 10⌟.

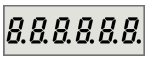
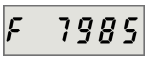
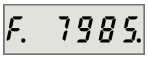
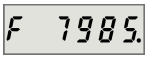
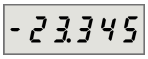
Menu structure

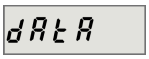
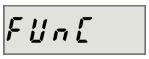
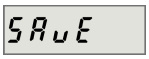
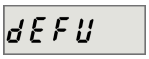
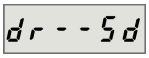
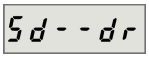
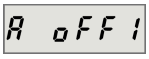
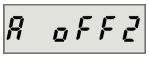
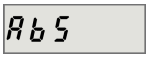
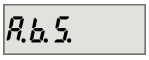
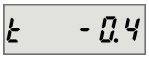
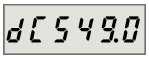
The overall menu structure of SINAMICS V90 BOP is designed as follows:



BOP displays

You can find the description and corresponding examples for BOP displays in the table below:

Display	Example	Description
8.8.8.8.8.8.		Drive is in startup state
------		Drive is busy
Fxxxxx		Fault code, in the case of a single fault
F.xxxxx.		Fault code of the first fault, in the case of multiple faults
Fxxxxx.		Fault code, in the case of multiple faults
Axxxxx		Alarm code, in the case of a single alarm
A.xxxxx.		Alarm code of the first alarm, in the case of multiple alarms
Axxxxx.		Alarm code, in the case of multiple alarms
Rxxxxx		Parameter number, read-only parameter
Pxxxxx		Parameter number, editable parameter
P.xxxxx		Parameter number, editable parameter; the dot means that at least one parameter has been changed
In xx		Indexed parameter Figure after "**In**" indicates the number of indices. For example, "**In 01**" means that this indexed parameter is 1.
xxx.xxx		Negative parameter value
xxx.xx<>		Current display can be moved to left or right
xxxx.xx>		Current display can be moved to right
xxxx.xx<		Current display can be moved to left
S Off		Operating display: servo off
Para		Editable parameter group

Display	Example	Description
P 0x		Parameter group Six groups are available: 1. **P0A**: basic 2. **P0B**: gain adjustment 3. **P0C**: speed control 4. **P0D**: torque control 5. **P0E**: position control 6. **P0F**: IO
Data		Read-only parameter group
Func		Function group
Jog		Jog function
Save		Save data in drive
defu		Restore drive to default settings
dr--sd		Save data from drive to SD card
sd--dr		Upload data from SD card to drive
Update		Update firmware
A OFF1		Adjust AI1 offset
A OFF2		Adjust AI2 offset
ABS		The zero position has not been set
A.B.S.		The zero position has been set
r xxx		Actual speed (positive direction)
r -xxx		Actual speed (negative direction)
T x.x		Actual torque (positive direction)
T -x.x		Actual torque (negative direction)
DCxxx.x		Actual DC link voltage

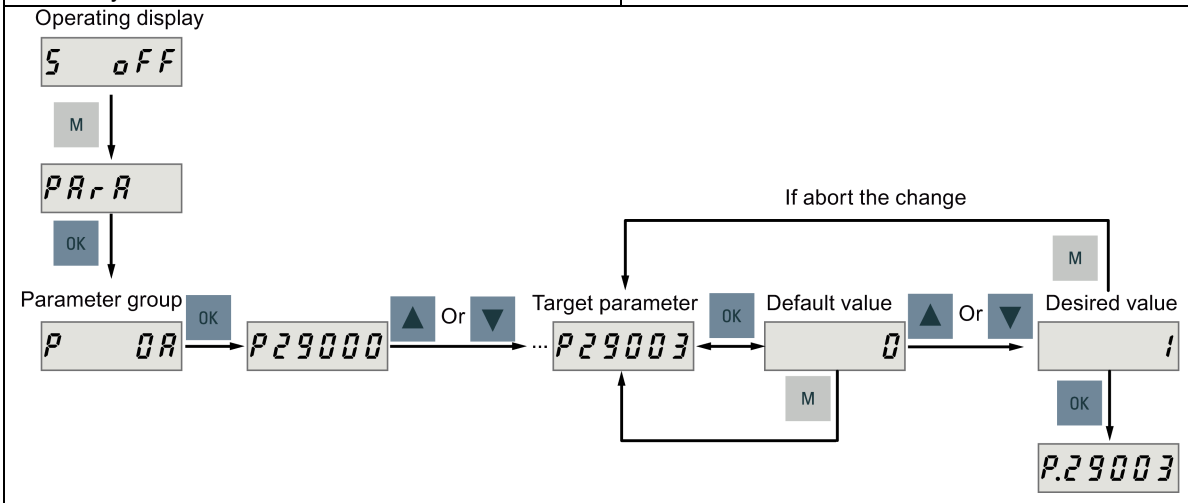
5.2 Initial commissioning in JOG mode

Prerequisites

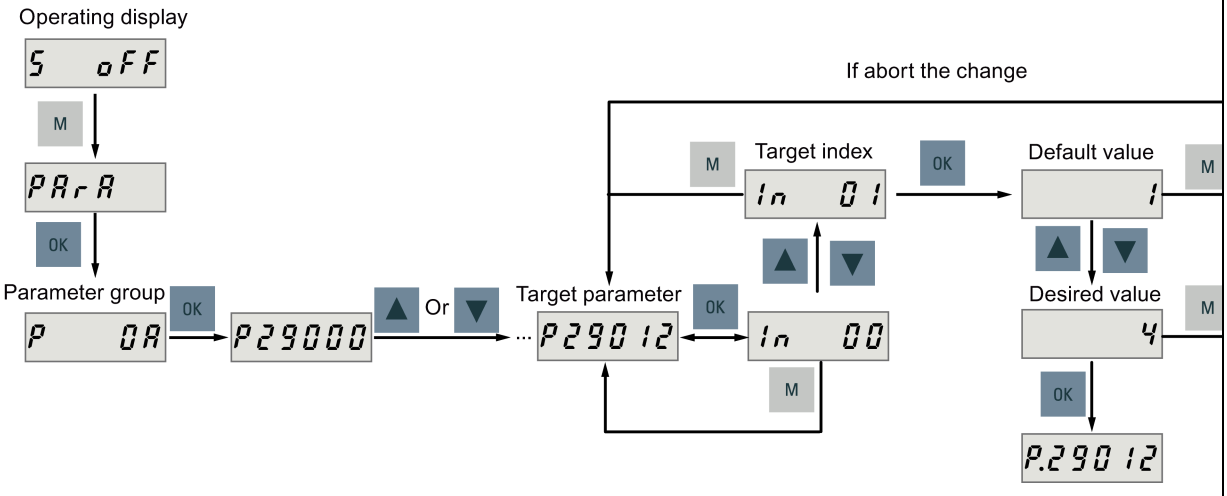
The servo drive is connected to the servo motor without load.

Operating sequence

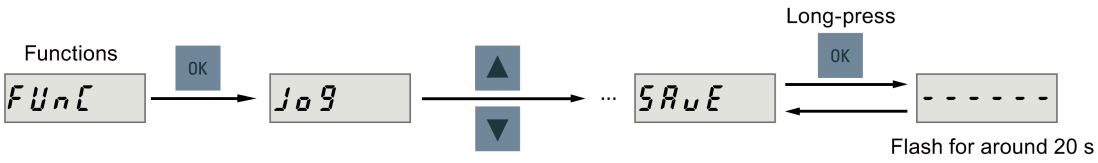
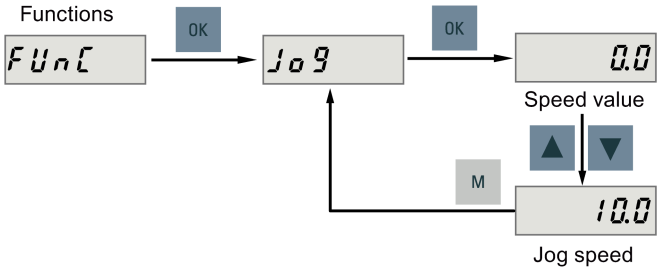
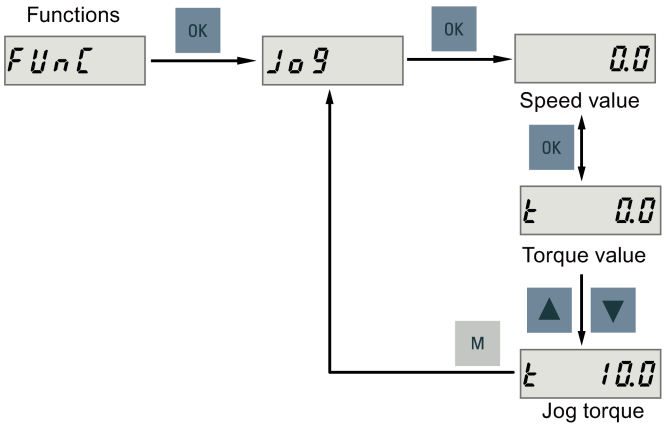
Step	Operation	Comment
1	Connect necessary units and check wirings.	It is necessary to connect the following cables: • Motor cable • Encoder cable • Brake cable • Line supply cable • DC 24 V cable
2	Switch on the 24 V power supply.	
3	Check the servo motor type. • If the servo motor has an incremental encoder, input motor ID (p29000). • If the servo motor has an absolute encoder, the servo drive can identify the servo motor automatically.	Fault **F52984** occurs when the servo motor is not identified. You can find the motor ID from the motor rating plate. Refer to the descriptions about the motor rating plate in "Motor components (Page 11)".
4	Check the direction of motor rotation. The default direction of rotation is CW (clockwise). You can change it by setting the parameter p29001 if necessary.	p29001=0: CW p29001=1: CCW



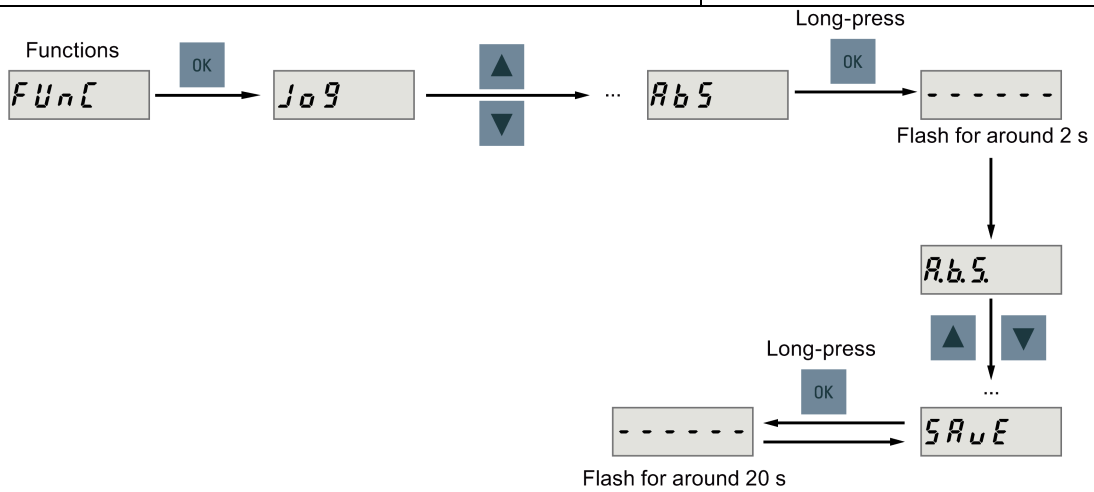
Setting a parameter without index (example)



Setting a parameter with index (example)

Step	Operation	Comment
5	Check the Jog speed. The default Jog speed is 200 rpm. You can change it by setting the parameter p1058.	
6	If the servo motor has a brake, configure the motor holding brake by setting parameter p1215.	• p1215=0: no motor holding brake available • p1215=1: motor holding brake according to sequence control (SON) • p1215=2: motor holding brake always open • p1215=3: SIEMENS internal use The factory setting is p1215=0 (no motor holding brake available).
7	Save parameters with the BOP menu function "Save".	
		
8	Clear faults and alarms.	Refer to Chapter "Diagnostics (Page 76)".
9	For the BOP, enter the Jog menu function and press the UP or DOWN button to run the servo motor.	
	 Jog in speed (example)	
	 Jog in torque (example)	
	For the engineering tool, use the Jog function to run the servo motor.	For detailed information about JOG with the SINAMICS V-ASSISTANT, refer to the SINAMICS V-ASSISTANT Online Help.

5.3 Commissioning in pulse train position control mode (PTI)

Step	Operation	Comment
1	Switch off the mains supply.	
2	Power off the servo drive and connect it to host controller (for example, SIMATIC PLCs) with the signal cable.	The digital signals CWL, CCWL and EMGS **must** be kept at high level (1) to ensure normal operation.
3	Power on the servo drive.	
4	Check current control mode by viewing value of the parameter p29003. Pulse train input position control mode (p29003=0) is the factory setting of SINAMICS V90 servo drives.	Refer to "Selecting a control mode (Page 45)".
5	Select a pulse input channel by setting parameter p29014.	• p29014=0: high speed 5V differential pulse train input (RS485) • p29014=1: 24V single end pulse train input 24V single end pulse train input is the factory setting. Refer to "Selecting a setpoint pulse train input channel (Page 45)".
6	Select a setpoint pulse train input form by setting parameter p29010.	• p29010=0: pulse + direction, positive logic • p29010=1: AB track, positive logic • p29010=2: pulse + direction, negative logic • p29010=3: AB track, negative logic The factory setting is p29010=0 (pulse + direction, positive logic). Refer to "Selecting a setpoint pulse train input form (Page 46)".
7	Calculate the electronic gear ratio, then input values into parameters p29012 and p29013.	• p29012: numerator of the electronic gear ratio. Four numerators in total (p29012[0] to p29012[3]) are available. • p29013: denominator of the electronic gear ratio. Refer to "Calculating electronic gear ratio (Page 46)".
8	Check the encoder type. If it is an absolute encoder, adjust the absolute encoder with the BOP menu function "ABS".	
		
9	Clear faults and alarms.	Refer to "Diagnostics (Page 76)".
10	Input setpoint pulse train from the command device and trigger SON to be high level, then the servo motor starts running.	Use a low pulse frequency at first to check the direction and speed of rotation.
11	The system commissioning in the pulse train input position control mode ends.	You can check the system performance. If it is not ok, you can adjust it.

5.4 Commissioning control functions

5.4.1 Selecting a control mode

Selecting a basic control mode

You can select a basic control mode by directly setting parameter p29003:

Parameter	Setting Value	Description
p29003	0 (default)	Pulse train input position control mode
	1	Internal position control mode
	2	Speed control mode
	3	Torque control mode

Control mode change for a compound control mode

For a compound control mode, you can change between two basic control modes by setting the parameter p29003 and configuring the level sensitive signal C-MODE on DI10:

p29003	C-MODE	
	0 (the first control mode)	1 (the second control mode)
4	PTI	S
5	IPos	S
6	PTI	T
7	IPos	T
8	S	T

Note

Fault F52904 occurs when the control mode is changed via p29003. You must save the parameter and then re-power on the servo drive to apply relevant configurations.

Note

Switching conditions

For the switching from PTI or IPos to S or T, you are recommended to perform control mode switching after the INP (in position) signal is at high level.

For the switching from S or T to PTI or IPos, you can perform control mode switching only after the motor speed is lower than 30 rpm.

5.4.2 Selecting a setpoint pulse train input channel

As mentioned before, the SINAMICS V90 servo drive supports two channels for the setpoint pulse train input:

- 24V single end pulse train input
- High speed 5V differential pulse train input (RS485)

You can select one of these two channels by setting parameter p29014:

Parameter	Value	Setpoint pulse train input channel	Default
p29014	0	High speed 5V differential pulse train input (RS485)	
	1	24V single end pulse train input	✓

The position pulse train inputs come from either of the following two terminal groups:

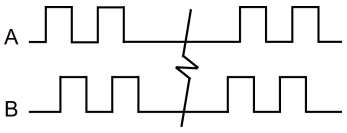
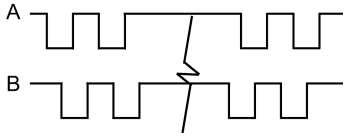
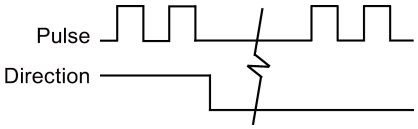
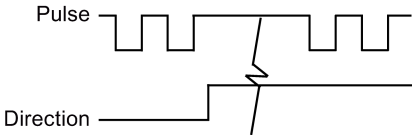
- X8-1 (PTIA_D+), X8-2 (PTIA_D-), X8-26 (PTIB_D+), X8-27 (PTIB_D-)
- X8-36 (PTI_A_24P), X8-37 (PTI_A_24M), X8-38 (PTI_B_24P), X8-39 (PTI_B_24M)

5.4.3 Selecting a setpoint pulse train input form

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				

You can select one of the setpoint pulse train input forms by setting the parameter p29010:

Parameter	Value	Setpoint pulse train input form	Default
p29010	0	Pulse + Direction, positive logic	✓
	1	AB track, positive logic	
	2	Pulse + Direction, negative logic	
	3	AB track, negative logic	

Note

After modifying parameter p29010, you must save the parameter and then restart the drive to ensure normal operation. In this case, you must perform referencing again because the reference point will be lost after p29010 changes.

5.4.4 In position (INP)

When the deviation between the position setpoint and the actual position is in the preset in-position range specified in p2544, the signal INP (in position) is output.

Parameter settings

Parameter	Value range	Setting value	Unit	Description
p2544	0 to 2147483647	40 (default)	LU	Position window (in-position range)
p29332	1 to 13	3	-	Digital output 3 assignment

DO configuration

Signal type	Signal name	Pin assignment	Setting	Description
DO	INP	X8-32	1	Number of droop pulses is in the preset in-position range (parameter p2544)
			0	Droop pulses are beyond the in-position range

5.4.5 Calculating electronic gear ratio

Encoder specifications

The encoder specifications are shown as follows:

1FL6□□□ -1A□61-0□□1

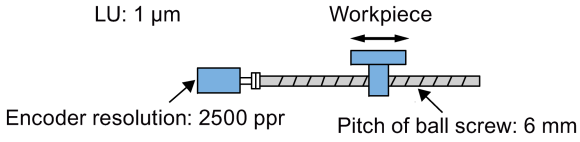
Type		Specification	Resolution (ppr)
A	Incremental encoder	2500	10000
L	Absolute encoder	20 bit	1048576

Electronic gear

With the function of electronic gear, you can define the motor revolutions according to the number of setpoint pulses, and sequentially define the distance of mechanical movement. The minimum number of setpoint pulses moving load is called length unit (LU); for example, one pulse results in 1 μm movement.

Benefits of electronic gear (example):

Move the workpiece for 10 mm:



Without electronic gear	With electronic gear
Required number of setpoint pulses: 2500 × 4 × (10/6) = 16666	Required number of setpoint pulses: (10 × 1000) / 1= 10000

The electronic gear ratio is a multiplier factor to pulse train setpoint. It is realized with a numerator and a denominator. Four numerators (p29012[0], p29012[1], p29012[2]. p29012[3]) and one denominator (p29013) are used for the four electronic gear ratios:

Parameter	Range	Factory setting	Unit	Description
p29012[0]	1 to 10000	1	-	The first numerator of electronic gear
p29012[1]	1 to 10000	1	-	The second numerator of electronic gear
p29012[2]	1 to 10000	1	-	The third numerator of electronic gear
p29012[3]	1 to 10000	1	-	The forth numerator of electronic gear
p29013	1 to 10000	1	-	The denominator of electronic gear

These four electronic gear ratios can be selected with the combination of the digital input signals EGEAR1 and EGEAR2:

EGEAR2 : EGEAR1	Electronic gear ratio	Ratio value
0 : 0	Electronic gear ratio 1	p29012[0] : p29013
0 : 1	Electronic gear ratio 2	p29012[1] : p29013
1 : 0	Electronic gear ratio 3	p29012[2] : p29013
1 : 1	Electronic gear ratio 4	p29012[3] : p29013

Note

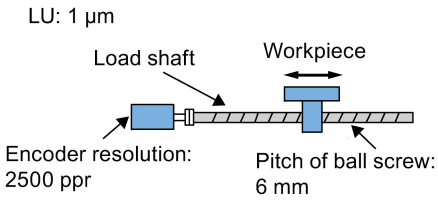
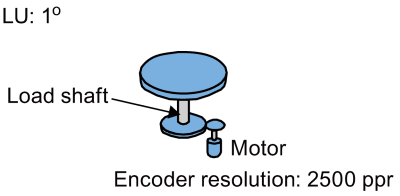
After a gear ratio is switched to another one via digital inputs, you need to wait three seconds and then perform **SERVO ON**.

Note

The range of electronic gear ratio is from 0.02 to 500.

The electronic gear ratio can be set at **SERVO OFF** state only.

Examples for calculating the electronic gear ratio

Step	Description		Mechanism	
			Ball screw	Disc table
				
1	Identify mechanism		• Pitch of ball screw: 6 mm • Deduction gear ratio: 1:1	• Rotary angle: 360° • Deduction gear ratio: 3:1
2	Identify encoder resolution		10000	10000
3	Define LU		1 LU=1 μm	1 LU=0.01°
4	Calculate the travel distance per load shaft revolution		6/0.001=6000 LU	360°/0.01°=360°=36000 LU
5	Calculate electronic gear ratio		(1/6000) × (1/1) × 10000 = 10000/6000	(1/36000) × (1/3) × 10000 = 10000/108000
6	Set parameters	p29012/p29013	10000/6000	10000/108000 = 5/54

6 Parameters

6.1 Overview

Parameter number

Numbers prefixed with an "r" indicate that parameter is a read-only parameter.

Numbers prefixed with a "P" indicate that the parameter is an editable parameter.

Effective

Indicates the conditions for making parameterization effective. Two conditions are possible:

- IM (**Im**mediately): Parameter value becomes effective immediately after changing.
- RE (**Re**set): Parameter value becomes effective after repower-on.

Can be changed

This indicates when the parameter can be changed. Two states are possible:

- **U** (Run): Can be changed in the "**Running**" state when the drive is in the servo on state. The "RDY" LED lights up green.
- **T** (Ready to run): Can be changed in the "**Ready**" state when the drive is in the servo off state. The "RDY" LEDY lights up red.

Note

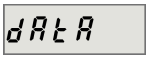
When judging the state of the drive according to the "RDY" LED, ensure that no faults or alarms exist.

Data type

Type	Description
I16	16-bit integer
I32	32-bit integer
U16	16 bits without sign
U32	32 bits without sign
Uint16	16-bit unsigned integer
Uint32	32-bit unsigned integer
Float	32-bit floating point number

Parameter groups

The SINAMICS V90 parameters are divided into the following groups:

Parameter group	Available parameters	Parameter group display on the BOP
Basic parameters	p290xx	
Gain adjustment parameters	p291xx	
Speed control parameters	p10xx to p14xx, p21xx	
Torque control parameters	p15xx to p16xx	
Position control parameters	p25xx to p26xx, p292xx	
I/O parameters	p293xx	
Status monitoring parameters	All read-only parameters	

6.2 Parameter list

Editable parameters

Par. No.	Name	Min	Max	Factory Setting	Unit	Data type	Effective	Can be changed
p1001	Fixed speed setpoint 1	-210000.000	210000.000	0.000	rpm	Float	IM	T, U
	Description: Sets a value for the fixed speed / velocity setpoint 1.							
p1002	Fixed speed setpoint 2	-210000.000	210000.000	0.000	rpm	Float	IM	T, U
	Description: Sets a value for the fixed speed / velocity setpoint 2.							
p1003	Fixed speed setpoint 3	-210000.000	210000.000	00.000	rpm	Float	IM	T, U
	Description: Sets a value for the fixed speed / velocity setpoint 3.							
p1004	Fixed speed setpoint 4	-210000.000	210000.000	0.000	rpm	Float	IM	T, U
	Description: Sets a value for the fixed speed / velocity setpoint 4.							
p1005	Fixed speed setpoint 5	-210000.000	210000.000	0.000	rpm	Float	IM	T, U
	Description: Sets a value for the fixed speed / velocity setpoint 5.							
p1006	Fixed speed setpoint 6	-210000.000	210000.000	0.000	rpm	Float	IM	T, U
	Description: Sets a value for the fixed speed / velocity setpoint 6.							

Par. No.	Name	Min	Max	Factory Setting	Unit	Data type	Effective	Can be changed
p1007	Fixed speed setpoint 7	-210000.000	210000.000	0.000	rpm	Float	IM	T, U
	Description: Sets a value for the fixed speed / velocity setpoint 7.							
p1058	Jog 1 speed setpoint	0.00	210000.000	100.00	rpm	Float	IM	T
	Description: Sets the speed/velocity for jog 1. Jogging is level-triggered and allows the motor to be incrementally moved.							
	Note: The parameter values displayed on the BOP are integers.							
p1082 *	**Description:** Maximum speed	0.000	210000.000	1500.000	rpm	Float	IM	T
	Description: Sets the highest possible speed.							
	Notice: After the value has been modified, no further parameter modifications can be made.							
	Note: The parameter values displayed on the BOP are integers. The parameter applies for both motor directions. The parameter has a limiting effect and is the reference quantity for all ramp-up and ramp-down times (e.g. down ramps, ramp-function generator, motor potentiometer).							
p1083 *	Speed limit in positive direction of rotation	0.000	210000.000	210000.000	rpm	Float	IM	T, U
	Description: Sets the maximum speed for the positive direction.							
	Note: The parameter values displayed on the BOP are integers.							
p1086 *	Speed limit in negative direction of rotation	-210000.000	0.000	-210000.000	rpm	Float	IM	T, U
	Description: Sets the speed limit for the negative direction.							
	Note: The parameter values displayed on the BOP are integers.							
p1115	Ramp-function generator selection	0	1	0	-	I16	IM	T
	Description: Sets the ramp-function generator type.							
	Note: Another ramp-function generator type can only be selected when the motor is at a standstill.							
p1120	Ramp-function generator ramp-up time	0.000	999999.000	1	s	Float	IM	T, U
	Description: The ramp-function generator ramps-up the speed setpoint from standstill (setpoint = 0) up to the maximum speed (p1082) in this time.							
	Dependency: Refer to p1082							
p1121	Ramp-function generator ramp-down time	0.000	999999.000	1	s	Float	IM	T, U
	Description: Sets the ramp-down time for the ramp-function generator. The ramp-function generator ramps-down the speed setpoint from the maximum speed (p1082) down to standstill (setpoint = 0) in this time. Further, the ramp-down time is always effective for OFF1.							
	Dependency: Refer to p1082							
p1130	Ramp-function generator initial rounding-off time	0.000	30.000	0.000	s	Float	IM	T, U
	Description: Sets the initial rounding-off time for the extended ramp generator. The value applies to ramp-up and ramp-down.							
	Note: Rounding-off times avoid an abrupt response and prevent damage to the mechanical system.							

Par. No.	Name	Min	Max	Factory Setting	Unit	Data type	Effective	Can be changed
p1131	Ramp-function generator final rounding-off time	0.000	30.000	0.000	s	Float	IM	T, U
	Description: Sets the final rounding-off time for the extended ramp generator. The value applies to ramp-up and ramp-down.							
	Note: Rounding-off times avoid an abrupt response and prevent damage to the mechanical system.							
p1215 *	Motor holding brake configuration	0	3	0	-	I16	IM	T
	Description: Sets the holding brake configuration.							
	Dependency: Refer to p1216, p1217, p1226, p1227, p1228							
	Caution: For the setting p1215 = 0, if a brake is used, it remains closed. If the motor moves, this will destroy the brake.							
	Notice: If p1215 was set to 1 or if p1215 was set to 3, then when the pulses are suppressed, the brake is closed even if the motor is still rotating.							
	Note: If a holding brake integrated in the motor is used, then it is not permissible that p1215 is set to 3. The parameter can only be set to zero when the pulses are inhibited.							
p1216 *	Motor holding brake opening time	0	10000	100	ms	Float	IM	T, U
	Description: Sets the time to open the motor holding brake. After controlling the holding brake (opens), the speed/velocity setpoint remains at zero for this time. After this, the speed/velocity setpoint is enabled.							
	Dependency: Refer to p1215, p1217							
	Note: For a motor with integrated brake, this time is pre-assigned the value saved in the motor. For p1216 = 0 ms, the monitoring and the message A7931 "Brake does not open" are deactivated.							
p1217 *	Motor holding brake closing time	0	10000	100	ms	Float	IM	T, U
	Description: Sets the time to apply the motor holding brake. After OFF1 or OFF3 and the holding brake is controlled (the brake closes), then the drive remains closed-loop controlled for this time stationary with a speed setpoint/velocity setpoint of zero. The pulses are suppressed when the time expires.							
	Dependency: Refer to p1215, p1216							
	Note: For a motor with integrated brake, this time is pre-assigned the value saved in the motor. For p1217 = 0 ms, the monitoring and the message A07932 "Brake does not close" are deactivated.							
p1226	Threshold for zero speed detection	0.00	210000.00	20.00	rpm	Float	IM	T, U
	Description: Sets the speed threshold for the standstill identification. Acts on the actual value and setpoint monitoring. When braking with OFF1 or OFF3, when the threshold is undershot, standstill is identified. The following applies when the brake control is activated: When the threshold is undershot, the brake control is started and the system waits for the brake closing time in p1217. The pulses are then suppressed. If the brake control is not activated, the following applies: When the threshold is undershot, the pulses are suppressed and the drive coasts down.							
	Dependency: Refer to p1215, p1216, p1217, p1227							
	Notice: For reasons relating to the compatibility to earlier firmware versions, a parameter value of zero in indices 1 to 31 is overwritten with the parameter value in index 0 when the drive boots.							

Par. No.	Name	Min	Max	Factory Setting	Unit	Data type	Effective	Can be changed
	Note: Standstill is identified in the following cases: - The speed actual value falls below the speed threshold in p1226 and the time started after this in p1228 has expired. - The speed setpoint falls below the speed threshold in p1226 and the time started after this in p1227 has expired. The actual value sensing is subject to measuring noise. For this reason, standstill cannot be detected if the speed threshold is too low.							
p1227	Zero speed detection monitoring time	0.000	300.000	300.000	s	Float	IM	T, U
	Description: Sets the monitoring time for the standstill identification. When braking with OFF1 or OFF3, standstill is identified after this time has expired, after the setpoint speed has fallen below p1226. After this, the brake control is started, the system waits for the closing time in p1217 and then the pulses are suppressed.							
	Dependency: Refer to p1215, p1216, p1217, p1226							
	Notice: The setpoint is not equal to zero dependent on the selected value. This can therefore cause the monitoring time in p1227 to be exceeded. In this case, for a driven motor, the pulses are not suppressed..							
	Note: Standstill is identified in the following cases: - The speed actual value falls below the speed threshold in p1226 and the time started after this in p1228 has expired. - The speed setpoint falls below the speed threshold in p1226 and the time started after this in p1227 has expired. For p1227 = 300.000 s, the following applies: Monitoring is de-activated. For p1227 = 0.000 s, the following applies: With OFF1 or OFF3 and a ramp-down time = 0, the pulses are immediately suppressed and the motor "coasts" down.							
p1228	Pulse suppression delay time	0.000	299.000	0.000	s	Float	IM	T, U
	Description: Sets the delay time for pulse suppression. After OFF1 or OFF3, the pulses are canceled, if at least one of the following conditions is fulfilled: - The speed actual value falls below the threshold in p1226 and the time started after this in p1228 has expired. - The speed setpoint falls below the threshold in p1226 and the time started after this in p1227 has expired.							
	Dependency: Refer to p1226, p1227							
	Notice: When the motor holding brake is activated, pulse cancellation is additionally delayed by the brake closing time (p1217).							
p1414	Speed setpoint filter activation	0000 bin	0011 bin	0000 bin	-	U16	IM	T, U
	Description: Setting for activating/de-activating the speed setpoint filter.							
	Dependency: The individual speed setpoint filters are parameterized as of p1415.							
	Note: The drive unit displays the value in hex format. To know the logic (high/low) assignment to each bit, you must convert the hex number to the binary number, for example, FF (hex)= 11111111 (bin).							

Par. No.	Name	Min	Max	Factory Setting	Unit	Data type	Effective	Can be changed
p1415	Speed setpoint filter 1 type	0	2	0	-	I16	IM	T, U
	Description: Sets the type for speed setpoint filter 1.							
	Dependency: PT1 low pass: p1416 PT2 low pass: p1417, p1418 General filter: p1417 ... p1420							
p1416	Speed setpoint filter 1 time constant	0.00	5000.00	0.00	ms	Float	IM	T, U
	Description: Sets the time constant for the speed setpoint filter 1 (PT1).							
	Dependency: Refer to p1414, p1415							
	Note: This parameter is only effective if the filter is set as a PT1 low pass.							
p1417	Speed setpoint filter 1 denominator natural frequency	0.5	16000.0	1999.0	Hz	Float	IM	T, U
	Description: Sets the denominator natural frequency for speed setpoint filter 1(PT2, general filter).							
	Dependency: Refer to p1414, p1415							
	Note: This parameter is only effective if the speed filter is parameterized as a PT2 low pass or as general filter. The filter is only effective if the natural frequency is less than half of the sampling frequency.							
p1418	Speed setpoint filter 1 denominator damping	0.001	10.000	0.700	-	Float	IM	T, U
	Description: Sets the denominator damping for speed setpoint filter 1 (PT2, general filter).							
	Dependency: Refer to p1414, p1415							
	Note: This parameter is only effective if the speed filter is parameterized as a PT2 low pass or as general filter.							
p1419	Speed setpoint filter 1 numerator natural frequency	0.5	16000.0	1999.0	Hz	Float	IM	T, U
	Description: Sets the numerator natural frequency for speed setpoint filter 1 (general filter).							
	Dependency: Refer to p1414, p1415							
	Note: This parameter is only effective if the speed filter is set as a general filter. The filter is only effective if the natural frequency is less than half of the sampling frequency.							
p1420	Speed setpoint filter 1 numerator damping	0.000	10.000	0.700	-	Float	IM	T, U
	Description: Sets the numerator damping for speed setpoint filter 1 (general filter).							
	Dependency: Refer to p1414, p1415							
	Note: This parameter is only effective if the speed filter is set as a general filter.							
p1421	Speed setpoint filter 2 type	0	2	0	-	I16	IM	T, U
	Description: Sets the type for speed setpoint filter 2.							
	Dependency: PT1 low pass: p1422 PT2 low pass: p1423, p1424 General filter: p1423 ... p1426							

Par. No.	Name	Min	Max	Factory Setting	Unit	Data type	Effective	Can be changed
p1422	Speed setpoint filter 2 time constant	0.00	5000.00	0.00	ms	Float	IM	T, U
	Description: Sets the time constant for the speed setpoint filter 2 (PT1).							
	Dependency: Refer to p1414, p1421							
	Note: This parameter is only effective if the speed filter is set as a PT1 low pass.							
p1423	Speed setpoint filter 2 denominator natural frequency	0.5	16000.0	1999.0	Hz	Float	IM	T, U
	Description: Sets the denominator natural frequency for speed setpoint filter 2 (PT2, general filter).							
	Dependency: Refer to p1414, p1421							
	Note: This parameter is only effective if the speed filter is parameterized as a PT2 low pass or as general filter. The filter is only effective if the natural frequency is less than half of the sampling frequency.							
p1424	Speed setpoint filter 2 denominator damping	0.001	10.000	0.700	-	Float	IM	T, U
	Description: Sets the denominator damping for speed setpoint filter 2 (PT2, general filter).							
	Dependency: Refer to p1414, p1421							
	Note: This parameter is only effective if the speed filter is parameterized as a PT2 low pass or as general filter.							
p1425	Speed setpoint filter 2 numerator natural frequency	0.5	16000.0	1999.0	Hz	Float	IM	T, U
	Description: Sets the numerator natural frequency for speed setpoint filter 2 (general filter).							
	Dependency: Refer to p1414, p1421							
	Note: This parameter is only effective if the speed filter is set as a general filter. The filter is only effective if the natural frequency is less than half of the sampling frequency.							
p1426	Speed setpoint filter 2 numerator damping	0.000	10.000	0.700	-	Float	IM	T, U
	Description: Sets the numerator damping for speed setpoint filter 2 (general filter).							
	Dependency: Refer to p1414, p1421							
	Note: This parameter is only effective if the speed filter is set as a general filter.							
p1520 *	Torque limit upper	-1000000.00	20000000.00	0.00	Nm	Float	IM	T, U
	Description: Sets the fixed upper torque limit.							
	Danger: Negative values when setting the upper torque limit (p1520 < 0) can result in the motor accelerating in an uncontrollable fashion.							
	Notice: The maximum value depends on the maximum torque of the connected motor.							
p1521 *	Torque limit lower	-20000000.00	1000000.00	0.00	Nm	Float	IM	T, U
	Description: Sets the fixed lower torque limit.							
	Danger: Positive values when setting the lower torque limit (p1521 > 0) can result in the motor accelerating in an uncontrollable fashion.							
	Notice: The maximum value depends on the maximum torque of the connected motor.							
p1656 *	Activates current setpoint filter	0000 bin	0011 bin	0011 bin	-	U16	IM	T, U
	Description: Setting for activating/de-activating the current setpoint filter.							
	Dependency: The individual current setpoint filters are parameterized as of p1657.							
	Note: If not all of the filters are required, then the filters should be used consecutively starting from filter 1. The drive unit displays the value in hex format. To know the logic (high/low) assignment to each bit, you must convert the hex number to the binary number, for example, FF (hex)= 11111111 (bin).							

Par. No.	Name	Min	Max	Factory Setting	Unit	Data type	Effective	Can be changed
p1657 *	Current setpoint filter 1 type	1	2	1	-	I16	IM	T, U
	Description: Sets the current setpoint filter 1 as low pass (PT2) or general 2nd order filter.							
	Dependency: The current setpoint filter 1 is activated via p1656.0 and parameterized via p1657 ... p1661.							
	Note: For a general 2nd-order filter, by inserting the same natural frequency in both the numerator and in the denominator, i.e. bandstop frequency, a bandstop filter is implemented. If the numerator damping of zero is selected, the bandstop frequency is completely suppressed. The denominator damping can be determined from the equation for the 3 dB bandwidth: f_3dB bandwidth = 2 * D_denominator * f_bandstop frequency							
p1658 *	Current setpoint filter 1 denominator natural frequency	0.5	16000.0	1000.0	Hz	Float	IM	T, U
	Description: Sets the denominator natural frequency for current setpoint filter 1 (PT2, general filter).							
	Dependency: The current setpoint filter 1 is activated via p1656.0 and parameterized via p1657 ... p1661.							
p1659 *	Current setpoint filter 1 denominator damping	0.001	10.000	0.700	-	Float	IM	T, U
	Description: Sets the denominator damping for current setpoint filter 1.							
	Dependency: The current setpoint filter 1 is activated via p1656.0 and parameterized via p1657 ... p1661.							
p1660	Current setpoint filter 1 numerator natural frequency	0.5	16000.0	1000.0	Hz	Float	IM	T, U
	Description: Sets the numerator natural frequency for current setpoint filter 1 (general filter).							
	Dependency: The current setpoint filter 1 is activated via p1656.0 and parameterized via p1657 ... p1661.							
p1661	Current setpoint filter 1 numerator damping	0.000	10.000	0.700	-	Float	IM	T, U
	Description: Sets the numerator damping for current setpoint filter 1.							
	Dependency: The current setpoint filter 1 is activated via p1656.0 and parameterized via p1657 ... p1661.							
p1662	Current setpoint filter 2 type	1	2	2	-	I16	IM	T, U
	Description: Sets the current setpoint filter 2 as low pass (PT2) or general 2nd order filter.							
	Dependency: Current setpoint filter 2 is activated via p1656.1 and parameterized via p1662 ... p1666.							
	Note: For a general 2nd-order filter, by inserting the same natural frequency in both the numerator and in the denominator, i.e. bandstop frequency, a bandstop filter is implemented. If the numerator damping of zero is selected, the bandstop frequency is completely suppressed. The denominator damping can be determined from the equation for the 3 dB bandwidth: f_3dB bandwidth = 2 * D_denominator * f_bandstop frequency							
p1663	Current setpoint filter 2 denominator natural frequency	0.5	16000.0	500.0	Hz	Float	IM	T, U
	Description: Sets the denominator natural frequency for current setpoint filter 2 (PT2, general filter).							
	Dependency: Current setpoint filter 2 is activated via p1656.1 and parameterized via p1662 ... p1666.							
p1664	Current setpoint filter 2 denominator damping	0.001	10.000	0.300	-	Float	IM	T, U
	Description: Sets the denominator damping for current setpoint filter 2.							
	Dependency: Current setpoint filter 2 is activated via p1656.1 and parameterized via p1662 ... p1666.							
p1665	Current setpoint filter 2 numerator natural frequency	0.5	16000.0	500.0	Hz	Float	IM	T, U
	Description: Sets the numerator natural frequency for current setpoint filter 2 (general filter).							
	Dependency: Current setpoint filter 2 is activated via p1656.1 and parameterized via p1662 ... p1666.							

Par. No.	Name	Min	Max	Factory Setting	Unit	Data type	Effective	Can be changed
p1666	Current setpoint filter 2 numerator damping	0.000	10.000	0.010	-	Float	IM	T, U
	Description: Sets the numerator damping for current setpoint filter 2.							
	Dependency: Current setpoint filter 2 is activated via p1656.1 and parameterized via p1662 ... p1666.							
p2153	Speed actual value filter time constant	0	1000000	0	ms	Float	IM	T, U
	Description: Sets the time constant of the PT1 element to smooth the speed / velocity actual value. The smoothed actual speed/velocity is compared with the threshold values and is only used for messages and signals.							
p2161 *	Speed threshold 3	0.00	210000.00	10.00	rpm	Float	IM	T, U
	Description: Sets the speed threshold value for the signal "|n_act| < speed threshold value 3".							
p2162 *	Hysteresis speed n_act > n_max	0.00	60000.00	0.00	rpm	Float	IM	T, U
	Description: Sets the hysteresis speed (bandwidth) for the signal "n_act > n_max".							
	Note: For a negative speed limit, the hysteresis is effective below the limit value and for a positive speed limit above the limit value. If significant overshoot occurs in the maximum speed range (for example, due to load shedding), you are advised to increase the dynamic response of the speed controller (if possible). If this is insufficient, the hysteresis p162 can only be increased by more than 10% of the rated speed when the maximum speed of the motor is sufficiently greater than the speed limit p1082.							
p2525	LR encoder adjustment offset	0	4294967295	0	LU	U32	IM	T
	Description: For the absolute encoder adjustment, a drive determines the position offset.							
	Note: The position offset is only relevant for absolute encoders. The drive determines it when making the adjustment and the user should not change it.							
p2533	LR position setpoint filter time constant	0.00	1000.00	0.00	ms	Float	IM	T, U
	Description: Sets the time constant for the position setpoint filter (PT1).							
	Note: The effective Kv factor (position loop gain) is reduced with the filter. This allows a softer control behavior with improved tolerance with respect to noise/disturbances. Applications: - Reduces the pre-control dynamic response. - Jerk limiting.							
p2542 *	LR standstill window	0	2147483647	1000	LU	U32	IM	T, U
	Description: Sets the standstill window for the standstill monitoring function. After the standstill monitoring time expires, it is cyclically checked whether the difference between the setpoint and actual position is located within the standstill window and, if required, an appropriate fault is output. Value = 0: The standstill monitoring is deactivated.							
	Dependency: Refer to: p2543, p2544, and F07450							
	Note: The following applies for the setting of the standstill and positioning window: Standstill window (p2542) ≥ positioning window (p2544)							
p2543 *	LR standstill monitoring time	0.00	100000.00	200.00	ms	Float	IM	T, U
	Description: Sets the standstill monitoring time for the standstill monitoring function. After the standstill monitoring time expires, it is cyclically checked whether the difference between the setpoint and actual position is located within the standstill window and, if required, an appropriate fault is output.							
	Dependency: Refer to: p2542, p245, and F07450							

Par. No.	Name	Min	Max	Factory Setting	Unit	Data type	Effective	Can be changed
	Note: The following applies for the setting of the standstill and positioning monitoring time: Standstill monitoring time (p2543) ≤ positioning monitoring time (p2545)							
p2544 *	LR positioning window	0	2147483647	40	LU	U32	IM	T, U
	Description: Sets the positioning window for the positioning monitoring function. After the positioning monitoring time expires, it is checked once as to whether the difference between the setpoint and actual position lies within the positioning window and if required an appropriate fault is output. Value = 0 --> The positioning monitoring function is de-activated.							
	Dependency: Refer to F07451.							
	Note: The following applies for the setting of the standstill and positioning window: Standstill window (p2542) ≥ positioning window (p2544)							
p2545 *	LR positioning monitoring time	0.00	100000.00	1000.00	ms	Float	IM	T, U
	Description: Sets the positioning monitoring time for the positioning monitoring. After the positioning monitoring time expires, it is checked once as to whether the difference between teh setpoint and actual position lies within the positioning window and if required an appropriate fault is output.							
	Dependency: Refer to: p2543, p2544, F07451							
	Note: The tolerance bandwidth is intended to prevent the dynamic following error monitoring incorrectly responding due to operational control sequences (for example, during load surges).							
p2546 *	LR dynamic following error monitoring tolerance	0	2147483647	1000	LU	U32	IM	T, U
	Description: Sets the tolerance for the dynamic following error monitoring. If the dynamic following error (r2563) exceeds the selected tolerance, then an appropriate fault is output. Value = 0 --> The dynamic following error monitoring is de-activated.							
	Dependency: Refer to r2563, F07452							
	Note: The tolerance bandwidth is intended to prevent the dynamic following error monitoring incorrectly responding due to operational control sequences (e.g. during load surges).							
p2572 *	EPOS maximum acceleration	1	2000000	-	1000 LU/s²	U32	IM	T
	Description: Sets the maximum acceleration for the "basic positioner" function (EPOS).							
	Note: The maximum acceleration appears to exhibit jumps (without jerk). "Traversing blocks" operating mode: The programmed acceleration override acts on the maximum acceleration. "Direct setpoint input/MDI" mode: The acceleration override is effective. "Jog" and "search for reference" modes: No acceleration override is active. The axis starts with the maximum acceleration.							
p2573 *	EPOS maximum deceleration	1	2000000	-	1000 LU/s²	U32	IM	T
	Description: Sets the maximum deceleration for the "basic positioner" function (EPOS).							
	Note: The maximum deceleration appears to exhibit jumps (without jerk). "Traversing blocks" operating mode: The programmed deceleration override acts on the maximum deceleration. "Direct setpoint input/MDI" mode: The deceleration override is effective. "Jog" and "search for reference" modes: No deceleration override is effective. The axis brakes with the maximum deceleration.							

Par. No.	Name	Min	Max	Factory Setting	Unit	Data type	Effective	Can be changed
p2580	EPOS software limit switch minus	-2147482648	2147482647	-2147482648	LU	I32	IM	T, U
	Description: Sets the software limit switch in the negative direction of travel.							
	Dependency: Refer to p2581, p2582							
p2581	EPOS software limit switch plus	-2147482648	2147482647	2147482647	LU	I32	IM	T, U
	Description: Sets the software limit switch in the positive direction of travel.							
	Dependency: Refer to p2580, p2582							
p2582	EPOS software limit switch activation	-	-	0	-	U32/Binary	IM	T
	Description: Sets the signal source to activate the "software limit switch".							
	Dependency: Refer to p2580, p2581							
	Caution: Software limit switch effective: - Axis is referenced. Software limit switch ineffective: - Modulo correction active. - Search for reference is executed.							
	Notice: Target position for relative positioning outside software limit switch: The traversing block is started and the axis comes to a standstill at the software limit switch. An appropriate alarm is output and the traversing block is interrupted. Traversing blocks with valid position can be activated. Target position for absolute positioning outside software limit switch: In the "traversing blocks" mode, the traversing block is not started and an appropriate fault is output. Axis outside the valid traversing range: If the axis is already outside the valid traversing range, then an appropriate fault is output. The fault can be acknowledged at standstill. Traversing blocks with valid position can be activated.							
	Note: The traversing range can also be limited using STOP cams.							
p2583	EPOS backlash compensation	-200000	200000	0	LU	I32	-	T, U
	Description: Sets the amount of play (backlash) for positive or negative play. • = 0: The backlash compensation is de-activated. • > 0: Positive backlash (normal case) When the direction is reversed, the encoder actual value leads the actual value. • < 0: Negative backlash When the direction is reversed, the actual value leads the encoder actual value.							
	Dependency: If a stationary axis is referenced by setting the reference point, or an adjusted with absolute encoder is powered up, then the setting of p2604 is relevant for entering the compensation value. p2604 = 1: Traveling in the positive direction -> A compensation value is immediately entered. Traveling in the negative direction -> A compensation value is not entered p2604 = 0: Traveling in the positive direction -> A compensation value is not entered Traveling in the negative direction -> A compensation value is immediately entered. When again setting the reference point (a referenced axis) or for "flying referencing", p2604 is not relevant but instead the history of the axis. Refer to p2604							

Par. No.	Name	Min	Max	Factory Setting	Unit	Data type	Effective	Can be changed
p2599	EPOS reference point coordinate value	-2147482648	2147482647	0	LU	I32	IM	T, U
	Description: Sets the position value for the reference point coordinate. This value is set as the actual axis position after referencing or adjustment.							
	Dependency: Refer to p2525							
p2600	EPOS search for reference point offset	-2147482648	2147482647	0	LU	I32	IM	T, U
	Description: Sets the reference point offset for search for reference.							
p2604	EPOS search for reference start direction	-	-	0	-	U32/Binary	IM	T
	Description: Sets the signal sources for the start direction of the search for reference. • 1 signal: Start in the negative direction. • 0 signal: Start in the positive direction.							
	Dependency: Refer to p2583							
p2605	EPOS search for reference approach velocity reference cam	1	40000000	5000	1000 LU/min	U32	IM	T, U
	Description: Sets the approach velocity to the reference cam for the search for reference.							
	Dependency: The search for reference only starts with the approach velocity to the reference cam when there is a reference cam. Refer to p2604, p2606							
	Note: When traversing to the reference cam, the velocity override is effective. If, at the start of the search for reference, the axis is already at the reference cam, then the axis immediately starts to traverse to the zero mark.							
p2606	EPOS search for reference cam maximum distance	0	2147482647	2147482647	LU	U32	IM	T, U
	Description: Sets the maximum distance after the start of the search for reference when traversing to the reference cam.							
	Dependency: Refer to p2604, p2605, F07458							
	Note: When using a reversing cam, the maximum distance must be set appropriately long.							
p2608	EPOS search for reference approach velocity zero mark	1	40000000	300	1000 LU/min	U32	IM	T, U
	Description: Sets the approach velocity after detecting the reference cam to search for the zero mark for the search for reference.							
	Dependency: If there is no reference cam, the search for reference immediately starts with the axis traversing to the zero mark. Refer to p2604, p2609							
	Caution: If the reference cam is not adjusted so that at each search for reference the same zero mark for synchronization is detected, then an "incorrect" axis reference point is obtained. After the reference cam has been left, the search for the zero mark is activated with a time delay due to internal factors. This is the reason that the reference cam should be adjusted in this center between two zero marks and the approach velocity should be adapted to the distance between two zero marks.							
	Note: The velocity override is not effective when traversing to the zero mark.							
p2609	EPOS search for reference max. distance ref. cam and zero mark	0	2147482647	20000	LU	U32	IM	T, U
	Description: Sets the maximum distance after leaving the reference cam when traversing to the zero mark.							
	Dependency: Refer to p2604, p2608, F07459							

Par. No.	Name	Min	Max	Factory Setting	Unit	Data type	Effective	Can be changed
p2611	EPOS search for reference approach velocity reference point	1	40000000	300	1000 LU/min	U32	IM	T, U
	Description: Sets the approach velocity after detecting the zero mark to approach the reference point.							
	Dependency: Refer to p2604, p2609							
	Note: When traversing to the reference point, the velocity override is not effective.							
p2617	EPOS traversing block position	-2147482648	2147482647	0	LU	I32	IM	T, U
	Description: Sets the target position for the traversing block.							
	Dependency: The number of indices depends on p2615. Refer to p2618							
	Note: The target position is approached in either relative or absolute terms depending on p2623.							
p2618	EPOS traversing block velocity	1	40000000	600	1000 LU/min	I32	IM	T, U
	Description: Sets the velocity for the traversing block.							
	Dependency: The number of indices depends on p2615. Refer to p2617							
	Note: The velocity can be influenced using the velocity override (p2646).							
p29000 *	Motor ID	0	54251	0	-	U16	RE	T
	Description: Motor type number is printed on the motor rating plate as motor ID. For a motor with an incremental encoder, users need to manually input the parameter value, ranging from 18 to 39. For a motor with an absolute encoder, the drive automatically reads the parameter value, ranging from 10009 to 10048.							
p29001	Reversal of motor direction	0	1	0	-	I16	RE	T
	Description: Reversal of motor running direction. By default, CW is the positive direction while CCW the negative direction. After changing of p29001, reference point will lost, A7461 will remind user to referencing again. • 0: No reversal • 1: Reverse							
p29002	BOP display selection	0	4	0	-	I16	IM	U
	Description: Selection of BOP operating display. • 0: Actual speed (default) • 1: DC voltage • 2: Actual torque • 3: Actual position • 4: Position offset							
p29003	Control mode	0	8	0	-	I16	RE	T
	Description: Selection of control mode. • 0: Position control with pulse train input (PTI) • 1: Internal position control (IPos) • 2: Speed control (S) • 3: Torque control (T) • 4: Control change mode: PTI/S • 5: Control change mode: IPos/S • 6: Control change mode: PTI/T • 7: Control change mode: IPos/T • 8: Control change mode: S/T							
	Note: The compound control mode can be controlled by the digital input signal C-MODE. When DI10 (C-MODE) is 0, the first control mode of control change mode is selected; otherwise, the second one is selected.							

Par. No.	Name	Min	Max	Factory Setting	Unit	Data type	Effective	Can be changed
p29004	RS485 address	0	31	0	-	U16	RE	T
	Description: Configuration of the RS485 bus address. The RS485 bus is used to transfer current absolute position of the servo drive to the controller/PLC.							
p29005	Brake resistor capacity percentage alarm threshold	0	100	85	%	Float	-	T
	Description: Alarm triggering threshold for the capacity of the internal braking resistor. Alarm number: A52902							
p29006	Line supply voltage	380	480	[0] 400	V	U16	IM	T
	Description: Nominal Line supply voltage, effective value of line to line voltage. Drive can operate within -15% +10% error.							
p29010	PTI: Selection of input pulse form	0	3	0	-	I16	RE	T
	Description: Selection of setpoint pulse train input form. After changing of p29010, reference point will lost, A7461 will remind user to referencing again. • 0: Pulse + direction, positive logic • 1: AB phase, positive logic • 2: Pulse + direction, negative logic • 3: AB phase, negative logic							
p29011	PTI: Number of Setpoint Pulse Per Revolution	0	16777215	0	-	U32	IM	T
	Description: The number of setpoint pulses per motor revolution. The servo motor rotates for one revolution when the number of the setpoint pulses reaches this value. When this value is 0, the number of required setpoint pulses is decided by the electronic gear ratio.							
p29012[0...3]	PTI: Numerator of Electronic Gear	1	10000	1	-	U32	IM	T
	Description: The numerator of the electronic gear ratio for the setpoint pulses. For the servo system with an absolute encoder, the value range of p29012 is 1 to 200. Four numerators in total are available. You can select one of the numerators by configuring the digital input signal EGEAR. For detailed information about the calculation of a numerator, refer to the SINAMICS V90 Operating Instructions or use SINAMICS V-ASSISTANT to do the calculation.							
p29013	PTI: Denominator of Electronic Gear	1	10000	1	-	U32	IM	T
	Description: The denominator of the electronic gear for the setpoint pulses.							
p29014	PTI: Selection of Pulse input Electrical Level	0	1	1	-	I16	IM	T
	Description: Selection of a logic level for the setpoint pulses. • 0: RS485 level • 1: 24V							
p29016	PTI: Pulse Input Filter	0	1	[0] 0	-	I16	IM	T
	Description: Select filter for PTI input to get better EMC performance, 0 for low frequency PTI input, 1 for high frequency PTI input.							
p29020	Tuning: Response Level	1	31	16	-	U16	IM	T
	Description: The dynamic factor of auto tuning. 31 dynamic factors in total are available.							

Par. No.	Name	Min	Max	Factory Setting	Unit	Data type	Effective	Can be changed
p29021	Tuning: Mode Selection	0	5	0	-	U16	IM	T
	Description: Selection of a tuning mode. • 0: Disabled • 3: Real-time tuning for positioning • 4: Real-time tuning for interpolation • 5: Disable with default controller parameters							
p29022	Tuning: Ratio of Total Inertia Moment to Motor Inertia Moment	1.00	10000.00	1.00	-	Float	IM	T, U
	Description: Ratio of total inertia moment to servo motor inertia moment.							
p29023	Resonance suppression enable	0	2	0	-	I16	IM	T, U
	Description: Activation of resonance suppression. • 0: Resonance suppression deactivated (manual input of resonance frequency) • 1: Real-time resonance suppression • 2: One-time resonance frequency search with excitation							
p29025	Tuning start	0	31	13	-	U16	IM	T, U
	Description: The configuration of auto tuning. **Note:** • Bit 0: For significant differences between the motor and load moment of inertia, or for low dynamic performance of the controller, then the P controller becomes a PD controller in the position control loop. As a consequence, the dynamic performance of the position controller is increased. This function should only be set when the speed pre-control (bit 3 = 1) or the torque pre-control (bit 4 = 1) is active. • Bit 1: At low speeds, the controller gain factors are automatically reduced in order to avoid noise and oscillation at standstill. This setting is recommended for TTL encoders. • Bit 2: The estimated load moment of inertia is taken into account for the speed controller gain. • Bit 3: Activates the speed pre-control for the position controller. • Bit 4: Activates the torque pre-control for the position controller.							
p29028	Auto-tuning pre-control time constant	0.0	60.0	7.5	ms	Float	IM	T, U
	Description: Sets the time constant for the pre-control symmetrization for auto tuning. As a consequence, the drive is allocated a defined, dynamic response via its pre-control. For drives, which must interpolate with one another, the same value must be entered. The higher this time constant is, the smoother the drive will follow the position set point. Note: This time constant is only effective if p29021 = 4.							
p29030	PTO: Number of pulse per revolution	0, 30	16384	1000	-	U32	IM	T
	Description: Number of output pulses per motor revolution. If this value is 0, the number of required output pulses is decided by the electronic gear ratio.							
p29031	PTO: Numerator of electronic gear	1	2147000000	1	-	U32	IM	T
	Description: The numerator of the electronic gear ratio for the output pulses. For detailed information about the calculation of the numerator, refer to SINAMICS V90 Operating Instructions or use the SINAMICS V-ASSISTANT to do the calculation.							
p29032	PTO: Denominator electronic gear	1	2147000000	1	-	U32	IM	T
	Description: The denominator of the electronic gear ratio for the output pulses. For detailed information about the calculation of the denominator, refer to the SINAMICS V90 Operating Instructions or use SINAMICS V-ASSISTANT to do the calculation.							

Par. No.	Name	Min	Max	Factory Setting	Unit	Data type	Effective	Can be changed
p29041[0...1]	Torque Scaling	0	[0] 100 [1] 300	[0] 100 [1] 300	%	Float	IM	T
	Description: • [0]The scaling for the analog torque setpoint. With this parameter, you can specify the torque setpoint corresponding to full analog input (10 V). • [1]The scaling for the analog torque limit. With this parameter, you can specify the torque limit corresponding to full analog input (10 V). You can select the internal parameters or the analog input as the source of the torque limit with the combination of the digital input signals TLIM1 and TLIM2.							
	Index: [0]: TORQUESETSCALE [1]: TORQUELIMITSCALE							
p29042	Offset Adjustment for Analog input 2	-0.50	0.50	0.00	V	Float	IM	T
	Description: Offset adjustment for the analog input 2.							
p29043	Fixed Torque Setpoint	-100	100	0	%	Float	IM	T
	Description: Fixed torque setpoint. You can select the internal parameters or the analog input as the source of the torque setpoint by configuring the digital input signal TSET.							
p29050[0...2]	Torque limit upper	-150	300	300	%	Float	IM	T
	Description: Positive torque limit. Three internal torque limits in total are available. You can select the internal parameters or the analog input as the source of the torque limit with the combination of the digital input signals TLIM1 and TLIM2.							
p29051[0...2]	Torque limit lower	-300	150	-300	%	Float	IM	T
	Description: Negative torque limit. Three internal torque limits in total are available. You can select the internal parameters or the analog input as the source of the torque limit with the combination of the digital input signals TLIM1 and TLIM2.							
p29060 *	Speed Scaling	6	210000	3000	rpm	Float	IM	T
	Description: The scaling for the analog speed setpoint. With this parameter, you can specify the speed setpoint corresponding to full analog input (10 V).							
p29061	Offset Adjustment for Analog input 1	-0.50	0.50	0.00	V	Float	IM	T
	Description: Offset adjustment for the analog input 1.							
p29070[0...2] *	Speed limit positive	0	210000	[0] 210000	rpm	Float	IM	T
	Description: Positive speed limit. Three internal speed limits in total are available. You can select the internal parameters or the analog input as the source of the speed limit with the combination of the digital input signals SLIM1 and SLIM2.							
p29071[0...2] *	Speed limit negative	-210000	0	[0] -210000	rpm	Float	IM	T
	Description: Negative speed limit. Three internal speed limits in total are available. You can select the internal parameters or the analog input as the source of the speed limit with the combination of the digital input signals SLIM1 and SLIM2.							

Par. No.	Name	Min	Max	Factory Setting	Unit	Data type	Effective	Can be changed
p29075	Speed Clamp Threshold	0	200	200	rpm	Float	IM	T
	Description: The threshold for the zero speed clamp. If the function of zero speed clamp has been enabled under the speed control mode, the motor speed is clamped to 0 when both the setpoint speed and the actual speed are below this threshold.							
p29078	Speed Reach Threshold	0.0	100.0	10	rpm	Float	IM	T
	Description: Speed reached range (deviation between setpoint and motor speed)							
p29080	Overload Threshold for Output Signal Triggering	10	300	100	%	Float	IM	T
	Description: Overload threshold for the output power.							
p29090	Offset Adjustment for Analog output 1	-0.50	0.50	0.00	V	Float	IM	T
	Description: Offset adjustment for analog output 1.							
p29091	Offset Adjustment for Analog output 2	-0.50	0.50	0.00	V	Float	IM	T
	Description: Offset adjustment for analog output 2.							
p29110[0...1]	Position Loop Gain	0.000	300.000	[0] 1.8	1000/ min	Float	IM	T, U
	Description: Position loop gain. Two position loop gains in total are available. You can switch between these two gains by configuring the digital input signal G-CHANGE or setting relevant condition parameters. The first position loop gain is the default setting.							
p29111	Speed Pre-control Factor (Feed Forward)	0.00	200.00	0.00	%	Float	IM	T, U
	Description: Setting to activate and weight the speed pre-control value. Value = 0 % --> The pre-control is de-activated.							
p29120[0...1] *	Speed Loop Gain	0.00	999999.00	[0] 0.30	Nms/r ad	Float	IM	T, U
	Description: Speed loop gain. Two speed loop gains in total are available. You can switch between these two gains by configuring the digital input signal G-CHANGE or setting relevant condition parameters. The first speed loop gain is the default setting.							
p29121[0...1] *	Speed Loop Integral time	0.00	100000.00	[0] 15 [1] 20	ms	Float	IM	T, U
	Description: Speed loop integral time. Two speed loop integral time values in total are available. You can switch between these two time values by configuring the digital input signal G-CHANGE or setting relevant condition parameters. The first speed loop integral time is the default setting.							
p29130	Gain Switching: Mode Selection	0	4	0	-	I16	IM	T
	Description: Selects gain switching mode. • 0: Disabled • 1: Switch through DI-G-CHANG • 2: Position deviation as switch condition • 3: Pulse input frequency as switch condition • 4: Actual speed as switch condition **Note:** Only when the auto tuning function (p20021=0) is disabled can the gain switching function be used.							

Par. No.	Name	Min	Max	Factory Setting	Unit	Data type	Effective	Can be changed
p29131	Gain Switching Condition: Pulse Deviation	0	2147483647	100	LU	I32	IM	T
	Description: Triggers position deviation threshold for gain switching. If the gain switching function is enabled and this condition is selected: • Switch from the first group of control parameters to the second group when the position deviation is larger than the threshold. • Switch from the second group of control parameters to the first group when the position deviation is smaller than the threshold.							
p29132	Gain Switching Condition: Position Setpoint Frequency	0	2147000064	100	1000 LU/min	Float	IM	T
	Description: Triggers pulse input frequency (PTI) threshold or internal position speed (IPos) threshold for gain switching. If the gain switching function is enabled and this condition is selected: 1. PTI – Switch from the first group of control parameters to the second group when the pulse train input pulse is higher than the threshold. – Switch from the second group of control parameters to the first group when the pulse train input is lower than the threshold. 2. IPos – Switch from the first group of control parameters to the second group when the speed of fixed position setpoint is larger than the threshold. – Switch from the second group of control parameters to the first group when the IPos is smaller than the threshold.							
p29133	Gain Switching Condition: Actual Speed	0	2147000064	100	rpm	Float	IM	T
	Description: Triggers speed threshold for gain switching. If the gain switching function is enabled and this condition is selected: • Switch from the first group of control parameters to the second group when the actual motor speed is larger than the threshold. • Switch from the second group of control parameters to the first group when the actual motor speed is smaller than the threshold.							
p29139	Gain switching Time Constant	8	1000	20	ms	Float	IM	T
	Description: Time constant for gain switching. Set this parameter to avoid frequent gain switches that reduces system reliability.							
p29140	PI to P: Mode Selection	0	5	0	-	U16	IM	T
	Description: Selects a condition for the switch from PI control to P control under the speed loop. • 0: Disabled • 1: Torque is higher than a parameterizable setting value. • 2: Using the digital input signal (G-CHANGE). • 3: Speed is higher than a parameterizable setting value. • 4: Acceleration is higher than a parameterizable setting value. • 5: Pulse deviation is higher than a parameterizable setting value. **Note:** Only when the auto tuning function (p29021=0) and gain switching function are both disabled can the PI/P switching function be used.							

Par. No.	Name	Min	Max	Factory Setting	Unit	Data type	Effective	Can be changed
p29141	PI to P Switching Condition: Torque	0	300	200	%	Float	IM	T
	Description: Triggers torque threshold for PI/P switching. If the PI/P switching function is enabled and this condition is selected: • Switch from the PI control to the P control when the actual torque is larger than the threshold. • Switch from the P control to the PI control when the actual torque is smaller than the threshold.							
p29142	PI to P Switching Condition: Speed	0	210000	2000	rpm	Float	IM	T
	Description: Triggers speed threshold for PI/P switching. If the PI/P switching function is enabled and this condition is selected: • Switch from the PI control to the P control when the actual speed is larger than the threshold. • Switch from the P control to the PI control when the actual speed is smaller than the threshold.							
p29143	PI to P Switching Condition: Acceleration	0	30000	20	rev/s²	Float	IM	T
	Description: Triggers acceleration threshold for PI/P switching. If the PI/P switching function is enabled and this condition is selected: • Switch from the PI control to the P control when the actual acceleration is larger than the threshold. • Switch from the P control to the PI control when the actual acceleration is smaller than the threshold.							
p29144	PI to P Switching Condition: Pulse Deviation	0	2147483647	30000	LU	U32	IM	T
	Description: Triggers pulse deviation threshold for PI/P switching. If the PI/P switching function is enabled and this condition is selected: • Switch from the PI control to the P control when the actual pulse deviation is larger than the threshold. • Switch from the P control to the PI control when the actual pulse deviation is smaller than the threshold.							
p29240	Select Referencing Mode	0	4	1	-	I16	RE	T
	Description: Selects referencing mode. • 0: Referencing with external signal REF • 1: Referencing with external reference cam (signal REF) • 2: Referencing with zero mark only • 3: Referencing with external reference cam (CCWL) and zero mark • 4: Referencing with external reference cam (CWL) and zero mark							
p29241	Motion Mode	0	3	0	-	U16	RE	T
	Description: Moves mode set for IPos: • 0: means relative moving • 1: means abs moving • 2: POS Mod • 3: NEG Mod							
p29242	CLR Pulse Mode	0	1	0	-	U16	IM	T
	Description: Indicates the mode for clear pulse. There are 4 bits for the setting, 3 is used and 1 is reserved. See below: bit 0: • 0: means automatically clear pulse when servo ON • 1: means clear pulse by the DI:CLR							

Par. No.	Name	Min	Max	Factory Setting	Unit	Data type	Effective	Can be changed
p29245	Axis mode state	0	1	0	-	U32	IM	T
	Description: Linear/modulo mode. • 0: Linear axis • 1: Modulo axis							
p29246 *	Axis mode no	1	4294967295	360000	-	U32	IM	T
	Description: Modulo number, effective on modulo mode (P29245=1).							
p29247 *	Mechanical gear: pulse per revolution	1	2147483647	10000	-	U32	IM	T
	Description: LU per load revolution							
p29248 *	Mechanical gear: numerator	1	1048576	1	-	U32	IM	T
	Description: (Load/Motor) Load revolutions							
p29249 *	Mechanical gear: denominator	1	1048576	1	-	U32	IM	T
	Description: (Load/Motor) Motor revolutions							
p29250	PTI Absolute Position Mode Enable	0	1	0	-	U32	IM	T
	Description: Absolute Position Mode Enable. • =1 Enable Absolute Mode • =0 Disable Absolute Mode							
p29300	Digital Input Forced Signals	0	63	0	-	U32	IM	T, U
	Description: Input signals are forced to be high. 6 bits in total. • bit 0: SON • bit 1: CWL • bit 2: CCWL • bit 3: TLIM1 • bit 4: SPD1 • bit 5: TSET If one or more bits are set to be high, the corresponding input signals are forced to be logical high signals.							
	Note: The drive unit displays the value in hex format. To know the logic (high/low) assignment to each bit, you must convert the hex number to the binary number, for example, FF (hex)= 11111111 (bin).							

Par. No.	Name	Min	Max	Factory Setting	Unit	Data type	Effective	Can be changed
p29301[0...3]	Digital Input 1 Assignment	0	28	1	-	I16	IM	T
	Description: Defines the function of digital input signal 1 (PTI mode). • SON 1 • RESET 2 • CWL 3 • CCWL 4 • G-CHANGE 5 • P-TRG 6 • CLR 7 • EGEAR1 8 • EGEAR2 9 • TLIMT1 10 • TLIMT2 11 • CWLE 12 • CCWLE 13 • ZSCLAMP 14 • SPD1 15 • SPD2 16 • SPD3 17 • TSET 18 • SLIMT1 19 • SLIMT2 20 • POS1 21 • POS2 22 • POS3 23 • REF 24 • SREF 25 • STEPF 26 • STEPB 27 • STEPH 28							
	Index: • [0]: DI1 for Control mode 0 • [1]: DI1 for Control mode 1 • [2]: DI1 for Control mode 2 • [3]: DI1 for Control mode 3							
p29302[0...3]	Digital Input 2 Assignment	0	28	2	-	I16	IM	T
	Description: Defines the function of digital input signal 2							
	Index: • [0]: DI2 for Control mode 0 • [1]: DI2 for Control mode 1 • [2]: DI2 for Control mode 2 • [3]: DI2 for Control mode 3							

Par. No.	Name	Min	Max	Factory Setting	Unit	Data type	Effective	Can be changed
p29303[0...3]	Digital Input 3 Assignment	0	28	3	-	I16	IM	T
	Description: Defines the function of digital input signal 3							
	Index: • [0]: DI3 for Control mode 0 • [1]: DI3 for Control mode 1 • [2]: DI3 for Control mode 2 • [3]: DI3 for Control mode 3							
p29304[0...3]	Digital Input 4 Assignment	0	28	4	-	I16	IM	T
	Description: Defines the function of digital input signal 4							
	Index: • [0]: DI4 for Control mode 0 • [1]: DI4 for Control mode 1 • [2]: DI4 for Control mode 2 • [3]: DI4 for Control mode 3							
p29305[0...3]	Digital Input 5 Assignment	0	28	[0] 5; [1] 5; [2] 12; [3] 12	-	I16	IM	T
	Description: Defines the function of digital input signal 5							
	Index: • [0]: DI5 for Control mode 0 • [1]: DI5 for Control mode 1 • [2]: DI5 for Control mode 2 • [3]: DI5 for Control mode 3							
p29306[0...3]	Digital Input 6 Assignment	0	28	[0] 6; [1] 6; [2] 13; [3] 13	-	I16	IM	T
	Description: Defines the function of digital input signal 6							
	Index: • [0]: DI6 for Control mode 0 • [1]: DI6 for Control mode 1 • [2]: DI6 for Control mode 2 • [3]: DI6 for Control mode 3							
p29307[0...3]	Digital Input 7 Assignment	0	28	[0] 7; [1] 21; [2] 15; [3] 18	-	I16	IM	T
	Description: Defines the function of digital input signal 7							
	Index: • [0]: DI7 for Control mode 0 • [1]: DI7 for Control mode 1 • [2]: DI7 for Control mode 2 • [3]: DI7 for Control mode 3							

Par. No.	Name	Min	Max	Factory Setting	Unit	Data type	Effective	Can be changed
p29308[0...3]	Digital Input 8 Assignment	0	28	[0] 10; [1] 22; [2] 16; [3] 19	-	I16	IM	T
	Description: Defines the function of digital input signal 8							
	Index: • [0]: DI8 for Control mode 0 • [1]: DI8 for Control mode 1 • [2]: DI8 for Control mode 2 • [3]: DI8 for Control mode 3							
p29330	Digital Output 1 Assignment	1	13	1	-	U16	IM	T
	Description: Defines the function of digital output signal DO1. • 1: RDY • 2: ALM • 3: INP • 4: ZSP • 5: SPDR • 6: TLR • 7: SPLR • 8: MBR • 9: OLL • 10: WRN1 • 11: WRN2 • 12: REFOK • 13: CM_STA							
p29331	Digital Output 2 Assignment	1	13	2	-	U16	IM	T
	Description: Defines the function of digital output signal DO2.							
p29332	Digital Output 3 Assignment	1	13	3	-	U16	IM	T
	Description: Defines the function of digital output signal DO3.							
p29333	Digital Output 4 Assignment	1	13	5	-	U16	IM	T
	Description: Defines the function of digital output signal DO4.							
p29334	Digital Output 5 Assignment	1	13	6	-	U16	IM	T
	Description: Defines the function of digital output signal DO5.							
p29335	Digital Output 6 Assignment	1	13	8	-	U16	IM	T
	Description: Defines the function of digital output signal DO6.							
p29340	Warning 1 Assigned for Digital Output	1	6	1	-	U16	IM	T
	Description: Defines conditions for WRN1. • 1: Motor overload protection warning: 85% of overload threshold has been reached. • 2: Holding brake power overload warning: 85% of overload threshold has been reached. • 3: Fan warning: fan has stopped for more than 1 s. • 4: Encoder warning • 5: Motor overtemperature warning: 85% of overtemperature threshold has been reached. • 6: Capacitor service life warning: The capacitor has reached its expiry, so replace it.							

Par. No.	Name	Min	Max	Factory Setting	Unit	Data type	Effective	Can be changed
p29341	Warning 2 Assigned for Digital Output	1	6	2	-	U16	IM	T
	Description: Defines conditions for WRN2. • 1: Motor overload protection warning: 85% of overload threshold has been reached. • 2: Holding brake power overload warning: 85% of overload threshold has been reached. • 3: Fan warning: life time of fan expired (40000 hours), replacement of fan needed. • 4: Encoder warning • 5: Motor overtemperature warning: 85% of overtemperature threshold has been reached. • 6: Capacitor service life warning: The capacitor has reached its expiry, so replace it.							
p29350	Select sources for analog output 1	0	12	0	-	U16	IM	T
	Description: Selects signal source for analog output 1. • 0: Actual speed (reference p29060) • 1: Actual torque (reference 3 × r0333) • 2: Speed setpoint (reference p29060) • 3: Torque setpoint (reference 3 × r0333) • 4: DC bus voltage (reference 1000 V) • 5: Pulse input frequency (reference 1k) • 6: Pulse input frequency (reference 10k) • 7: Pulse input frequency (reference 100k) • 8: Pulse input frequency (reference 1000k) • 9: Remaining number of pulses (reference 1k) • 10: Remaining number of pulses (reference 10k) • 11: Remaining number of pulses (reference 100k) • 12: Remaining number of pulses (reference 1000k)							
p29351	Select Signal Source for Analog 2	0	12	1	-	U16	IM	T
	Description: Selects signals for analog output 2. • 0: Actual speed (reference p29060) • 1: Actual torque (reference 3 × r0333) • 2: Speed setpoint (reference p29060) • 3: Torque setpoint (reference 3 × r0333) • 4: DC bus voltage (reference 1000 V) • 5: Pulse input frequency (reference 1k) • 6: Pulse input frequency (reference 10k) • 7: Pulse input frequency (reference 100k) • 8: Pulse input frequency (reference 1000k) • 9: Remaining number of pulses (reference 1k) • 10: Remaining number of pulses (reference 10k) • 11: Remaining number of pulses (reference 100k) • 12: Remaining number of pulses (reference 1000k)							

* Note that the parameter value may be changed after commissioning. Make sure you back up the parameters first as required if you desire to change the motor.

Read-only parameters

Par. No.	Name	Unit	Data type
r0020	Speed setpoint smoothed	rpm	Float
	Description: Displays the currently smoothed speed setpoint at the input of the speed controller or U/f characteristic (after the interpolator).		
	Note: Smoothing time constant = 100 ms The signal is not suitable as a process quantity and may only be used as a display quantity. The speed setpoint is available smoothed (r0020) and unsmoothed.		
r0021	Actual speed smoothed	rpm	Float
	Description: Displays the smoothed actual value of the motor speed.		
	Note: Smoothing time constant = 100 ms The signal is not suitable as a process quantity and may only be used as a display quantity. The speed actual value is available smoothed (r0021) and unsmoothed.		
r0026	DC link voltage smoothed	V	Float
	Description: Displays the smoothed actual value of the DC link voltage.		
	Notice: When measuring a DC link voltage < 200 V, for the Power Module (e.g. PM340) a valid measured value is not supplied. In this case, when an external 24 V power supply is connected, a value of approx. 24 V is displayed in the display parameter.		
	Note: Smoothing time constant = 100 ms The signal is not suitable as a process quantity and may only be used as a display quantity. The DC link voltage is available smoothed (r0026) and unsmoothed.		
r0027	Absolute actual current smoothed	Arms	Float
	Description: Displays the smoothed absolute actual current value.		
	Notice: This smoothed signal is not suitable for diagnostics or evaluation of dynamic operations. In this case, the unsmoothed value should be used.		
	Note: Smoothing time constant = 100 ms The signal is not suitable as a process quantity and may only be used as a display quantity. The absolute current actual value is available smoothed (r0027) and unsmoothed.		
r0029	Current actual value field-generating smoothed	Arms	Float
	Description: Displays the smoothed field-generating actual current.		
	Note: Smoothing time constant = 100 ms The signal is not suitable as a process quantity and may only be used as a display quantity. The field-generating current actual value is available smoothed (r0029) and unsmoothed.		
r0030	Current actual value torque-generating smoothed	Arms	Float
	Description: Displays the smoothed torque-generating actual current.		
	Note: Smoothing time constant = 100 ms The signal is not suitable as a process quantity and may only be used as a display quantity. The torque-generating current actual value is available smoothed.		
r0031	Actual torque smoothed	Nm	Float
	Description: Displays the smoothed torque actual value.		
	Note: Smoothing time constant = 100 ms The signal is not suitable as a process quantity and may only be used as a display quantity. The torque actual value is available smoothed (r0031) and unsmoothed.		

Par. No.	Name	Unit	Data type
r0033	Torque utilization smoothed	%	Float
	Description: Displays the smoothed torque utilization as a percentage. The torque utilization is obtained from the required smoothed torque in reference to the torque limit, scaled using p2196.		
	Note: Smoothing time constant = 100 ms The signal is not suitable as a process quantity and may only be used as a display quantity. The torque utilization is available smoothed (r0033) and unsmoothed. For M_set total (r0079) > M_max offset, the following applies: • demanded torque = M_set total - M_max offset • actual torque limit = M_max upper effective - M_max offset For M_set total (r0079) <= M_max offset (p1532), the following applies: • demanded torque = M_max offset - M_set total • actual torque limit = M_max offset - M_max lower effective For the actual torque limit = 0, the following applies: r0033 = 100 % For the actual torque limit < 0, the following applies: r0033 = 0 %		
r0037[0...19]	Power unit temperatures	°C	Float
	Description: Displays the temperatures in the power unit.		
	Index: • [0]: Inverter maximum value • [1]: Depletion layer maximum value • [2]: Rectifier maximum value • [3]: Air intake • [4]: Interior of power unit • [5]: Inverter 1 • [6]: Inverter 2 • [7]: Inverter 3 • [8]: Inverter 4 • [9]: Inverter 5 • [10]: Inverter 6 • [11]: Rectifier 1 • [12]: Rectifier 2 • [13]: Depletion layer 1 • [14]: Depletion layer 2 • [15]: Depletion layer 3 • [16]: Depletion layer 4 • [17]: Depletion layer 5 • [18]: Depletion layer 6 • [19]: Cooling unit liquid intake		
	Dependency: Refer to A01009		
	Notice: Only for internal Siemens troubleshooting.		
	Note: The value of -200 indicates that there is no measuring signal. • r0037[0]: Maximum value of the inverter temperatures (r0037[5...10]). • r0037[1]: Maximum value of the depletion layer temperatures (r0037[13...18]). • r0037[2]: Maximum value of the rectifier temperatures (r0037[11...12]). The maximum value is the temperature of the hottest inverter, depletion layer, or rectifier.		
r0079[0...1]	Torque setpoint total	Nm	Float
	Description: Displays and connector output for the torque setpoint at the output of the speed controller (before clock cycle interpolation).		

Par. No.	Name	Unit	Data type
	Index: • [0]: Unsmoothed • [1]: Smoothed		
r0296	DC link voltage undervoltage threshold	V	U16
	Description: Threshold to detect a DC link undervoltage. If the DC link voltage falls below this threshold, the drive unit is tripped due to a DC link undervoltage condition.		
	Note: The value depends on the device type and the selected device rated voltage (p0210).		
r0297	DC link voltage overvoltage threshold	V	U16
	Description: If the DC link voltage exceeds the threshold specified here, the drive unit is tripped due to DC link overvoltage.		
	Dependency: Refer to F30002.		
r0311	Rated motor speed	rpm	Float
	Description: Displays the rated motor speed (rating plate).		
r0333	Rated motor torque	Nm	Float
	Description: Displays the rated motor torque. IEC drive: unit Nm NEMA drive: unit lbf ft		
r0482[0...2]	Encoder actual position value Gn_XIST1	-	U32
	Description: Displays the encoder actual position value Gn_XIST1.		
	Index: • [0]: Encoder 1 • [1]: Encoder 2 • [2]: Reserved		
	Note: • In this value, the measuring gear is only taken into account when the position tracking is activated. • The update time for the position control (EPOS) corresponds to the position controller clock cycle. • The update time in isochronous operation corresponds to the bus cycle time. • The update time in isochronous operation and with position control (EPOS) corresponds to the position controller clock cycle. • The update time in non-isochronous operation or without position control (EPOS) comprises the following: – Update time = 4 * least common multiple (LCM) of all current controller clock cycles in the drive group (infeed + drives). The minimum update time is 1 ms. – Example 1: infeed, servo Update time = 4 * LCM(250 µs, 125 µs) = 4 * 250 µs = 1 ms – Example 2: infeed, servo, vector Update time = 4 * LCM(250 µs, 125 µs, 500 µs) = 4 * 500 µs = 2 ms		
r0632	Motor temperature model, stator winding temperature	°C	Float
	Description: Displays the stator winding temperature of the motor temperature model.		
r0722	CU digital inputs status	-	U32
	Description: Displays the status of the digital inputs.		
	Note: DI: Digital Input DI/DO: Bidirectional Digital Input/Output The drive unit displays the value in hex format. You can convert the hex number to the binary number, for example, FF (hex)= 11111111 (bin).		

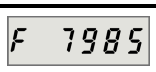
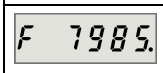
Par. No.	Name	Unit	Data type
r0747	CU digital outputs status	-	U32
	Description: Displays the status of digital outputs.		
	Note: DI/DO: Bidirectional Digital Input/Output The drive unit displays the value in hex format. You can convert the hex number to the binary number, for example, FF (hex)= 11111111 (bin).		
r2521[0...3]	LR position actual value	LU	I32
	Description: Displays the actual position actual value determined by the position actual value preprocessing.		
	Index: • [0]: Cl-loop pos ctrl • [1]: Encoder 1 • [2]: Encoder 2 • [3]: Reserved		
r2563	LR following error dynamic model	LU	I32
	Description: Displays the dynamic following error. This value is the deviation, corrected by the velocity-dependent component, between the position setpoint and the position actual value.		
r2665	EPOS position setpoint	LU	I32
	Description: Displays the actual absolute position setpoint.		
r29015	PTI: Pulse input frequency	Hz	Float
	Description: Displays the PTI input pulse frequency.		
r29018	OA version	-	Float
	Description: Firmware version		
r29400	Internal Control Signal Status Indicating	-	U32
	Description: Control signal status identifiers bit00 SON bit01 RESET bit02 CWL bit03 CCWL bit04 G-CHANGE bit05 P-TRG bit06 CLR bit07 EGEAR1 bit08 EGEAR2 bit09 TLIMT1 bit10 TLIMT2 bit11 CWLE bit12 CCWLE bit13 ZSCLAMP bit14 SPD1 bit15 SPD2 bit16 SPD3 bit17 TSET bit18 SLIMT1 bit19 SLIMT2 bit20 POS1 bit21 POS2 bit22 POS3 bit23 REF bit24 SREF bit25 STEPF bit26 STEPB bit27 STEPH bit28 EMGS bit29 C-MODE		
r29942	DO signals status indicating	-	U32
	Description: Indicates the status of DO signals. • bit 0: RD • bit 1: FAULT • bit 2: INP • bit 3: ZSP • bit 4: SPDR • bit 5: TLR • bit 6: SPLR • bit 7: MBR • bit 8: OLL • bit 9: WARNING1 • bit 10: WARNING2 • bit 11: REFOK • bit 12: MODE_SELECTED		

7 Diagnostics

7.1 Overview

Differences between faults and alarms

The differences between faults and alarms are shown as follows:

Type	BOP display (example)		Status indicator		Reaction	Acknowledgement
			RDY	COM		
Fault		Single fault	Slow flashing in red	-	• **NONE**: no reaction • **OFF1**: servo motor ramps down • **OFF2**: servo motor coasts down • **OFF3**: servo motor stops quickly (emergency stop) • **ENOCDER**: Encoder fault causes OFF2.	• **POWER ON**: re-power on the servo drive to clear a fault after eliminating its cause. • **IMMEDIATELY**: the fault disappears immediately after eliminating its cause. • **PULSE INHIBIT**: The fault can only be acknowledged with a pulse inhibit. The same options are available for acknowledging as described under acknowledgment with IMMEDIATELY.
		The first fault in the case of multiple faults				
		Non-first fault in the case of multiple faults				
Alarm		Single alarm	Slow flashing in red	-	• **NONE**: no reaction	Self-acknowledgement
		The first alarm in the case of multiple alarms				
		Non-first alarm in the case of multiple alarms				

NOTICE
Faults have higher display priority than alarms In the case that both faults and alarms occur, only faults are displayed until they have been acknowledged.

BOP operations for faults and alarms

To view faults or alarms, proceed as follows:

- Faults

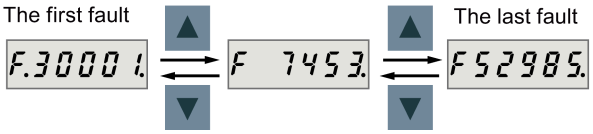


Figure 7-1 Viewing faults

- Alarms

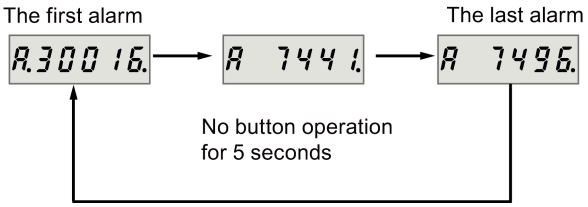


Figure 7-2 Viewing alarms

To exit from fault or alarm display, proceed as follows:

- Faults

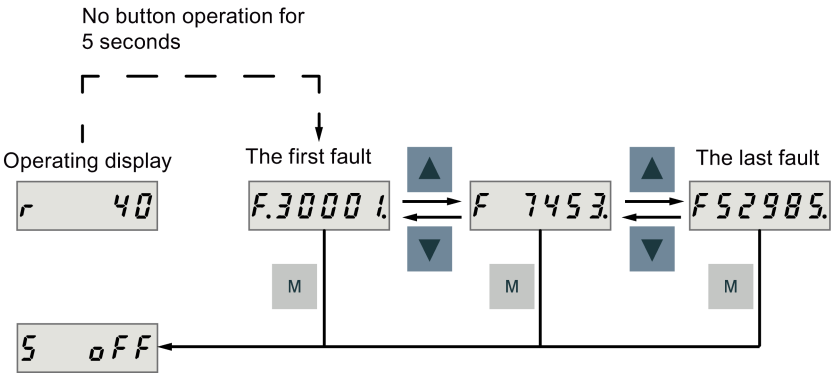


Figure 7-3 Exiting from fault display

- Alarms

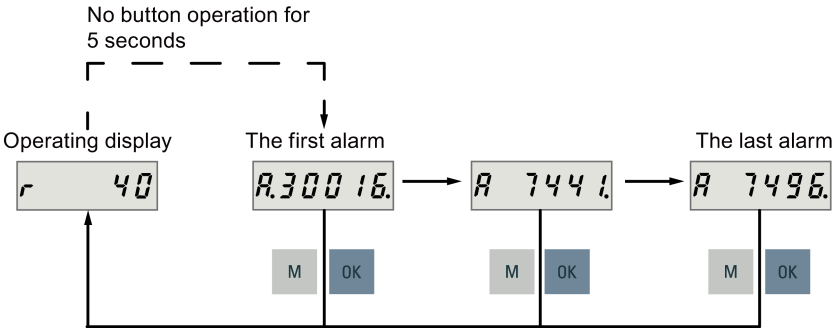


Figure 7-4 Exiting from alarm display

To acknowledge faults, proceed as follows:

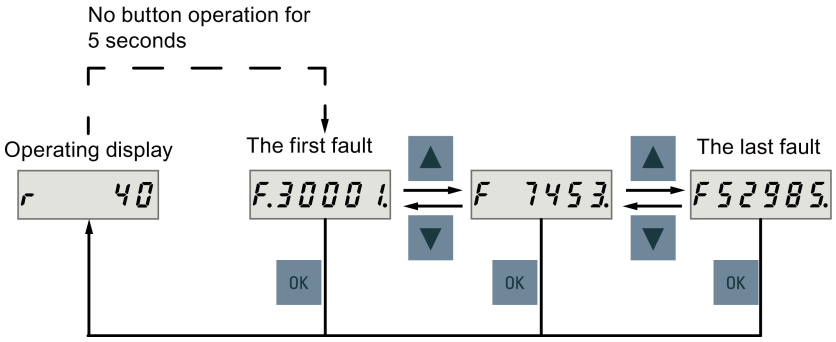
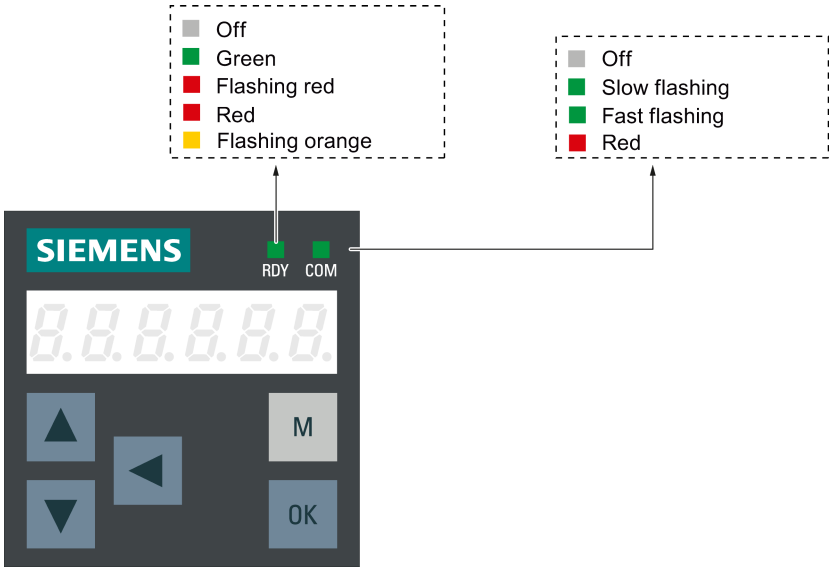


Figure 7-5 Acknowledging faults

Note

- If you do not eliminate the cause(s) of the fault, it can appear again after no button operation for five seconds. Make sure that you have eliminated the cause(s) of the fault.
- You can acknowledge faults using RESET signal. For details, refer to *Operating Instructions*.
- You can acknowledge faults using SINAMICS V-ASSISTANT. For details, refer to the *SINAMICS V-ASSISTANT Online Help*.

Two LED status indicators (RDY and COM) are available to indicate drive status. Both LEDs are dual color (green/red).



You can find detailed information about the status indications in the table below:

Status indicator	Color	Status	Description
RDY	-	Off	24 V control board power supply is missing
	Green	Continuously lit	The drive is in the servo on state
	Red	Continuously lit	The drive is in the servo off state or in the startup state
		Flash at 1 Hz	Alarms or faults occurs
	Red and orange	Flash alternatively at an interval of 0.5 s	The servo drive is located
COM	-	Off	Communication with PC is not active
	Green	Flash at 0.5 Hz	Communication with PC is active
		Flash at 2 Hz	SD card operating (read or write)
	Red	Continuously lit	Communication with PC is in error

7.2 List of faults and alarms

For the details of the faults and alarms, refer to *Operating Instructions*.

Fault list

Fault	Description	Fault	Description
F1000	Internal software error	F7900	Motor blocked/speed controller at its limit
F1001	Floating Point exception	F7901	Motor overspeed
F1002	Internal software error	F7995	Motor identification failure
F1003	Acknowledgement delay when accessing the memory	F30001	Power unit: Overcurrent
F1015	Internal software error	F30002	DC link voltage, overvoltage
F1018	Booting has been interrupted several times	F30003	DC link voltage, undervoltage
F1030	Sign-of-life failure for master control	F30004	Drive heat sink overtemperature
F1611	SI CU: Defect detected	F30005	Power unit: Overload I^2t
F1910	Drive Bus: setpoint timeout	F30011	Line phase failure in main circuit
F1911	Drive Bus clock cycle synchronous operation clock cycle failure	F30015	Phase failure motor cable
F1912	Clock cycle synchronous operation sign-of-life failure	F30021	Ground fault
F7011	Motor overtemperature	F30027	Precharging DC link time monitoring
F7085	Open-loop/closed-loop control parameters changed	F30036	Internal overtemperature
F7403	Lower DC link voltage threshold reached	F30050	24 V supply overvoltage
F7404	Upper DC link voltage threshold reached	F31100	Zero mark distance error
F7410	Current controller output limited	F31110	Serial communications error
F7412	Commutation angle incorrect (motor model)	F31112	Error bit set in the serial protocol
F7430	Changeover to open-loop torque controlled operation not possible	F31117	Inversion error signals A/B/R
F7431	Changeover to encoderless operation not possible	F31130	Zero mark and position error from the coarse synchronization
F7450	Standstill monitoring has responded	F31150	Initialization error
F7452	Following error too high	F52931	Gear box limit
F7453	Position actual value preprocessing error	F52904	Control mode change
F7459	Zero mark not detected	F52980	Absolute encoder motor changed
F7490	Enable signal withdrawn while traversing	F52981	Absolute encoder motor mismatched
F7491	STOP cam minus reached	F52983	No encoder detected
F7492	STOP cam plus reached	F52984	Incremental encoder motor not configured
F7801	Motor overcurrent	F52985	Absolute encoder motor wrong
F7802	Infeed or power unit not ready	F52987	Absolute encoder replaced
F7815	Power unit has been changed		

Alarm list

Alarm	Description	Alarm	Description
A1009	Control module overtemperature	A7965	Save required
A1019	Writing to the removable data medium unsuccessful	A7971	Angular commutation offset determination activated
A1032	All parameters must be saved	A7991	Motor data identification activated
A1045	Configuring data invalid	A30016	Load supply switched off
A1920	Drive Bus: Receive setpoints after To	A30031	Hardware current limiting in phase U
A1932	Drive Bus clock cycle synchronization missing for DSC	A31411	Absolute encoder signals internal alarms
A5000	Drive heat sink overtemperature	A31412	Error bit set in the serial protocol
A7012	Motor temperature model 1/3 overtemperature	A52900	Failure during data copying
A7461	EPOS: Reference point not set	A52901	Braking resistor reaches alarm threshold
A7496	Enable not possible	A52902	Emergency missing
A7576	Encoderless operation due to a fault active		
A7585	P-TRG or CLR active		

Siemens AG
Industry Sector
Postfach 48 48
90026 NÜRNBERG

SINAMICS V90, SIMOTICS S-1FL6
A5E32100920, 08/2013