SIEMENS

Operating Instructions

SINAMICS/SIMOTICS

Servo drive system SINAMICS S210

SINAMICS S210 converter
SIMOTICS S-1FK2 servomotor

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SINAMICS S210 servo drive system

Operating Instructions

Firmware V5.2 SP3

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Preface

Keeping the documentation safe

This documentation should be kept in a location where it can be easily accessed. Make the documentation available to the personnel responsible.

Target group

These operating instructions are intended for persons who perform different tasks in the drive environment, e.g. for:

- Planning engineers
- Project engineers
- Machine manufacturers
- Commissioning engineers
- Electricians
- Installation personnel
- Service technician
- Warehouse personnel

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Fundamental safety instructions

1

1.1 General safety instructions

⚠ WARNING

Electric shock and danger to life due to other energy sources

Touching live components can result in death or severe injury.

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

Generally, the following steps apply when establishing safety:

1. Prepare for disconnection. Notify all those who will be affected by the procedure.
2. Isolate the drive system from the power supply and take measures to prevent it being switched back on again.
3. Wait until the discharge time specified on the warning labels has elapsed.
4. Check that there is no voltage between any of the power connections, and between any of the power connections and the protective conductor connection.
5. Check whether the existing auxiliary supply circuits are de-energized.
6. Ensure that the motors cannot move.
7. Identify all other dangerous energy sources, e.g. compressed air, hydraulic systems, or water. Switch the energy sources to a safe state.
8. Check that the correct drive system is completely locked.

After you have completed the work, restore the operational readiness in the inverse sequence.

⚠ WARNING

Risk of electric shock and fire from supply networks with an excessively high impedance

Excessively low short-circuit currents can lead to the protective devices not tripping or tripping too late, and thus causing electric shock or a fire.

- In the case of a conductor-conductor or conductor-ground short-circuit, ensure that the short-circuit current at the point where the converter is connected to the line supply at least meets the minimum requirements for the response of the protective device used.
- You must use an additional residual-current device (RCD) if a conductor-ground short circuit does not reach the short-circuit current required for the protective device to respond. The required short-circuit current can be too low, especially for TT supply systems.

⚠ WARNING

Risk of electric shock and fire from supply networks with an excessively low impedance

Excessively high short-circuit currents can lead to the protective devices not being able to interrupt these short-circuit currents and being destroyed, and thus causing electric shock or a fire.

- Ensure that the prospective short-circuit current at the line terminal of the converter does not exceed the breaking capacity (SCCR or Icc) of the protective device used.

⚠ WARNING

Electric shock if there is no ground connection

For missing or incorrectly implemented protective conductor connection for devices with protection class I, high voltages can be present at open, exposed parts, which when touched, can result in death or severe injury.

- Ground the device in compliance with the applicable regulations.

⚠ WARNING

Electric shock due to connection to an unsuitable power supply

When equipment is connected to an unsuitable power supply, exposed components may carry a hazardous voltage. Contact with hazardous voltage can result in severe injury or death.

- 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

Electric shock due to damaged motors or devices

Improper handling of motors or devices can damage them.

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

- Ensure compliance with the limit values specified in the technical data during transport, storage and operation.
- Do not use any damaged motors or devices.

⚠ WARNING

Electric shock due to unconnected cable shields

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

- As a minimum, connect cable shields and the cores of cables that are not used at one end at the grounded housing potential.

⚠ WARNING

Arcing when a plug connection is opened during operation

Opening a plug connection when a system is operation can result in arcing that may cause serious injury or death.

- Only open plug connections when the equipment is in a voltage-free state, unless it has been explicitly stated that they can be opened in operation.

⚠ WARNING

Electric shock due to residual charges in power components

Because of the capacitors, a hazardous voltage is present for up to 5 minutes after the power supply has been switched off. Contact with live parts can result in death or serious injury.

- Wait for 5 minutes before you check that the unit really is in a no-voltage condition and start work.

NOTICE

Damage to equipment due to unsuitable tightening tools.

Unsuitable tightening tools or fastening methods can damage the screws of the equipment.

- Be sure to only use screwdrivers which exactly match the heads of the screws.
- Tighten the screws with the torque specified in the technical documentation.
- Use a torque wrench or a mechanical precision nut runner with a dynamic torque sensor and speed limitation system.

⚠ WARNING

Spread of fire from built-in devices

In the event of fire outbreak, the enclosures of built-in devices cannot prevent the escape of fire and smoke. This can result in serious personal injury or property damage.

- Install built-in units in a suitable metal cabinet in such a way that personnel are protected against fire and smoke, or take other appropriate measures to protect personnel.
- Ensure that smoke can only escape via controlled and monitored paths.

⚠ WARNING

Active implant malfunctions due to electromagnetic fields

Converters generate electromagnetic fields (EMF) in operation. Electromagnetic fields may interfere with active implants, e.g. pacemakers. People with active implants in the immediate vicinity of an converter are at risk.

- As the operator of an EMF-emitting installation, assess the individual risks of persons with active implants.
- Observe the data on EMF emission provided in the product documentation.

⚠ WARNING

Active implant malfunctions due to permanent-magnet fields

Even when switched off, electric motors with permanent magnets represent a potential risk for persons with heart pacemakers or implants if they are close to converters/motors.

- If you have a heart pacemaker or implant, maintain the minimum distance specified in the Chapter "Technical data".
- When transporting or storing permanent-magnet motors always use the original packing materials with the warning labels attached.
- Clearly mark the storage locations with the appropriate warning labels.
- IATA regulations must be observed when transported by air.

⚠ WARNING

Unexpected movement of machines caused by radio devices or mobile phones

Using radio devices or mobile telephones in the immediate vicinity of the components can result in equipment malfunction. Malfunctions may impair the functional safety of machines and can therefore put people in danger or lead to property damage.

- Therefore, if you move closer than 20 cm to the components, be sure to switch off radio devices or mobile telephones.
- Use the "SIEMENS Industry Online Support app" only on equipment that has already been switched off.

NOTICE

Damage to motor insulation due to excessive voltages

When operated on systems with grounded line conductor or in the event of a ground fault in the IT system, the motor insulation can be damaged by the higher voltage to ground. If you use motors that have insulation that is not designed for operation with grounded line conductors, you must perform the following measures:

- IT system: Use a ground fault monitor and eliminate the fault as quickly as possible.
- TN or TT systems with grounded line conductor: Use an isolating transformer on the line side.

⚠ WARNING

Fire due to inadequate ventilation clearances

Inadequate ventilation clearances can cause overheating of components with subsequent fire and smoke. This can cause severe injury or even death. 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.

NOTICE

Overheating due to inadmissible mounting position

The device may overheat and therefore be damaged if mounted in an inadmissible position.

- Only operate the device in admissible mounting positions.

⚠ WARNING

Unrecognized dangers due to missing or illegible warning labels

Dangers might not be recognized if warning labels are missing or illegible. Unrecognized dangers may cause accidents resulting in serious injury or death.

- Check that the warning labels are complete based on the documentation.
- Attach any missing warning labels to the components, where necessary in the national language.
- Replace illegible warning labels.

NOTICE

Device damage caused by incorrect voltage/insulation tests

Incorrect voltage/insulation tests can damage the device.

- Before carrying out a voltage/insulation check of the system/machine, disconnect the devices as all converters and motors have been subject to a high voltage test by the manufacturer, and therefore it is not necessary to perform an additional test within the system/machine.

⚠ WARNING

Unexpected movement of machines caused by inactive safety functions

Inactive or non-adapted safety functions can trigger unexpected machine movements that may result in 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.
- Perform 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 Integrated functions

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

⚠ WARNING

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

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

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

⚠ WARNING

Injury caused by moving or ejected parts

Contact with moving motor parts or drive output elements and the ejection of loose motor parts (e.g. feather keys) out of the motor enclosure can result in severe injury or death.

- Remove any loose parts or secure them so that they cannot be flung out.
- Do not touch any moving parts.
- Safeguard all moving parts using the appropriate safety guards.

⚠ WARNING

Fire due to inadequate cooling

Inadequate cooling can cause the motor to overheat, resulting in death or severe injury as a result of smoke and fire. This can also result in increased failures and reduced service lives of motors.

- Comply with the specified cooling requirements for the motor.

⚠ WARNING

Fire due to incorrect operation of the motor

When incorrectly operated and in the case of a fault, the motor can overheat resulting in fire and smoke. This can result in severe injury or death. Further, excessively high temperatures destroy motor components and result in increased failures as well as shorter service lives of motors.

- Operate the motor according to the relevant specifications.
- Only operate the motors in conjunction with effective temperature monitoring.
- Immediately switch off the motor if excessively high temperatures occur.

⚠ CAUTION

Burn injuries caused by hot surfaces

In operation, the motor can reach high temperatures, which can cause burns if touched.

- Mount the motor so that it is not accessible in operation.

Measures when maintenance is required:

- Allow the motor to cool down before starting any work.
- Use the appropriate personnel protection equipment, e.g. gloves.

1.2 Equipment damage due to electric fields or electrostatic discharge

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

NOTICE

Equipment damage due to 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).

1.3 Warranty and liability for application examples

Application examples are not binding and do not claim to be complete regarding configuration, equipment or any eventuality which may arise. Application examples do not represent specific customer solutions, but are only intended to provide support for typical tasks.

As the user you yourself are responsible for ensuring that the products described are operated correctly. Application examples do not relieve you of your responsibility for safe handling when using, installing, operating and maintaining the equipment.

1.4 Security information

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

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

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit
https://www.siemens.com/industrialsecurity (https://www.siemens.com/industrialsecurity).

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

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under
https://www.siemens.com/industrialsecurity (https://new.siemens.com/global/en/products/services/cert.html#Subscriptions).

Further information is provided on the Internet:

Industrial Security Configuration Manual (https://support.industry.siemens.com/cs/ww/en/view/108862708)

⚠ WARNING

Unsafe operating states resulting from software manipulation

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

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

1.5 Residual risks of power drive systems

When assessing the machine- or system-related risk in accordance with the respective local regulations (e.g., EC Machinery Directive), the machine manufacturer or system installer 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 or system components during commissioning, operation, maintenance, and repairs caused by, for example,
   - Hardware and/or software errors in the sensors, control system, actuators, and cables and connections
   - Response times of the control system and of the drive
   - Operation and/or environmental conditions outside the specification
   - Condensation/conductive contamination
   - Parameterization, programming, cabling, and installation errors
   - Use of wireless devices/mobile phones in the immediate vicinity of electronic components
   - External influences/damage
   - X-ray, ionizing radiation and cosmic radiation
2. Unusually high temperatures, including open flames, as well as emissions of light, noise, particles, gases, etc., can occur inside and outside the components under fault conditions caused by, for example:
   - Component failure
   - Software errors
   - Operation and/or environmental conditions outside the specification
   - External influences/damage
3. Hazardous shock voltages caused by, for example:
   - Component failure
   - Influence during electrostatic charging
   - Induction of voltages in moving motors
   - Operation and/or environmental conditions outside 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
6. Influence of network-connected communication systems, e.g. ripple-control transmitters or data communication via the network

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

Overview 2

2.1 Intended use

⚠ WARNING

Motors not used for the intended purpose

If you do not use the motors correctly, there is a risk of death, severe injury and/or material damage.

- Only use the motors for their intended purpose.
- Make sure that the conditions at the location of use comply with all the rating plate data.
- Make sure that the conditions at the location of use comply with the conditions specified in this documentation. When necessary, take into account deviations regarding approvals or country-specific regulations.

⚠ WARNING

Malfunctions of active active implants due to magnetic and electrical fields

Electric motors endanger people with active implants, for example heart pacemakers, who come close to the motors.

- If you are affected, stay a minimum distance of 300 mm from the motors (tripping threshold for static magnetic fields of 0.5 mT according to Directive 2013/35/EU).

If you wish to use special versions and design variants whose specifications vary from the motors described in this document, then contact your local Siemens office.

If you have any questions regarding the intended usage, please contact your local Siemens office.

The components described in this manual – motor, converter and associated connection cables – are optimally tailored to one another and thereby facilitate the installation and commissioning in a few steps.

You perform commissioning and diagnostics with a commissioning device (PG/PC) via the web server integrated in the converter or using the Startdrive engineering tool.

You can find more information under "Commissioning and diagnostics using the web server (Page 185)" or under "Commissioning and diagnostics with Startdrive (Page 253)".

Correct usage

The components are intended for industrial and commercial use in industrial networks.

The 1FK2 motor is only approved for operation through a converter.

Any other application of the motor or the converter is considered to be incorrect usage.

Correct usage includes compliance with all of the specifications in the operating instructions.

Please observe the data on the rating plates of the motor and converter.

Observe the permitted environmental conditions:

- "Permissible environmental conditions for the motor (Page 340)"
- "Permissible environmental conditions for the converter (Page 409)"

Typical applications

- Robots and handling systems
- Packaging, plastics and textile machines
- Wood, glass, ceramics and stone working machines
- Printing machines

2.2 System overview

The drive system comprises the following system components tailored to one another:

- SINAMICS S210 converter
- SIMOTICS S-1FK2 motor
- OCC MOTION-CONNECT cable (OCC = "One Cable Connection")

The converter and the motor are intended for use with a higher-level controller (PLC). Connection to the controller is via PROFINET:

Prefabricated MOTION-CONNECT cables in various lengths are available to simply connect the motor to the converter and to ensure safe and reliable operation.

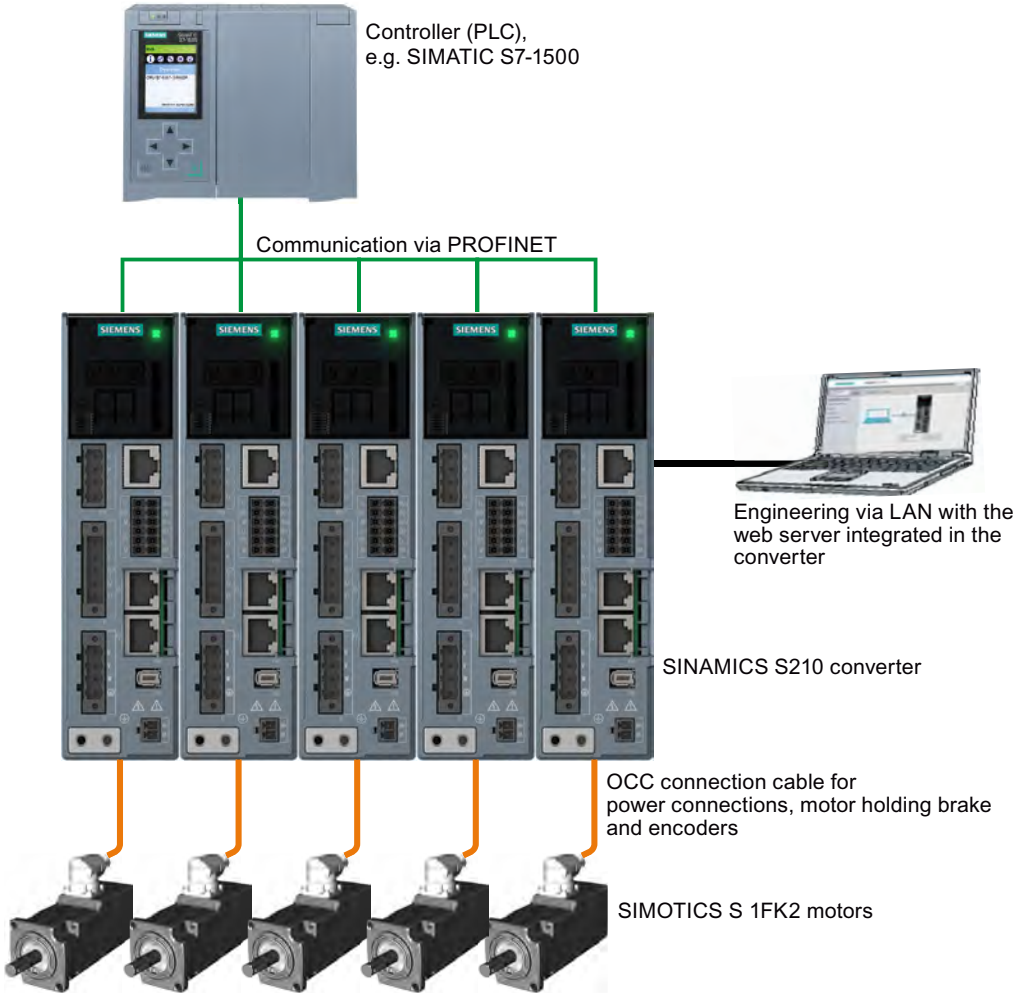


Figure 2-1 System

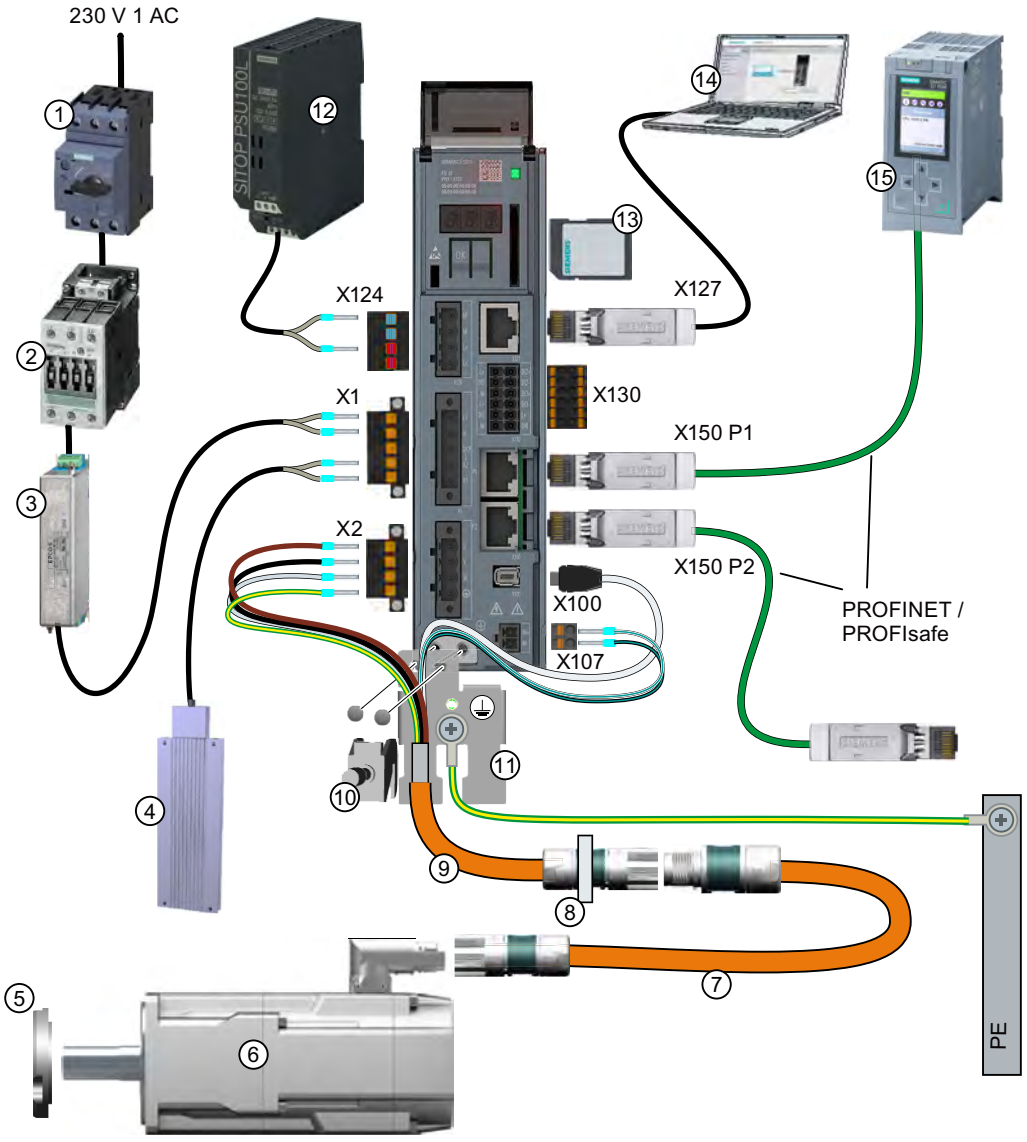


Figure 2-2 System components and accessories for converters with 1 AC line connection

① Fuse or circuit breaker
② Line contactor (optional)
③ Line filter (optional)
④ External braking resistor (optional)
⑤ Shaft sealing ring for IP65 (optional)
⑥ 1FK2 servomotor
⑦ OCC extension cable (optional)
⑧ Mounting flange for control cabinet bushing (optional)
⑨ OCC connection cable for motor, motor holding brake and encoder
⑩ Shield clamp
⑪ Shield plate
⑫ 24 V power supply
⑬ SD memory card (optional)
⑭ Commissioning device
⑮ Controller, e.g. SIMATIC S7-1500

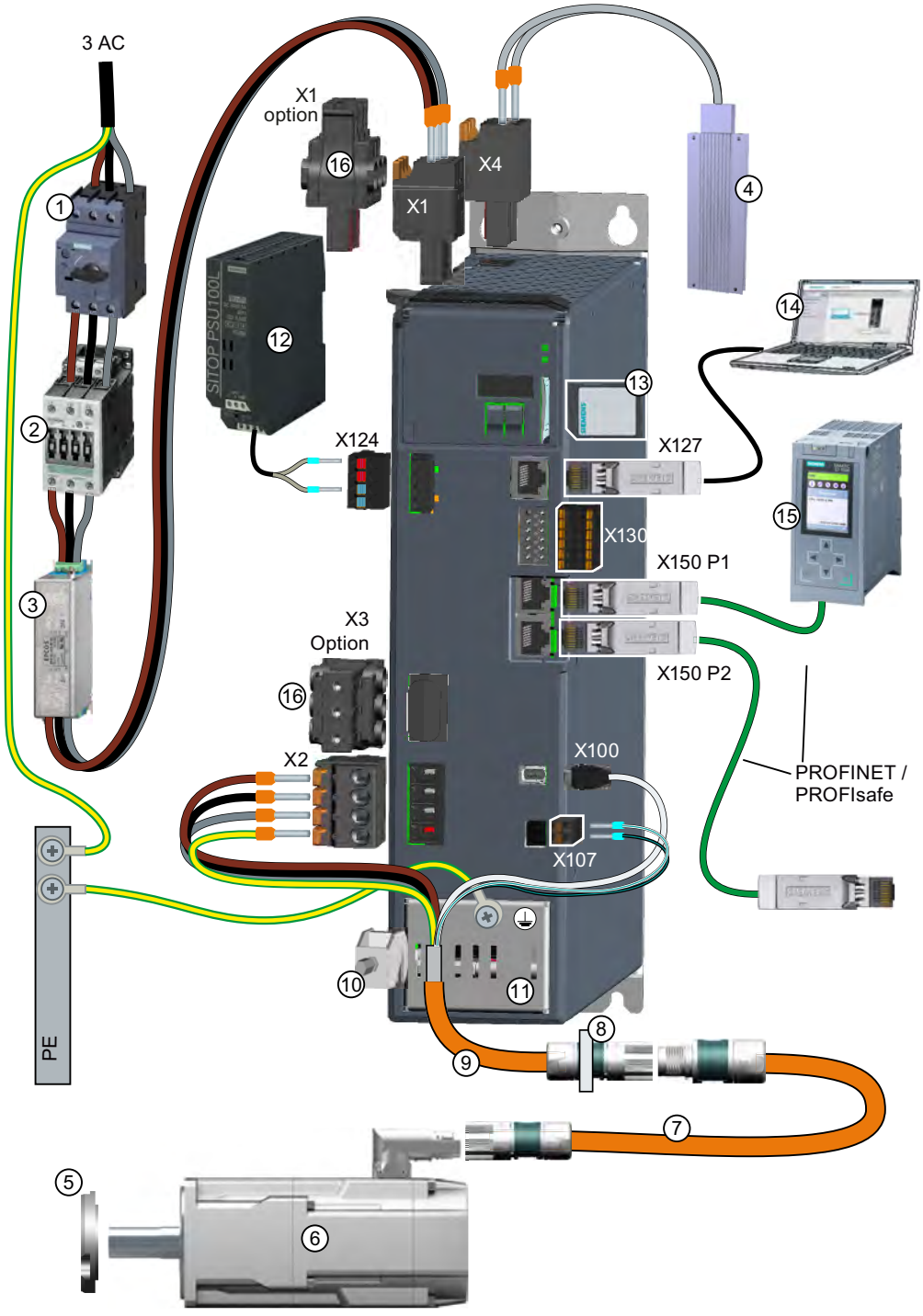


Figure 2-3 System components and accessories for converters with 3 AC line connection

① ... ⑮ Same as in the previous figure

⑯ X1: Connector for AC coupling (optional)
X3: Connector for DC link coupling (optional)

2.3 The scope of supply for the system components

You must order the following components individually.

Motor

Included in the scope of supply:

- A "Safety instructions" sheet
- A sheet referencing links to product information
- A second rating plate

Converter

The components listed below are included in the scope of delivery:

For all converters

- A "Safety instructions" sheet
- The Quick Installation Guide (English)
- A warning label for affixing in the control cabinet
- X2: Connector for motor connection
- X107: Connector for motor holding brake
- X124: Connector for 24 V DC supply voltage
- X130: Connector for digital inputs

For converters with 1 AC line connection

- Shield plate
- X1: Connector for line connection and external braking resistor (jumper for internal braking resistor is included)

For converters with 3 AC line connection

- The shield plate for FSA
  For FSB and FSC, the shield connection is integrated in the converter itself.
- X1: Connector for line connection
- X4: Connector for external braking resistor (jumper for internal braking resistor is included)

Note

All connectors are designed so that they cannot be inadvertently interchanged.

MOTION-CONNECT cable (OCC cable)

The scope of supply for the prefabricated MOTION-CONNECT cables includes:

- The MOTION-CONNECT cable with assembled connectors for connecting to motors and encoders
- A shield clamp for the connection of the shield to the shield plate of the converter
- A safety data sheet

Details of the MOTION-CONNECT OCC cables can be found in section "Ordering data of the connection system (Page 462)".

Optional accessories

The optional accessories are listed in the section "Accessories (Page 435)".

2.4 Motor

The SIMOTICS S-1FK2, called "1FK2" in the following, is a permanent-magnet compact synchronous motor with an integrated encoder and a high degree of protection.

The 1FK2 meets the requirements of standards EN 60034 and EN 60204-1 - and complies with the Low-Voltage Directive 2014/35/EU.

Dynamic versions

- 1FK21 "High Dynamic" with low moment of inertia for a maximum acceleration capability in applications involving low load moments of inertia
- 1FK22 "Compact" with average moment of inertia and precise positioning and synchronous operation characteristics for applications with a high and variable load moment of inertia

Torque range

- 0.16 Nm ... 3.6 Nm for a 1 AC 230 V line supply
- 0.16 Nm ... 40 Nm for a 3 AC 240 V line supply
- 1.3 Nm ... 40 Nm for a 3 AC 400 V line supply

Degree of protection

- IP64
- IP65 with radial shaft sealing ring

You can find additional information on the degree of protection in the section "Degree of protection (Page 345)".

Cooling

The 1FK2 is a non-ventilated motor.

The motor thermal losses are dissipated by thermal conduction, thermal radiation and natural convection.

If the ambient temperature exceeds 40 °C (104 °F) or the installation altitude 1000 meters above sea level, you must reduce torque and power of the motor (derating).

Information on derating can be found in section "Derating factors (Page 344)".

Observe the instructions for mounting the motor in section "Cooling (Page 342)".

Bearing version

The motors have deep groove ball bearings with life-long lubrication.

The average bearing service life is designed for 25000 operating hours.

The motors have spring-loaded bearings in the NDE direction. For version with holding brake, the NDE bearing is a locating bearing.

The permissible axial and radial forces can be found in the technical specifications in section "Axial and radial forces (Page 349)".

Shaft extension

- Cylindrical shaft without feather key
- Cylindrical shaft with feather key (half-key balancing)

You can find additional information in section "Shaft extension (Page 347)".

Encoder

The encoder resolution is 22 bit per revolution (singleturn). An optional multiturn encoder is available that is equipped with an additional 12-bit revolution counter (traversing range of 4096 revolutions).

The encoder designations are as follows:

- AS22DQC: Absolute encoder, singleturn, 22 bit
- AM22DQC: Absolute encoder 22 bit + 12 bit multiturn

You can find additional information in section "Available encoders (Page 355)".

Holding brake

The 1FK2 servomotor is available with integrated holding brake.

The holding brake closes in the current-free state and locks the motor shaft at a standstill. When current flows, the holding brake opens and releases the motor shaft.

SINAMICS S210 controls the holding brake without any additional devices.

The holding brake is not a working brake for braking the rotating motor. Limited EMERGENCY STOP operation is permissible.

The brake data can be found in section "Brake data (Page 356)".

Rating plate

The rating plate contains the article number and the technical data of the motor.

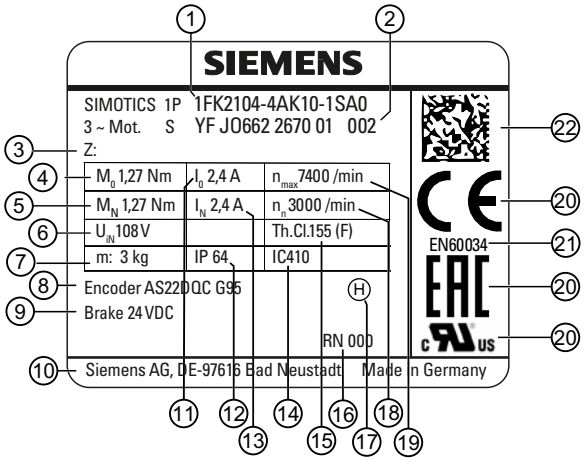


Figure 2-4 Rating plate

Position	Description / technical specifications	Position	Description / technical specifications
1	Article number	12	Degree of protection
2	ID No., serial number	13	Rated current I_N
3	Additional options specified as a supplement to the article number	14	Cooling method according to EN 60034-6
4	Static torque M_0	15	Temperature class of the insulation system
5	Rated torque M_N	16	Revision
6	Induced voltage at rated speed U_{IN}	17	Type of balancing (only for motors with feather key)
7	Motor weight m	18	Rated speed n_N
8	Marking of encoder type	19	Maximum speed n_{max}
9	Data of the holding brake	20	Certifications
10	Manufacturer's address	21	Standard for all rotating electrical machines
11	Stall current I_0	22	Data matrix code

2.5 Motor-converter combinations

2.5.1 Motor-converter combinations for 1 AC 200 ... 240 V

Converter with line connection 1 AC 200 V ... 240 V

The following table lists recommended combinations of converters connected to a 1 AC 200 V ... 240 V line supply and motors with the associated connecting cables.

Motor		Converter		OCC cable	
Article number (positions 1 ... 10 of the article number)	**Torque M_0 / Nm**	**Rated power P_N / kW**	**Article number 6SL3210-5HB10-...**	**Connector size**	**Article number 6FX . 002-8Q..**
High Dynamic					
1FK2102-0AG	0.16	0.1	...1UF0	M12	...N04-...
1FK2102-1AG	0.32				
1FK2103-2AG	0.64	0.2	...2UF0		
1FK2103-4AG	1.27	0.4	...4UF0		
1FK2104-4AF		0.2	...2UF0	M17	...N08-...
1FK2104-4AK		0.4	...4UF0		
1FK2104-5AF	2.4				
1FK2104-5AK		0.75	...8UF0		
1FK2104-6AF	3.2				
Compact					
1FK2203-2AG	0.64	0.2	...2UF0	M12	...N04-...
1FK2203-4AG	1.27	0.4	...4UF0		
1FK2204-5AF	2.4			M17	...N08-...
1FK2204-5AK		0.75	...8UF0		
1FK2204-6AF	3.2				
1FK2205-2AF	3.6				

2.5.2 Motor-converter combinations for 3 AC 200 ... 240 V

Converter with line connection 200 V ... 240 V 3 AC

The following table lists recommended combinations of converters connected to a 3 AC 200 V ... 240 V line supply and motors with the associated connecting cables.

Motor		Converter		OCC cable	
Article number (positions 1 ... 10 of the article number)	**Torque M_0 / Nm**	**Rated power P_N / kW**	**Article number 6SL3210-5HE...**	**Connector size**	**Article number 6FX . 002-8Q..**
High Dynamic					
1FK2102-0AG	0.16	0.4	...10-4U...	M12	...N04...
1FK2102-1AG	0.32				
1FK2103-2AG	0.64	0.75	...10-8U...		
1FK2103-4AG	1.27	1.0	...11-0U...		
1FK2104-4AF		0.4	...10-4U...	M17	...N08...
1FK2104-4AK		1.0	...11-0U...		
1FK2104-5AF	2.4	0.75	...10-8U...		
1FK2104-5AK		1.5	...11-5U...		
1FK2104-6AF	3.2	1.0	...11-0U...		
1FK2105-4AF	5	1.5	...11-5U...		
1FK2105-6AF	8	2.0	...12-0U...		
1FK2106-3AF	9	5.0	...15-0U...	M23	...N11...
1FK2106-4AF	12				
1FK2106-6AF	16	7.0	...17-0U...		
Compact					
1FK2203-2AG	0.64	0.75	...10-8U...	M12	...N04...
1FK2203-4AG	1.27	1.0	...11-0U...		
1FK2204-5AF	2.4	0.75	...10-8U...	M17	...N08...
1FK2204-5AK		1.5	...11-5U...		
1FK2204-6AF	3.2	1.0	...11-0U...		
1FK2205-2AF	3.6				
1FK2205-4AF	6	1.5	...11-5U...		
1FK2206-2AF	6.5			M23	...N11...
1FK2206-4AF	12	3.5	...13-5U...		
1FK2208-3AC	18				
1FK2208-4AC	22	5.0	...15-0U...		
1FK2208-5AC	27	7.0	...17-0U...		
1FK2210-3AB	30	3.5	...13-5U...		
1FK2210-3AC		7.0	...17-0U...		
1FK2210-4AB	40	5.0	...15-0U...		
1FK2210-4AC		7.0	...17-0U...		

2.5.3 Motor-converter combinations for 3 AC 380 ... 480 V

Converter with line connection 380 V ... 480 V 3 AC

The following table lists recommended combinations of converters connected to a 3 AC 380 V ... 480 V line supply and motors with the associated connecting cables.

Motor		Converter		OCC cable	
Article number (positions 1 ... 10 of the article number)	**Torque M_0 / Nm**	**Rated power P_N / kW**	**Article number 6SL3210-5HE...**	**Connector size**	**Article number 6FX . 002-8Q.**
High Dynamic					
1FK2104-4AF	1.27	0.4	...10-4UF0	M17	N08-...
1FK2104-5AF	2.4	0.75	...10-8UF0		
1FK2104-6AF	3.2	1.0	...11-0UF0		
1FK2105-4AF	5	1.5	...11-5UF0		
1FK2105-6AF	8	2.0	...12-0UF0		
1FK2106-3AF	9	5.0	...15-0UF0	M23	N11-..
1FK2106-4AF	12				
1FK2106-6AF	16	7.0	...17-0UF0		
Compact					
1FK2204-5AF	2.4	0.75	...10-8UF0	M17	N08-...
1FK2204-5AK		1.5	...11-5UF0		
1FK2204-6AF	3.2	1.0	...11-0UF0		
1FK2205-2AF	3.6				
1FK2205-4AF	6	1.5	...11-5UF0		
1FK2206-2AF	6.5			M23	N11-...
1FK2206-4AF	12	3.5	...13-5UF0		
1FK2208-3AC	18				
1FK2208-4AC	22	5.0	...15-0UF0		
1FK2208-5AC	27	7.0	...17-0UF0		
1FK2210-3AB	30	3.5	...13-5UF0		
1FK2210-3AC		7.0	...17-0UF0		
1FK2210-4AB	40	5.0	...15-0UF0		
1FK2210-4AC		7.0	...17-0UF0		

2.6 Converter

The converter is a single-axis device (complete converter with integrated infeed). It is characterized by a compact design, side-by-side installation and high overload capability.

The converter is intended for use with 1FK2 motors and is available in the following versions:

- Line supply voltage 230 V 1 AC (200 V ... 240 V)
  Power range 0.1 kW ... 0.75 kW
- Line supply voltage 240 V 3 AC (200 V ... 240 V) and 400 V 3 AC (380 V ... 480 V)
  Power range when connected to 3 AC 400 V: 0.4 kW ... 7 kW
  With 3 AC converters, connection to a network with grounded neutral point is required.

Control mode

Servo control, optimized for 1FK2 motors

Safety functions integrated in the drive

The converter offers the following safety functions integrated in the drive:

Table 2-1 Overview of safety functions integrated in the drive (Safety Integrated)

	Functions	Abbr.	Brief description
Basic Functions	Safe Torque Off	STO	Safe Torque Off according to stop Category 0
	Safe Stop 1	SS1	Safe stopping process in accordance with stop category 1
	Safe Brake Control	SBC	Safe brake control
Extended Functions	Safe Torque Off	STO	Safe Torque Off according to stop Category 0
	Safe Stop 1	SS1	Safe stopping process in accordance with stop category 1
	Safe Brake Control	SBC	Safe brake control
	Safe Operating Stop	SOS	Safe monitoring of the standstill position
	Safe Stop 2	SS2	Safe stopping process in accordance with stop category 2
	Safely-Limited Speed	SLS	Safe monitoring of the maximum speed
	Safe Speed Monitor	SSM	Safe monitoring of the minimum speed
	Safe Direction	SDI	Safe monitoring of the direction of motion
	Safely-Limited Acceleration	SLA	Safely-limited acceleration
	Diagnostic function Safe Brake Test	SBT	Safe test of the required holding torque of a brake

You can find additional information in section "Safety functions integrated in the drive (Page 85)".

Note

The Basic Functions are included in the scope of delivery of the converter.

The Extended Functions require a license. For additional information, see "Using functions that require a license (Page 249)".

Integrated braking resistor

In order to absorb the regenerative load of the motor, converters have an internal braking resistor (exception: 100 W device).

If the internal braking resistor is not sufficient, you have the option of connecting an external braking resistor. Additional information:

- "Configuring the braking resistor (Page 71)"
- "Connecting the converter (Page 161)"

DC link coupling (devices of the 3 AC series only)

For devices of the 3 AC series, the DC links of up to 6 converters can be coupled. This means that energy balancing between the axes is possible and braking energy can be used by other axes for accelerating. This also reduces the dissipated heat in the control cabinet because the braking energy no longer has to be converted into heat in the braking resistor. Additional information:

- "DC link coupling (Page 78)"

Communicating with the controller via PROFINET

The converter supports the following functions:

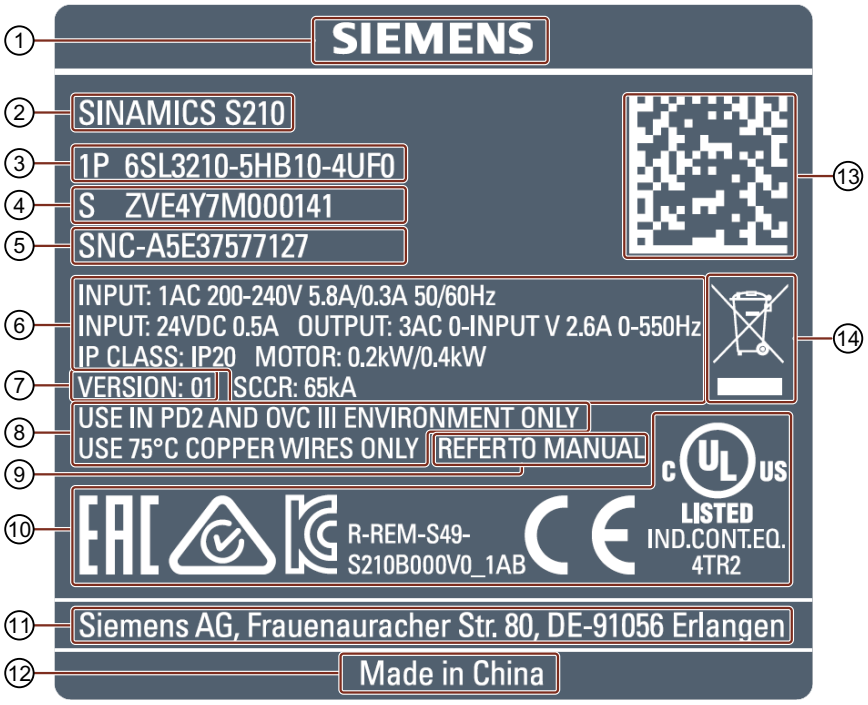
- RT (Real Time)
- IRT (Isochronous Real Time) with the telegrams 5 and 105
- MRP (media redundancy) with RT
- MRPD (seamless media redundancy) with IRT
- Shared Device
- PROFIsafe
- PROFIenergy
- Automatic telegram selection

Commissioning, diagnostics and data backup

Commissioning, diagnostics and data backup are performed using a PC or notebook (commissioning device). The following commissioning tools are available to you:

- Web server (integrated in the converter):
  "Commissioning and diagnostics using the web server (Page 185)"
- Startdrive (commissioning software):
  "Commissioning and diagnostics with Startdrive (Page 253)"

Nameplate and date of manufacture - 1 AC



①	Manufacturer	⑧	Environmental conditions
②	Product designation	⑨	Reference to the manual
③	Article number	⑩	Certificates
④	Serial number	⑪	Manufacturer's address
⑤	Material number	⑫	Production location
⑥	Electrical data and degree of protection	⑬	Data matrix code
⑦	Function release/version	⑭	Note on disposal

Date of manufacture

The date of manufacture of the converter is coded in the serial number:

S Z V K 6 Y 7 M 0 0 0 1 4 1

Month of manufacture

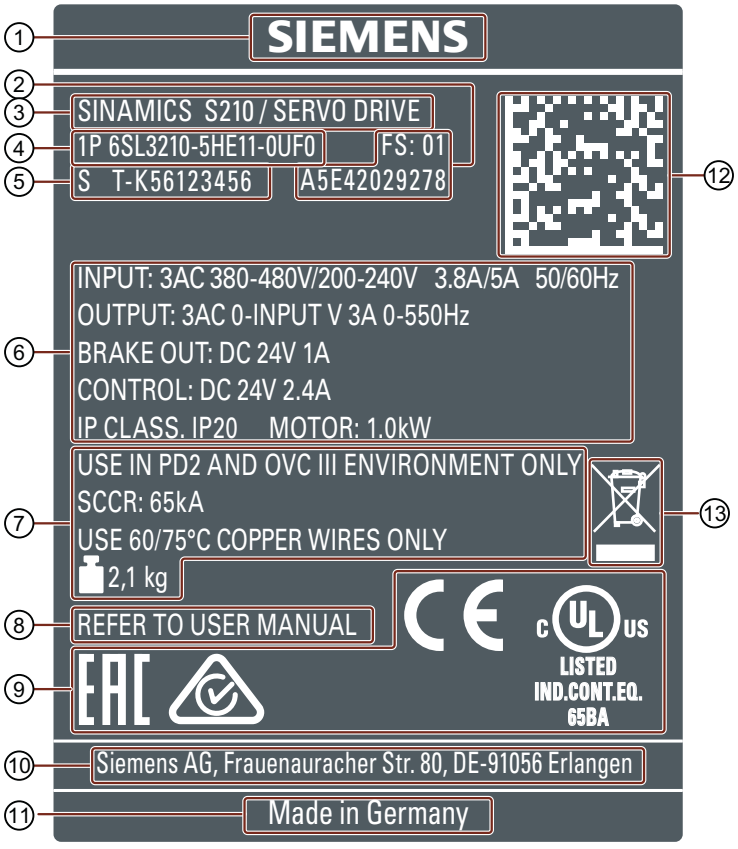
1	January	2	February	3	March	4	April
5	May	6	June	7	July	8	August
9	September	O	October	N	November	D	December

Year of manufacture

E	2014	F	2015	H	2016	J	2017	K	2018	L	2019	M	2020
N	2021	P	2022	R	2023	S	2024	T	2025	U	2026	V	2027
W	2028	X	2029										

Figure 2-5 Date of manufacture (example June 2018)

Nameplate and date of manufacture - 3 AC



1. Manufacturer
2. Function status and material number
3. Product designation
4. Article number
5. Serial number
6. Electrical data and degree of protection
7. Environmental conditions
8. Reference to the manual
9. Certificates
10. Manufacturer's address
11. Production location
12. Data matrix code
13. Note on disposal

Date of manufacture

The date of manufacture of the converter is coded in the serial number:

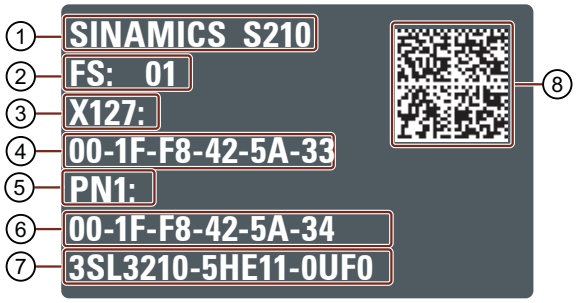
S T-K 5 6 1 2 3 4 5 6

Month of manufacture							
1	January	2	February	3	March	4	April
5	May	6	June	7	July	8	August
9	September	O	October	N	November	D	December

Year of manufacture													
J	2017	K	2018	L	2019	M	2020	N	2021	P	2022	R	2023
S	2024	T	2025	U	2026	V	2027	W	2028	X	2029		

Figure 2-6 Date of manufacture (example May 2018)

Information label



1	Product designation	5	PROFINET interface
2	Function release/version	6	MAC address of the PROFINET interface
3	Service interface	7	Article number
4	MAC address of the service interface	8	Data matrix code

2.7 Connection systems

The motor is connected to the converter by a MOTION-CONNECT cable.

The cable uses all-in-one cable technology (One Cable Connection, OCC cable). As a result of its flexibility and low diameter, it permits very tight bending radii.

The OCC cables are available in the following variants:

- MOTION-CONNECT 500
  - Cost-effective solution for mainly fixed installation
  - Suitable for low mechanical loading
- MOTION-CONNECT 800PLUS
  - Fulfills the requirements for use in cable carriers
    - Tested for horizontal traversing paths up to 50 m
    - Not self-supporting
  - Suitable for high mechanical loading
  - Oil-resistant

The OCC cables can be supplied in lengths by the decimeter.

Extensions and cabinet bushings are available for the OCC cables.

You will find more information under:

- "Technical data and properties of the connection system (Page 417)"
- "Ordering data of the connection system (Page 462)"

Configuring 3

3.1 EMC-compliant installation of a machine or system

The converter is designed for operation in industrial environments.

Reliable and disturbance-free operation is only guaranteed for EMC-compliant installation.

Additional information

Additional information about EMC-compliant installation is available in the Internet:

- EMC installation guideline (http://support.automation.siemens.com/WW/view/en/60612658)

3.1.1 Control cabinet

Control cabinet assembly

- Install a shield support for shielded cables that are routed out of the control cabinet.
- Connect the PE bar and the shield support to the control cabinet frame through a large surface area to establish a good electrical connection.
- Mount the converter, the 24 V DC power supply and the optional line filter on a bare metal mounting plate.
- Connect the mounting plate to the control cabinet frame and PE bar and shield support through a large surface area to establish a good electrical connection.

Permissible protective elements and the required control cabinet sizes:

- Protective devices (https://support.industry.siemens.com/cs/ww/en/view/109748999)

3.1.2 Cables

Cables with a high level of interference and cables with a low level of interference are connected to the converter.

Note

Cables with a high level of interference must be shielded.

- Cables with a high level of interference:
  - Cable between the line filter and converter
  - Motor cable
  - Cable between the converter and external braking resistor
- Cables with a low level of interference:
  - Cable between the line and line filter
  - Signal and data cables

Cable routing inside the cabinet

- Route the cables with a high level of interference so that there is the largest possible clearance to cables with a low level of interference.
- Cables with a high level of interference and cables with a low level of interference may only cross over at right angles:
- Keep all of the cables as short as possible.
- Route all of the cables close to the mounting plates or cabinet frames.
- Route signal and data cables - as well as the associated equipotential bonding cables - parallel and close to one another.
- Twist incoming and outgoing unshielded individual conductors.
  Alternatively, you can route incoming and outgoing conductors in parallel, but close to one another.
- Ground any unused conductors of signal and data cables at both ends.
- Signal and data cables must only enter the cabinet from one side, e.g. from below.

- Use shielded cables for the following connections:
  - Cable between the converter and line filter (for 230 V 1AC only)
  - Cable between the converter and motor
  - Cable between the converter and external braking resistor
  - Signal cables if they are routed next to cables with high levels of noise and interference
- When connecting a line filter, note the following information (according to the EMC installation guideline http://support.automation.siemens.com/WW/view/en/60612658 (http://support.automation.siemens.com/WW/view/en/60612658)):
  - The cable routing must adhere to the EMC zone concept.
  - Unshielded cables within the control cabinet (e.g. cables from the 24 V supply) must not cross the line filter and must be routed separately from it.

NOTICE
Damage caused by connecting several loads to the same line infeed point Damage can be caused if several loads are connected to the same line infeed point. • Provide interference suppression for the other loads using appropriate line filters. To prevent mutual interference, it is not permissible that this line filter is equipped with capacitors with respect to ground. Use of a series B84144A*R120 filter (EPCOS) is recommended for 3-phase connection of the 24-V power supply.

Routing converter cables inside and outside a control cabinet

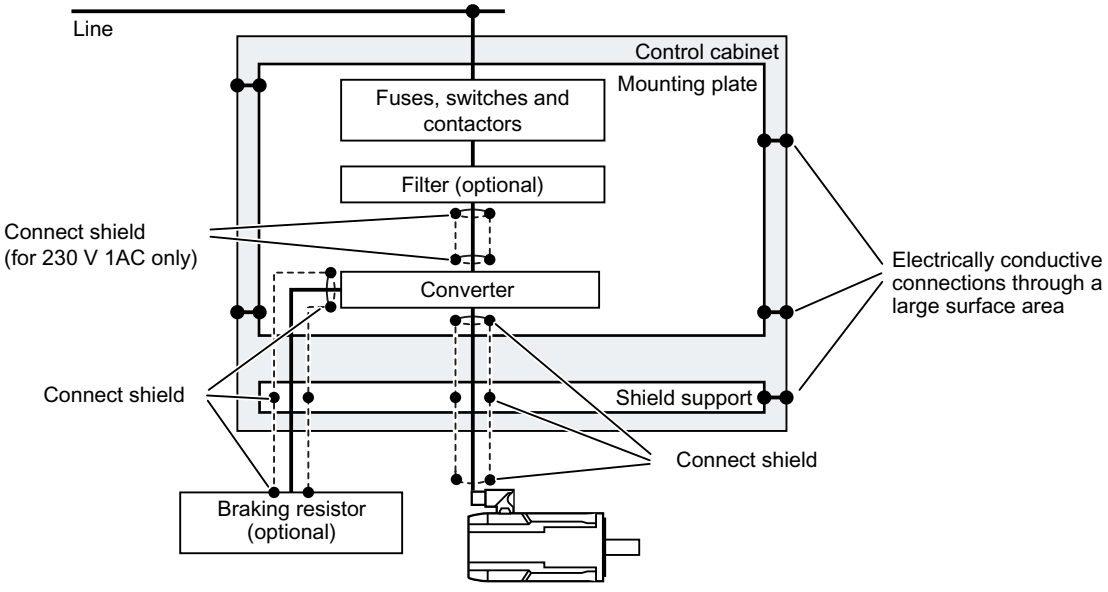


Figure 3-1 Routing converter cables inside and outside a control cabinet

Routing cables outside the control cabinet

- Maintain a minimum clearance of 25 cm between cables with a high level of interference and cables with a low level of interference.
- Use shielded cables for the following connections:
  - Converter motor cable
  - Cable between the converter and braking resistor
  - Signal and data cables

Requirements relating to shielded cables

- Use cables with finely-stranded, braided shields.
- Connect the shield at both ends of the cable.

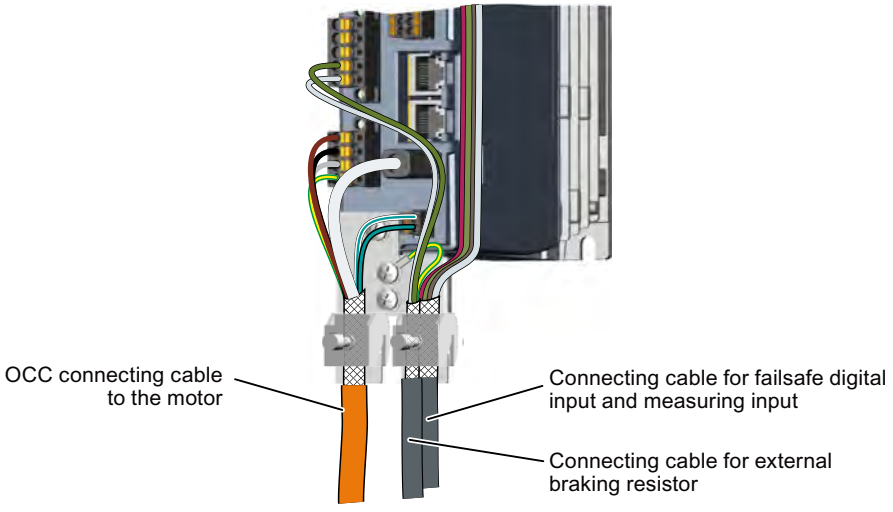


Figure 3-2 Shield support with the shield terminal from the scope of delivery of the MOTION-CONNECT OCC cable.

- Connect the shield to the shield support.
- Do not interrupt the shield.

3.1.3 Electromechanical components

Surge voltage protection circuit

- Connect surge voltage protection circuits to the following components:
  - Coils of contactors
  - Relays
  - Solenoid valves
- Connect the surge voltage protection circuit directly at the coil.
- Use RC elements or varistors for AC-operated coils and freewheeling diodes or varistors for DC-operated coils.

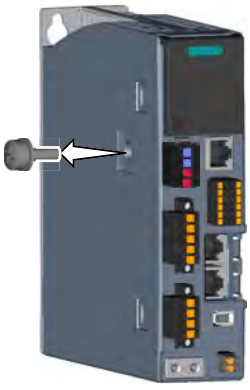
3.2 Permissible line supplies and connection options

The converter is designed for the following line supplies according to IEC 60364-1 (2005).

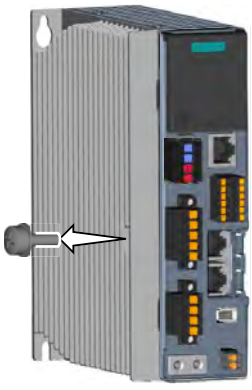
- TN system
- TT system
- IT system (only 1 AC devices)

Converter with 1 AC line connection on an IT line system

You must remove the grounding screw when operating the converter on an IT line system. As a consequence, you remove the grounding of the integrated EMC filter.



FSA / FSB,
1 AC 230 V



FSC,
1 AC 230 V

⚠ WARNING

Electric shock when the grounding screw is removed

Because of the capacitors, hazardous voltage is present at the grounding screw for up to 5 minutes after the power supply has been switched off.

Contact with live parts can result in death or serious injury.

- After switching off the supply voltage, wait for 5 minutes before you check that the unit really is in a no-voltage condition and start work.

Converters with 3 AC line connection

You must observe the following when operating converters with a 3 AC line connection:

- TN and TT line systems with grounded neutral point:
  The converter can be directly connected.
- IT line systems as well as TN and TT line systems that are not grounded at the neutral point (for example, with grounded line conductor):
  The converter must be connected up via an isolating transformer. The neutral point on the secondary side of the isolating transformer must be grounded.

⚠ WARNING

Electric shock when operating the converter without grounding screw

If the converter is operated without a grounding screw, there is a risk of electric shock through contact with live parts when the cover is open or missing.

- Do not open the cover and do not remove the grounding screw.

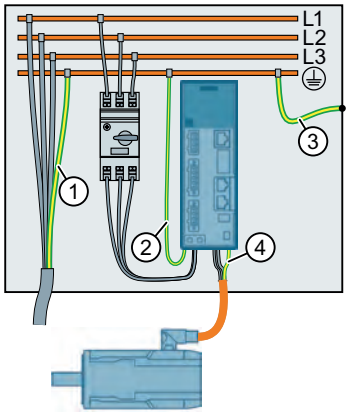
NOTICE

Destruction of the converter when operated without grounding screw

Operating the converter with 3 AC line connection without grounding screw will destroy it.

- Do not remove the grounding screw.

Minimum cross-section of the protective conductor



① The protective conductor (PE) must be dimensioned in accordance with the local installation rules for equipment with increased discharge currents. As a minimum, one of the following conditions must be satisfied:

- The protective conductor is routed so that along its complete length it is protected against mechanical damage.
- The protective conductor has a cross-section ≥ 10 mm² Cu.
- A second protective conductor with the same cross-section is provided.
- When establishing the connection using an industrial plug connector according to EN 60309, the protective conductor of a multi-conductor cable must have a cross-section ≥ 2.5 mm² Cu.
- As a conductor of a multi-conductor cable, the protective conductor has a cross-section ≥ 2.5 mm² Cu

② The protective conductor must be dimensioned in compliance with local installation rules.

- If each converter is individually protected, the protective conductor with the same cross-section must be routed in the same way as the line connection cable to the converter.
- If a group of converters is connected via the AC coupling, the protective conductors must, within the scope of IEC, be routed with at least 6 mm² Cu[1)] and for the USA and Canada with 8 AWG Cu[2)].

③ The cable cross-section must be dimensioned in compliance with local installation rules.

④ Same cross-section as the line conductor of the motor cable. The protective conductor is part of the OCC cable.

[1)] According to IEC 60364-5-54, Chap. 543.1.2

[2)] According to NEC (NFPA 70) Table 250.122 / CEC (CSA 22.1.18) Rule 10-6149

Figure 3-3 Protective connection concept

⚠ WARNING

Electric shock due to interrupted protective conductor

The drive components conduct high discharge currents via the protective conductor. Touching conductive parts when the protective conductor is interrupted can result in death or serious injury.

- Comply with the requirements placed on protective conductors.

3.2.1 Connecting options for converters with 1 AC line connection

Basic connection options

You have the following options to supply the converter with an input voltage of 230 V.

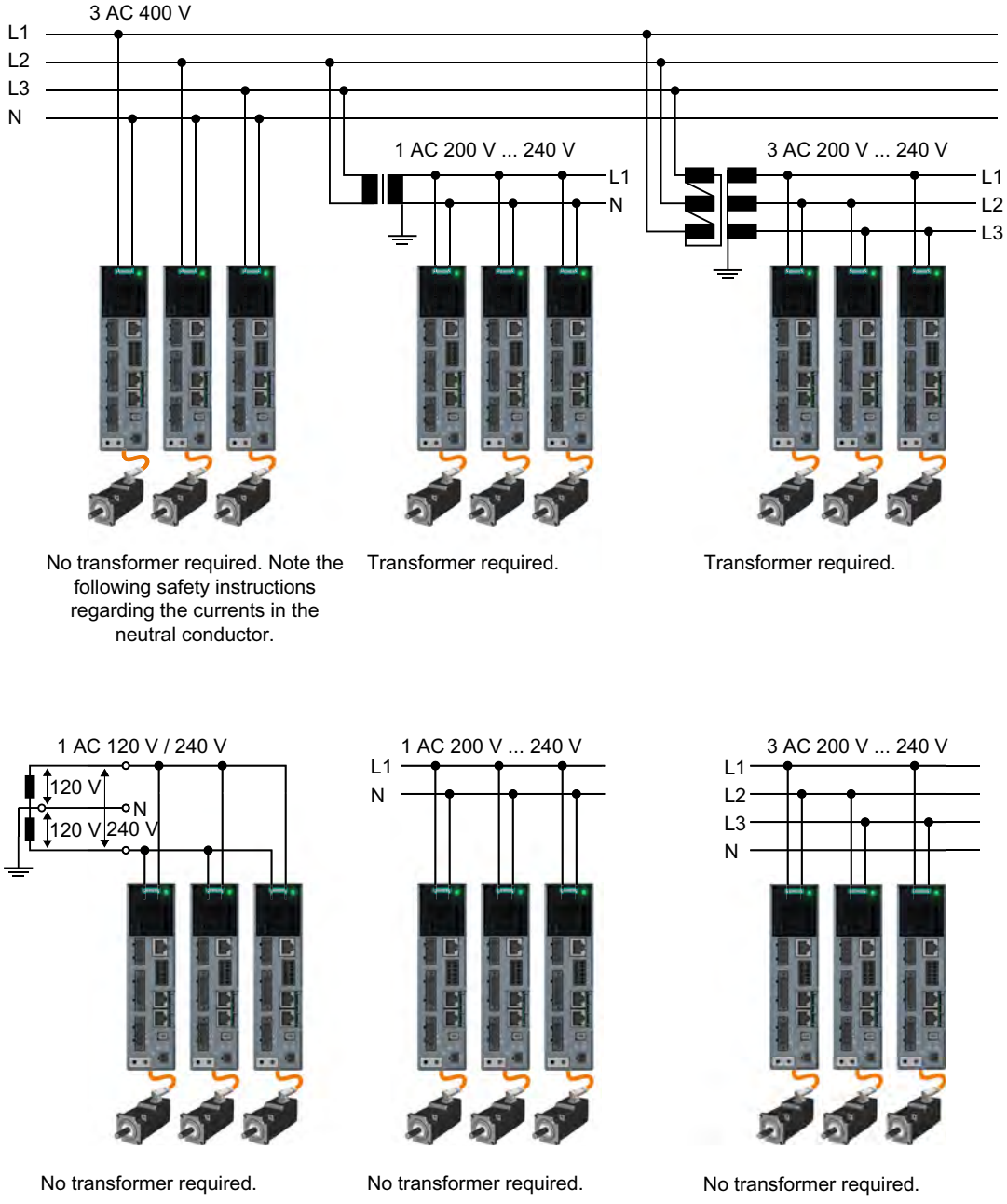


Figure 3-4 Connection options

⚠ WARNING

Neutral conductor fire caused by high currents

If you connect the converter without an isolating transformer to a supply system with 400 V 3 AC between the N-conductor and a line conductor (L1, L2 or L3), the harmonic currents in the N-conductor can add up to values that are greater than the currents in the line conductors. This heats up the N-conductor and can cause a fire.

- Take the harmonic currents into account when dimensioning the power supply cables.

Connection examples and cable cross-sections

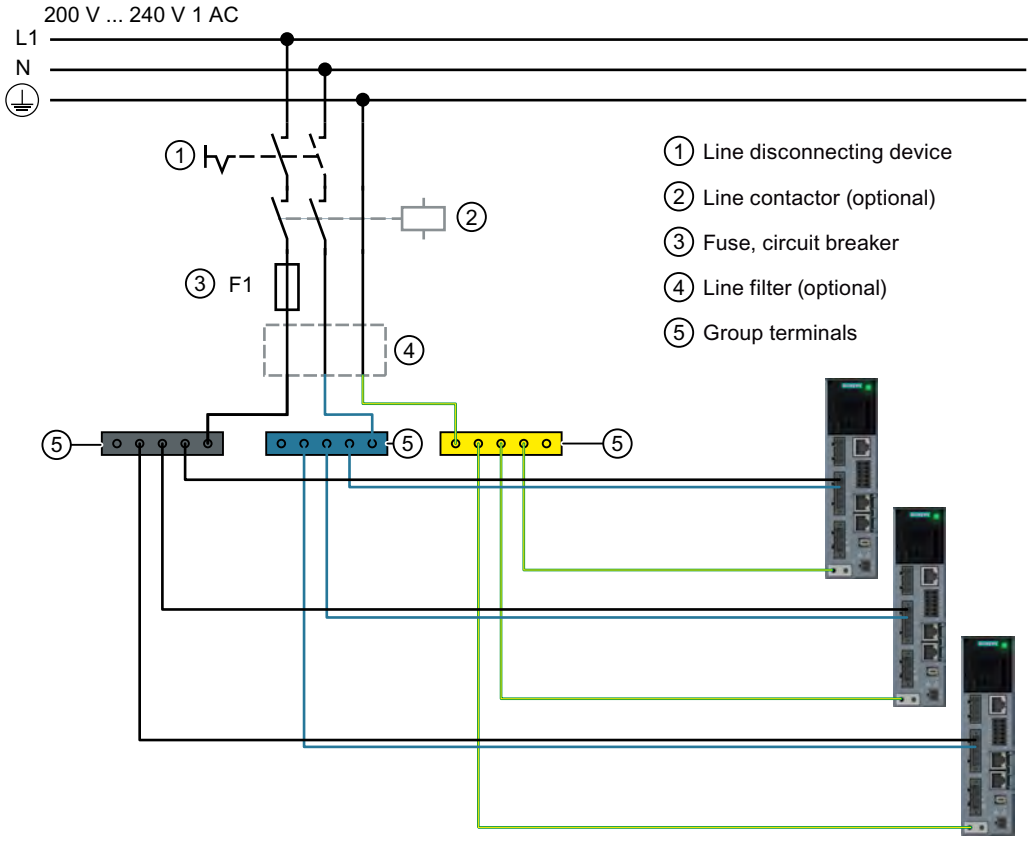


Figure 3-5 Connection example for 230 V 1 AC

• Sum of the input currents of all converters	≤ 24 A
• Fuses	3NA3812 or Class J 30 A for UL/CSA (see "Protective Devices for SINAMICS S210 (https://support.industry.siemens.com/cs/ww/en/view/109748999)")

• Cables for the line connection up to the terminal box	4 mm²
• Cables for establishing the connection between the terminal box and the converter	2.5 mm²

Note

Please observe the local installation regulations for the current-carrying capacity.

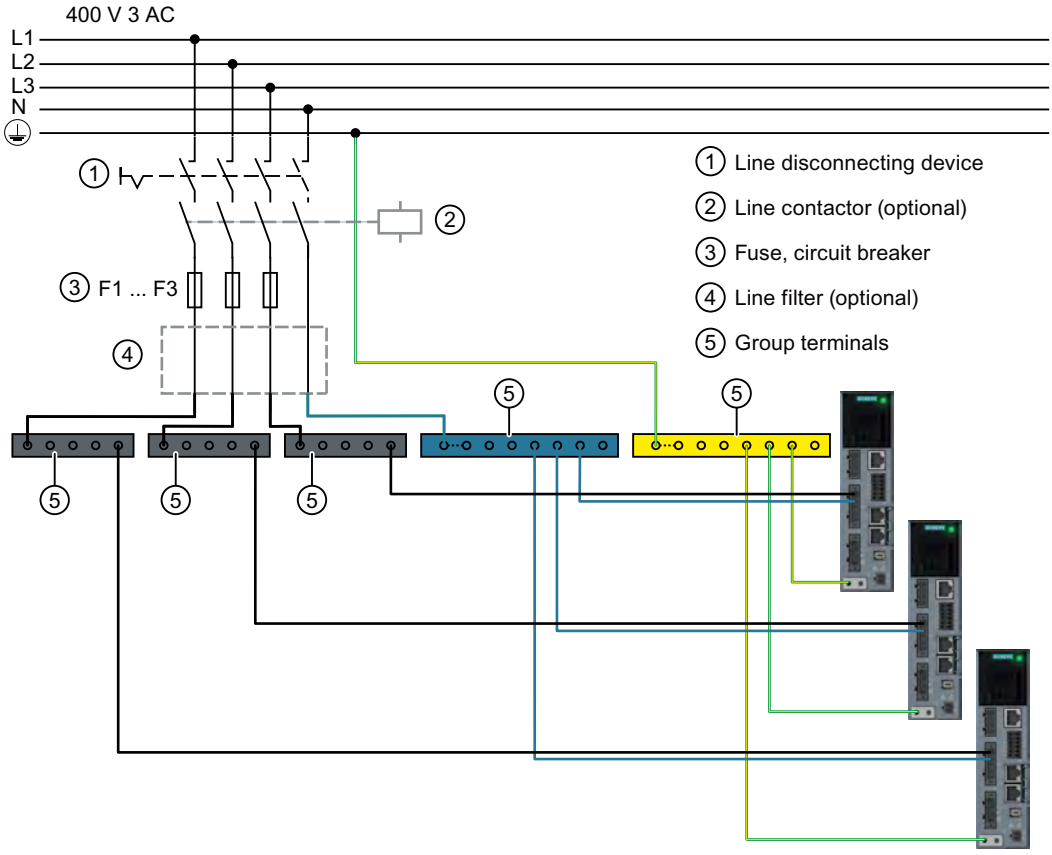


Figure 3-6 Connection example for 400 V 3 AC

• Sum of the input currents of all converters per phase	≤ 24 A
• Fuses, F1 ... F3	3NA3812 or Class J 30 A for UL/CSA (see "Protective Devices for SINAMICS S210")
• Cables for the line connection up to the terminal box	4 mm²
• Cables for establishing the connection between the terminal box and the converter	2.5 mm²

Note

Please observe the local installation regulations for the current-carrying capacity.

3.2.2 Connecting options for converters with 3 AC line connection

Operating the converter on 3 AC 200 V ... 240 V line supplies

Use an external, intrinsically safe braking resistor to ensure safe and reliable converter operation.

When using an external braking resistor, connections DCP and R2 must not be jumpered at connector X4. Connect the braking resistor via the DCP and R1 terminals.

When operating on a 200 V ... 240 V 3 AC line supply, the jumper for the internal braking resistor must not be installed at connector X4. In this particular case, connect an external, intrinsically safe braking resistor.

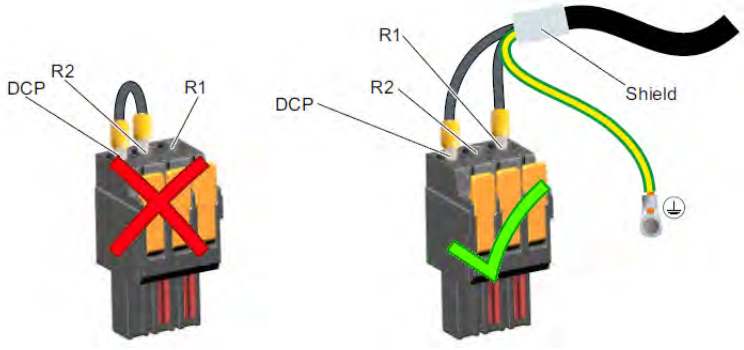


Figure 3-7 Connector X4: Connection for an external braking resistor

⚠ WARNING

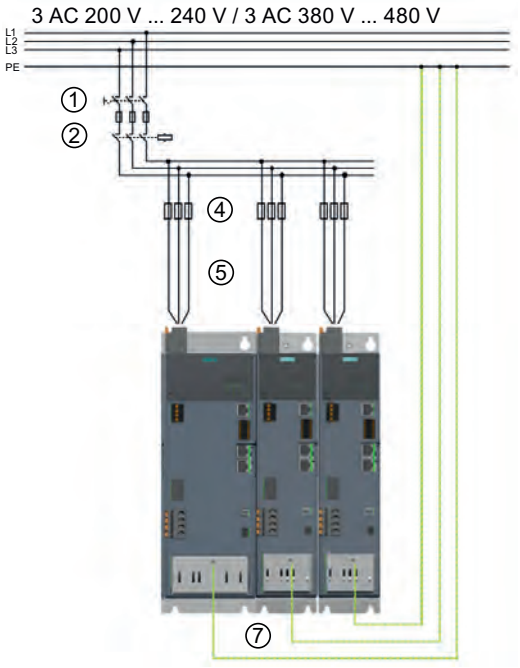
Fire due to not carefully complying with connection and installation notes

When incorrectly connected and in the case of a fault, the converter can overheat resulting in fire and smoke. This can result in severe injury or death.

- Install built-in units in a suitable metal cabinet in such a way that personnel are protected against fire and smoke, or take other appropriate measures to protect personnel.
- It is crucial that you carefully observe connection and installation notes.

Connection options

You can connect each converter individually via the standard terminals and the protective devices assigned to them in accordance with the local regulations or you can connect a group of converters via the optional AC coupling and a common protective device.

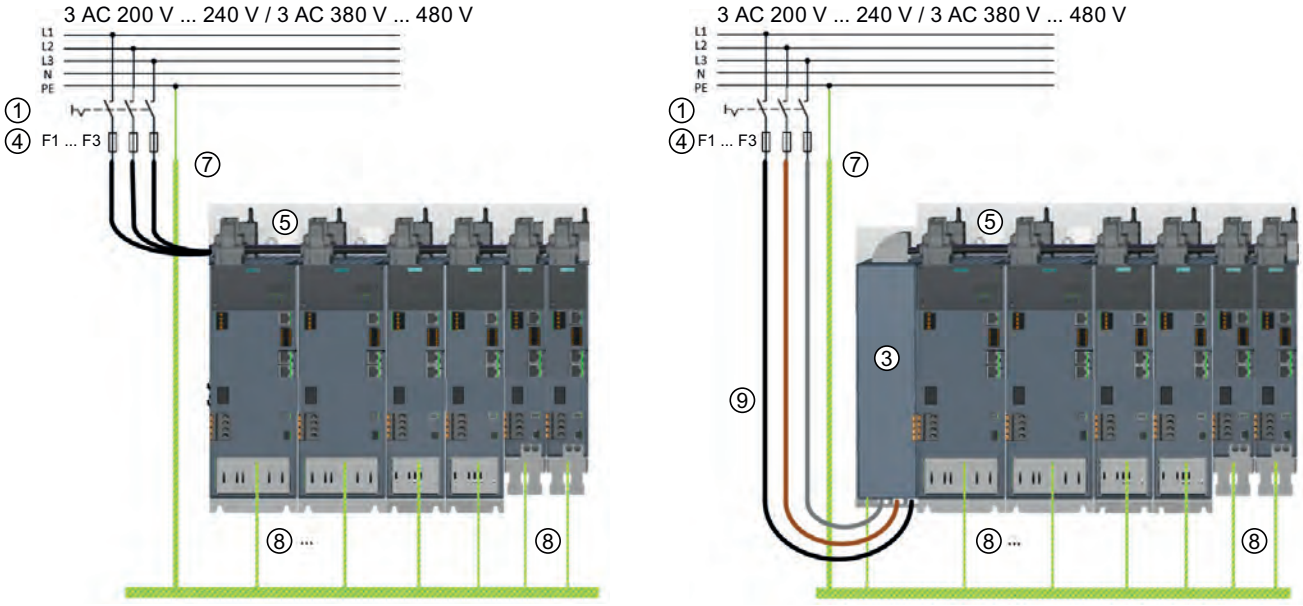


①	Line disconnecting device	e.g. load breaker switch
②	Line contactor	optional
④	Protective device for fault protection	e.g. fuses, circuit breakers, miniature circuit breakers (see "Protective Devices for SINAMICS S210 (https://support.industry.siemens.com/cs/ww/en/view/109748999)")
⑤	Line connection	1.5 mm^2 ... 6 mm^2 / AWG 16 ... AWG 10 in accordance with the conditions in the installation (type of cable installation and ambient temperature) and the local regulations
⑦	Protective conductor connection	Same cross-section as the line connection cable ⑤

Figure 3-8 Individually connected converters with 3 AC line connection

AC coupling

You can connect a group of up to 6 converters via a common protective device if you order the connector kit for AC coupling 6SL3260-2DC10-0AA0 (AC-Link) for each converter. The connector in the connector kit for the AC coupling (16 mm²/AWG 6) replaces the line connector contained in the scope of delivery of the converter (6 mm²/AWG 10). The single-core cable is routed through this connector and electrical contact with the cable is made with a set screw. In this way, the line connections of a phase are connected via a cable for all converters (see also section "Establishing an AC coupling and DC link coupling (Page 176)").



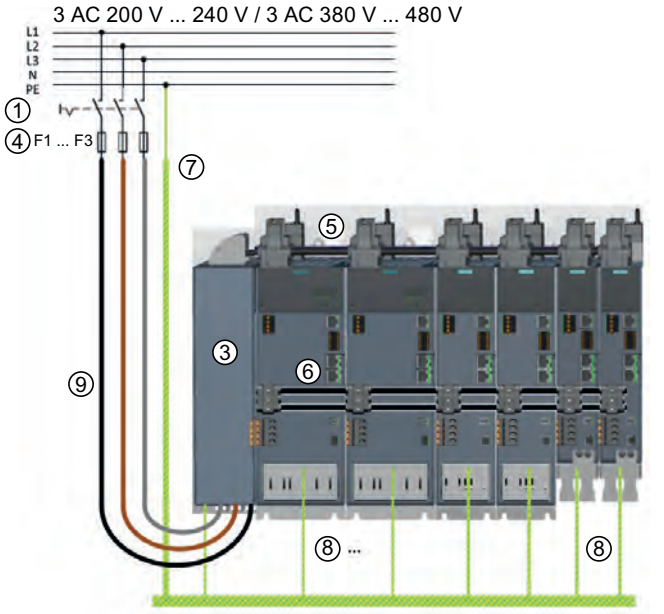
①	Line disconnecting device	e.g. load breaker switch
③	Line filter (optional)	6SL3203-0BE23-5HA0: Rated current 35 A 6SL3203-0BE26-5HA0: Rated current 65 A
④	Protective device for fault protection	e.g. fuses, circuit breakers, miniature circuit breakers (see Product Information "Protective Devices for SINAMICS S210 (https://support.industry.siemens.com/cs/ww/en/view/109748999)")
⑤	Cables for the AC coupling	For the permissible cables for IEC, UL and CSA applications, see section "Establishing an AC coupling and DC link coupling (Page 176)"
⑦	Protective conductor	For the cross-section according to ⑨ minimum cross-section, see ⑧
⑧	Protective connection	Group protection according to IEC: • 6 mm² / 10 AWG Group protection according to NEC/CEC: • 6 mm² / 10 AWG for overcurrent protection devices up to 60 A • 10 mm² / 8 AWG for overcurrent protection devices up to 100 A
⑨	Cable to the line filter	Depending on conditions in the installation (type of cable installation and ambient temperature) and the local regulations with reference to the total rated input currents.

Figure 3-9 Converter with AC coupling (without/with line filter)

DC link coupling

You can couple the DC links of up to 6 converters to exchange energy within this drive line-up. To couple the DC links, the line connections of the coupled converters must also be connected. For this purpose, order the connector kit 6SL3260-2DC00-0AA0 (AC and DC link) for each converter.

The following figure shows the basic structure of such a system.



①	Line disconnecting device	e.g. load breaker switch
③	Line filter (optional)	6SL3203-0BE23-5HA0: Rated current 35 A 6SL3203-0BE26-5HA0: Rated current 65 A
④	Protective device for fault protection	e.g. fuses, circuit breakers, miniature circuit breakers (see Product Information "Protective Devices for SINAMICS S210 (https://support.industry.siemens.com/cs/ww/en/view/109748999)")
⑤	Cables for the AC coupling	For the permissible cables for IEC, UL and CSA applications, see section "Establishing an AC coupling and DC link coupling (Page 176)"
⑥	Cables for the DC link coupling	same as ⑤
⑦	Protective conductor	For the cross-section according to ⑨ minimum cross-section, see ⑧
⑧	Protective connection	Group protection according to IEC: • 6 mm² / 10 AWG Group protection according to NEC/CEC: • 6 mm² / 10 AWG for overcurrent protection devices up to 60 A • 10 mm² / 8 AWG for overcurrent protection devices up to 100 A
⑨	Cable to the line filter	Depending on conditions in the installation (type of cable installation and ambient temperature) and the local regulations with reference to the total rated input currents.

Figure 3-10 Converters with AC coupling and DC link coupling

Note that for the cables for the line connection ⑤ and for coupling the DC links ⑥, only the specified cable types are permissible to achieve degree of protection IP20 and ensure reliable contacting.

The cables for the AC coupling ⑤ of a drive line-up must be loaded with no more than 65 A due to the plug-in connector. Calculate the permissible current-carrying capacity of the cables in accordance with the local installation standards and make sure that the total of the rated input currents of all devices that are connected to a common AC coupling does not exceed the calculated current-carrying capacity of the cables or the optional radio interference suppression filter.

Example of a calculation according to IEC 60364-5-52:

- Cross-section: 16 mm^2
- Insulating material: PVC
- No. of loaded conductors: 3
- Type of cable installation: E
- Ambient temperature: 50 °C
- Current carrying capacity: 56.8 A

Ambient temperature [°C]	Max. current at 70 °C cables [A]	Max. current at 90 °C cables [A]
40	65.0	65.0
45	63.2	65.0
50	56.8	65.0

For end use in the USA or Canada, the relevant national standards that apply there must be observed in installations.

The common protective device must disconnect the power supply of the drive line-up in the event of a fault without thermally overloading the AC coupling.

For suitable protective elements, see the product information "Protective Devices for SINAMICS S210 (https://support.industry.siemens.com/cs/ww/en/view/109748999)".

The selection of the protective device can be as follows with estimation:

- Calculate the input current of group I_{L_group} as the total of the rated input currents (see section "Specific data of the converter with 3 AC line connection (Page 415)").
- The input current of group I_{L_group} must be less than the current-carrying capacity I_Z of the AC coupling
- The rated current I_N of the protective device should be 25 % greater than the previously calculated input current of the group, but must not exceed the maximum permissible rated current of the largest protective element according to "Protective Devices for SINAMICS S210".

3.3 Configuring the motor

3.3.1 Configuration sequence

Motion Control

Drives are optimized for motion control applications. They execute linear or rotary movements within a defined movement cycle. All movements should be optimized in terms of time.

As a result, drives must meet the following requirements:

- High dynamic response, i.e. short rise times
- Capable of overload, i.e. a high reserve for accelerating
- Wide control range, i.e. high resolution for precise positioning.

The following table "Configuring procedure" is valid for synchronous and induction motors.

General configuring procedure

The function description of the machine provides the basis for configuration. The components are selected according to physical interdependencies and the selection process is usually carried out in the following sequence of steps:

Table 3-1 Configuration sequence

step	Description of the configuring activity	
1.	Clarify the drive type	See the next section
2.	Define the constraints and incorporate them into the automation system	
3.	Define the load case, calculate the maximum load torque and determine the motor	
4.	Define the converter required	See catalog
5.	Repeat steps 3 and 4 for additional axes	
6.	Determine line-side power options (main switch, fuses, line filters, etc.)	
7.	Define other system components (e.g. braking resistors)	
8.	Calculate the current demand of the components for the 24 V DC power supply - and specify the power supplies (SITOP devices, Control Supply Modules)	
9.	Determine the connection system components	
10.	Configure the drive line-up components	
11.	Calculate the required cable cross sections for power supply and motor connections	
12.	Inclusion of mandatory installation clearances	

Observe also the recommended combinations of converters and motors with the associated connecting cables in the section "Motor-converter combinations (Page 37)".

3.3.2 Clarify the drive type

Select the motor on the basis of the required torque (load torque), which is defined by the application, e.g. traveling drives, hoisting drives, test stands, centrifuges, paper and rolling mill drives, feed drives or main spindle drives.

Gearboxes to convert motion or to adapt the motor speed and motor torque to the load conditions must also be taken into account when selecting the motor.

You must know the following mechanical data in order to determine the torque to be supplied by the motor:

- The load torque specified by the application
- Masses to be moved
- Diameter of the drive wheel
- Leadscrew pitch, gear ratios
- Frictional resistance data
- Mechanical efficiency
- Traversing distances
- Maximum velocity
- Maximum acceleration and maximum deceleration
- Cycle time

3.3.3 Define the boundary conditions and incorporate them into the automation system

Take the following into account during the confguration:

- The line system configuration when using specific motor types and/or line filters
- Rated values of the motor
- The ambient temperatures and the installation altitude of the motors and drive components
- Heat dissipation from the motors

Other conditions apply when integrating the drives into an automation environment such as SIMATIC or SIMOTION.

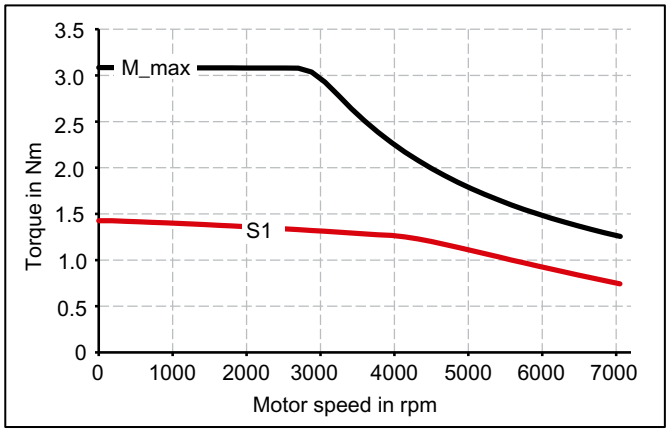
For motion control and technology functions (e.g. positioning), as well as for synchronous operation functions, the corresponding automation system, e.g. SIMATIC S7-1500 or SIMOTION D is used.

3.3.4 Define the load case, calculate the maximum load torque and determine the motor

The motors are defined bases on the motor type-specific limiting characteristic curves.

The limiting characteristic curves describe the torque or power curve over the speed.

The limiting characteristic curves take the limits of the motor into account on the basis of the DC-link voltage. The DC-link voltage is dependent on the line voltage.



M_max	Curve of the maximum torque
S1	S1 characteristic

Figure 3-11 Limit characteristics for synchronous motors

Procedure

1. Determine the load which is specified by the application.
   Use different characteristics for the different loads.
   The following operating scenarios have been defined:
   - Duty cycle with constant ON duration
   - Free duty cycle
2. Determine the characteristic torque and speed operating points of the motor for the defined load.
3. Calculate the acceleration torque of the motor.
   Add the load torque and the acceleration torque. to obtain the maximum required torque.
4. Verify the maximum motor torque with the limiting characteristic curves of the motors.
   The following criteria must be taken into account when selecting the motor:
   - Compliance with the dynamic limits
     All torque-speed points of the load must be below the relevant limiting characteristic curve.
   - Compliance with the thermal limits
     At average speed, the effective motor torque must be below the S1 characteristic (continuous operation) during the load.

You have specified a motor.

Duty cycles with constant ON duration

For duty cycles with constant ON duration, there are specific requirements for the torque characteristic curve as a function of the speed, for example:

M = constant, M ~ n^2, M ~ n or P = constant.

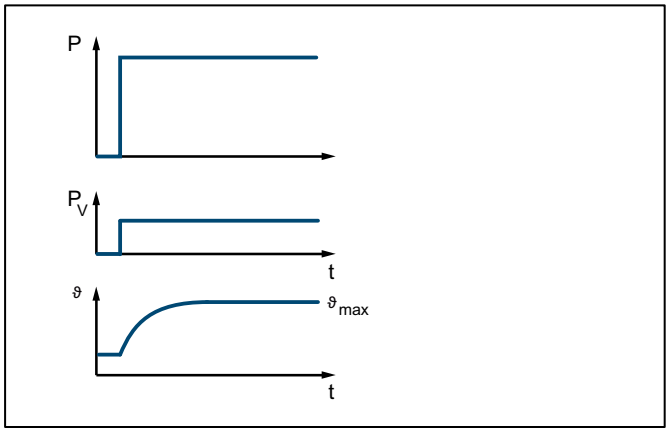
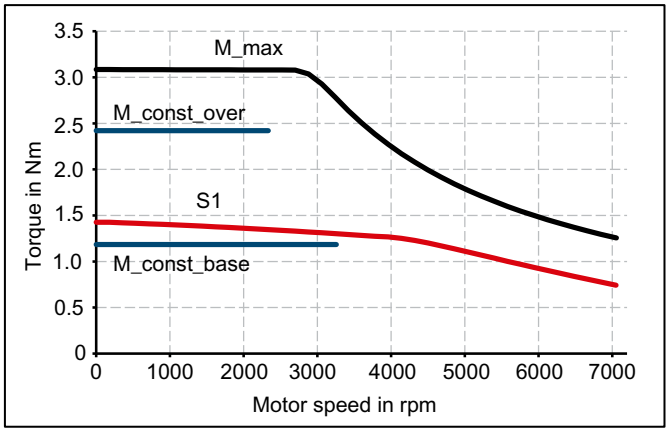


Figure 3-12 S1 duty (continuous operation)

The drives with this load cycle typically operate at a stationary operating point.

Procedure

1. Configure a base load for the stationary operating point. The base load torque must lie below the S1 characteristic.
2. In the event of transient overloads (e.g. during acceleration), configure an overload. Calculate the overload current in relation to the required overload torque. The overload torque must lie below the M_max characteristic.
   In summary, the motor is configured as follows:



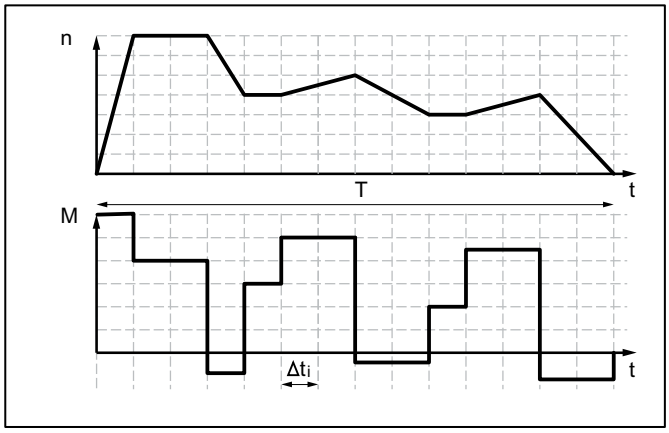
M_max	Curve of the maximum torque	M_const_over	Curve of the overload torque
S1	S1 characteristic	M_const_base	Curve of the base load torque

Figure 3-13 Motor selection for a duty cycle with constant switch-on duration

3. Select a motor that satisfies the requirements of S1 duty.

Free duty cycle

A free duty cycle defines the curve of the motor speed and the torque over time.



n	Speed	T	Cycle time
M	Torque	Δt_i	Time interval
t	Time		

Figure 3-14 Example of free duty cycle

Procedure

Determine the required motor torque as follows:

- Define a load torque for each time slice. Also take the average load moment of inertia and motor moment of inertia into account for acceleration operations. If required, take a frictional torque into account that opposes the direction of motion.
- With mounted gearbox:
  Determine the load torque and the acceleration torque that must be supplied by the motor. Take the gear ratio and gear efficiency into account.

Note

A higher gear ratio increases positioning accuracy in terms of encoder resolution. For any given encoder resolution, as the gear ratio increases, so does the resolution of the machine position to be detected.

The following formulas can be used for duty cycles outside the field weakening range.

For the motor torque in a time slice Δt_i the following applies:

$$M_{Mot,\,i} = (J_M + J_G) \bullet \frac{2\pi}{60} \bullet \frac{\Delta n_{Last,\,i}}{\Delta t_i} \bullet i + \left(J_{Last} \bullet \frac{2\pi}{60} \bullet \frac{\Delta n_{Last,\,i}}{\Delta t_i} + M_{Last,\,i} + M_R\right) \bullet \frac{1}{i \bullet \eta_G}$$

The motor speed is:

$$n_{Mot,\,i} = n_{Last,\,i} \bullet i$$

The effective torque is obtained as follows:

$$M_{Mot,\,eff} = \sqrt{\frac{\sum M_{Mot,\,i}^2 \cdot \Delta t_i}{T}}$$

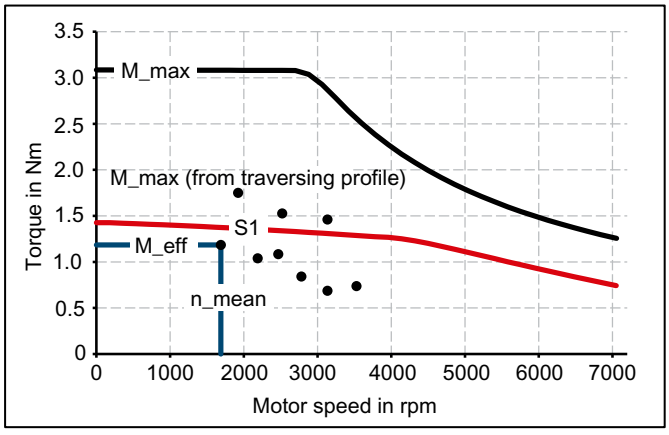
The average motor speed is calculated as follows:

$$n_{Mot,\,mittel} = \frac{\sum \frac{n_{Mot,\,i,\,A} + n_{Mot,\,i,\,E}}{2} \cdot \Delta t_i}{T}$$

J_M	Motor moment of inertia
J_G	Gearbox moment of inertia
J_{load}	Load moment of inertia
n_{load}	Load speed
i	Gear ratio
η_G	Gearbox efficiency
M_{load}	Load torque
M_R	Frictional torque
T	Cycle time
A; E	Initial value, final value in time slice Δt_i
t_e	ON duration
Δt_i	Time interval

The effective torque M_{eff} must lie below the S1 characteristic.

The maximum torque M_{max} is produced during the acceleration operation. M_{max} must lie below the voltage limiting characteristic curve. In summary, the motor is configured as follows:



M_max	Curve of the maximum torque	S1	S1 characteristic = M_0
M_eff	Effective torque	●	Points from the traversing profile
n_mean	Mean speed		

Figure 3-15 Motor selection for duty cycle

You have defined the characteristic motor values corresponding to the duty cycle.

Defining the motor

By varying, you can find the motor that satisfies the conditions of the operating mode (duty cycle).

- Determine the motor current at base load. The calculation depends on the type of motor (synchronous motor or induction motor) and the operating mode (duty cycle) used.

  Note

  When configuring according to duty cycle with constant ON duration with overload, the overload current is calculated in relation to the required overload torque.

- Comply with the thermal limits of the motor.
- Configure the other properties of the motor through the available motor options.

3.4 Configuring the braking resistor

Note

Operating the converter on 3 AC 200 V ... 240 V line supplies

Use an external, intrinsically safe braking resistor to ensure safe and reliable converter operation.

The use of the internal braking resistor on a 3 AC 200 V ... 240 V line supply is not permissible, see Section "Connecting options for converters with 3 AC line connection (Page 59)".

The converter has a Braking Module that converts regenerative energy of the servomotor into heat via an integrated braking resistor. Regenerative energy is produced, for example, when braking the connected mechanical system.

If the motor feeds back more energy than can be dissipated by the braking resistor, then the converter shuts down with fault F30002 (DC link overvoltage). In this case, you will require an external braking resistor.

If you are familiar with your system's moments of inertia in relation to the motor shaft, calculate the generated braking energy using the formula in the section "Calculating the braking energy (Page 72)".

Table 3-2 Values of the integrated braking resistor in relation to the shaft of the servomotor

Article number	Rated power in kW	Continuous braking power in W	Peak power in kW	Braking energy in kJ
Converter with line connection 200 V ... 240 V 1 AC				
6SL3210-5HB10-1UF0	0.1	5	0.35	0.01
6SL3210-5HB10-2UF0	0.2	10	0.6	0.15
6SL3210-5HB10-4UF0	0.4	20	1.3	0.325
6SL3210-5HB10-8UF0	0.75	40	2.4	0.60
Converter with line connection 3 AC 380 V ... 480 V				
6SL3210-5HE10-4UF0	0.4	50	1.2	0.30
6SL3210-5HE10-8UF0	0.75	50	2.4	0.30
6SL3210-5HE11-0UF0	1.0	50	3.0	0.30
6SL3210-5HE11-5UF0	1.5	100	5.7	0.60
6SL3210-5HE12-0UF0	2.0	100	6.0	0.60
6SL3210-5HE13-5UF0	3.5	325	15.0	1.95
6SL3210-5HE15-0UF0	5.0	325	19.0	1.95
6SL3210-5HE17-0UF0	7.0	325	19.5	1.95

Internal braking resistors for connection to 200 ... 240 V 3 AC

For operation with a supply voltage of 3 AC 200 V to 240 V, an external, intrinsically safe braking resistor is always required for each device. Use of braking resistors integrated in the device is not permissible with this supply voltage. For further information, see section "Requirements placed on the external braking resistor (Page 73)".

3.4.1 Calculating the braking energy

To find out whether you require an external braking resistor, calculate the braking energy according to the following formula:

$$W = \frac{1}{2} (J_{mot} + J) \frac{4\pi^2}{3600} (n_1^2 - n_2^2)$$

W / J	Braking energy
J_{mot} / kgm^2	Moment of inertia of the servo motor • "High Dynamic" • "Compact"
J / kgm^2	Moment of inertia of the driven mechanical system in relation to the shaft of the servomotor
n_1 / rpm	Initial speed
n_2 / rpm	Speed after braking

Note

As the friction is not taken into account in the above formula, less energy is fed back to the servo drive system in practice than that calculated in the formula.

Example

Servomotor with low moment of inertia, power 0.75 kW

Moment of inertia of the servomotor 1FK2104-5AK1... $J_{mot} = 0.65 \times 10^{-4}$ kgm^2

Moment of inertia of the driven mechanical system $J = 4 \times 10^{-4}$ kgm^2

$n_1 = 3000$ rpm $n_2 = 600$ rpm

$\Rightarrow W = 22.03$ J (1 J = 1 Ws)

The braking energy that can be absorbed by the integrated braking resistor (1640 J) is higher than the actual braking energy (22.03 J). In this case, therefore, no external braking resistor is required.

3.4.2 Requirements placed on the external braking resistor

⚠ WARNING

Risk of fire caused by continuous overload

If the external braking resistor is continuously overloaded, for example as the result of a defective Braking Module, an explosion or fire could occur. This can result in severe injury or death and/or the enclosure could melt.

- Use only braking resistors that are intrinsically safe.
- Use only a braking resistor with temperature monitoring and connect it to DI4 of the converter.

NOTICE

Damage to the converter due to its maximum load being exceeded

If the maximum permissible continuous power, peak power or braking energy is exceeded, the converter may be damaged.

- Only ever operate the converter within its maximum permissible working range.

Load cycles for braking resistors

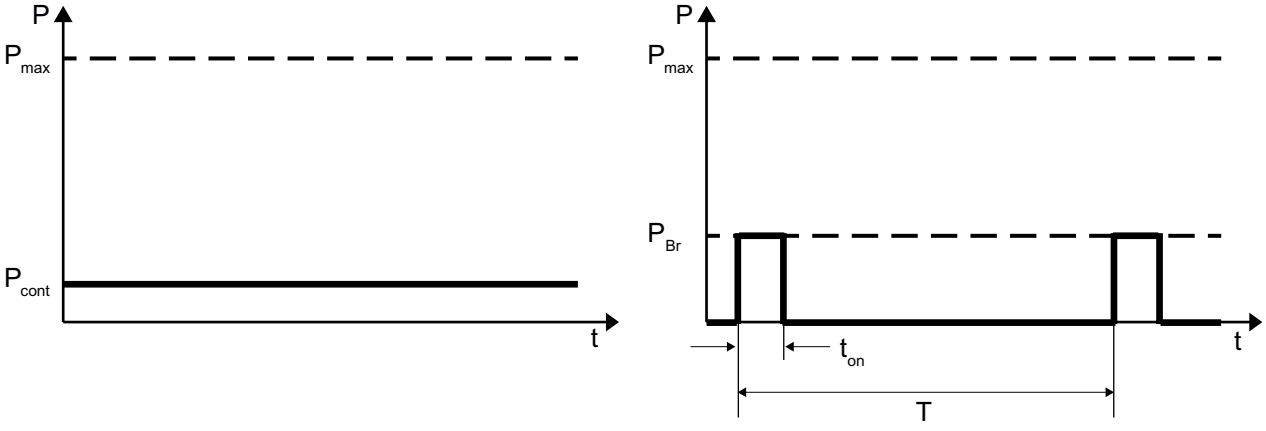


Figure 3-16 Peak power, continuous power and duty cycle of the braking resistor

$P_{Br} \leq P_{max}$
$E_{Br} = P_{Br} \cdot t_{on}$
$E_{Br} \leq E_{max}$
$T \geq E_{Br} / P_{cont}$

P_{max} [kW]: Maximum peak power
P_{cont} [kW]: Maximum continuous power
P_{Br} [kW]: Application-specific braking power
E_{max} [kJ]: Maximum braking energy
E_{Br} [kJ]: Application-specific braking energy
t_{on} [s]: Braking duration
T [s]: Cycle duration

The following should be observed:

- The braking power required in the application must not exceed the maximum peak power (according to the tables).
- The required braking energy results from the product of the required braking power and the duty cycle (integral of the braking power over time).
- The required braking energy must not exceed the maximum braking energy (according to the tables).
- The average braking power (arithmetic mean of the braking cycle) must not exceed the maximum continuous power (according to the tables).

Table 3-3 Resistance data for a maximum external braking resistor

Converter		Braking resistor			
Article number	**Rated power in kW**	**Minimum resistance in Ω**	**Maximum continuous power in W**	**Maximum peak power in W**	**Maximum braking energy in kJ**
Line voltage 200 ... 240 V 1 AC					
6SL3210-5HB10-1UF0	0.1	300	50	350	0.7
6SL3210-5HB10-2UF0	0.2	150	100	600	1.3
6SL3210-5HB10-4UF0	0.4	100	200	1300	2.3
6SL3210-5HB10-8UF0	0.75	50	380	2400	3.8
Line voltage 3 AC 200 ... 240 V					
6SL3210-5HE10-4UF0	0.4	100	200	600	1
6SL3210-5HE10-8UF0	0.75	100	380	1200	1
6SL3210-5HE11-0UF0	1.0	100	500	1700	1
6SL3210-5HE11-5UF0	1.5	50	880	2900	20
6SL3210-5HE12-0UF0	2.0	50	1000	3800	20
6SL3210-5HE13-5UF0	3.5	15	1750	7500	25
6SL3210-5HE15-0UF0	5.0	15	2500	9500	25
6SL3210-5HE17-0UF0	7.0	15	3250	12500	25
Line voltage 3 AC 380 ... 480 V					
6SL3210-5HE10-4UF0	0.4	200	200	1200	8
6SL3210-5HE10-8UF0	0.75	200	380	2400	8
6SL3210-5HE11-0UF0	1.0	200	500	3400	8
6SL3210-5HE11-5UF0	1.5	100	880	5700	80
6SL3210-5HE12-0UF0	2.0	100	1000	7600	80
6SL3210-5HE13-5UF0	3.5	30	1750	15000	100
6SL3210-5HE15-0UF0	5.0	30	2500	19000	100
6SL3210-5HE17-0UF0	7.0	30	3250	25000	100

Table 3-4 Examples of suitable braking resistors from a third-party supplier

Converter		Braking resistor, Michael Koch GmbH				
Article number	**Rated power in kW**	**Order designation with temperature sensor 190 °C**	**Continuous power in W for CE**	**Continuous power in W for UL**	**Maximum peak power in W**	**Maximum braking energy in kJ**
Line voltage 200 ... 240 V 1 AC						
6SL3210-5HB10-1UF0	0.1	BWG250047TS-190	50	50	350	0.7
6SL3210-5HB10-2UF0	0.2	BWG250047TS-190	100	100	600	1.1
6SL3210-5HB10-4UF0	0.4	BWG250047TS-190	100	100	1300	1.8
6SL3210-5HB10-8UF0	0.75	BWG500027TS-190	200	200	2400	2.7
Line voltage 3 AC 200 ... 240 V						
6SL3210-5HE10-4UF0	0.4	BWG500027TS-190	200	200	600	0.9
6SL3210-5HE10-8UF0	0.75	BWG600014TS-190	380	240	1200	0.8
6SL3210-5HE11-0UF0	1.0	BWG600014TS-190	400	240	1700	0.8
6SL3210-5HE11-5UF0	1.5	BWD500027K03LIP65IS	600	600	2900	14.5
6SL3210-5HE12-0UF0	2.0	BWD500027K03LIP65IS	600	600	3800	13.9
6SL3210-5HE13-5UF0	3.5	BWD600014K03LIP65IS	1200	720	7500	18.7
6SL3210-5HE15-0UF0	5.0	BWD600014K03LIP65IS	1200	720	9500	17.8
6SL3210-5HE17-0UF0	7.0	BWD600014K03LIP65IS	1200	720	12500	18.2
Line voltage 3 AC 380 ... 480 V						
6SL3210-5HE10-4UF0	0.4	BWG500100TS-190	200	200	1200	5.2
6SL3210-5HE10-8UF0	0.75	BWG600047TS-190	380	240	2400	6.2
6SL3210-5HE11-0UF0	1.0	BWG600047TS-190	400	240	3400	6.1
6SL3210-5HE11-5UF0	1.5	BWD500100K03LIP65IS	600	600	5700	30.4
6SL3210-5HE12-0UF0	2.0	BWD500100K03LIP65IS	600	600	7600	30.4
6SL3210-5HE13-5UF0	3.5	BWD600047K03LIP65IS	1200	720	15000	50.0
6SL3210-5HE15-0UF0	5.0	BWD600047K03LIP65IS	1200	720	19000	47.5
6SL3210-5HE17-0UF0	7.0	BWD600047K03LIP65IS	1200	720	25000	41.7

External braking resistors for 3 AC 200 ... 240 V

For operation with a supply voltage of 3 AC 200 V to 240 V, an external, intrinsically safe braking resistor is always required for each device. Use of braking resistors integrated in the device is not permissible with this supply voltage.

We recommend the following resistors as a substitute for the internal braking resistors. If these are not sufficient, you can use the resistors stated in the tables above (3 AC 200 ... 240 V).

- For FSA and FSB devices — GXK:BWG250047TS-190
100 W, 47 ohm
- For FSC devices — GXK:BWG600014TS-190[1)]
240 W, 14 ohm

[1)] For UL, the resistor has only a 240 W braking power. According to CE, 400 W braking power is also possible.

The resistors have approvals for the North American market (cURus and CSA).

The temperature sensor of the resistor can by connected at input DI4 on the converter for temperature monitoring. This switches the converter off when the braking resistor is overloaded.

Table 3-5 Converter with line connection 3 AC 200 V ... 240 V

Article number	Rated power in kW	Order designation with temperature sensor 190 °C	Continuous braking power in W	Peak power in W	Braking energy in kJ
6SL3210-5HE10-4UF0	0.4	GXK:BWG250047TS-190	100	600	0.6
6SL3210-5HE10-8UF0	0.75	GXK:BWG250047TS-190	100	1200	1.0
6SL3210-5HE11-0UF0	1.0	GXK:BWG250047TS-190	100	1700	1.0
6SL3210-5HE11-5UF0	1.5	GXK:BWG250047TS-190	100	2900	1.7
6SL3210-5HE12-0UF0	2.0	GXK:BWG250047TS-190	100	3200	2.0
6SL3210-5HE13-5UF0	3.5	GXK:BWG600014TS-190	240[1)]	7500	5.4
6SL3210-5HE15-0UF0	5.0	GXK:BWG600014TS-190	240[1)]	9500	6.5
6SL3210-5HE17-0UF0	7.0	GXK:BWG600014TS-190	240[1)]	11000	6.7

[1)] For UL, the resistor has only a 240 W braking power. According to CE, 400 W braking power is also possible.

3.4.3 Connecting an external braking resistor

Connecting an external braking resistor

Use shielded cables to connect power to the external braking resistor.

How to connect the external braking resistor and the temperature monitoring is described in the sections:

- For converters with 1 AC line connection: "Connecting a 1 AC braking resistor (Page 170)"
- For converters with 3 AC line connection: "Connecting a 3 AC braking resistor (Page 178)"

Setting the temperature monitoring of the external braking resistor

If you have connected the external braking resistor with motor temperature monitoring, you must activate the temperature monitoring via the web server of the converter.

- "Connecting the digital input (Page 178)"
- "Configuring digital inputs (Page 212)"

Activate the DI4 digital input "Temperature monitoring of the external braking resistor".

The converter switches the motor off as soon as the external braking resistor is too hot or when no external braking resistor is connected (wire break).

F7860 power unit: Thermal overload of external braking resistor

Cause: The external braking resistor is thermally overloaded. Its use is therefore disabled.

Note: The monitoring of the external braking resistor configured via DI4 of X130 has tripped.

3.5 DC link coupling

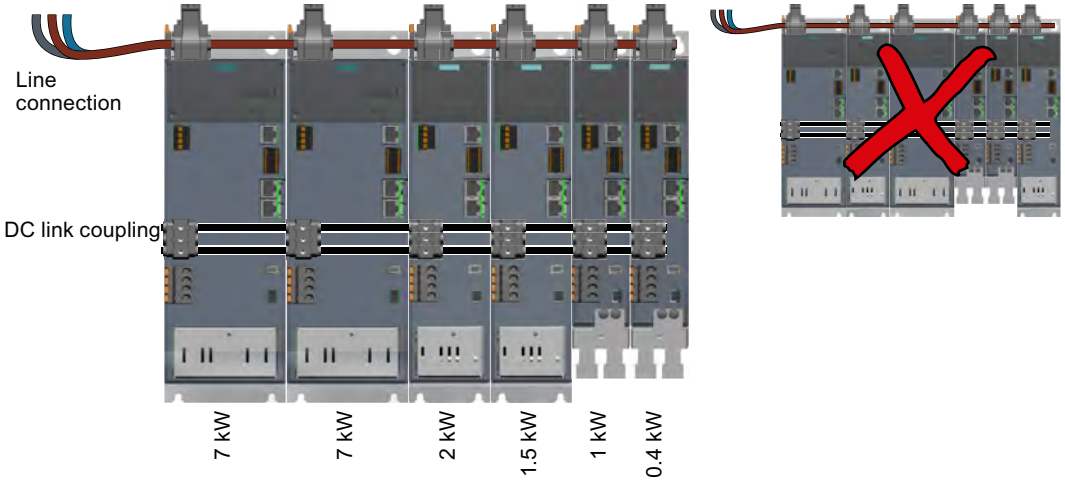
DC link coupling for converters with 3 AC 400 V line connection

Using connector X3 you can connect the DC links of up to six converters with one another.

With the DC link coupling, energy recovered by drives operating in the generating mode does not have to be converted into heat via the braking resistor, but is instead used by drives operating in the motoring mode.

Prerequisites and conditions for the DC link coupling

- It is permissible to couple the DC links of converters with different power ratings.
- The converters must be mounted with decreasing power ratings starting from the line supply infeed.



- The AC coupling for up to six converters is permissible even if they are not operated in a common DC link group.
- The coupled converters must be housed in the same control cabinet.
- Only a 1-row setup is permissible. It is not possible to distribute the coupled converters over 2 or more rows.

Note

- For a DC link coupling, line connection via the standard connector is not permissible.
- Feeding in DC power directly at the DC link is not permissible!

Procedure to establish the DC link coupling

1. Mount the converters, without any intermediate spaces, with decreasing power ratings starting from the line supply infeed.
   If an EMC filter is used, the power must be fed in from the left-hand side because of the connection method used.
2. Establishing the AC and DC link coupling:
   Use the connectors and cables that are described in the following section:
   – "Establishing the AC and DC link coupling (Page 176)"
   – "Connectors and cables for the AC and DC link coupling (Page 436)"

Additional external braking resistors for the DC link coupling

The entire braking power of all converters coupled in a group is always available for braking.

If you require an external braking resistor for your system in spite of a DC link coupling, then you must connect this to the converter with the highest power rating. You can find additional information in section:

- "Configuring the braking resistor (Page 71)"

Special features for converters with a 3 AC 200 V ... 240 V line connection

- The DC link coupling is only permissible for converters of the same size. Otherwise, the above mentioned points apply.
- In the case of connection to 3 AC 200 V ... 240 V line supplies, also refer to the section: "Connecting options for converters with 3 AC line connection (Page 59)"
- For operation with a supply voltage of 3 AC 200 V to 240 V, an external, intrinsically safe braking resistor is always required for each device. Use of braking resistors integrated in the device is not permissible with this supply voltage. For more details, see section "Requirements placed on the external braking resistor (Page 73)".

3.6 Vertical axis

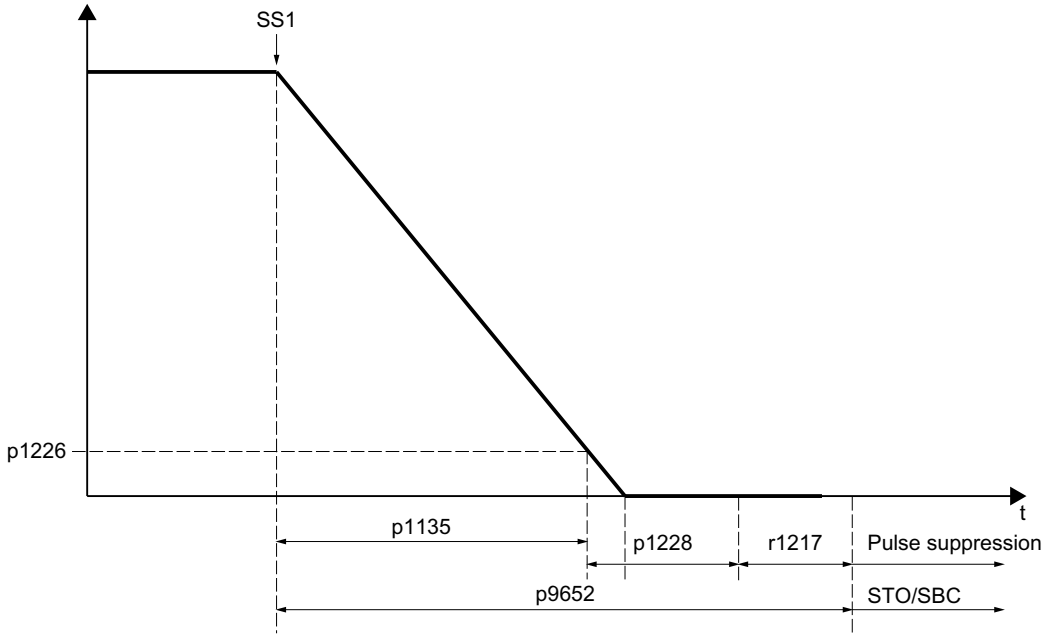
If you use a vertical axis, please pay attention to the following notes:

- Vertical axes in combination with STO/SS1 (Page 80)
- Electronic weight counterbalance for a vertical axis (Page 81)

3.6.1 Vertical axes in combination with STO/SS1

If you use the Safety functions SS1 or STO with a vertical axis, you must consider the following condition in the parameterization to ensure that the axis does not drop after the transition to STO:

p9652 > p1135 + p1228 + r1217



p1135[0]	OFF3 ramp-down time
r1217	Motor holding brake application time
p1226[0]	Speed threshold for standstill detection
p1228	Pulse suppression delay time
p9652	SI SS1 delay time

Behavior

- The drive brakes the motor due to immediate setting of n_set = 0 along the OFF3 ramp down (p1135).
- After detection of standstill, the drive applies the motor holding brake.
- At the end of the holding brake application time (r1217), the drive cancels the pulses.

- Standstill is detected when the actual speed value is less than the speed threshold (p1226) or when the monitoring time (p1227) that started when speed setpoint ≤ speed threshold (p1226) has expired.
- The drive activates Switching On Inhibited.

3.6.2 Electronic weight counterbalance for a vertical axis

Overview

With a vertical axis without mechanical weight compensation, you can set an electronic weight compensation.

Procedure

Proceed as follows to set the electronic counterweight:

1. Make a note of the necessary offset value when the axis is at standstill:
   r0031 (actual torque smoothed)
2. Set the value from r0031 in p1532 (torque limit offset).
3. Save the change.
4. To prevent the axis from dropping after the brake is released, specify the torque offset as an additional torque setpoint (M_ADD) via the supplementary telegram 750.
   The supplementary telegram 750 must be configured in the PLC.
   As a result, the holding torque is specified when the brake is released.

Note

Due to the specified supplementary torque setpoint via the controller, a switchover of the supplementary torque is also possible. Thus, when the load is lifted, you can specify a supplementary torque that is different from the supplementary torque for movement without a load.

You can find more information on supplementary telegram 750 in section "Supplementary telegrams (Page 663)".

3.7 Application examples

You can find SINAMICS application examples on the Internet page "SINAMICS application examples".

1. Call the following site in your Internet browser:
   SINAMICS application examples (https://www.automation.siemens.com/mc-app/sinamics-application-examples/Home/Index?language=en)
2. Select the required filter in the search mask.
   Example:

   The result list is updated every time a filter setting is specified.

Application	DriveType	DriveFunction	Control	EngineeringEnvironment	Communication	Speciality
> SINAMICS S: Safety-control of a S120 using S7-300/400 (STEP 7 V5) with PROFIBUS and Safety Integrated (via PROFIsafe)	S120	Safety-control	S7-300/400	STEP 7 V5	PROFIBUS	Safety Integrated
> SINAMICS S: Safety-control of a S120 using S7-300/400 (STEP 7 V5) with PROFIBUS and Safety Integrated (via TM54F)	S120	Safety-control	S7-300/400	STEP 7 V5	PROFIBUS	Safety Integrated
> SINAMICS S: Safety-control of a S120 using S7-300/400 (STEP 7 V5) with PROFINET (Shared Device) and Safety Integrated (via PROFIsafe)	S120	Safety-control	S7-300/400	STEP 7 V5	PROFIBUS PROFINET	Safety Integrated

   You reset individual filters by clicking the X to the right of the filter. You reset all filters simultaneously by clicking the "Reset filters" button.

3.8 Establishing communication of the converter with the controller

To ensure that communication between the PLC and converter is possible, configure the converter or converters in the PLC, and activate the topology-based initialization. When powering up, the converter takes the PROFINET device name as well as the IP address from the PLC.

The converter also imports the telegram settings from the PLC.

The converter supports a standard telegram with 2 supplementary telegrams and a PROFIsafe telegram.

The following telegrams are possible:

- Standard telegrams
  - Telegram 3
  - Telegram 5
  - Telegram 102
  - Telegram 105

  The telegrams are suitable for IRT communication.
  Telegrams 3 and 102 are also suitable for RT communication.
  IRT communication is mandatory for telegrams 5 and 105.
- Supplementary telegrams
  - Telegram 700
  - Telegram 701
  - Telegram 750
- PROFIsafe telegrams
  - Telegram 30 (recommended for Safety Integrated Basic Functions)
  - Telegram 901 (recommended for Safety Integrated Extended Functions)

For further information about telegrams

- Communication telegrams (Page 661)

3.9 Functions that require a license

You require a memory card with a license key for function packages that require a license.

The function packages requiring a license are released by inserting the memory card with the license key into a converter. The function packages are no longer released if the card is removed from the converter.

A "Certificate of License" (abbreviated, CoL) belongs to each license key as proof that you own the license.

Properties of the license key

- The license key is permanently assigned to a memory card.
- A license key cannot be transferred

Assigning a license key to a memory card

The license key can only be assigned to a SINAMICS memory card:

- Memory cards (Page 435)

You have the following options of assigning a license key to a memory card:

- You order a license together with a memory card.
  You receive a memory card with the license key and a Certificate of License.
- Proceed as follows if your converter works with a memory card that you wish to assign a license to:
  - You purchase a Certificate of License.
  - With the Certificate of License, you generate a license key using the "WEB License Manager":
    WEB License Manager (http://www.siemens.com/automation/license)
  - Assign the license key to the memory card:
    Using functions that require a license (Page 249)

Note

Refer to your ordering documentation (e.g. catalogs) for information on basic functions and functions that require a license.

The licenses are saved to folder "KEYS" on the memory card.

Safety functions integrated in the drive

4

In comparison to standard drive functions, safety functions (Safety Integrated) have an especially low error rate. Performance Level (PL) and Safety Integrity Level (SIL) of the corresponding standards are a measure of the error rate.

As a consequence, the safety functions are suitable for use in safety-related applications to minimize risk. An application is safety-related if the risk analysis of the machine or the system indicates a special hazard potential in the application.

Safety Integrated ("drive-integrated") means that the safety functions are integrated in the drive and can be executed without requiring additional external components.

Conformity

The safety functions are in conformance with:

- Safety Integrity Level (SIL) 2 according to DIN EN 61508
- Category 3 according to DIN EN ISO 13849-1
- Performance level (PL) d according to DIN EN ISO 13849-1

The safety functions correspond to the functions according to DIN EN 61800-5-2.

PFH values

The probability of failure of safety functions must be specified in the form of a PFH value (Probability of Failure per Hour) according to IEC 61508, IEC 62061 and DIN EN ISO 13849-1. The PFH value of a safety function depends on the safety concept of the drive unit and its hardware configuration, as well as on the PFH values of other components used for this safety function.

- The PFH values of the SINAMICS S210 can be found at:
  PFH values (https://support.industry.siemens.com/cs/ww/en/view/76254308)
- The PFH values of all Safety components from Siemens are available in the "Safety Evaluation Tool"; see:
  Safety Evaluation Tool (http://www.industry.siemens.com/topics/global/en/safety-integrated/machine-safety/safety-evaluation-tool/Pages/default.aspx)

4.1 Basic Functions

These functions are part of the standard scope of the drive and can be used without requiring an additional license. The Basic Functions comprise the following functions:

- Safe Torque Off (STO)
- Safe Brake Control (SBC)
- Safe Stop 1 time-controlled (SS1-t)

Functions STO and SS1-t are selected via the F-PLC and/or via the failsafe digital input.

- "Safety settings in the web server (Page 218)"
- "Safety settings in Startdrive (Page 282)"

In order to select the functions via the F-PLC, communication via PROFIsafe must be configured in the F-PLC and in the drive.

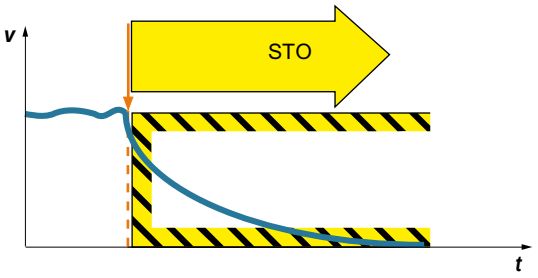
You can find details on the settings in the following sections:

- "Configuring safety functions (Page 128)"
- "Establishing communication of the converter with the controller (Page 83)"

The safety functions are executed with a safety monitoring cycle of 4 ms.

4.1.1 Safe Torque Off (STO)

Overview



Safe Torque Off (STO) is a safety function that immediately ensures that torque or force-generating energy is not fed to the motor. This function corresponds to stop category 0 to EN 60204-1.

If the motor is still rotating when STO is selected, then it coasts down to standstill.

Functional features

The switching on inhibited prevents an automatic restart after deselection of STO and therefore satisfies the requirements of EN 60204-1. Consequently, the STO function prevents an electrically-driven machine component from restarting.

Note

There is no galvanic isolation between motor and drive.

You can select the STO function via PROFIsafe and/or the Failsafe Digital Input (F-DI).

Applications

Applications include all machines and systems with moving axes (e.g. conveyor technology, handling).

STO is suitable for applications where the motor is already at a standstill or will come to a standstill in a short, safe period of time as a result of friction.

STO allows you to work safely on the machine with the protective door open. A classic Emergency Stop with electromechanical isolation is not required. The drive remains connected to the line and can be fully diagnosed.

Note

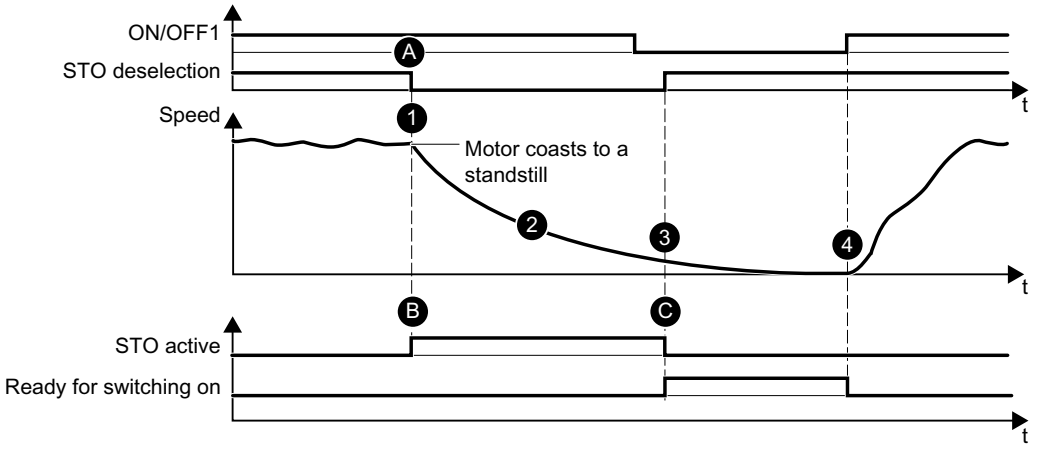
The distinction between Emergency Off and Emergency Stop

"Emergency Off" and "Emergency Stop" are commands that minimize different risks in the machine or plant.

The STO function is suitable for implementing an Emergency Stop - but not an Emergency Off.

You can find details on the distinction between Emergency Off and Emergency Stop in the section "What is the difference between the Emergency Off and Emergency Stop functions? (Page 700)".

Flow diagram



Behavior	
1	• During operation, STO is selected via PROFIsafe and/or F-DI.
2	• After the response time, the drive immediately initiates safe pulse suppression. This safely interrupts the torque-generating energy fed to the motor. • The motor coasts down to a standstill. • STO safely prevents the motor restarting.
3	• STO is deactivated by the drive with (manual or automatic program-controlled) deselection. • The drive is again "ready for switching on".
4	• You restart the drive with a positive signal edge at ON/OFF1.

Settings	
A	• STO is selected via the control bit of the selected PROFIsafe telegram or via the F-DI.
B	• The "STO_active" status is signaled in the status bit of the PROFIsafe telegram. This value can be applied in the higher-level controller.
C	• The Safety error is acknowledged with selection/deselection of the STO function. You can find additional information in section "Faults (Page 323)".

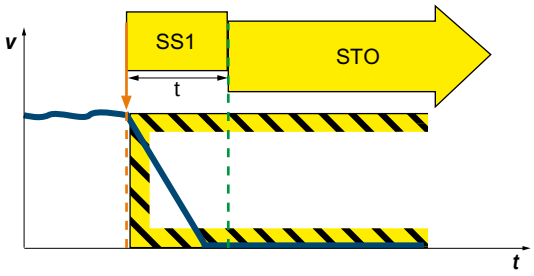
Selecting/deselecting "Safe Torque Off"

If "Safe Torque Off" is selected, the motor holding brake is closed (if connected and configured).

Deselecting "Safe Torque Off" represents an internal safety acknowledgment. You can find additional information in section "Responses to safety faults and alarms (Page 129)".

4.1.2 Safe Stop 1 (SS1, time-controlled)

Overview



The "Safe Stop 1" function (SS1, time-controlled) causes a drive-autonomous deceleration of the motor and initiates the "Safe Torque Off" (STO) function after a predefined time interval has elapsed. This function corresponds to stop category 1 to EN 60204-1.

Functional features

The Safety Integrated Basic Function "Safe Stop 1" is available in the following versions:

- SS1 with OFF3 (SS1-t according to IEC 61800-5-2)
- SS1 with external stop (SS1E-t)

Set the SS1 response for Safety commissioning in the "Parameterization" step.

Applications

SS1 can be applied in the following cases:

- The load torque cannot reduce the motor to a standstill through friction within a sufficiently short time.
- Coasting down of the drive (STO) will pose risks to safety.

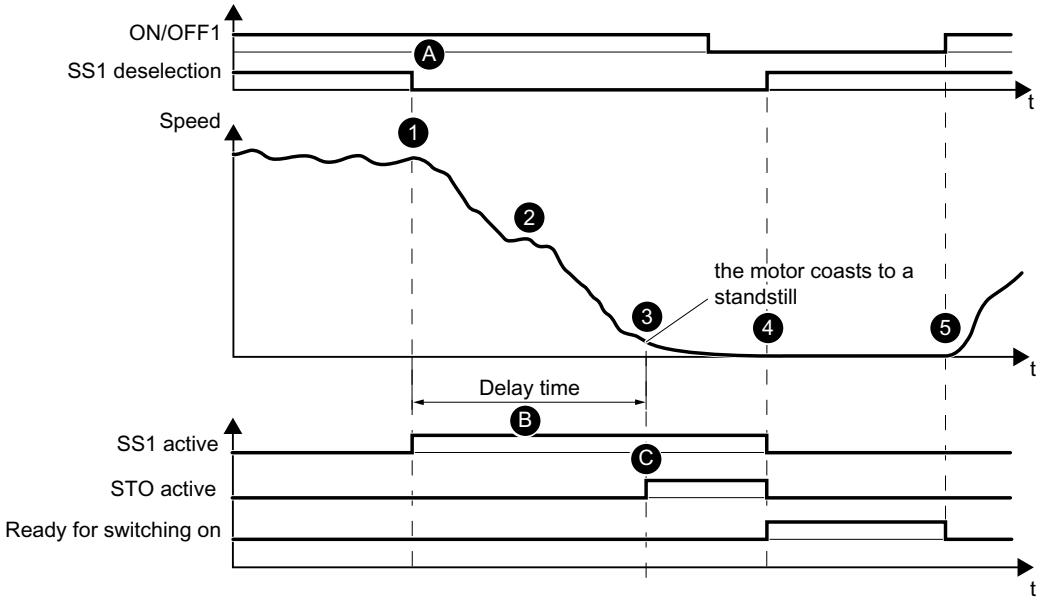
SS1 with OFF3 (SS1-t)

When SS1-t is selected, the motor speed is reduced along the OFF3 ramp for the duration of the selected delay time. After the delay time expires, the drive activates the STO function (independent of the actual speed).

Note

Braking at the OFF3 ramp is not monitored!

Flow diagram SS1 with OFF3 (SS1-t)



Behavior	
1	• SS1 is selected in operation.
2	• The drive immediately initiates braking following the response time via the OFF3 ramp. • At the same time, the drive initiates the SS1 delay time.
3	• The drive triggers STO once the SS1 delay time has elapsed. • The motor coasts down to a standstill. • STO safely prevents the motor restarting.
4	• SS1 and STO are deactivated by the drive with (manual or automatic program-controlled) deselection. • The drive is again "ready for switching on".
5	• You restart the drive with a positive signal edge at ON/OFF1.

Settings	
A	• SS1 is selected via the control bit of the selected PROFIsafe telegram or via the F-DI.
B	• The drive brakes the motor along the OFF3 ramp. • Once the SS1 delay time (p9652) has expired, the drive automatically triggers STO independently of the current speed.
C	• The "SS1_active" status is signaled in the status bit of the PROFIsafe telegram. • This value can be applied in the higher-level controller. • When STO becomes active, the "SS1_active" status is also signaled in the status bit of the PROFIsafe telegram.

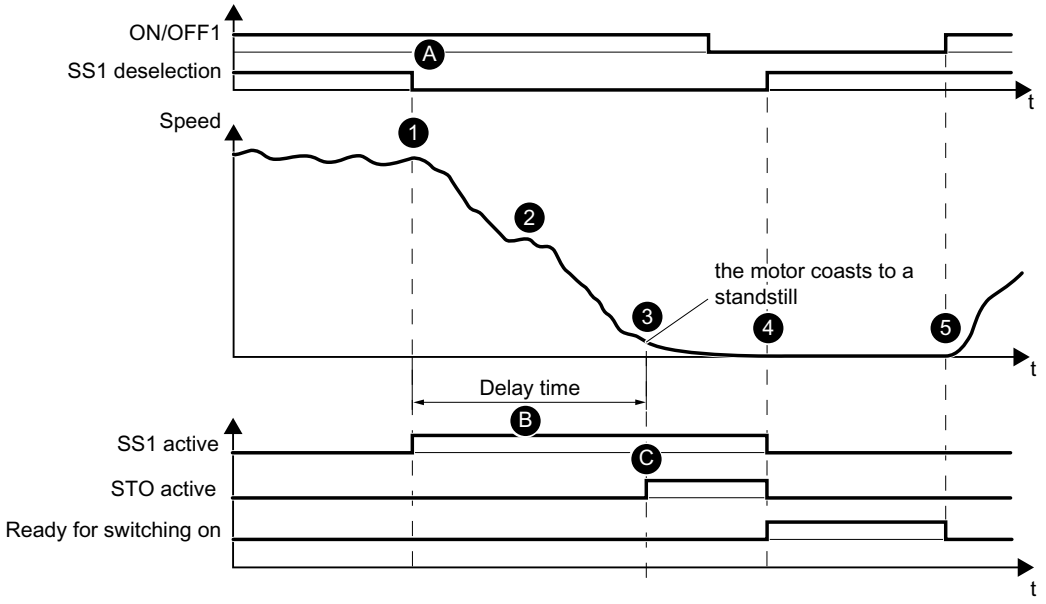
SS1 with external stop (SS1E-t)

If several drives are connected with one another through a material web, then braking initiated by a single drive at the related OFF3 ramp can damage the machine or system.

When the safety function SS1E-t is used, the drive is shut down using the user program of a higher-level control system. Although the safe delay time is activated when SS1E-t is selected, OFF3 is not activated. Using an appropriate program, the control must then ramp down the drives involved within the delay time to the safe state. After the delay time has elapsed, the drive activates the STO function and safely interrupts the energy feed to the motor (independent of the actual speed).

In Startdrive, select this function from the drop-down list "SI SS1 drive based braking response".

Flow diagram, SS1 with external stop (SS1E-t)



Behavior	
1	• SS1 is selected in operation.
2	• The control system initiates stopping using the setpoint that is entered. • At the same time, the drive initiates the SS1 delay time.
3	• The drive triggers STO once the SS1 delay time has elapsed. • The motor coasts down to a standstill. • The pulse inhibit safely prevents the motor restarting.
4	• SS1 and STO are deactivated by the drive with (manual or automatic program-controlled) deselection. • The drive is again "ready for switching on".
5	• You restart the drive with a positive signal edge at ON/OFF1.

Settings	
A	• To use SS1E, set the braking response (p9507.3 = 1) to "SS1E external stop". • SS1 is selected via the control bit of the selected PROFIsafe telegram or via the F-DI.
B	• The motor is braked by the external setpoint that is entered. • Once the SS1 delay time (p9652) has expired, the drive automatically triggers STO independent of the actual speed.
C	• The "SS1_active" status is signaled in the status bit of the PROFIsafe telegram. • This value can be applied in the higher-level controller. • When STO becomes active, the "SS1_active" status is also signaled in the status bit of the PROFIsafe telegram.

Note

SS1 cannot be interrupted

- If SS1 is deselected again during this time, the STO function is selected and deselected again by the drive immediately after the delay time has elapsed or the speed has dropped below the shutdown speed. This terminates the SS1 function normally. It cannot be interrupted.
- During the delay time, SS1 cannot be deselected by withdrawing the control command, therefore fulfilling the requirements of EN 60204-1 relating to an Emergency Stop function.

Setting the delay time for SS1

Select the SS1 delay time so that the drive can travel the complete OFF3 ramp, and close any motor holding brake before the torque is safely switched off.

The OFF3 ramp-down time must be orientated to the actual braking capacity of the system or machine.

Use the following procedure to select the SS1 delay time:

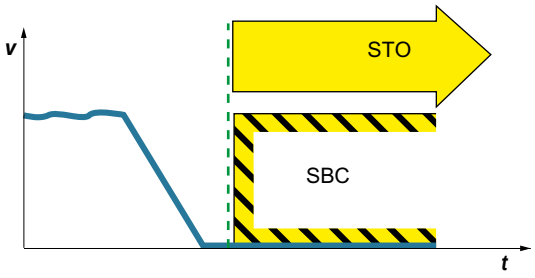
- SS1 delay time with parameterized motor holding brake
  SS1 delay time (p9652) ≥ OFF3 ramp-down time (p1135) + pulse suppression delay time (p1228) + motor holding brake closing time (r1217)
- SS1 delay time, without parameterized motor holding brake:
  SS1 delay time (p9652) ≥ OFF3 ramp-down time (p1135) + pulse suppression delay time (p1228)

Parameterize the Emergency Stop function using the "SI SS1 delay time":

- SS1 delay time = 0 → STO (stop category 0 according to EN 60204-1)
- SS1 delay time ≠ 0 → SS1 (stop category 1 according to EN 60204-1)

4.1.3 Safe Brake Control (SBC)

Overview



The "Safe Brake Control" function (SBC) is used to safely control the motor-integrated holding brake, which operates according to the closed-circuit principle.

Functional features

You must enable the function when commissioning in order that SBC can become active.

Note

You cannot select SBC as an autonomous function: SBC is activated (if enabled) immediately upon selection of STO.

Applications

Use SBC in applications where the drive must maintain a safe position, even when the motor is in a no-current condition. SBC thus prevents suspended or passing loads from dropping (e.g. for lifting gear, passenger elevators, winders). No external logic or switching elements required, as the functionality is completely integrated in the drive.

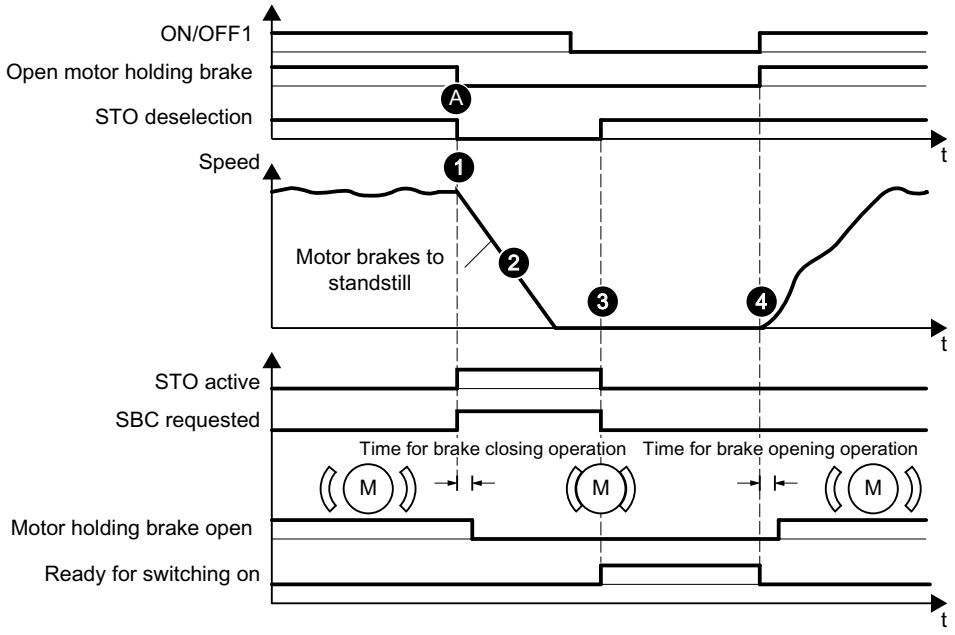
Note

Condition of the motor holding brake

SBC is not able to identify as to whether a holding brake is mechanically worn or is a defective.

As a consequence, observe the maximum permissible number of emergency braking operations for the motor holding brake being used.

Flow diagram



Behavior	
1	• STO is selected in operation. • At the same time, the drive activates SBC. • Taking the brake closing time into account, the command to close the motor holding brake closes the brake, thus supporting the shutdown process initiated by STO.
2	• The mechanical brake brakes the motor to a standstill.
3	• STO is deactivated by the drive with (manual or automatic program-controlled) deselection. • The drive is again "ready for switching on". • SBC is also simultaneously deactivated with deselection of STO. The brake remains (unsafely) closed, however, until the standard program executes the command to open the brake
4	• You restart the drive with a positive signal edge at ON/OFF1. Taking the brake opening time into account, the command to open the brake opens the brake.

Settings	
A	• STO is selected via the control bit of the selected PROFIsafe telegram or via the F-DI. • The drive activates SBC when the safe brake control is enabled (p9602 = 1). • The drive triggers SBC simultaneously with STO. • Brake management is resulted within the context of standard parameterization of the drive.

The drive adopts a controlling function for the "Safe Brake Control" function and ensures the following behavior:

- If the drive detects a fault or failure of the brake, it deactivates the brake current.
- The brake closes and a safe state is reached.

⚠ WARNING

Danger to life as a result of undesirable motor motion due to a defective brake

"Safe Brake Control" function does not detect mechanical defects of the brake.

An interrupted cable or a short-circuit in the brake winding is only detected when the state changes, i.e. when the brake either opens or closes.

The defects described above may initiate unwanted motor motion, which may result in injury or death.

- In particular, ensure the brake is not powered from an external source. Information on this topic can be found in EN 61800-5-2:2007, Appendix D.
- During commissioning, test the brake using the Safety Integrated Extended Function "Safe Brake Test (SBT)":
  You can find additional information in section "Safe Brake Test (SBT) (Page 120)".

4.2 Extended Functions

The Extended Functions are not included in the standard scope of the converter.

You need a license to be able to use the Extended Functions. With a license, you can use all of the Extended Functions of the converter. You require a license for each converter.

You can find details on the licenses in the section:

- "Using functions that require a license (Page 249)"

Overview of the Extended Functions

- Safe Torque Off (STO)
- Safe Stop 1 (SS1)
- Safe Brake Control (SBC)
- Safe Operating Stop (SOS)
- Safe Stop 2 (SS2)
- Safely-Limited Speed (SLS)
- Safe Speed Monitor (SSM)
- Safe Direction (SDI)
- Safely-Limited Acceleration (SLA)
- Safe Brake Test (SBT) **diagnostic function**

You select Extended Functions via the F-PLC. You can also select the STO or SS1 functions via the failsafe digital input.

- "Safety settings in the web server (Page 218)"
- "Safety settings in Startdrive (Page 282)"

In order to be able to select the functions via the F-PLC, the communication must be configured in the F-PLC via PROFIsafe.

You can find details on the settings in the sections:

- "Configuring safety functions (Page 128)"
- "Establishing communication of the converter with the controller (Page 83)"

The safety functions are executed with a safety monitoring cycle of 4 ms.

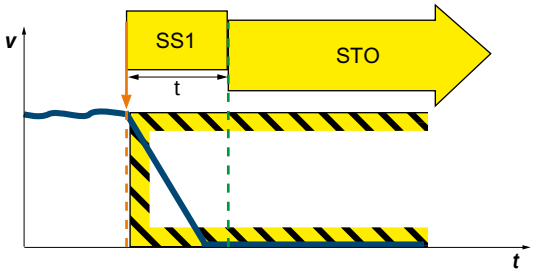
4.2.1 Safe Torque Off (STO)

The response of STO is identical with Basic and Extended Functions: See Chapter "Safe Torque Off (STO) (Page 87)"

4.2.2 Safe Brake Control (SBC)

The response of SBC is identical with Basic and Extended Functions: See Chapter "Safe Brake Control (SBC) (Page 94)"

4.2.3 Safe Stop 1 (SS1)



The "Safe Stop 1" function (SS1, time-controlled) causes a drive-autonomous deceleration of the motor and initiates the "Safe Torque Off" (STO) function after a predefined time interval has elapsed. This function corresponds to stop category 1 to EN 60204-1.

Functional features

The Safety Integrated Extended Function "Safe Stop 1" is available in the following versions:

- SS1-a with acceleration monitoring (SAM)
- SS1-r with braking ramp monitoring (SBR)
- Additionally, SS1 can be parameterized with a delay time before activation of STO.

Set the SS1 response for Safety commissioning in the "Parameterization" step.

Note

Braking operation for SS1

When SS1 is selected, the drive brakes the motor along a braking ramp. In addition to the braking function along the OFF3 ramp integrated in the drive, you can also stop the drive using a user program in a higher-level control system (function SS1E).

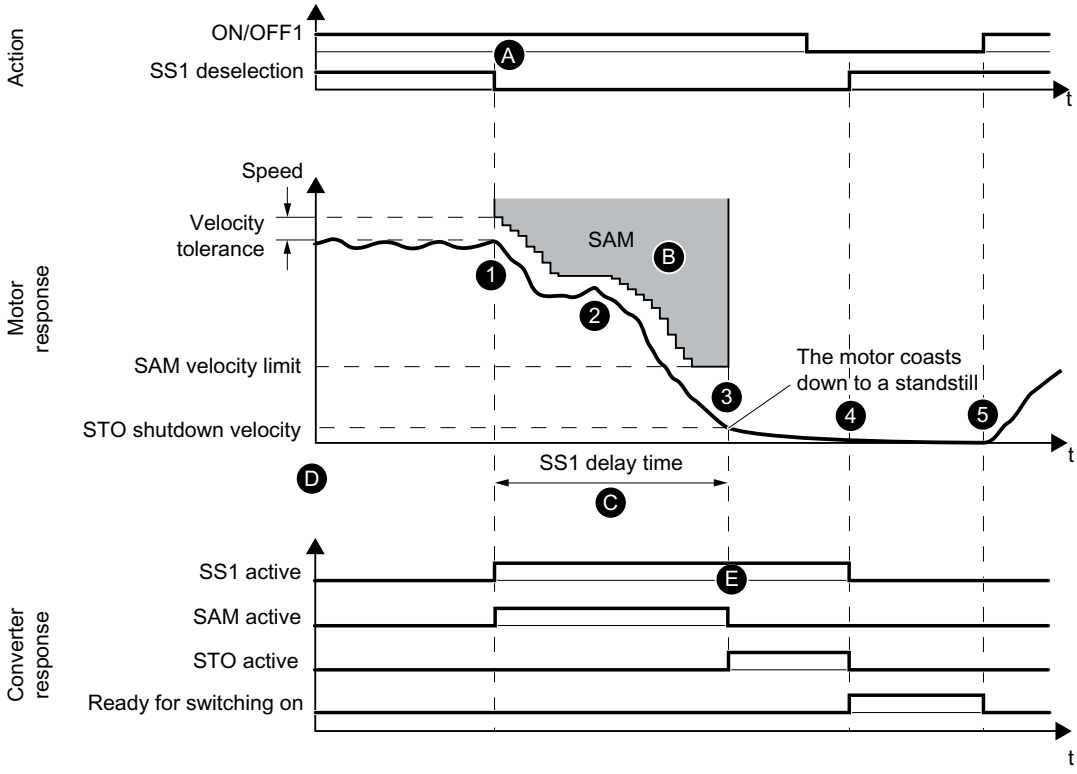
Applications

SS1 can be applied in the following cases:

- The load torque does not reduce the motor to a standstill through friction within a sufficiently short time.
- Coasting down of the drive (STO) will pose risks to safety.

4.2.3.1 Safe Stop 1 with acceleration monitoring (SS1-a)

Flow diagram



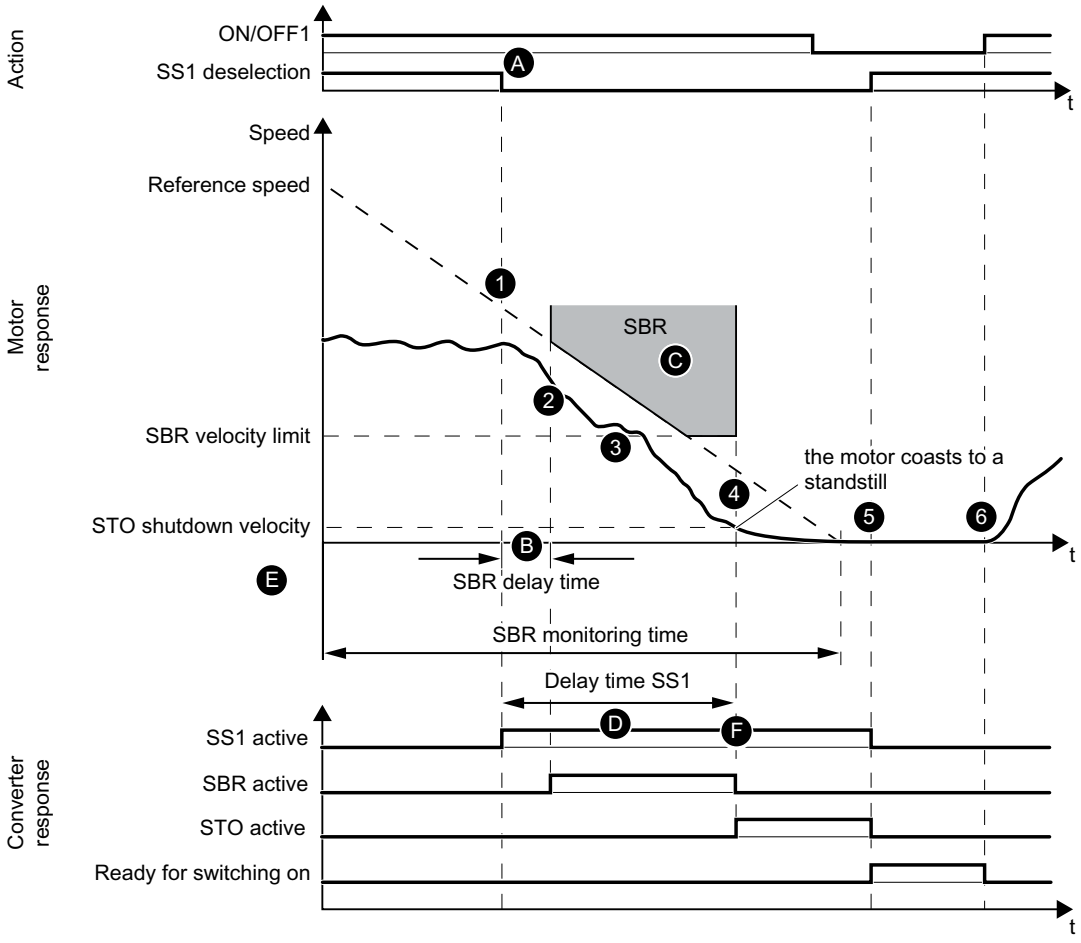
Behavior	
1	• SS1 is selected in operation.
2	• The drive immediately initiates braking following the response time via the OFF3 ramp. • At the same time, safe acceleration monitoring (SAM) is activated. • The drive monitors the speed of the motor and prevents the motor from re-accelerating by continuously adjusting the monitoring threshold to the decreasing speed.
3	• STO is triggered upon reaching the STO shutdown speed or once the SS1 delay time has elapsed. • The motor coasts down to a standstill. • STO safely prevents the motor restarting.

4	• STO and SS1 are deactivated by the drive with (manual or automatic program-controlled) deselection. • The drive is again "ready for switching on".
5	• You restart the drive with a positive signal edge at ON/OFF1.

Settings	
A	• SS1 is selected via the control bit of the selected PROFIsafe telegram or via the F-DI.
B	• You set the acceleration monitoring with the speed tolerance (p9548). • As long as the speed reduces, the drive continuously adds the speed tolerance to the current speed so that the monitoring tracks the speed. • The monitoring is deactivated when the SAM speed limit is fallen below (p9568).
C	• In parallel to monitoring the acceleration, while braking along the OFF3 ramp you can apply the SS1 delay time (p9556). You set this time analogous to the SS1-t delay time of the Basic Functions. Once this time has expired, the drive automatically triggers STO independently of the current speed.
D	• When the SS1 delay time (p9556) elapses OR if the speed falls below the STO shutdown speed (p9560), then the drive triggers STO.
E	• The "SS1_active" status is signaled in the status bit of the PROFIsafe telegram. • You can utilize this status in the higher-level controller. • If STO is active, the "STO_active" status is also signaled in the corresponding status bit of the PROFIsafe telegram.

4.2.3.2 Safe Stop 1 with braking ramp monitoring (SS1-r)

Flow diagram

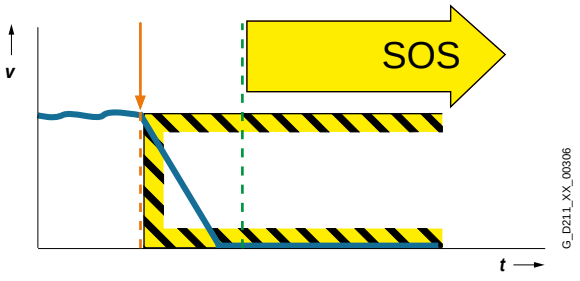


Behavior	
1	• SS1 is selected in operation.
2	• The drive immediately initiates braking following the response time via the OFF3 ramp. • At the same time, the drive initiates the SBR delay time.
3	• The drive monitors the motor to ensure that it does not exceed the set braking ramp when braking. • Upon reaching the SBR speed limit, the drive deactivates monitoring of the braking ramp. Braking continues.
4	• STO is triggered by the drive when the STO shutdown speed is reached or when the SS1 delay time has elapsed. • The motor coasts down to a standstill. • The drive safely prevents a restart of the motor with the pulse inhibit.

5	• STO and SS1 are deactivated by the drive with (manual or automatic program-controlled) deselection. • The drive is again "ready for switching on".
6	• You restart the drive with a positive signal edge at ON/OFF1.

Settings	
A	• SS1 is selected via the control bit of the selected PROFIsafe telegram or via the F-DI.
B	• The drive initiates the SBR delay time (p9582) with selection of SS1. • Monitoring of the braking ramp is initiated by the drive when the delay time has elapsed.
C	• You set the braking ramp with the reference speed (p9581) and the SBR monitoring time (p9583). • The drive deactivates monitoring of the braking ramp if speed falls below the SBR speed limit (p9568).
D	• In parallel to monitoring the braking ramp, while braking along the OFF3 ramp, you can apply the SS1 delay time (p9556). When this time elapses, the drive automatically triggers STO independently of the current speed.
E	• When the SS1 delay time (p9556) elapses OR if the speed falls below the STO shutdown speed (p9560), then the drive triggers STO.
F	• The drive signals the "SS1_active" status in the status bit of the PROFIsafe telegram. • You can utilize this status in the higher-level controller. • If STO is active, the drive also signals the "STO_active" status in the corresponding status bit of the PROFIsafe telegram.

4.2.4 Safe Stop 2 (SS2)



The SS2 function brings the motor to a standstill with subsequent safe monitoring of the standstill position. When SS2-r is selected, the drive brakes the motor along a braking ramp. In addition to the braking function along the OFF3 ramp integrated in the drive, you can also stop the drive using a user program in a higher-level control system (function SS2E).

SS2 distinguishes the following variants:

- SS2-a with acceleration monitoring (SAM)
- SS2-r with braking ramp monitoring (SBR)
- Additionally, SS2 can be parameterized with a delay time before activation of SOS.

Selection and monitoring of the acceleration (SAM) and the braking ramp (SBR) are realized with two channels. Braking with the OFF3 ramp is realized with one channel.

Interruption of the ramp function with OFF2

Activating SS2 can mean that the higher-level controller (PLC, motion controller) which specifies the speed setpoint, interrupts the ramp function (e.g. with OFF2). The device behaves in this way as a result of a fault response triggered by OFF3 activation. This fault reaction must be prevented by way of appropriate parameterization/configuration.

Note

If you are using a higher-level motion controller, then for SLS, SDI and SLA, you must apply stop response STO when a limit value is violated.

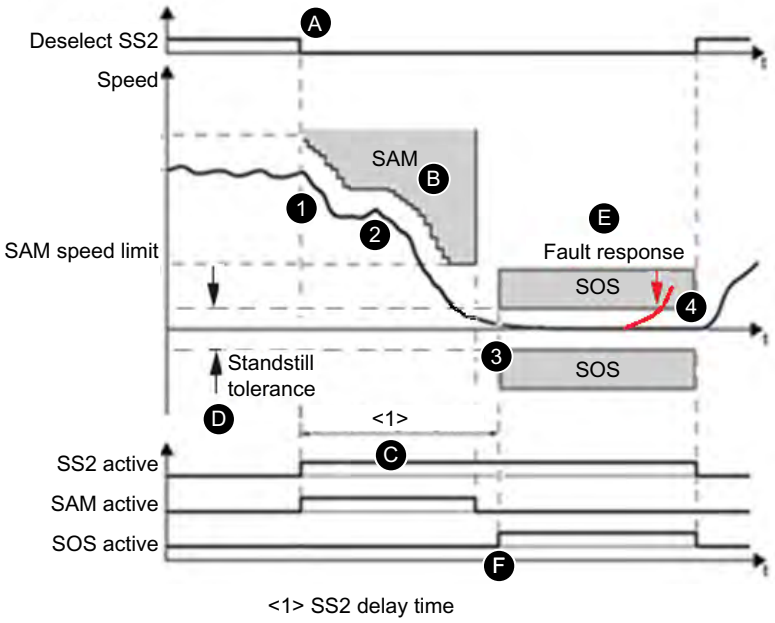
Reason: With safety function SS2-r/SS2-a, SINAMICS S210 brakes autonomously along the OFF3 ramp. The motion controller detects a deviation between target value and actual value and shifts the drive to pulse suppression.

Applications

Use the SS2 for applications where an axis must be safely stopped and where the standstill position must then be safely monitored. Following deselection of SS2, you can continue traversing the axis without reference point approach.

4.2.4.1 SS2 with acceleration monitoring (SS2-a)

Flow diagram



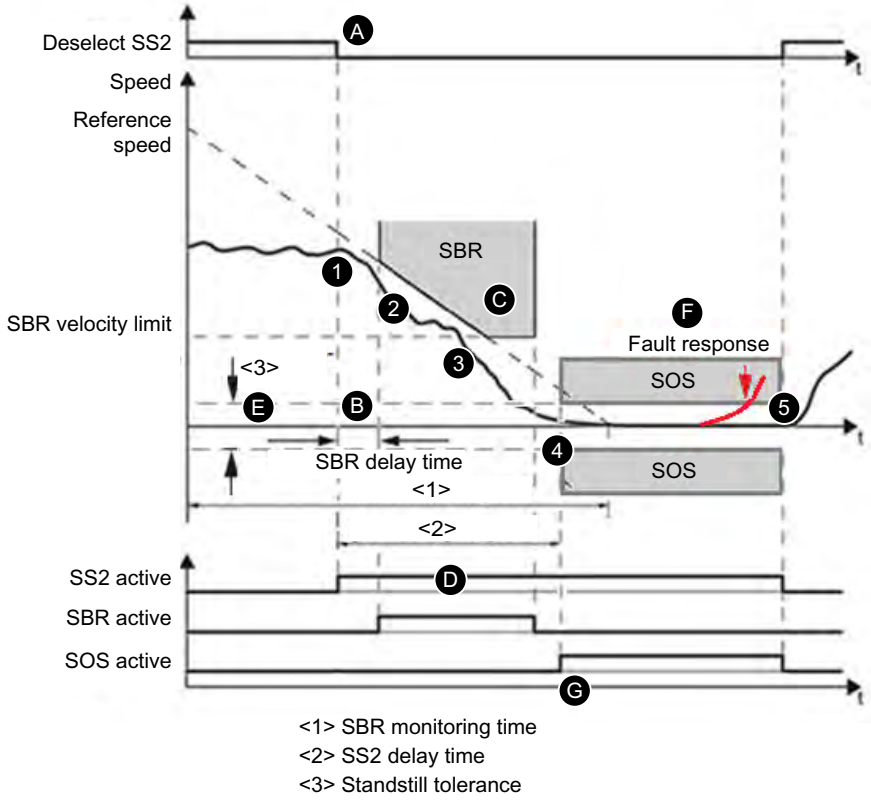
Behavior	
1	• SS2 is selected during operation.
2	• The drive immediately initiates braking following the response time via the OFF3 ramp. • At the same time, the drive activates safe acceleration monitoring (SAM). The drive monitors the speed of the motor and prevents the motor from re-accelerating by continuously adjusting the monitoring threshold to the decreasing speed.
3	• SOS is triggered once the SS2 delay time has elapsed. The SS2 delay time set must allow the drive to brake to a standstill from every speed of the operating process within this time. • The drive safely monitors standstill of the motor with the safety function SOS. The motor remains in control mode.
4	• SS2 and SOS are deactivated by the drive with (manual or automatic program-controlled) deselection. • You can immediately continue traversing the axis from the standstill position.

Settings	
A	• SS2 is selected via the control bit of the selected PROFIsafe telegram.
B	• The acceleration monitoring SAM is set with the speed tolerance (p9548). • SINAMICS S210 monitors the change in speed between 2 safety monitoring cycles to ensure that it does not exceed the speed tolerance (p9548). The monitoring is deactivated when the SAM speed limit is fallen below (p9568).
C	• Standstill is safely monitored (SOS becomes active) once the SS2 delay time (p9552) has elapsed.

D	• The drive is in control mode and monitors the standstill tolerance (p9530).
E	• If the standstill tolerance is violated, the drive executes SS1 as a stop reaction with subsequent transition to STO.
F	• The "SS2_active" status is signaled in the status bit of the PROFIsafe telegram. • You can utilize this status in the higher-level controller. • If SOS is active, the drive also signals "SOS_active" in the corresponding status bit of the PROFIsafe telegram.

4.2.4.2 SS2 with braking ramp monitoring (SS2-r)

Flow diagram

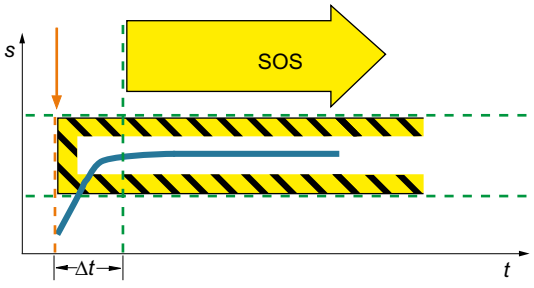


Behavior	
1	• SS2 is selected during operation.
2	• The drive immediately initiates braking following the response time via the OFF3 ramp. The SBR delay time is initiated at the same time.
3	• The drive monitors the motor to ensure that it does not exceed the set braking ramp when braking. • Upon reaching the SBR speed limit, monitoring of the braking ramp is deactivated. Braking continues.
4	• SOS is triggered once the SS2 delay time has elapsed. • The SS2 delay time set must allow the drive to brake to a standstill from every speed of the operating process within this time. • Standstill of the motor is safely monitored with SOS. The motor remains in control mode.
5	• SS2 and SOS are deactivated with (manual or automatic program-controlled) deselection. • You can immediately continue traversing the axis from the standstill position.

Settings	
A	• SS2 is selected via the control bit of the selected PROFIsafe telegram.

B	• The SBR delay time (p9582) is initiated with selection of SS2. Monitoring of the braking ramp is initiated once the delay time has elapsed.
C	• You set the braking ramp with the reference speed (p9581) and the SBR monitoring time (p9583). • The drive deactivates monitoring of the braking ramp if speed falls below the SBR speed limit (p9568).
D	• Standstill is safely monitored (SOS becomes active) once the SS2 delay time (p9552) has elapsed.
E	• The drive is in control mode and monitors the standstill tolerance (p9530).
F	• If the standstill tolerance is violated, then the drive responds with SS1 and then transitions into STO.
G	• The "SS2_active" status is signaled in the status bit of the PROFIsafe telegram. This value can be applied in the higher-level controller. • If SOS is active, the "SOS_active" status is also signaled in the corresponding status bit of the PROFIsafe telegram.

4.2.5 Safe Operating Stop (SOS)



When SOS is selected, the drive safely monitors the drive position for standstill. The drive is in the closed-loop control mode, and can therefore withstand external forces.

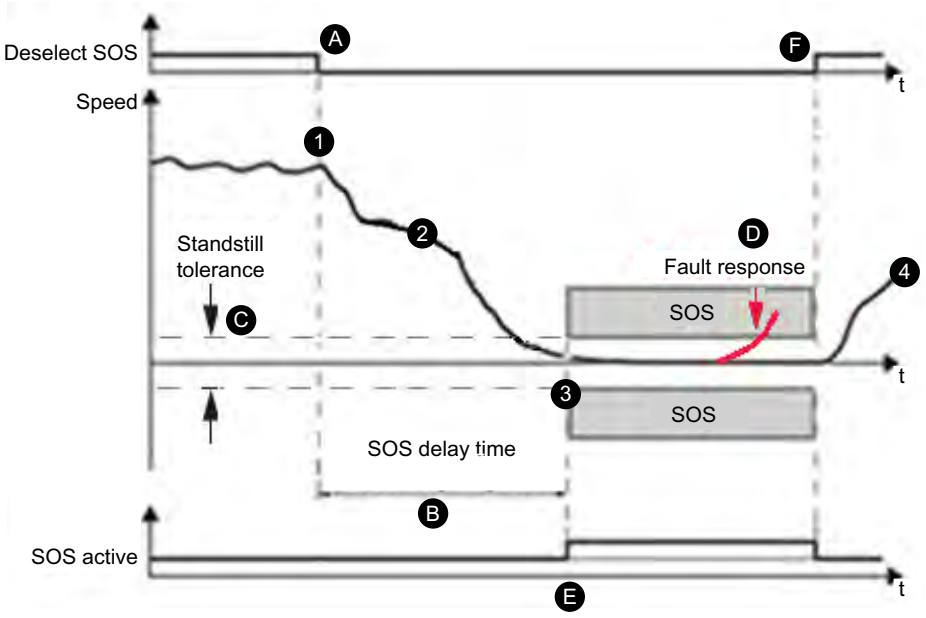
After SOS has been selected it becomes active after the parameterizable delay time has expired. The drive must be braked to standstill within this delay time, e.g. by the controller.

Applications

SOS is suitable for the following applications:

- Machine parts must be safely monitored that they actually are at a standstill.
- A holding torque is required.

Flow diagram



Behavior	
1	• SOS is selected during operation.
2	• The control system initiates stopping using the setpoint that is entered. • At the same time, the drive initiates the SOS delay time.
3	• SOS is triggered when the SOS delay time elapses. • The SOS delay time set must allow the drive to brake to a standstill from every speed of the operating process within this time. • The motor is then safely monitored in the standstill position.
4	• SOS is deactivated by the drive with (manual or automatic program-controlled) deselection. • You can immediately continue traversing the axis from the standstill position.

Settings	
A	• SOS is selected via the control bit of the selected PROFIsafe telegram.
B	• The drive is braked by external setpoint value specification. • SOS becomes active when the SOS delay time (p9551) has elapsed.
C	• The drive is in control mode and monitors the standstill tolerance (p9530).
D	• If the standstill tolerance is violated, then the drive responds with SS1 and then transitions into STO.
E	• The "SOS active" status is signaled in the status bit of the PROFIsafe telegram. • You can utilize this status in the higher-level controller.
F	• Monitoring of the position window is concluded with "Deselect SOS" via the control bit of the selected PROFIsafe telegram. • The drive may be operated freely.

Contrary to SS1 and SS2, SOS does not automatically brake the drive.

The control still enters the setpoint.

The response to "Deselect SOS" in the user program of the control must ensure that the control brings the drive to a standstill within the delay time.

⚠ WARNING

Drive can be forced out of the SOS position by mechanical forces

A drive under position control can be forced out of the "Safe Operating Stop" (SOS) position by mechanical forces that are greater than the maximum torque of the drive. This unwanted drive movement then triggers a Category 1 Stop function according to EN 60204-1 (fault response function SS1). The alarms for SS1 and STO must be observed.

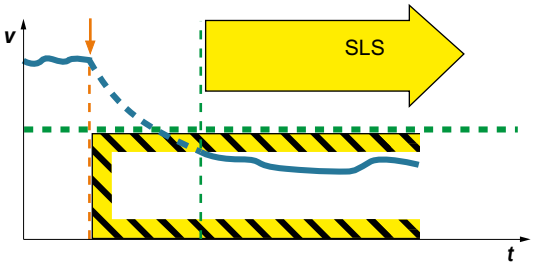
- If there is a hazard due to unwanted motion in your application, take measures to counter it, for example, by using a brake with safe monitoring. You can find additional information in section "Safe Brake Control (SBC) (Page 94)".

Note

Size of the tolerance window

The size of the tolerance window must be adapted to the respective application, otherwise the standard monitoring functions will no longer be effective.

4.2.6 Safely-Limited Speed (SLS)



The drive with active SLS function monitors speed/velocity of the motor to ensure that it does not exceed the speed/velocity threshold valid for the SLS (SLS monitoring).

The SLS function prevents the parameterized maximum velocity from being exceeded. If the permitted speed is exceeded, then the drive initiates a parameterizable stop response. It is possible to switch between 4 different limit value levels in operation. Additionally, you can specify variable limit values during operation via PROFIsafe.

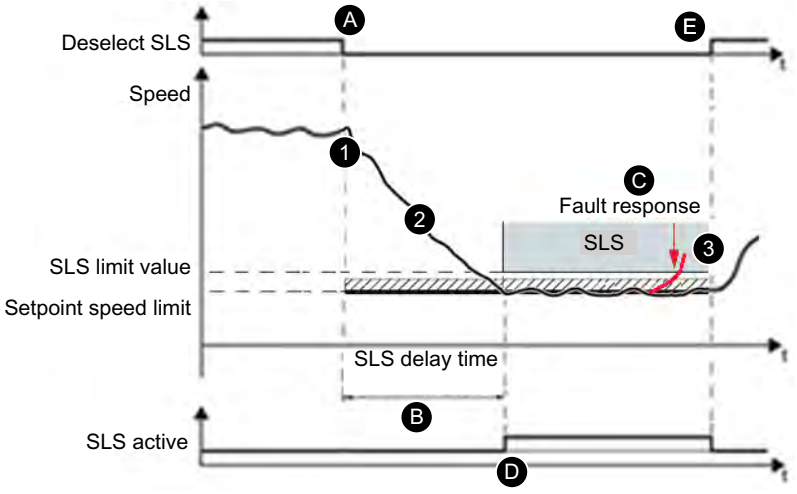
Applications

SLS is suitable for machines susceptible to hazardous situations if a speed is exceeded and wherever work must be performed directly on a machine, for example:

- During operation
- In setup mode
- For maintenance work

4.2.6.1 SLS with a speed level

Flow diagram

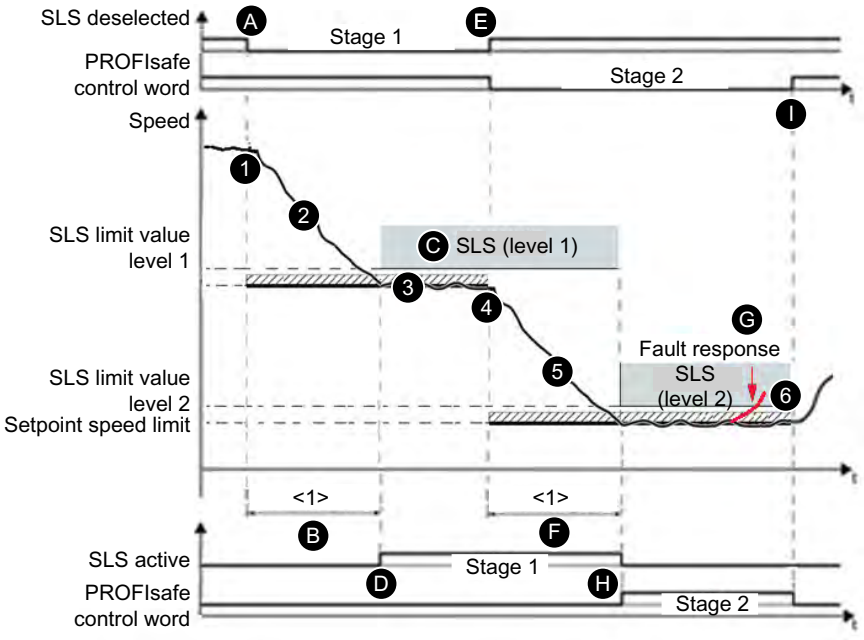


Behavior	
1	• SLS is selected during operation. The speed is higher than the SLS limit value. • The drive initiates the SLS delay time.
2	• The actual speed must remain below the SLS limit value until the SLS delay time has elapsed. • Monitoring becomes effective once the SLS delay time has elapsed (e.g. in the "Setup" operating mode).
3	• SLS is deactivated by the drive with (manual or automatic program-controlled) deselection. • You can continue traversing the axis immediately with greater setpoints (e.g. changing over to "Automatic" mode).

Settings	
A	• SLS is selected via the control bit of the selected PROFIsafe telegram.
B	• The drive is braked by external setpoint value specification. • Monitoring of the SLS limit value (level 1 = p9531[0]) becomes effective once the SLS delay time (p9551) has elapsed.
C	• If the SLS limit value is violated, the drive executes the set stop reaction (level 1 = p9563[0]).
D	• The drive signals the "SLS active" status in the status bit of the PROFIsafe telegram. • You can utilize this status in the higher-level controller.
E	• The drive ends monitoring of the SLS limit value with deselection of SLS via the control bit of the selected PROFIsafe telegram. • The drive may be operated freely.

4.2.6.2 SLS with switchover of speed levels

Flow diagram



<1> SLS delay time

Behavior	
1	• SLS level 1 is selected during operation. The speed is higher than the SLS limit value. • The drive initiates the SLS delay time.
2	• The actual speed must remain below the SLS limit value level 1 until the SLS delay time has elapsed. • Monitoring of level 1 becomes active once the SLS delay time has elapsed.
3	• The SLS limit value level 1 can be evaluated with the relative setpoint speed limit and made available as a setpoint limit.
4	• Switchover to SLS level 2 is initiated subsequently in the process.
5	• When changing over to a lower limit value, the SLS delay time is (re)started. • The actual speed must remain below the SLS limit value level 2 until this delay time has elapsed. • The existing limit remains active during the delay time. • The lower limit value becomes active and monitoring of SLS level 2 becomes effective once the SLS delay time has elapsed.
6	• SLS is deactivated by the drive with (manual or automatic program-controlled) deselection. • You can continue traversing the axis immediately with greater setpoints (e.g. changing over to "Automatic" mode).

Settings	
A	• SLS (level 1) is selected via the control bit of the selected PROFIsafe telegram.

B	• The drive is braked by external setpoint value specification. • The SLS limit value (level 1 = p9531[0]) is monitored once the SLS delay time (p9551) has elapsed.
C	• If the SLS limit value (level 1) is violated, the drive executes the set stop response (level 1 = p9563[0]).
D	• The drive signals the "SLS active (level 1)" status in the status bit of the PROFIsafe telegram. • You can utilize this status in the higher-level controller.
E	• Switchover to SLS (level 2) is performed via the control bit of the selected PROFIsafe telegram.
F	• The drive is braked by external setpoint value specification. • Monitoring of the SLS limit value (level 2 = p9531[1]) becomes effective once the delay time for SLS switchover = SLS delay time (p9551) has elapsed.
G	• If the SLS limit value (level 2) is violated, the drive executes the set stop response (level 2 = p9563[1]).
H	• The SLS active (level 1 and level 2) statuses are signaled in the status bits of the PROFIsafe telegram. • You can utilize these values in the higher-level controller.
I	• The drive ends monitoring of the SLS limit value with deselection of SLS (level 2) via the control bit of the selected PROFIsafe telegram. • The drive may be operated freely.

4.2.6.3 SLS with variable speed limit value

SINAMICS offers the option of influencing the first SLS limit value via PROFIsafe:

- The transfer of the first SLS limit value via PROFIsafe is active if the speed level 1 in the PROFIsafe telegram is selected and the bit "Enable transfer SLS limit value via PROFIsafe" (p9501.24) is set.
- S_SLS_LIMIT_A has the value range 1 ... 32767; the following applies:
  - 32767 ≙ 100% of the 1st SLS level
  - The actually monitored limit value is calculated as follows:
    SLS limit value = (S_SLS_LIMIT_A/32767) · p9531[0]
- Speed levels 2, 3 and 4 can also be parameterized and selected in this case.
- The selected delay time cannot be changed during operation. If you require various delay times in your application, then you must realize this requirement using a time-delayed transfer of the SLS limit value using your control system (F-CPU).
- If an incorrect SLS limit value is transferred, the drive responds with the stop response parameterized in p9563 for speed level 1 and Safety alarm A01711.

4.2.6.4 Additional functional features

Setpoint speed limit and SLS

It makes sense to configure the set velocity limit if SLS is also parameterized. This configuration is realized, for example in a higher-level control that evaluates the Safety Info Channel.

In parameter "SI Motion SLS setpoint speed limiting" (p9533) enter the weighting factor to determine the setpoint limit from the selected actual speed limit in percent. The active limit value is evaluated using this factor, and is made available as "Setpoint speed limit effective" (r9733).

- r9733[0] = p9531[x] · p9533 (converted from the load to the motor side)
- r9733[1] = -p9531[x] · p9533 (converted from the load to the motor side)
  [x] = selected SLS stage

Conversion factor from the motor to the load side:

- Motor type = rotary and axis type = linear: p9522/(p9521 · p9520)
- Otherwise: p9522/p9521

SLS limit value

- r9733[0] = p9531[x] · p9533
- r9733[1] = -p9531[x] · p9533
  [x] = selected SLS limit value

"Setpoint speed limit effective" r9733 is used, for example, for transferring values to a higher-level control, which can then, for example, adjust traversing speeds to the SLS levels. r9733 is a part of the Safety Info Channel (SIC).

Toggling between SLS limit values

The changeover is performed binary-coded via 2 PROFIsafe control bits. The speed selection statuses can be checked using parameters "Select SLS bit 0" and "Select SLS bit 1" (r9720.9 and r9720.10). The actual speed limit value is indicated using parameters "Active SLS level bit 0" and "Active SLS level bit 1" (r9722.9 and r9722.10), "SLS active" (r9722.4) must be a "1".

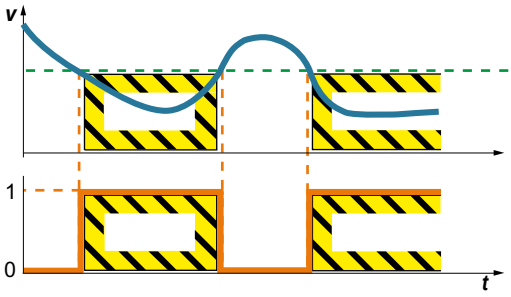
Switchover to another stage may also be performed with time delay. This corresponds to the processes from "SLS with one speed level" with a different respective SLS stage.

When changing over from a lower to a higher limit value, the delay time is not effective: The higher limit value immediately becomes active.

Response in the event of a communication error

If the "Stop response delay bus failure" (p9580) ≠ 0 and SLS is active, in the event of communication failure, the parameterized ESR reaction is only realized if, as SLS response, a stop reaction with delayed pulse suppression when the bus fails has been parameterized (p9563[0...3] ≥ 10).

4.2.7 Safe Speed Monitor (SSM)



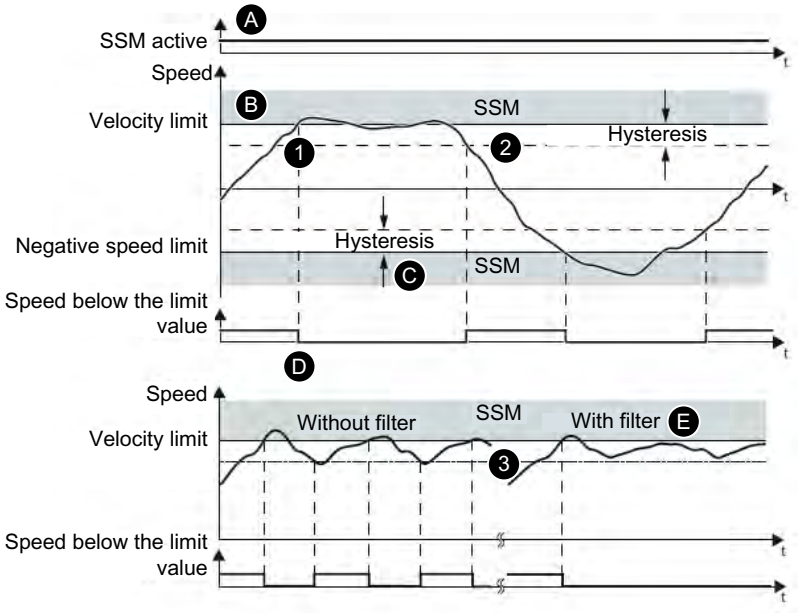
The Safe Speed Monitor function is used for safely identifying when a speed limit is fallen below in both directions of rotation, e.g. to identify zero speed.

The drive provides a safe output signal for further processing.

Applications

SSM is suitable for the realization of enabling access to the machine by way of safe SSM feedback. For example, to ensure that protective doors can only be unlocked when the critical speeds fall below those specified.

Flow diagram



Behavior	
1	• Function SSM is enabled with p9501.16. • If the speed falls below the speed limit, the "Speed below limit value" signal is set. • If the speed is greater than the limit, the "Speed below limit value" is not set.

2	• The parameterizable hysteresis ensures that a stable signal characteristic is achieved for speeds close to the monitoring threshold: This ensures that the SSM output signal does not jump between the values "0" and "1" in the limit range. • When "hysteresis and filtering" is activated with output signal SSM, a time-delayed SSM feedback signal occurs for the axes. This is a characteristic of the filter.
3	• The signal filter smoothes the speed measured by the drive. Use the filter if you wish to monitor speeds that lie just below the speed limit.

Settings	
A	• The function is activated automatically as soon as the Safety Integrated Extended Functions (p9501.0 = 1) are enabled - and the enable for SSM with hysteresis and filtering is set (p9501.16 = 1).
B	• The speed limit (p9546) is effective in both directions of rotation. The SSM function is deactivated with the setting speed limit = 0.
C	• The speed hysteresis (p9547) stabilizes the output signal speed below limit value. • The speed hysteresis must be ≤ 0.75 · speed limit.
D	• The "Speed below limit value" status is signaled in the status bit of the PROFIsafe telegram. • You can utilize this status in the higher-level controller.
E	• You set the response with the filter time (p9545).

SSM is a pure signaling function

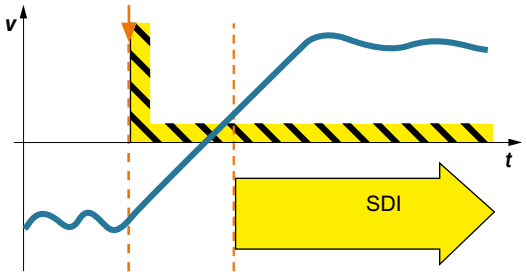
Contrary to other drive-autonomous safety functions, a violation of the SSM limit does not result in a stop response.

Relationship between SSM and SAM

If 0 is entered for p9568 (SAM shutdown threshold), the speed limit of the SSM function (p9546) is simultaneously the lower limit for the Safe Acceleration Monitor function (SAM).

In this case, the effects of safe acceleration monitoring are therefore restricted if a relatively high SSM speed limit is set when using the SS1 and SS2 stop functions.

4.2.8 Safe Direction (SDI)



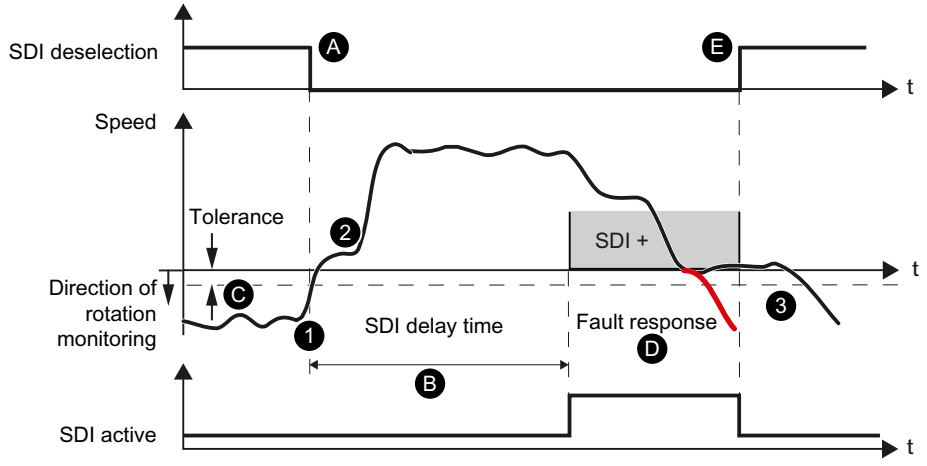
The drive with active SDI function monitors the motor's direction of rotation. If the motor rotates in the impermissible direction, the drive stops the motor as quickly as possible.

Applications

SDI is suitable for the following cases:

- Machines on which cyclic material must be loaded and removed
- For protection against impermissible direction of rotation

Flow diagram



Behavior	
1	• SDI is selected during operation. • The drive initiates the SDI delay time.
2	• You must actuate the drive in the enabled safe direction until the SDI delay time has elapsed. • Monitoring of the direction of rotation becomes effective once the SDI delay time has elapsed.
3	• SDI is deactivated by the drive with (manual or automatic program-controlled) deselection. • You can traverse the axis immediately in both directions of rotation.

Settings	
A	• "Select SDI" is performed via the control bits of the selected PROFIsafe telegram.
B	• The drive is operated in the enabled direction via external setpoint specification. • Monitoring of the direction of rotation becomes effective once the SDI delay time (p9565) has elapsed.
C	• Monitoring takes the tolerance (p9564) into account.
D	• The drive reports the status "SDI active" in the status bit of the PROFIsafe telegram. • You can utilize this status in the higher-level controller.
E	• The drive ends monitoring of the direction of rotation with "Deselect SDI" via the control bit of the selected PROFIsafe telegram. • You can traverse the axis immediately in both directions of rotation.

No detection of a change in direction by means of p1821

If the direction of rotation is reversed using p1821 (direction of rotation), then safe monitoring is still possible: However, in this case, the setpoint limitation r9733 is calculated with the wrong direction of rotation. A reversal of the direction of rotation with p1821 is therefore not practical.

Response to bus failure

If p9580 ≠ 0 and SDI is active, in the event of a communication failure, the parameterized ESR reaction only occurs if a stop response with delayed pulse suppression when the bus fails has been parameterized as the SDI response (p9566[0...3] ≥ 10).

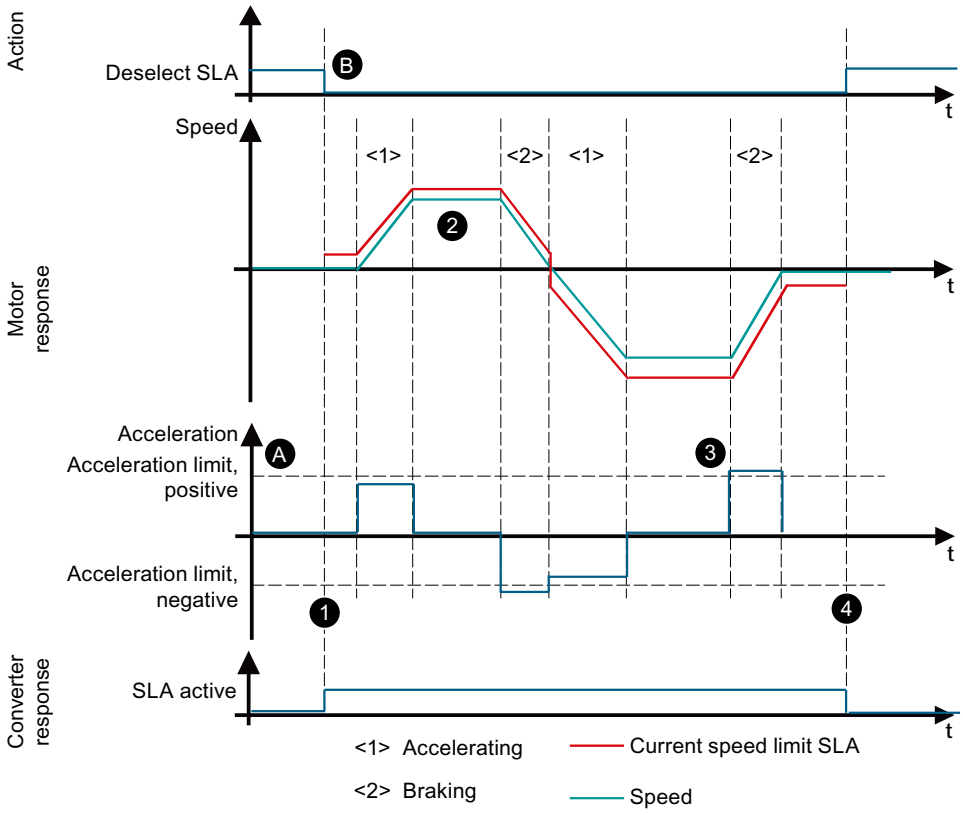
4.2.9 Safely-Limited Acceleration (SLA)

"The SLA function prevents the motor from exceeding the defined acceleration limit."

Applications

SLA is suitable for machines for which the permissible acceleration may not be exceeded, for example in setup mode.

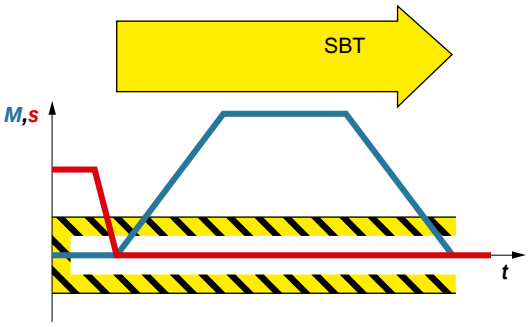
Flow diagram



Behavior	
1	• SLA is selected during operation. • The drive initiates acceleration monitoring. • The drive signals the "SLA active" status in the status bit of the PROFIsafe telegram. You can utilize this status in the higher-level controller.
2	• When accelerating, the drive monitors to ensure that the defined acceleration limit is not exceeded.
3	• If SLA detects that the acceleration limit has been violated, the drive initiates the configured stop response.
4	• SLA is deactivated with (manual or automatic program-controlled) deselection. • If you deactivate SLA with "Deselect SLA" = 1 in the Profisafe telegram, then the drive responds by withdrawing the "SLA active" (= 0) signal. • You can traverse the axis immediately in both directions of rotation.

Settings	
A	• Define the maximum permissible acceleration with the acceleration limit (p9578).
B	• Select SLA via a control bit of the PROFIsafe telegram.

4.2.10 Safe Brake Test (SBT)



The diagnostic function "Safe Brake Test" (SBT) checks the required holding torque of a motor holding brake.

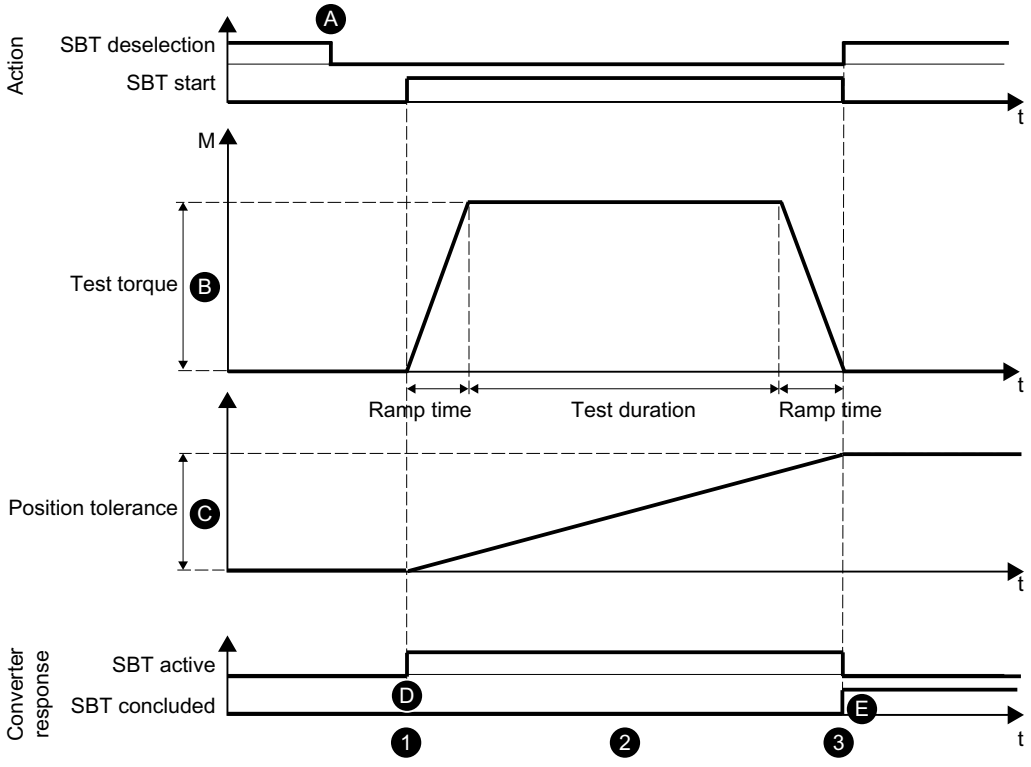
This diagnostic function exceeds the scope of EN 61800-5-2.

The drive purposely generates a force/torque against the applied brake. If the brake is operating correctly, the axis movement remains within a parameterized tolerance. However, if the drive determines higher axis motion, then this indicates that the braking force or the braking torque has diminished. In this case, maintenance work must be performed.

Applications

SBT is suitable for implementing a "safe brake" in conjunction with SBC. This allows errors or wear to be detected in the brake mechanics. Automatic testing of the braking effect reduces maintenance costs and increases safety and availability of the machine or plant.

Flow diagram



Behavior	
1	• SBT is selected during operation. • The drive initiates the brake test.
2	• The drive generates the test torque against the applied brake. If the brake is functioning correctly, motion of the axis remains within a defined tolerance. However, if a larger axis movement is identified from the encoder actual values, the brake is not in a position to provide the specified holding torque. • Service or replace the brake.
3	• SLS is deactivated by the drive with (manual or automatic program-controlled) deselection. • Depending on the result of the brake test, the automation program can initiate the next step.

Settings	
A	• Select SBT and Start SBT are implemented via the control bits of the Safety Control Channel (SCC) - in PROFIdrive telegram 701. The SBT function is thus controlled directly from a higher-level controller.
B	• The drive performs the brake test with the following variables: – Ramp time (p10208[0]) – Holding torque (p10209[0]) – Test torque = Factor (p10210[0]) – Test duration (p10211[0])
C	• Define the maximum permissible axis motion with the position tolerance (p10212[0]).
D	• The drive signals the "SBT active" status in the status bit of the SIC/SCC. • You can utilize this status in the higher-level controller.
E	• Once SBT is concluded, the drive withdraws the SBT selection.

Starting SBT

1. Enable
   – Selection via fieldbus (SCC)
   Selection of brake test sequence with 0/1 edge in S_STW3B.0

   Note

   Observe sequence

   With selection via fieldbus (SCC, S_STW3B.0), the sequence of steps 2 to 5 described as follows must be observed.

2. Wait for the following feedback: r10231[0] = 1
3. Select brake and test sequence.
   Decide upon the following before initiating the brake test sequence:
   – Brake to be tested S_STW3B.2
   – Positive or negative direction of the test torque S_STW3B.3
   – Brake test sequence 1 or 2 S_STW3B.4

4. Start brake test
   Start the brake test sequence in S_STW3B.1.
5. Exit brake test
   – Withdraw the "Start brake test" in S_STW3B.1.
   – Withdraw "Select brake test" in S_STW3B.0.

4.2.11 Safe Acceleration Monitor (SAM)

The "Safe Acceleration Monitor" (SAM) function is used for safe monitoring of braking. The Safe Acceleration Monitor function is applied to monitor braking for functions SS1 and SS2 (selected directly or as a response to a limit value violation).

- As long as the speed reduces, the drive continuously adds the adjustable speed tolerance to the current speed so that the monitoring tracks the speed.
- A renewed acceleration, i.e. an increase in speed by more than the speed tolerance (p9548), will trigger the limit violation function.
- The drive continues to reduce the monitoring limit in accordance with the current speed until it has fallen below the SAM speed limit (p9568).
- If the speed does not decrease temporarily, then the drive freezes the monitoring limit until the speed again decreases.
- If the motor accelerates by the speed tolerance during the OFF3 deceleration ramp, SAM detects the process and triggers STO. Monitoring using SAM is activated for SS1 and SS2, and ends if STO or SOS take over the monitoring.

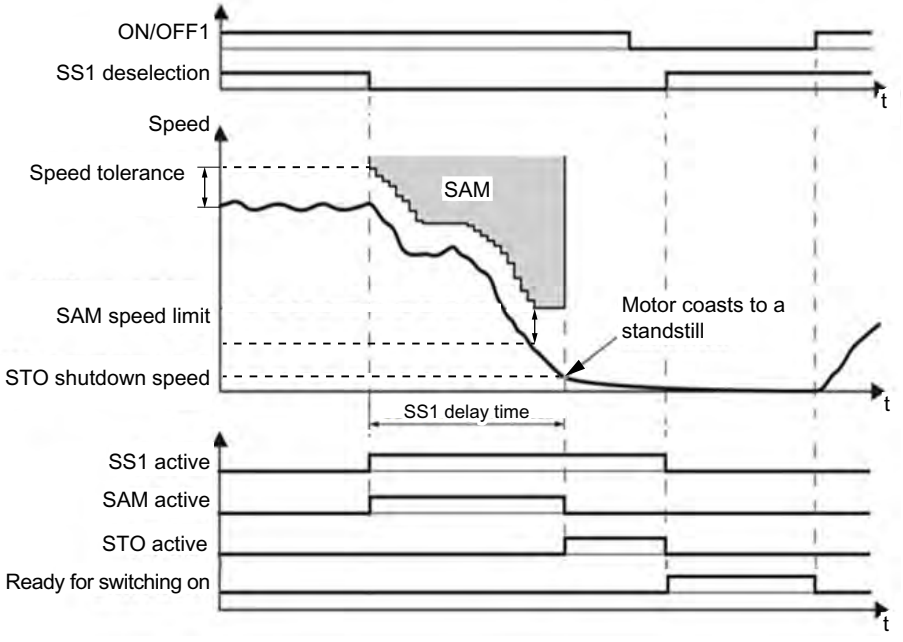


Figure 4-1 Example: SS1 with SAM

Calculating the SAM tolerance of the actual velocity

- The following applies when parameterizing the SAM tolerance:
  - The possible velocity increase after SS1 or SS2 is triggered results from the effective acceleration a and the duration of the acceleration phase.
  - The duration of the acceleration phase is equal to a monitoring cycle (MC = 4 ms)
- The following applies for calculation of the SAM tolerance:
  Actual velocity for SAM = acceleration · acceleration duration
  The following setup rule is derived thereof:
  - For a linear axis:
    SAM tolerance [mm/min] = a [m/s^2] · MC [s] · 1000 [mm/m] · 60 [s/min]
  - For a rotary axis:
    SAM tolerance [rpm] = a [rev/s^2] · MC [s] · 60 [s/min]
- Recommendation
  The SAM tolerance value entered should be approx. 20% higher than the calculated value.
- You set the tolerance such that the "overshoot" is tolerated that necessarily occurs when standstill is reached after braking along the OFF3 ramp. However, the size of this cannot be calculated.

Responses to braking ramp violations

- Safety alarm A01706 (SI Motion: SAM/SBR limit exceeded)
- Stopping the drive with STO

4.2.12 Safe Brake Ramp (SBR)

The Safe Brake Ramp (SBR) function provides a safe method for monitoring the brake ramp. Safe Brake Ramp is applied for monitoring of braking for functions SS1 and SS2 (selected directly or as a response to a limit value violation).

The drive brakes the motor immediately with the OFF3 ramp as soon as SS1 or SS2 is triggered. Monitoring of the braking ramp is activated once the SBR delay time (p9582) has elapsed. The drive monitors the motor to ensure that it does not exceed the set braking ramp (SBR) when braking. The drive deactivates safe monitoring of the braking ramp for the various functions used as follows:

- For SS1
  - As soon as the speed drops below the STO shutdown speed (p9560).
    or
  - As soon as the SS1 delay time (p9556) has elapsed.

  For SS2
  - As soon as the SS2 delay time (p9552) has elapsed.

Following deactivation of the SBR monitoring, depending on the function used, the drive activates the specific subsequent function:

Function used	Subsequent function
SS1	STO
SS2	SOS

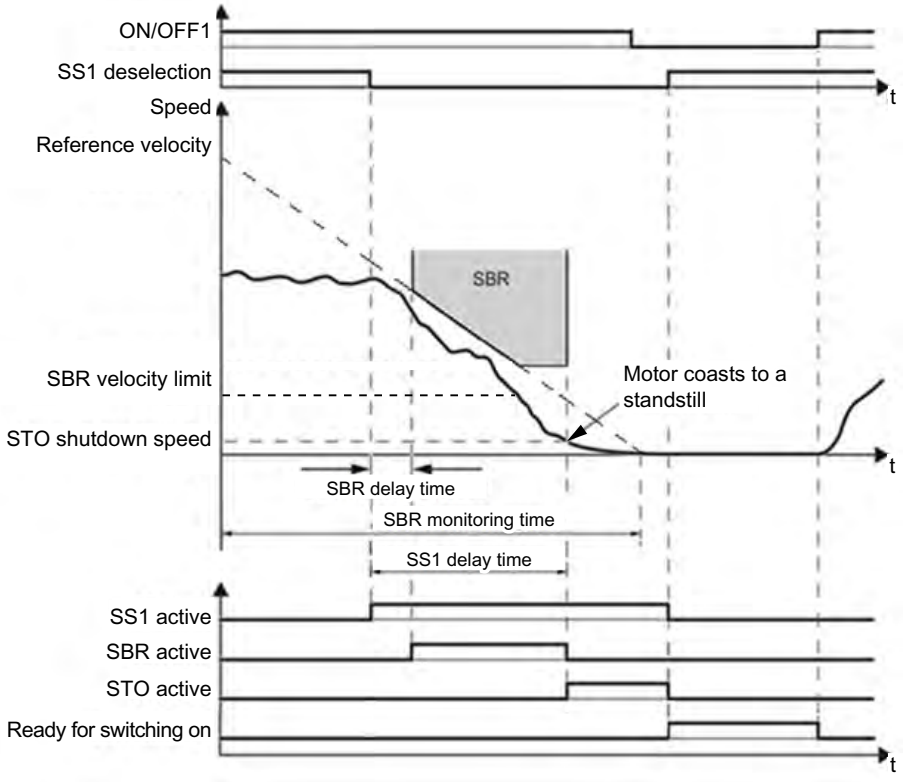


Figure 4-2 Example: SS1 with SBR

Limitation of the SBR delay time

The SBR delay time (p9582) has a minimum value of 10 ms or twice the value of the safety monitoring cycle time. SBR becomes active upon SS1 selection after the SBR delay time (p9582).

It should be noted that the specified SBR delay time is rounded to an integer multiple of the safety monitoring cycle of 4 ms.

Note

If the ramp-down time OFF3 (p1135) in your application is less than 10 seconds, then leave the SBR delay time (p9582) at its factory setting (250 ms). If SS1 goes into a fault condition during the function test, increase this value until the motor brakes normally without a fault. If the ramp-down time OFF3 (p1135) is set to several minutes, you must extend the delay time to several seconds in order to avoid any unwanted faults when selecting SS1.

Setting the SBR ramp

Align the SBR curve to the OFF3 curve. Also check that for every load condition the drive can follow this OFF3 ramp. If you want a monitoring curve that is parallel to the down ramp of the load, then you must set the following:

- Set the reference velocity (p9581) (reference speed) to the value of the maximum speed.
- SBR monitoring time (p9583) = OFF3 ramp-down time (p1135)/gear ratio

- Where: Gear ratio = Load revolutions / motor revolutions.
- Example: Gear ratio = 1/3 ⇒ SBR monitoring time = OFF3 ramp-down time (p1135) · 3

An SBR monitoring time shorter than the value calculated above does not make sense, as the drive in this case can reduce its monitoring curve faster than the load can be braked.

The longer the monitoring time settings, the more tolerant the monitoring.

Responses to braking ramp violations

- Safety alarm A01706 (SI Motion: SAM/SBR limit exceeded)
- Stopping the drive with STO

4.3 Configuring safety functions

When configuring the safety functions, you specify the interfaces that activate the safety functions.

Selecting Basic Functions via F-DI

You can select or deselect the safety function via the Failsafe Digital Input (F-DI).

Whether STO or SS1 is activated when you select the safety function depends on the setting of the SS1 delay time:

- SS1 delay time = 0: STO is activated immediately
- SS1 delay time > 0: SS1 is activated; STO is activated after the SS1 delay time has expired

Controlling Basic and Extended Functions

The following safety telegrams are available for the safety functions:

- PROFIsafe telegram 30
- Telegram 901

If you enable the Safety Integrated Extended Functions SS2E (p9501.18 = 1) or "Transfer SLS limit value via PROFIsafe" (p9501.24 = 1), then it is imperative that you use PROFIsafe telegram 901. This means that if you do not enable these two functions, then you can use telegram 30 or 901 for PROFIsafe communication.

You can find detailed information about the telegrams and the control word and status word assignments in sections "Standard telegrams (Page 661)" and "Supplementary telegrams (Page 663)".

Supplementary telegrams for the safety functions

The following supplementary telegrams are available for non-safety-relevant diagnostics of the safety functions:

- Telegram 700
- Telegram 701
  For example, you use telegram 701 to perform the Safe Brake Test - or the manual test stop for Safety Integrated Extended Functions.

You can find detailed information about the telegrams and the control word and status word assignments in sections "Standard telegrams (Page 661)" and "Supplementary telegrams (Page 663)".

4.4 Responses to safety faults and alarms

The stop responses of the safety functions are initiated by faults and serve to brake a moving drive down to standstill. The type of response that occurs in the event of alarms and faults can either be permanently specified by the system or configured by the machine manufacturer – for example, if a limit value is violated or an internal fault occurs. The converter internally initiates the responses. They do not have to be selected by selecting an external source, e.g. PROFIsafe or F-DI.

In this way, you can stop the machine optimally adapted to the specific situation.

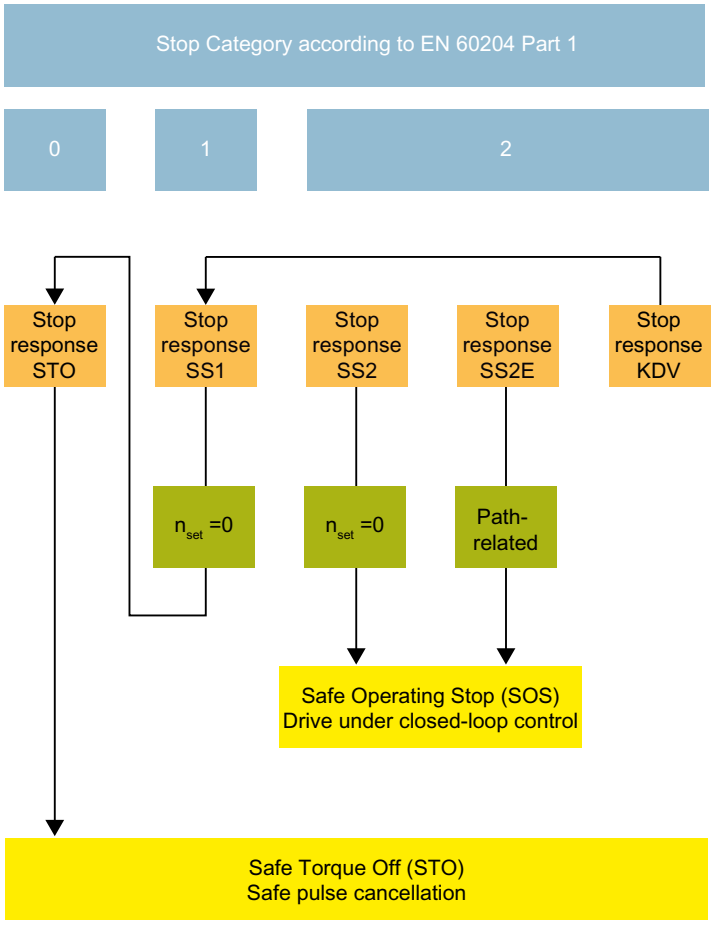


Figure 4-3 Overview of the responses

More detailed information about the various stop responses is provided in the description of the specific safety function.

4.4.1 Discrepancy at the inputs of the F-DI

The safety functions must be selected/deselected simultaneously in both monitoring channels via the input terminals and only have an effect on the associated drive.

- 1 signal: Deselecting the function
- 0 signal: Selecting the function

A time delay, for example caused by mechanical switching operations, cannot be avoided. Define a (permissible) discrepancy time so that undesirable converter responses do not occur. The selection or deselection must take place in both monitoring channels within this (permissible) discrepancy time to be interpreted as "simultaneous".

Note

Parameterization of the (permissible) discrepancy time (p9650)

To avoid that faults (nuisance faults) are incorrectly initiated, at these inputs the (permissible) discrepancy time (p9650) must always be set shorter than the shortest time between 2 switching events (ON/OFF, OFF/ON).

- If the permissible discrepancy time was exceeded (discrepancy error) then the converter outputs F01611/F30611.
  Under "Response of the safety functions in detail", detailed information is provided as to precisely when STO becomes active.
- The drive indicates the discrepancy error when the RDY-LED flashes quickly red. More detailed information on this can be found in section "Table 9-3 Status explanation of the RDY LED during operation (Page 317)".
- The drive sets the error bit of the safety functions (= internal event):
  - Communication telegrams (Page 661)
  - Bit assignments of the process data (Page 665)

Response of the safety functions in detail

Regarding the drive response, a distinction should be made between 2 cases:

- The initial state of both DIs is "Low" and STO is active:
  - If one of the two digital inputs is switched to "High", then the debounce time (p9651) elapses.
  - The converter does not respond if the DI returns to "Low" within the debounce time (p9651) (filtering noise pulses).
  - The (permissible) discrepancy time then elapses (p9650).
  - If there is still a discrepancy at the F-DI after the (permissible) discrepancy time elapses, the converter issues faults F01611/F30611 ("Fault in a monitoring channel").
  - The transition time "F01611 → STO" (p9658) elapses. The converter outputs faults F01600/F30600(9999) after this transition time elapses. STO remains active or becomes active again.
  - **Please note:** Even for an active internal event, i.e. after p9650 elapses, STO becomes inactive if the other DI is also switched to "High" before p9658 elapses. In this case, this means that the motor can be switched on as long as the transition time (p9658) has not yet expired.
- The initial state of both DIs is "High":
  - If one of the two digital inputs is switched to "Low", then the debounce time (p9651) elapses.
  - The converter does not respond if the DI returns to "High" within this debounce time (filtering noise pulses).
  - The following response chain subsequently occurs:
    (a) The converter immediately initiates SS1 (for "SI SS1 delay time" (p9652) ≠ 0) or STO (for "SI SS1 delay time" = 0); regardless of when the other DI is switched.
    (b) If "SI SS1 delay time" ≠ 0 is parameterized, then the converter starts the transition time SS1 → STO.
    (c) The (permissible) discrepancy time (p9650) elapses. If there is still a discrepancy at the F-DI after the (permissible) discrepancy time from (p9650) elapses, the converter issues faults F01611/F30611 ("Fault in a monitoring channel").
  - After the (permissible) discrepancy time (p9650) elapses, the "transition time F01611 to STO" (p9658) elapses. The converter then initiates faults F01600/F30600(9999). For "SI SS1 delay time" (p9652) ≠ 0, STO is initiated as follows (depending on which occurs first):
    - After the "SI SS1 delay time" expires
    Or
    - After "(permissible) discrepancy time" + "transition time F01611 to STO" expires (p9650 + p9658).
  - **Please note:** For active discrepancy errors F01611/F30611 ("Fault in a monitoring channel"), the motor can still be operated as long as STO is not yet active.

4.4.2 Acknowledging alarms and/or faults and switching on the motor again

Acknowledging a fault

To acknowledge faults and to switch on the motor again, proceed as follows:

1. Rectify the cause of this fault.
2. Acknowledge the fault:
   - Basic Functions - Safety faults
     Safety faults associated with Basic Functions require a safety-related acknowledgment followed by a standard acknowledgment.
   - Extended Functions - Safety alarms
     Safety alarms associated with Extended Functions become active after a limit value is exceeded or other internal events. After the cause has been removed, these alarms require safety-related acknowledgment.
   - Extended Functions - Safety faults
     Stop responses initiated by internal events are indicated using Safety faults, which after safety-related acknowledgment, require a standard acknowledgment.
3. You have the following options:

• POWER ON	By switching off the supply voltage and switching it on again
• Selecting/deselecting STO	• By selecting/deselecting F-DI or • Using the PROFIsafe telegram Note that you can only acknowledge Safety alarms, such as A01711 and other internal events caused by limit values being exceeded for Extended Safety, safely using STO if p9507.0 = 1 is set (extended message acknowledgment to default value). The following happens once the cause of the fault has been eliminated: 1. The Safety requirement "Close motor holding brake" is canceled. 2. The possibly active F01611 fault or STO is withdrawn. 3. In addition, reset the messages in the fault buffer using the general acknowledgment mechanism.
• Safe acknowledgment	Using PROFIsafe telegram (S_STWx byte 0 bit 7)

Switching the motor on again

- Acknowledge the drive faults.
- Switch the motor off and then on again. (Bit 0 in the STW1: 0 → 1)
- Safety alarms, such as A01711 and other internal events caused by limit values being exceeded for Extended Safety, can only be acknowledged in a safety-related way using STO if p9507.0 = 1 is set. (extended message acknowledgment to default value).

See also

Communication telegrams (Page 661)
Bit assignments of the process data (Page 665)

4.5 Response times

The safety functions (Safety Integrated) are executed with a safety monitoring cycle of 4 ms.

PROFIsafe telegrams are evaluated in the PROFIsafe scan cycle. The PROFIsafe scan cycle corresponds to twice the monitoring cycle.

Note for understanding the following tables

The drive system is the component that provides the safety functions. The designation "fault-free drive system" means that the component that provides the safety functions does not have a defect itself:

- Worst case for a fault-free drive system
  For faults outside the drive system, the "Worst case for a fault-free drive system" reaction time is guaranteed.
  Examples of faults outside the drive system are faulty setpoint specification by the control system, limit value violations as a result of the behavior of the motor, closed-loop control, load, etc.
- Worst case when a fault exists
  For a single fault within the drive system, the "Worst case when a fault exists" reaction time is guaranteed.
  Faults within the drive system are, for example, a defect in a switch-off signal path of the power unit, a defect in an encoder actual value measurement, a defect in a microprocessor, etc.

4.5.1 Response times when controlling via terminals (Basic Functions)

The following table lists the response times from the control via terminals until the response actually occurs.

Table 4-1 Response times when controlling via terminals

Function	Worst case for	
	Drive system has no fault	**A fault is present**
STO	8 ms + t_E[1)]	12 ms + t_E[1)]
SBC	16 ms + t_E[1)]	32 ms + t_E[1)]
SS1/SS1E (time-controlled) Selection until STO is initiated	8 ms + p9652[2)] + t_E[1)]	12 ms + p9652[2)] + t_E[1)]
SS1/SS1E (time-controlled) Selection until SBC is initiated	16 ms + p9652[2)] + t_E[1)]	32 ms + p9652[2)] + t_E[1)]
SS1 (time-controlled) Selection until braking is initiated	12 ms + 2 ms + t_E[1)]	16 ms + 2 ms + t_E[1)]

1) The following applies for t_E (debounce time of the digital input being used):

p9651[3)] = 0	t_E = 8 ms
p9651[3)] ≠ 0	t_E = p9651 + 5 ms

2) p9652: SI SS1 delay time

3) p9651: SI STO/SBC/SS1 debounce time

4.5.2 Response times when controlling via PROFIsafe (Basic Functions)

The following table lists the response times[1] from receiving the PROFIsafe telegram at the converter up to initiating the specific response.

Table 4-2 Response times when controlling via PROFIsafe

Function	Worst case for	
	Drive system has no fault	**A fault is present**
STO	20 ms + t_K[2]	20 ms + t_K[2]
SBC	24 ms + t_K[2]	40 ms + t_K[2]
SS1/SS1E (time-controlled) Selection until STO is initiated	20 ms + p9652[3] + t_K[2]	20 ms + p9652[3] + t_K[2]
SS1/SS1E (time-controlled) Selection until SBC is initiated	24 ms + p9652[3] + t_K[2]	40 ms + p9652[3] + t_K[2]
SS1 (time-controlled) Selection until braking is initiated	20 ms + 2 ms + t_K[2]	20 ms + 2 ms + t_K[2]

[1] The specified response times involve SINAMICS-internal response times. Program run times in the F-host and the transmission time via PROFINET are not taken into account. When calculating the response times between the F-CPU and the drive, you must take into account that faults in the communication can result in a safety function only being selected after the PROFIsafe monitoring time (F_WD_Time) has expired. The PROFIsafe monitoring time (F_WD_Time) must also be included in the calculation when an error occurs.

[2] t_K is the time for internal communication within the SINAMICS module; t_K can be determined as follows:

For isochronous communication	t_K = To (determine To from the bus configuration on the control side)
For non-isochronous communication	t_K = 4 ms

[3] p9652: SI SS1 delay time

4.5.3 Response times when controlling via PROFIsafe (Extended Functions)

The following table lists the response times[1] from receiving the PROFIsafe telegram on the drive until the specific response is initiated.

Table 4-3 Response times when controlling via PROFIsafe

Function	Worst case for	
	Drive system has no fault	**A fault is present**
STO	5 · t_EF[5] + t_BF[6] + t_K[4]	5 · t_EF[5] + 2 · t_BF[6] + t_K[4]
SBC	5 · t_EF[5] + 2 · t_BF[6] + t_K[4]	5 · t_EF[5] + 6 · t_BF[6] + t_K[4]
SS1 (time controlled), SS1E, SS2E: Time from selecting up to starting the safe timer SS1 (acceleration controlled), SS2: Time from selecting up to initiating braking SOS: Time from selecting up to starting standstill monitoring	5 · t_EF[5] + 2 ms + t_K[4]	5 · t_EF[5] + 2 ms + t_K[4]
SBR or SAM (limit value violation until STO active)	2 · t_EF[5] + t_BF[6]	2.5 · t_EF[5] + t_BF[6] + 1 ms
SOS standstill tolerance window violated	1.5 · t_EF[5] + 2 ms	3 · t_EF[5] + 2 ms + 1 ms
SLS speed limit violated[2]	2 · t_EF[5] + 2 ms	3.5 · t_EF[5] + 2 ms + 1 ms
SSM[3]	4 · t_EF[5]	4.5 · t_EF[5] + 1 ms
SDI (limit value violation until braking is initiated)	1.5 · t_EF[5] + 2 ms	3 · t_EF[5] + 2 ms + 1 ms
SLA: Selection or deselection	5 · t_EF[5] + t_K[4]	5 · t_EF[5] + t_K[4]
SLA: Limit value violation	3 · t_EF[5] + 2 ms	4 · t_EF[5] + 2 ms + 1 ms

1) The specified response times involve internal SINAMICS response times. Program run times in the F-host and the transmission time via PROFINET are not taken into account. When calculating the response times between the F-CPU and the drive, you must take into account that faults in the communication can result in a safety function only being selected after the PROFIsafe monitoring time (F_WD_Time) has expired. The PROFIsafe monitoring time (F_WD_Time) must also be included in the calculation when an error occurs.

2) SLS: Specification of the response time required to initiate a braking response in the drive - or for the output of the "SOS selected" message to the motion control system.

3) SSM: The data corresponds to the times between the limit value being undershot up to sending the information via PROFIsafe.

4) t_K is the time for internal communication within the SINAMICS module; t_K can be determined as follows:

For isochronous communication	t_K = To (determine To from the bus configuration on the control side)
For non-isochronous communication	t_K = 4 ms

5) Safety monitoring cycle Extended Functions t_EF = 4 ms

6) Safety monitoring cycle Basic Functions t_BF = 4 ms

4.6 Acceptance - completion of commissioning

What is an acceptance?

The machine manufacturer is responsible in ensuring that the plant or machine functions perfectly. As a consequence, after commissioning, the machine manufacturer must check those functions or have them checked by specialist personnel, which represent an increased risk of injury or material damage. This acceptance or validation is, for example, also specified in the European Machinery Directive and essentially comprises two parts:

- **Acceptance test:** Checking the safety-relevant functions and machine parts after startup.
- **Documentation:** Generate an "Acceptance report" that describes the test results.

Supply information for the validation, e.g. the harmonized European standards EN ISO 13849-1 and EN ISO 13849-2.

Acceptance test of the machine or plant

The acceptance test is used to check whether the safety-relevant functions in the machine or system function properly. The documentation of the components used in the safety functions can also provide information about the necessary tests. Testing the safety-relevant functions includes, e.g. the following:

- Are all safety equipment such as protective door monitoring devices, light barriers or emergency-off switches connected and ready for operation?
- Does the higher-level control respond as expected to the safety-relevant feedback signals of the drive?
- Do the drive settings match the configured safety-relevant function in the machine?

Acceptance test of the drive

The acceptance test of the drive is a part of the acceptance test of the entire machine or plant.

The acceptance test (configuration check) requirements for electrical drive safety functions emanate from DIN EN 61800-5-2, Section 7.1 Point f). The acceptance test is called "configuration check" in this standard.

- Description of the application including a picture
- Description of the safety-relevant components (including software versions) that are used in the application
- List of the PDS(SR) [Power Drive System(Safety Related)] safety functions used
- Results of all tests of these safety functions using the specified test procedure
- List of all safety-relevant parameters and their values in the PDS(SR)
- Checksum, test date and confirmation by test personnel

Documentation

The following must be documented for the drive:

- Result of the acceptance tests
- Settings of the integrated drive safety functions

This documentation must be countersigned.

Persons authorized for acceptance

Personnel from the machine manufacturer, who, on account of their technical qualifications and knowledge of the safety functions, are in a position to perform the acceptance test in the correct manner are authorized to perform the acceptance testing of the drive.

Recommendations

For the acceptance test, check whether the safety functions in the drive have been set correctly.

- Perform the acceptance test with the maximum possible velocity and acceleration to test the expected maximum braking distances and braking times.
- Alarm A01697 (Test stop for motion monitoring is required):
  This alarm is issued following each system startup and is not critical for acceptance.

After the acceptance test of the drive's safety functions, you must also check whether the safety-related functions in the machine or system are functioning correctly.

Note

Examples of acceptance tests

The following acceptance tests are examples which demonstrate the basic procedure. They are not suitable for every possible setting of the drive.

When do you have to conduct an acceptance test of the machine or plant?

You must conduct an acceptance test of the machine or plant in the following cases:

- After commissioning
- After importing a new firmware version to the drive
- If you changed the parameter assignment of the drive
- After the maximum time between 2 acceptance tests set using p9659 has expired (forced checking procedures).

When do you have to conduct an acceptance test of the drive?

If you replaced the drive, you have to conduct an acceptance test for it.

Note

When you replace the drive, an error message appears. Acknowledge this error message, e.g. by switching off and on.

What does the acceptance test for the drive consist of?

Documentation

1. Supplement/change the hardware data
2. Supplement/change the software data (specify version)

Function test, safety functions

You must perform an acceptance test individually for each function used and each configured control.

As far as possible, the acceptance tests are to be carried out at the maximum possible machine speed and acceleration rates to determine the maximum braking distances and braking times that can be expected.

If Basic Functions and Extended Functions are combined, the acceptance test for both types must be carried out for the functions used.

Functional testing of forced checking procedure (test stop)

Select and deselect STO. More detailed information on the topic of "Forced checking procedure (test stop)" is provided in Chapter "Test stop (forced checking procedure) (Page 228)".

4.6.1 Performing acceptance tests

You must perform an acceptance test both for each of the Basic Functions and for each Extended Function and each control type that you use.

As of version 15.1 of the commissioning tool Startdrive, a wizard is available for this purpose to guide you step by step through the acceptance process; see section "Acceptance test (Page 294)".

4.7 Information pertaining to component replacements

Replacing a component from the perspective of Safety Integrated

Note

Note additional safety instructions

Observe the instructions with regard to changing or replacing software components in Section "Safety instructions"!

The faulty component was replaced according to safety regulations. The information relevant from the perspective of Safety Integrated is provided in the following.

- Based on the NodeID and the saved CRC of the particular hardware component, the drive identifies that a component has been replaced. You can take the responses of the drive and the actions that have to be carried out from the following table:

	Replaced component	Control type	Drive response (fault)	User action			Diagnostic parameters
				Fault acknowledgment required[1]	Acknowledgment is required that the component has been replaced[2]	Save[3]	
Basic Functions	Motor	All	F01641.1 = 1	Yes	No	Yes	r9776.2 = 1
Extended Functions	Motor	All	F01640.3 = 1 F01640.4 = 1 F01641.1 = 1 F01641.5 = 1 F01641.6 = 1	Yes	Yes	Yes	r9776.2 = 1 r9776.3 = 1

1) The fault must be acknowledged each time a component is replaced using a standard acknowledgment. However, even without acknowledgment the drive can still be operated.

2) To acknowledge that the component has been replaced, set parameter p9702 = 29. p9702 jumps back up to a value of 0 once the acknowledgment process has been completed.

3) You must save the modified data after a component has been replaced:
- It is not permissible that the firmware update is active on the drive object.
- Copy from RAM to ROM by setting p0977 = 1.
If the modified data is not saved, then the drive re-issues the fault at the next power on.

Acceptance test and acceptance report

⚠ WARNING

Unwanted motion if components are replaced without a function test

After a component replacement, connections or functions can be defective so that death or serious injury can result if a person enters the danger zone of the motors.

- After component replacement, always run a simplified function test.

After the machine has been modified, a full verification is required again – including the acceptance test and appropriate documentation. The drive identifies when a component has been replaced based on the saved checksums (CRC):

- Message F01640/F01641 identifies as to which component was replaced.
- Message F01650 indicates as to whether an acceptance test is required, and the test depth that should be performed.
- Each time a component is replaced, a function test should always be carried out so that incorrect connections and/or wiring can be ruled out.
- For SINAMICS drives, after a component has been replaced, generally a reduced/partial acceptance test is sufficient.

Replacing a converter

When replacing a converter, after it has run-up, fault F01641 is displayed as a result of the changed checksums. No additional stop response is initiated, and operation of the drive is not restricted as a result.

- The message can be deleted with a standard acknowledgment.
- Copying from RAM to ROM should be carried out to avoid that the message is output again after the next power on.
- A reduced acceptance test of the safety functions is required.
  - Check the Emergency Stop function (STO or SS1), as well as the SBC function assuming that it is being used.
  - Test the forced checking procedure (test stop) of the safety function on the drive
  - After replacing a component, perform a general check of the actual value acquisition by switching on the drive and briefly operating with movement in both directions of rotation.
  - The converter data (hardware/software version) should be added to the acceptance protocol, the changed checksum and time stamp should be documented and countersigned.

Replacing the motor

When replacing the motor, after it has run-up, fault F01640 (channel 2) and F01641 (channel 1) is displayed as a result of the changed checksums. Further, a fault response is initiated, which prevents the drive from being operated.

- Acknowledge the component replacement:
  - Set p9702 = 1D hex.
  - Save with "Copy from RAM to ROM".
- A reduced acceptance test is required.
  - After replacing a component, perform a general check of the actual value acquisition by switching on the drive and briefly operating with movement in both directions of rotation.
  - Only for Extended Functions - Check the safety-related actual value acquisition:
    With the motion monitoring functions activated (e.g. SLS or SSM with hysteresis), briefly operate the drive in both directions.
  - Only for Extended Functions and only after the encoder has been replaced:
    Test the encoder parameterization (a trace recording is not required)
- The converter data (hardware/software version) should be added to the acceptance protocol, the changed checksum and time stamp should be documented and countersigned.

4.8 Functional safety

Safety, from the perspective of the object to be protected, cannot be split-up. The causes of hazards and, in turn, the technical measures to avoid them can vary significantly. This is why a differentiation is made between different types of safety (e.g. by specifying the cause of possible hazards). "Functional safety" is involved if safety depends on the correct function.

To ensure the functional safety of a machine or plant, the safety-related parts of the protection and control devices must function correctly. In addition, the systems must behave in such a way that either the plant remains in a safe state or it is brought into a safe state if a fault occurs. In this case, it is necessary to use specially qualified technology that fulfills the requirements described in the associated Standards. The requirements to implement functional safety are based on the following basic goals:

- Avoiding systematic faults
- Controlling random faults or failures

Benchmarks for establishing whether or not a sufficient level of functional safety has been achieved include the probability of hazardous failures, the fault tolerance, and the quality that is to be ensured by avoiding systematic faults. This is expressed in the standards using specific classification. In IEC/EN 61508, IEC/EN 62061 "Safety Integrity Level" (SIL) and EN ISO 13849-1 "Category" and "Performance Level" (PL).

4.9 Machinery Directive

The basic safety and health requirements specified in Annex I of the Directive must be fulfilled for the safety of machines.

The protective goals must be implemented responsibly to ensure compliance with the Directive.

Manufacturers of a machine must verify that their machine complies with the basic requirements. This verification is facilitated by means of harmonized standards.

IEC 61800-5-2 Adjustable-speed electrical power drive systems Part 5-2 is relevant for the Machinery Directive: Safety requirements - Functional safety

Within the context of IEC 61508, IEC 61800-5-2 considers adjustable speed electric power drive systems (PDS), which are suitable for use in safety-related applications (PDS(SR)).

IEC 61800-5-2 places demands on PDS(SR) as subsystems of a safety-related system. This therefore permits the implementation of the electrical/electronic/programmable electronic elements of a PDS(SR) taking into account the safety-relevant performance of the safety function(s) of a PDS.

Manufacturers and suppliers of PDS(SR) can prove to users (e.g. integrators of control systems, developers of machines and plants etc.) the safety-relevant performance of their equipment by implementing the specifications stipulated in standard IEC 61800-5-2.

Installing

5

5.1 Safety instructions

NOTICE

Thermal damage to temperature-sensitive parts

Some parts of the electrical motor enclosure can reach temperatures that exceed 100 °C. If temperature-sensitive parts, for instance electric cables or electronic components, come into contact with hot surfaces then these parts can be damaged.

- Ensure that no temperature-sensitive parts come into contact with hot surfaces.

5.2 Installing the motor

Note

Required checks

The checks listed below are a minimum benchmark and must be performed in any case. Further checks before, during and after the installation of the motor depend on the system-specific conditions and are the responsibility of the plant or system manufacturer.

- Thoroughly familiarize yourself with the safety instructions and observe the checklists below before starting any work.

Table 5-1 Checklist before installing

Check	OK
General checks	
Are the environmental conditions in the permissible range? • Section "Permissible environmental conditions for the motor (Page 340)"	
Checks regarding the mechanical system	
Is the motor free of visible damage?	
Have the mounting surfaces (e.g. flange, shaft) on the customer machine and on the motor been cleaned?	
Are the mounting surfaces free of corrosion?	
Do the mounting dimensions (e.g. shaft diameter, shaft length, true run) on the customer machine meet the specification?	

5.2.1 Mounting instructions for the motor

NOTICE

Damage to shaft sealing rings caused by solvent

If shaft sealing rings come into contact with solvents when removing the corrosion protection, the shaft sealing rings can be damaged.

- Avoid contact between solvents and shaft sealing rings.

NOTICE

Damage to the motor due to runout on the shaft extension

Blows and pressure applied to the motor shaft extension can damage the motor.

- Mount the drive output elements without applying any blows and pressure to the shaft extension.

- Observe the specifications on the rating plate.
- Observe the warning and information plates on the motor.
- Remove the anti-corrosion protection thoroughly from the motor shaft. Use commercially available solvents.
- Please pay attention to the notes on the thermal mounting variants.
- If the motor is installed vertically with the shaft extension facing up, ensure that no liquid can enter the upper bearing.
- Ensure that the flange is in even contact with the mounting surface.
- Use hexagon socket head cap screws with a property class of at least 8.8.
- When tightening the fastening bolts avoid any uneven stressing.
- Observe the tightening torques for the fastening bolts.

Tightening torques for fastening bolts

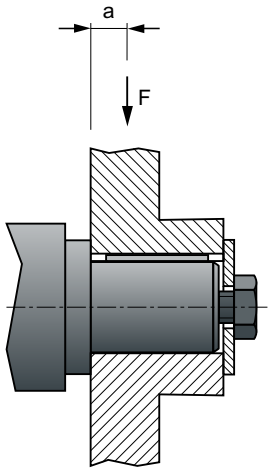
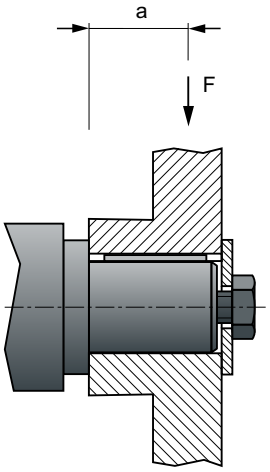
The general tolerance for the tightening torque is 10%. The tightening torque is based on a friction coefficient of μ = 0.14.

Motor	Bolt DIN 7984	Washer ISO 7092 in mm	Tightening torque for bolts (not for electrical connections)
1FK2□02	M4	4 (d2 = 8)	2.2 Nm
1FK2□03	M5	5 (d2 = 9)	4 Nm
1FK2□04 1FK2105	M6	6 (d2 = 11)	8 Nm
1FK2205 1FK2□06	M8	8 (d2 = 15)	20 Nm
1FK2□08	M10	10 (d2 = 18)	35 Nm
1FK2□10	M12	12 (d2 = 20)	60 Nm

5.2.2 Attaching the output elements

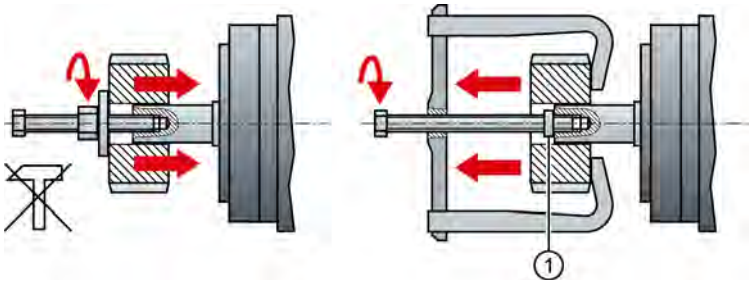
Reduce the bending torque load applied to the shaft and the bearing by appropriately arranging the output elements.

Mount the output elements as close as possible to the motor bearing.

optimum	unfavorable
	
low stress on shafts and bearings	high stress on shafts and bearings

Mount or remove the power output elements (e.g. couplings, gear wheels, belt pulleys) using suitable devices only (see figure).

- Use the threaded hole in the shaft extension.
- If required, heat up the output elements before mounting or removing.
- When removing the output elements, use an intermediate disk to protect the centering in the shaft extension.



1 Intermediate washer/disk (to protect the centering in the shaft extension)

Figure 5-1 Mounting and removing output elements

- If necessary, completely balance the motor together with the output elements according to ISO 1940.

Note

Motors with feather key are half-key balanced. The motors have been balanced with half a feather key.

The motor dimensions can be found in section "Dimension drawings (Page 419)".

5.3 Installing the converter

5.3.1 Installation conditions

When installing the converter carefully observe the conditions listed below in order to guarantee reliable, continuous and trouble-free operation.

- The converter is designed for installation in a control cabinet.
- The converter is certified for use in environments with degree of pollution 2 without condensation; i.e. in environments where no conductive pollution/dirt occurs. Condensation is not permissible.
- The converter fulfills degree of protection IP20 according to IEC 60529.
- EMC-compliant installation:
  - Section "EMC-compliant installation of a machine or system (Page 47)"

Note

Keep the cover of the operator panel closed to protect the operator controls and the SD card.

Additional requirements for plants and systems in the United States / Canada (UL/cUL)

A label with the following number is provided with the device: A5E36790112.

Note the instructions on the label and attach the label in a clearly visible location close to the converter in the control cabinet.

Installation notes

- Install the converter vertically with the flap for the LED display facing upwards.

Figure 5-2 Mounting position of the converter

- Maintain the minimum clearances to other components.
- Use the recommended fastening elements and comply with the specified torques.

Clearances to cabinet panels and other components

Leave a minimum 100 mm clearance to other devices at the top and bottom. A lateral clearance between multiple SINAMICS S210 converters is not mandatory.
Observe a lateral clearance of at least 10 mm to other devices.

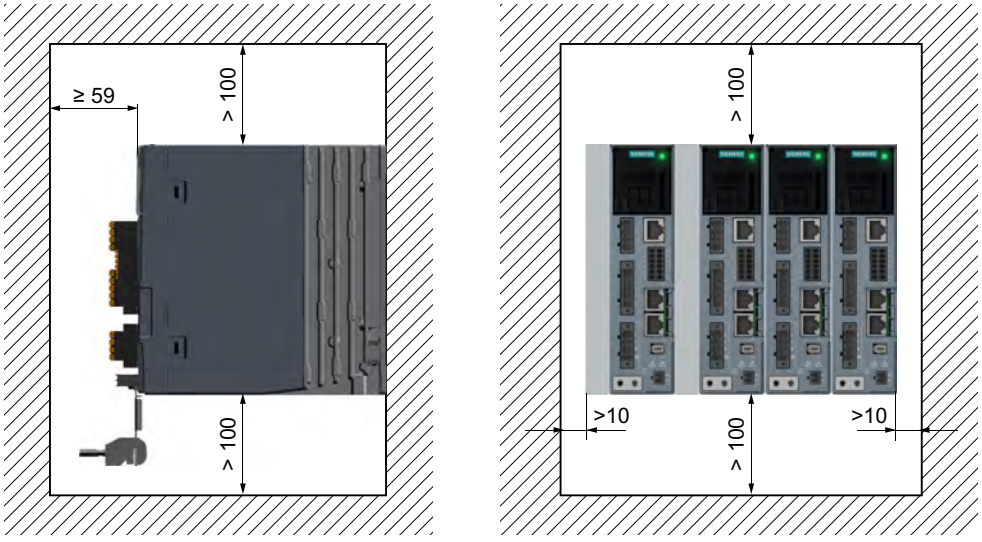


Figure 5-3 Clearances to cabinet panels and other components for converters with 1 AC line connection

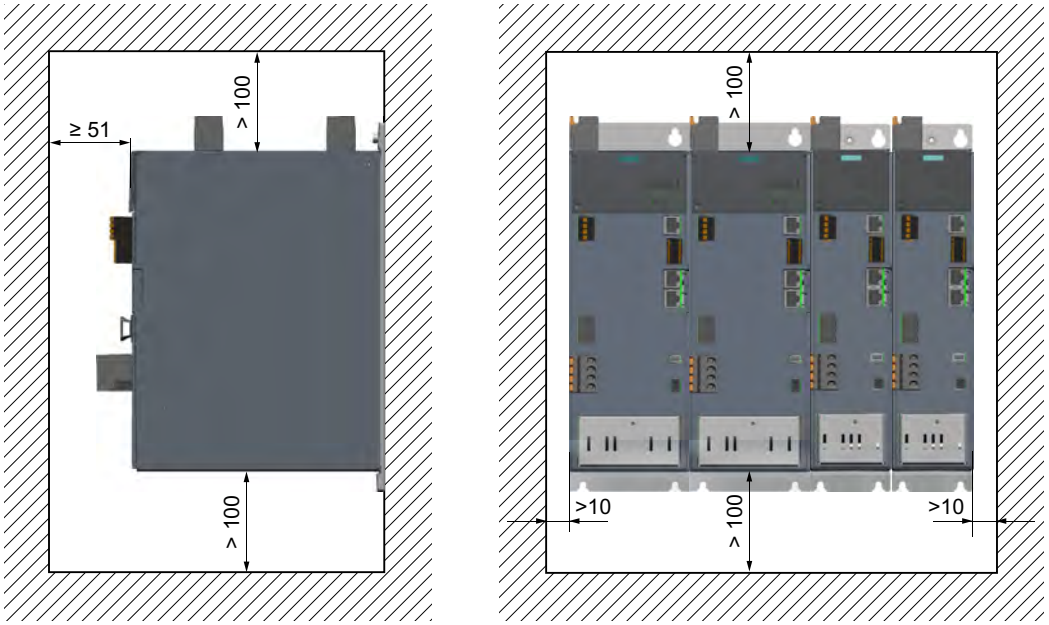


Figure 5-4 Clearances to cabinet panels and other components for converters with 3 AC line connection

5.3.2 Dimensions and drilling dimensions

Dimension drawings and drilling dimensions for converters with 1 AC line connection

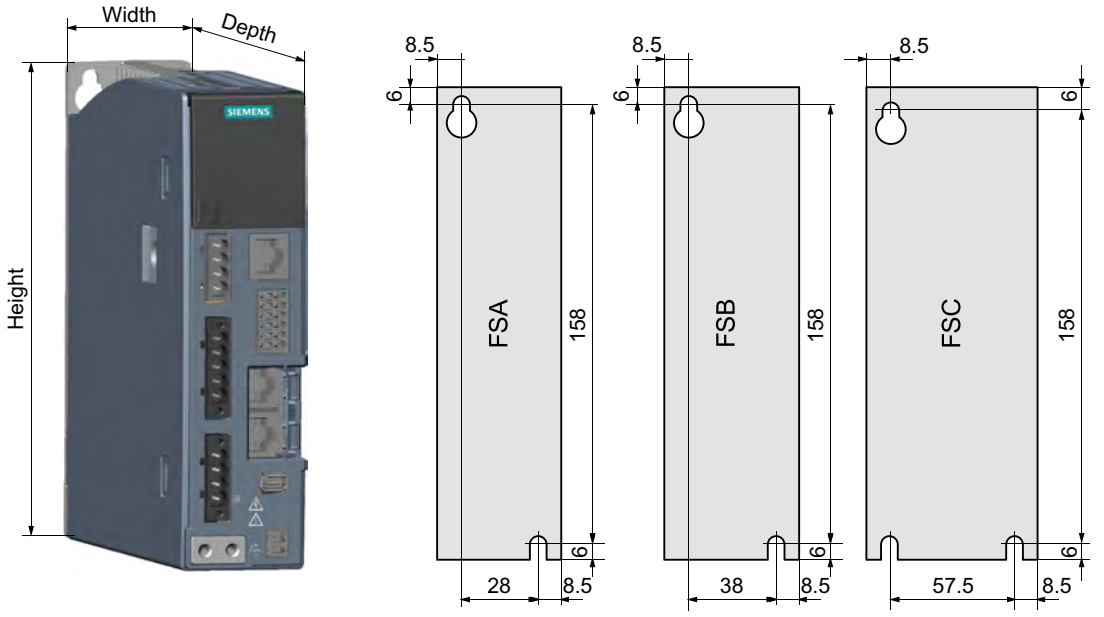


Figure 5-5 Dimension drawing and drilling dimensions

Table 5-2 Dimensions and mounting

Frame size	Width	Height	Depth	Weight	Mounting
FSA	45 mm	170 mm	170 mm	1.1 kg	2 x M5 / 4 Nm
FSB	55 mm	170 mm	170 mm	1.2 kg	2 x M5 / 4 Nm
FSC	74.5 mm	170 mm	197.4 mm	1.9 kg	3 x M5 / 4 Nm

Dimension drawings and drilling dimensions for converters with 3 AC line connection

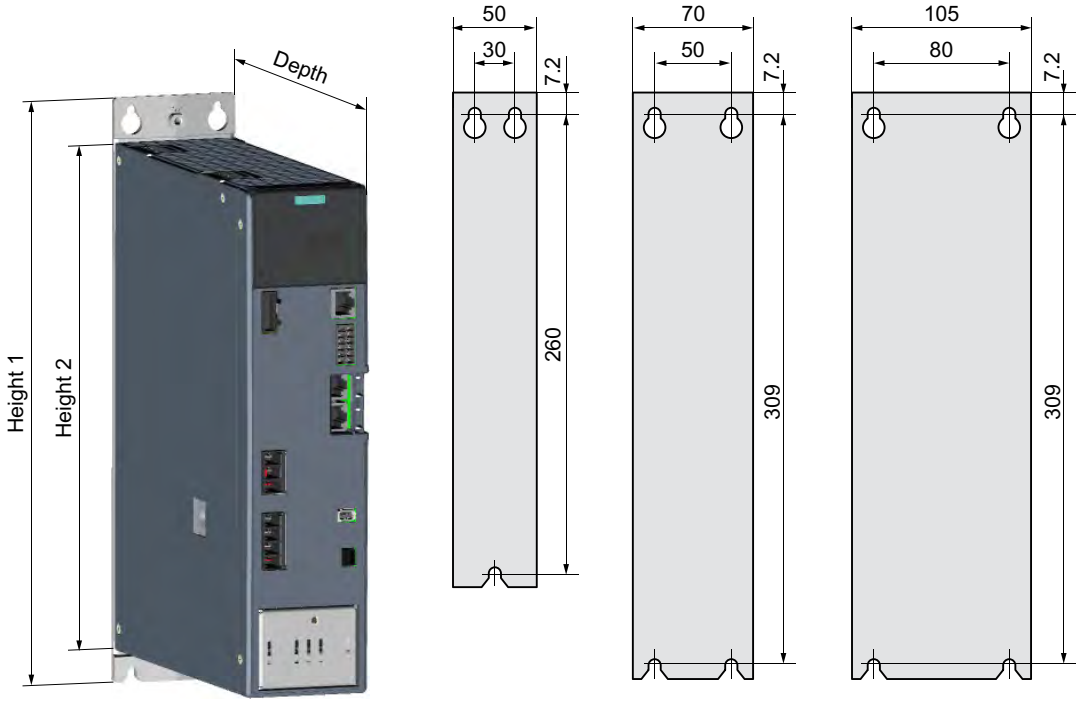


Figure 5-6 Dimension drawing and drilling dimensions

Table 5-3 Dimensions and mounting

Frame size	Width	Height 1	Height 2	Depth	Weight	Mounting
FSA	50 mm	272.9 mm	231 mm	223.3 mm	2.1 kg	3 x M5 / 4 Nm
FSB	70 mm	322 mm	280 mm	223.3 mm	3.3 kg	4 x M5 / 4 Nm
FSC	105 mm	322 mm	280 mm	223.3 mm	5.0 kg	4 x M5 / 4 Nm

5.4 Connecting the converter and the motor

You can find general information in chapter "Permissible line supplies and connection options (Page 52)".

5.4.1 Cable lengths

Cable lengths for the converter connections

Type of connection	Connection via	Permissible cable length
Control voltage 24 V DC	X124	30 m
External braking resistor for converters with 1 AC line connection	X1 (R1, DCP)	3 m
External braking resistor for converters with 3 AC line connection	X4 (R1, DCP)	10 m
Service interface	X127	10 m
Digital inputs	X130	30 m
Connection to the control system via PROFINET	X150 P1 X150 P2	100 m
Motor power connections	X2	50 m
Encoder	X100	50 m
Motor holding brake	X107	50 m

Cable lengths for connecting the motor to the converter

The motor is connected to the converter using a one cable system (OCC - one cable connection) via the MOTION-CONNECT cable. The MOTION-CONNECT cable includes the power connections for the motor, the encoder connection and the connections for the motor holding brake.

The permissible cable lengths for the various EMC categories are given in the section:

- "Electromagnetic compatibility according to IEC 61800-3 (Page 406)"

Ordering information for MOTION-CONNECT cables is provided in the section:

- "Ordering data of the connection system (Page 462)"

Ordering information for external line filters is provided in the section:

- "Technical data (Page 448)"

5.4.2 Connecting a MOTION-CONNECT cable at the motor

NOTICE
Destruction of the motor if it is directly connected to the three-phase line supply
The motor will be destroyed if it is directly connected to the three-phase line supply. • Only operate motors with the permitted converters.

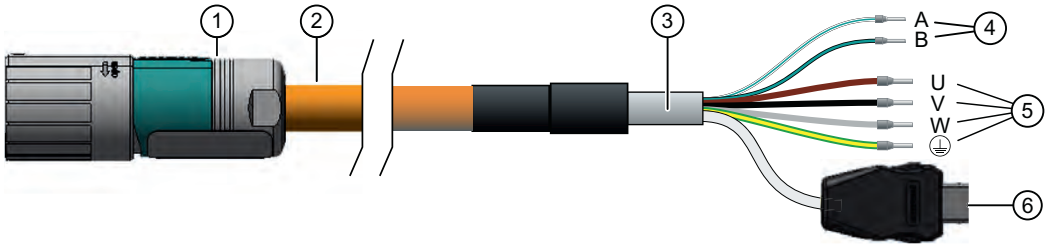
The manufacturer of the system/machine is responsible for ensuring that installation is performed correctly.

Ensure that the associated warning labels in the appropriate national language are attached.

The motors have SPEED-CONNECT M12, M17 or M23 connectors that can be rotated.

You connect the motor to the converter using a MOTION-CONNECT OCC cable. The cables for the power, the holding brake, the encoder and the shielding are integrated in the OCC cable.

- Use the prefabricated MOTION-CONNECT OCC cables from SIEMENS. This reduces the installation time and costs, and increases the operational reliability of the drive.



① M12, M17, M23 or M40 round connector, 10 pin
② MOTION-CONNECT OCC cable
③ Shielding
④ Cables for holding brake
⑤ Power cables
⑥ SIEMENS IX connector for signal line

Figure 5-7 MOTION-CONNECT OCC (sample image)

- Check that the sealing surfaces of the connectors have not been damaged.

Clearance required when connecting the motor

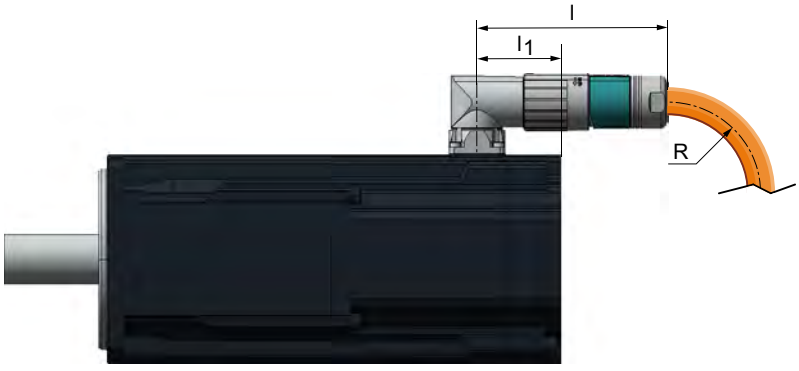


Figure 5-8 Sample image

Motor	Connector size	Distance, point of rotation to NDE		Length of the plug connection	Minimum bending radius, static	
		Without brake	With brake		MC500	MC800 PLUS
		l_1 / mm		l / mm	R_{static} / mm	
1FK2☐02	M12	33		61	23.5	28.2
1FK2☐03		23				
1FK2☐04	M17	26		70	25.5	30.6
1FK2205		28	34			
1FK2105		20	36			
1FK2☐06	M23	41	53	99	30.7	36.9
1FK2☐08		39				
1FK2☐10		43				

Rotation range of the OCC connector on the motor

You can rotate the motor connector. Use a suitable socket connector as lever to rotate the connector.

Note

A maximum of 10 rotations are permitted so as not to impair the degree of protection of the motor.

Table 5-4 Rotational range of the connector

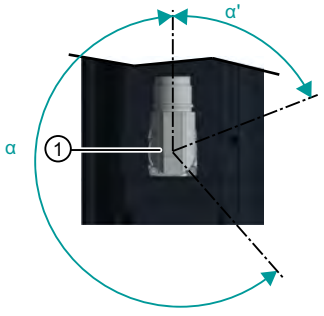
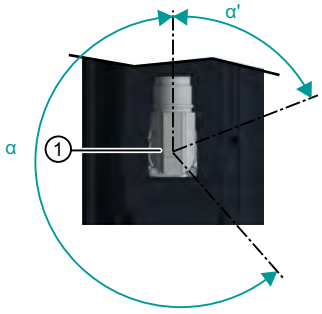
Motor	Angle α	Angle α'	Connector size	Drawing
1FK2☐02 1FK2☐03	261°	45°	M12	

Table 5-5 Rotational range of the connector

Motor	Angle α	Angle α'	Connector size	Drawing
1FK2☐04	205°	80°	M17	
1FK2☐05	255°	35°		
1FK2☐06 1FK2☐08 1FK2☐10	312°	13°	M23	

The motors are equipped with SPEED-CONNECT connectors.

You can connect quick-connection cables with SPEED-CONNECT as well as conventional cables with screw locks (fully threaded) to the motor connector.

Note

We recommend cables with SPEED-CONNECT because they are easier to use.

Establishing a SPEED-CONNECT connection

Procedure

Note

- Only tighten the connector by hand.
- Do not use any wrenches or similar tools.

1. Ensure that the union nut of the SPEED-CONNECT connector is rotated to the end stop in the direction of the "open" arrow.
2. Align the SPEED-CONNECT connector so that the triangles on the top of the connectors are opposite one another.

3. Push the power connector onto the motor connecting socket as far as it will go.
4. Turn the union nut by hand in the direction of "close" by at least 45° (position A) or up to the end stop (position B)

A Minimum locking

B Maximum locking up to the end stop

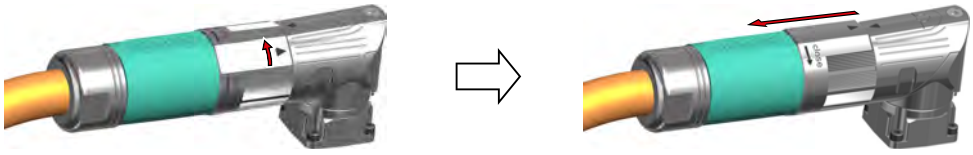
Note

A secure connection is only guaranteed from position A onward.

You have established a secure connection.

Releasing a SPEED-CONNECT connection

Procedure



1. Turn the union nut of the SPEED-CONNECT connector in the direction of "open" to the end stop. The triangles on the top of the connectors must be opposite one another.
2. Withdraw the connector.

Note

Pull out the connector at the connector itself, do not pull on the cable.

You have terminated the SPEED-CONNECT connection.

Routing cables in damp environments

If you are operating the motor in environments in which moisture can arise follow the installation instructions below.

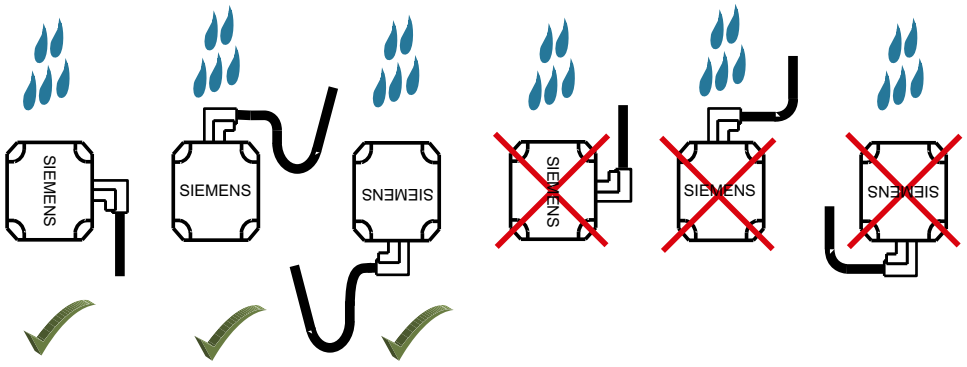


Figure 5-9 Permissible and impermissible cable routing when connecting in a damp environment

5.4.3 Connecting the converter

Install the converter so that you are compliant with local regulations for erecting and installing low-voltage systems.

Carefully observe the following product note about protection against indirect contact:

To protect against indirectly touching part of the motor circuit of a frequency converter and to automatically shut down in the case of a fault according to DIN EN 60364-4-41 (VDE 0100-410) (http://support.automation.siemens.com/WW/view/en/103474630)

Protection and monitoring equipment

Terminology

Abbreviation	Meaning
RCD	= generic term • Residual Current Device • Residual-current protective device
RCCB	• Residual Current Circuit Breaker • Residual current operated circuit breaker • Ground-fault circuit interrupter
MRCD	• Modular Residual Current Device • Modular residual current device

Description

Selectively tripping, AC/DC-sensitive residual-current devices (type B) can be used in addition to the overcurrent protection devices. You will find more details on the protective devices in the Product Information "Protective Devices for SINAMICS S210 (https://support.industry.siemens.com/cs/ww/en/view/109748999)".

Residual-current devices (RCD) have to be installed if the power supply conditions in terms of short-circuit power and loop impedance at the infeed point are not such that the installed overcurrent protection devices will trip within the prescribed period if a fault occurs. Residual current protection devices also offer preventative fire protection in the case of insulation faults, e.g. for use in high-fire-risk working environments.

- Converters can be operated on RCCBs up to 36 kW.

⚠ WARNING

Electric shock or fire when using unsuitable residual current protective devices

Frequency converters can produce DC fault currents in the event of a fault that render RCDs of type A or AC useless.

- Use the recommended RCDs of type B to protect the converter.
- If you use higher-level RCDs, they must also be of type B.

⚠ WARNING

Electric shock or fire if damaged residual current protective devices are used

The opening of the branch-circuit protective device may be an indication that a fault current has been interrupted.

- To reduce the risk of fire or electric shock, current-carrying parts and other components of the controller should be examined and replaced if damaged.
- If burnout of the current element of an overload relay occurs, the complete overload relay must be replaced.

Note

Unwanted tripping of RCDs

In unfavorable power system conditions and certain installation configurations, frequency converters can produce capacitive leakage currents that cause unwanted tripping of RCDs.

Conditions for using residual current protective devices

- Super-resistant (short time-delayed) universal current-sensitive RCDs, type B
- Rated residual current 300 mA
- Separate RCD for each converter
- Ensure that the loop impedance is maintained corresponding to local installation regulations.
- Only operate the system with the internal or recommended line filters.
- Ensure that the switching elements (disconnector unit, contactors) for connecting and disconnecting the drive system have a delay time of max. 35 ms between the closing/ opening of the individual main contacts.

Notes for connecting up the converter

Operating displays for converter operation

If, when switching over a function from ON to OFF, an LED or other similar display is not lit or not active; this does not indicate that the device is switched-off or in a no-current condition.

Shield plate

For converters, frame sizes FSB and FSC with 3 AC line connection, the shield plate is integrated in the converter itself. For the other converters, the shield plate is included in the accessories pack of the converter.

Fixing connecting cables

Fix all of the connecting cables using shield clamps or suitable cable ties to the converter shield plate.

Connection of motor holding brake, connector X107

Also connect the conductors for the motor holding brake to the connector at X107, even when you are using a motor without holding brake.

Shielded cables

Shielded cables are required for connecting the OCC cable, the external braking resistor and the fail-safe digital inputs to ensure that the drive functions perfectly.

- Connect the shield at both ends of the cable.
  Use the converter shield plate to connect the shield at the converter.
  Siemens recommends connecting the shield using the shield clamp that is provided with the prefabricated OCC cable for the motor connection. See the following diagram:
- Use cables with finely-stranded, braided shields.
- Carefully ensure that the shield is not interrupted or broken.

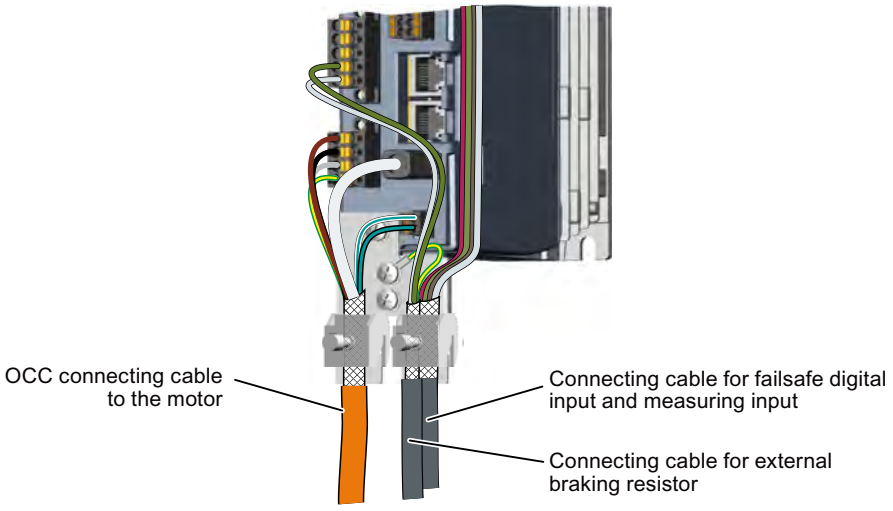


Figure 5-10 Shield support with shield plate and shield clamps for prefabricated OCC cable shown using an example of a converter with 1 AC line connection

Extension of the cable for the braking resistor

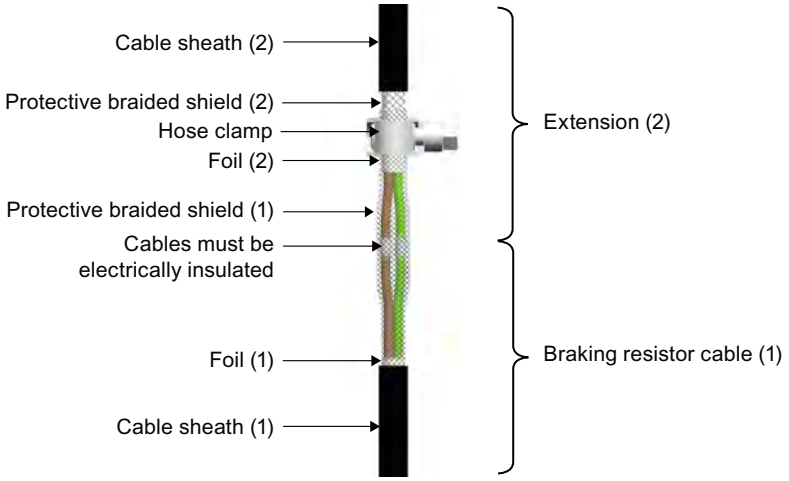
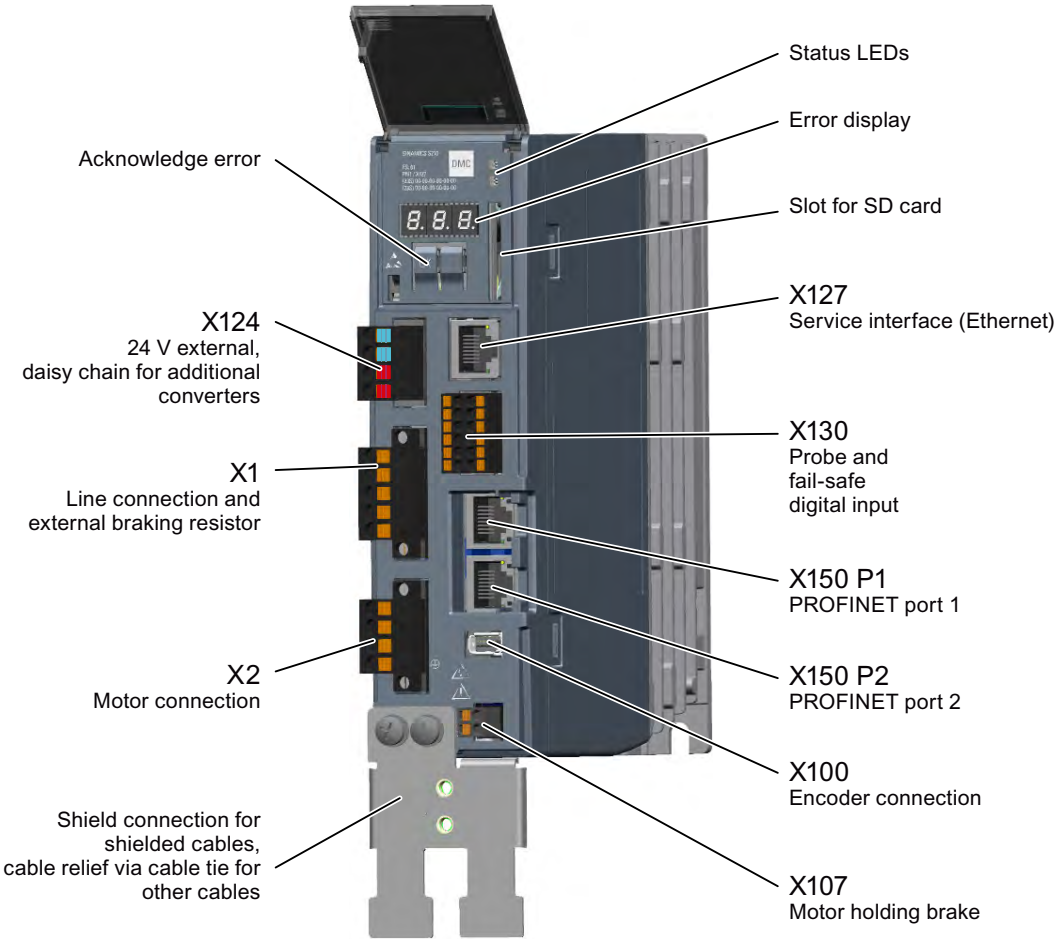


Figure 5-11 Connection of the braking resistor cable and an extension

Perform the following steps to extend the braking resistor cable:

1. Insulate the cable sheaths of the braking resistor cable (1) and the extension (2) until the protective braided shield is exposed over about 60 mm on the braking resistor cable and over about 30 mm on the extension. Later the different lengths will be used to overlap the shields.
2. Push the protective braided shield of both cables back so that the foils underneath them are exposed.
3. Push the foils to one side or remove them.
4. Shorten the longer, exposed single cores of the braking resistor cable by about 30 mm.
5. Insulate the single conductors of both cable ends by about 10 mm at each end, push the heat-shrink tubing over the single conductors and solder the ends of the cores together.
6. Insulate these connections with heat-shrink tubing or similar.
7. Push the protective braided shield of the extension and the braking resistor cable over the single cores. Also push the longer protective braided shield of the braking resistor cable beyond this over the protective braided shield of the extension.
8. Fix the protective braided shield using a hose clamp.

Connections and operating elements of the converter with 1 AC line connection

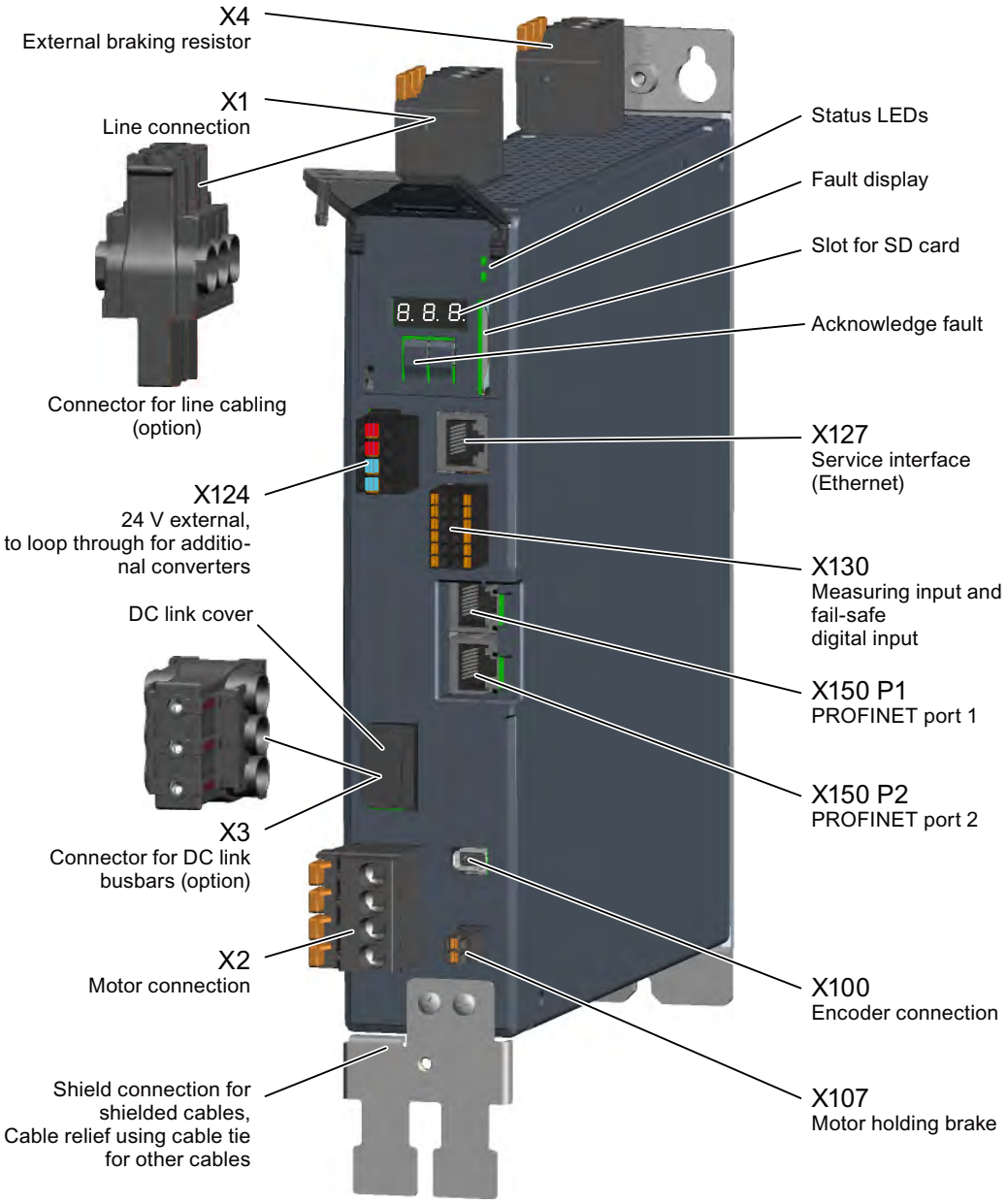


Connectors X1, X2, X107, X124 and X130 are included in the scope of delivery of the converter.

Encoder connector X100 is included with the OCC cable.

You require Ethernet cables with RJ45 connectors to connect service interface X127, as well as for PROFINET ports X150 P1 and X150 P2.

Connections and operating elements of the converter with 3 AC line connection



Connectors X1 standard, X2, X4, X107, X124 and X130 are included in the scope of delivery of the converter.

Encoder connector X100 is included with the OCC cable.

You require Ethernet cables with RJ45 connectors to connect service interface X127, as well as for PROFINET ports X150 P1 and X150 P2.

You must order the connectors for AC coupling X1 and for DC link coupling X3 separately as required:

- Section "Connectors and cables for the AC and DC link coupling (Page 436)".

5.4.4

5.4.4.1 Connecting the MOTION-CONNECT cable to the converter

In addition to the motor connections, the MOTION-CONNECT cable from the motor to the converter also includes the conductors for the encoder and the motor holding brake.

NOTICE
Damage to the device by connecting other motors or devices Connecting other devices (motors, encoders) can destroy the converter or the connected device. • Only connect 1FK2 motors to the converter. • Use only MOTION-CONNECT cables from Siemens or cables that you have fabricated yourself with the correct pin assignment.

Connecting the motor cable to the converter

Connect conductors U, V, W of the MOTION-CONNECT cable to connector X2 of the converter as shown below.

Connect the shield of the MOTION-CONNECT cable to the shield plate through a large surface area. Use commercially available clamps, the clamps supplied with the prefabricated cable or the shield connection clamps supplied as accessories.

The terminals are spring-type terminals.

Color coding for MOTION-CONNECT cables: Phase U = brown, phase = V black, phase W = gray

Connecting the encoder to the converter

The cables and the connector for the encoder connection are part of the MOTION-CONNECT cable from the motor to the converter.

Insert the Siemens IX connector in the X100 socket connector as shown in the diagram.

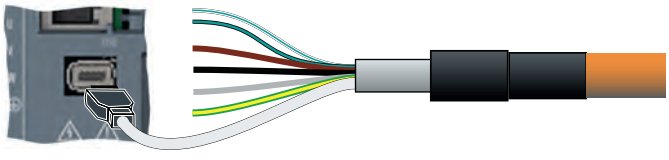


Figure 5-12 X100 - encoder connection

Connecting the motor holding brake

The cables for the motor holding brake are part of the MOTION-CONNECT cable from the motor to the converter.

Connect the cables to the connector X107 of the converter as shown in the diagram.

The terminals are spring-type terminals.

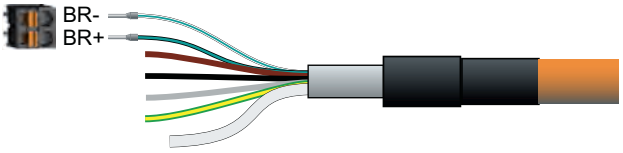


Figure 5-13 X107 - Motor holding brake connection

Permissible conductor cross-sections:

- For single-conductor cables or for flexible cable conductors with end sleeves without plastic protection or long end sleeves with plastic protection:
  - 0.25 mm^2 ... 1.5 mm^2
  - AWG: 24 ... 16
- For flexible cables with end sleeves with plastic protection:
  - 0.25 mm^2 ... 0.75 mm^2
  - AWG: 24 ... 19
- Insulation stripping length: 10 mm

Note

Connection of motor holding brake, connector X107

Connect the conductors for the motor holding brake to connector X107 even if you are using a motor without holding brake.

5.4.4.2 Connecting the converter to the line supply

Connect the line supply as shown in the following to connector X1 of the converter. Connect the protective conductor with a cable lug and an M4 screw to the shield plate of the converter.

The terminals are spring-type terminals.

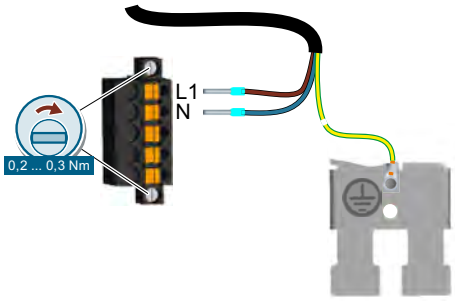


Figure 5-14 X1 - line connection 1 AC

The shield plate is fixed with 2 M4 screws with a tightening torque of 1.8 Nm.

Permissible conductor cross-sections for single-conductor connection or for connecting flexible cables with end sleeves:

- 0.2 mm^2 ... 2.5 mm^2
- AWG: 26 ... 12
- Insulation stripping length: 10 mm

5.4.4.3 Using several single-phase converters in machines and plants

Overview

Evaluate the input currents of single-phase converters in your machine or plant in terms of harmonics and unbalance.

Description

In unfavorable cases, the harmonic currents of several converters in the neutral conductor (N) add up to a value greater than the currents of the line conductors (L1, L2, L3). The current-carrying capacity of the neutral conductor must be sufficient for this. IEC 60364-5-52:2019, section 524, makes recommendations for sizing the neutral conductor. If no more precise information is available, the standard recommends dimensioning the neutral conductor for 1.45 times the current-carrying capacity of the line conductors.

⚠ WARNING

Fire caused by neutral conductor (N) overload

The neutral conductor can heat up due to the load from harmonic currents and cause a fire.

- Consider the harmonic currents when dimensioning the neutral conductor.

⚠ WARNING

Electric shock caused by PEN conductor overload

In TN-C supply networks, the protective function of the PEN conductor can be adversely affected by exposure to harmonic currents.

- Consider the harmonic currents when dimensioning the PEN conductor.

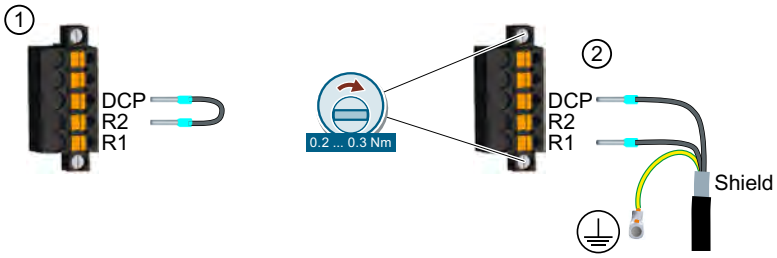
5.4.4.4 Connecting a braking resistor

If you are using the internal braking resistor, DCP and R2 must be jumpered.

If you are using an external braking resistor, DCP and R2 must not be jumpered. Connect the braking resistor via the DCP and R1 terminals.

The terminals are spring-type terminals.

The permissible cable length cable length is 3 m.



① Jumper between DCP and R2 when you use the internal braking resistor.
The jumper is included in the scope of delivery of the converter.

② Connect an external braking resistor
Protective conductor connection and shield support via the shield plate

Figure 5-15 X1 - connection for an external braking resistor

Permissible conductor cross-sections for single-conductor connection or for connecting flexible cables with end sleeves:

- 0.2 mm^2 ... 2.5 mm^2
- AWG: 26 ... 12
- Insulation stripping length: 10 mm

5.4.5 Converter with 3 AC line connection

5.4.5.1 Connecting the MOTION-CONNECT cable to the converter

In addition to the motor connections, the MOTION-CONNECT cable from the motor to the converter also includes the conductors for the encoder and the motor holding brake.

NOTICE
Damage to the device by connecting other motors or devices Connecting other devices (motors, encoders) can destroy the converter or the connected device. • Only connect 1FK2 motors to the converter. • Use only MOTION-CONNECT cables from Siemens or cables that you have fabricated yourself with the correct pin assignment.

Connecting the motor cable to the converter

Connect conductors U, V, W of the MOTION-CONNECT cable to connector X2 of the converter as shown below.

Connect the shield of the MOTION-CONNECT cable to the shield plate through a large surface area. Use commercially available clamps, the clamps supplied with the prefabricated cable or the shield connection clamps supplied as accessories.

The terminals are spring-type terminals.

Color coding for MOTION-CONNECT cables: Phase U = brown, phase = V black, phase W = gray

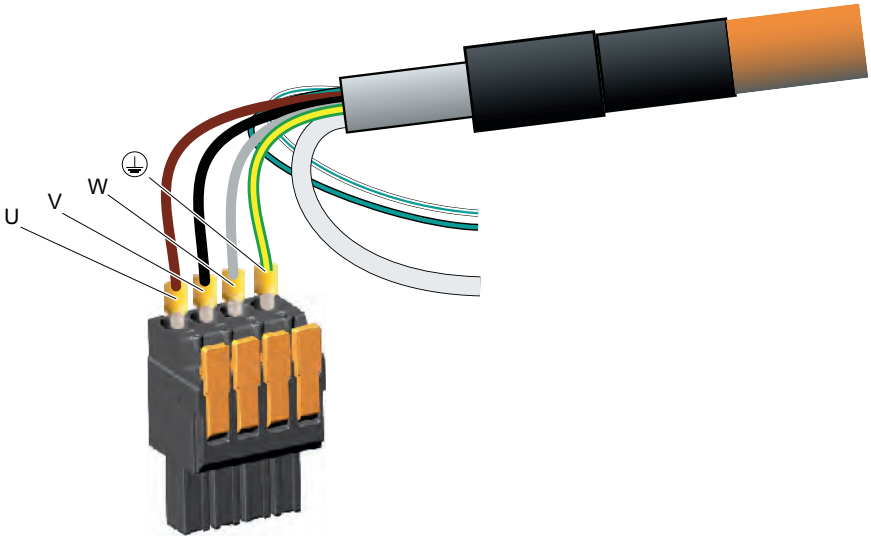


Figure 5-16 X2 - motor connection

Permissible conductor cross-sections for single-conductor connection or for connecting flexible cables with or without end sleeves:

- 0.75 mm^2 ... 6 mm^2
- AWG: 18 ... 10
- Insulation stripping length: 18 mm

Connecting the encoder to the converter

The cables and the connector for the encoder connection are part of the MOTION-CONNECT cable from the motor to the converter.

Insert the Siemens IX connector in the X100 socket connector as shown in the diagram.

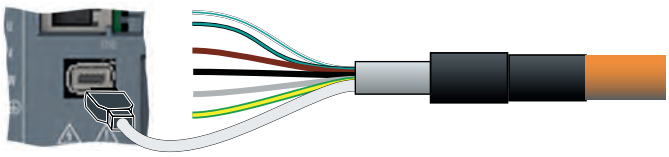


Figure 5-17 X100 - encoder connection

Connecting the motor holding brake

The cables for the motor holding brake are part of the MOTION-CONNECT cable from the motor to the converter.

Connect the cables to the connector X107 of the converter as shown in the diagram.

The terminals are spring-type terminals.

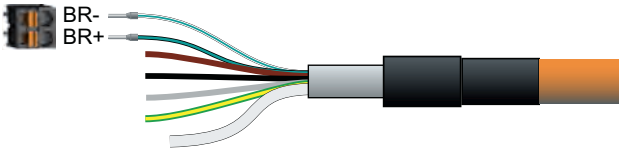


Figure 5-18 X107 - Motor holding brake connection

Permissible conductor cross-sections:

- For single-conductor cables or for flexible cable conductors with end sleeves without plastic protection or long end sleeves with plastic protection:
  - 0.25 mm^2 ... 1.5 mm^2
  - AWG: 24 ... 16
- For flexible cables with end sleeves with plastic protection:
  - 0.25 mm^2 ... 0.75 mm^2
  - AWG: 24 ... 19
- Insulation stripping length: 10 mm

Note

Connection of motor holding brake, connector X107

Connect the conductors for the motor holding brake to connector X107 even if you are using a motor without holding brake.

5.4.5.2 Connecting the converter to the line supply

Spring-type terminals are provided with the converter to connect it to the line supply.

If you connect several converters in parallel, the optional terminals for the AC coupling are available to connect to the line supply. This significantly reduces the wiring costs.

Both connection options are shown below.

Connecting a converter with standard terminals

The terminals are spring-type terminals.

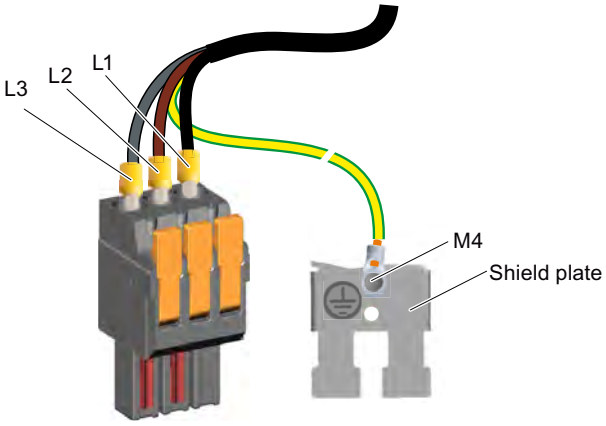


Figure 5-19 X1 - line connection 3 AC - standard

The shield plate is fixed with 2 M4 screws with a tightening torque of 1.8 Nm.

Permissible conductor cross-sections for single-conductor connection or for connecting flexible cables with or without end sleeves:

- 0.75 mm^2 ... 6 mm^2
- AWG: 18 ... 10
- Insulation stripping length: 18 mm

Note

Connector X4 for braking resistor

Insert connector X4 even if you are not using an external braking resistor. In this case, you need to bridge the terminals DCP and R2 to use the internal resistor with the supplied jumper. Otherwise, pre-charging of the converter will not take place.

You can find more detailed information in the section "Connecting a braking resistor (Page 178)".

Connecting a converter with terminals for the AC coupling

The connectors for the AC coupling are not included in the scope of delivery of the converter. Ordering data:

- "Connectors and cables for the AC and DC link coupling (Page 436)"

The permissible cables for the AC coupling as well as the installation instructions are provided in the section:

- "Establishing the AC and DC link coupling (Page 176)"

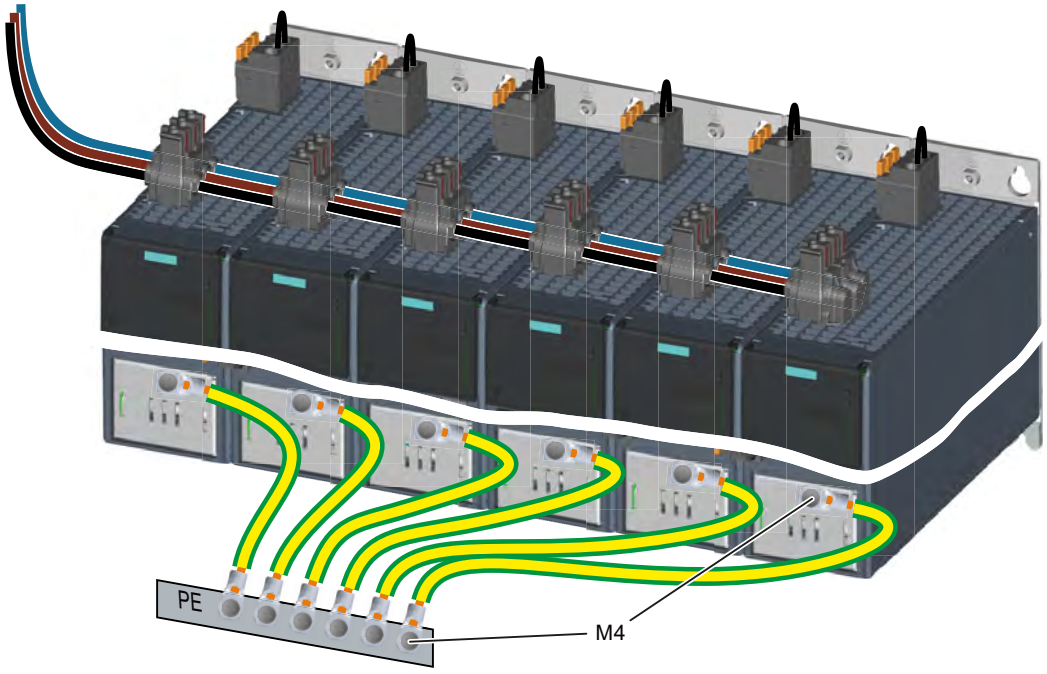


Figure 5-20 X1 - line connection with AC coupling

5.4.5.3 DC link coupling

The connectors for the DC link coupling are not included in the scope of delivery of the converter.

Ordering data:

- "Connectors and cables for the AC and DC link coupling (Page 436)"

The permissible cables for the DC link coupling as well as the installation instructions are provided in the section:

- " Establishing the AC and DC link coupling (Page 176)"

You can find the prerequisites for the DC link coupling in section:

- "DC link coupling (Page 78)"

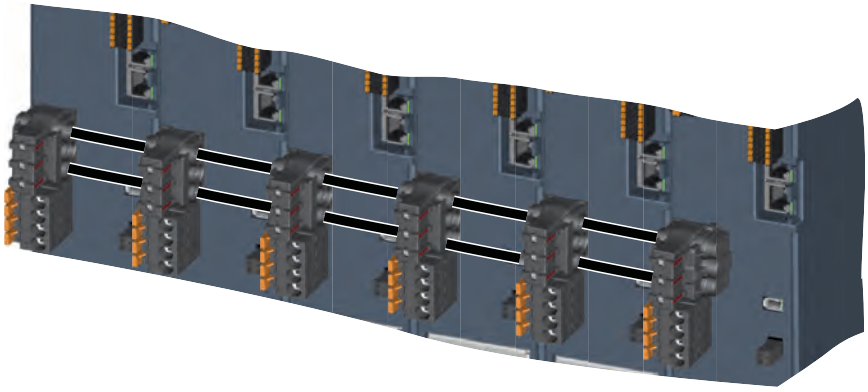


Figure 5-21 X3 - connection of the coupling

If no DC link coupling is used, seal the socket in the device with a DC link cover.

5.4.5.4 Establishing the AC and DC link coupling

Permissible cables for the AC and DC link coupling

The cables required for the AC and DC link coupling are standard cables and therefore not included in the scope of delivery.

Permissible cables for IEC applications:

Use the following cables for the line connection and for the DC link coupling:

- 16 mm², Class 5 (finely-stranded, PVC-insulated), H07V-K + H07V2-K according to DIN EN 50525-2-31
- HELUTHERM® 145 [helukabel.com]: 16 mm², Class 5 (finely-stranded, crosslinked polyolefin-copolymer, halogen-free)
- Outer diameter 6.7 mm ... 8.1 mm

Permissible cables for UL and cUL applications:

Only use copper cables for 60/75 °C with the following properties for the line connection and the DC link coupling:

- AWG 6, copper conductor with PVC insulation, with or without nylon jacket, 19 strands
- Types: MTW, THHW, THW, THW-2, THHN, THWN-2, TW, TWN
- CSA types: TW, TWU, TWN75, TW75, TWU75, T90. It is not permissible that other cables are used.

You can also use cables with a higher rated temperature value. It is not permissible to reduce the conductor cross-section.

Establishing the coupling

1. Connect the converters with one another using the insulated cables. Tighten the connector screws with a torque of 3 Nm. Please note that you must tighten the screws so that the red marking on the connector is no longer visible. The electrical contact has not been reliably established if the red marking is still visible.
2. At the end connectors, allow the cable to protrude by 3 mm ... 5 mm.
   Markings are provided on the end caps showing the permissible amount of protrusion. To do this, place the end cap on the connector as shown in the diagram and then pinch off the conductors.

3. For the AC coupling, close and seal the connector of the last converter using an end cap - and for the DC link coupling of the first and last converter using end caps.

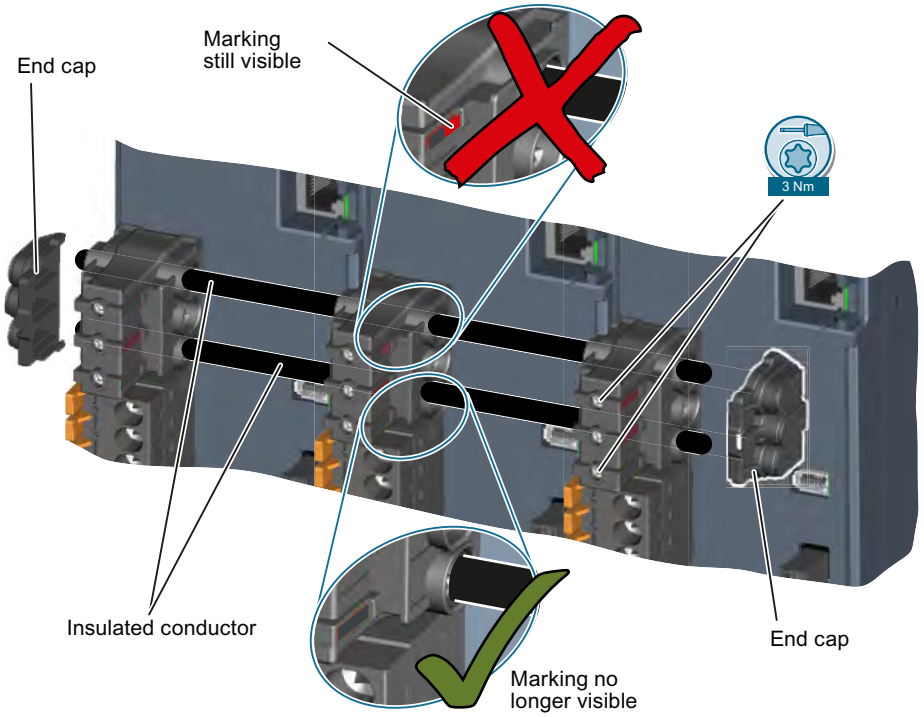


Figure 5-22 Establishing the coupling - example for the DC link

Note

The cables for the AC and DC link coupling may only be used once.

Further, comply with the notes provided in the documentation supplied with the contactors.

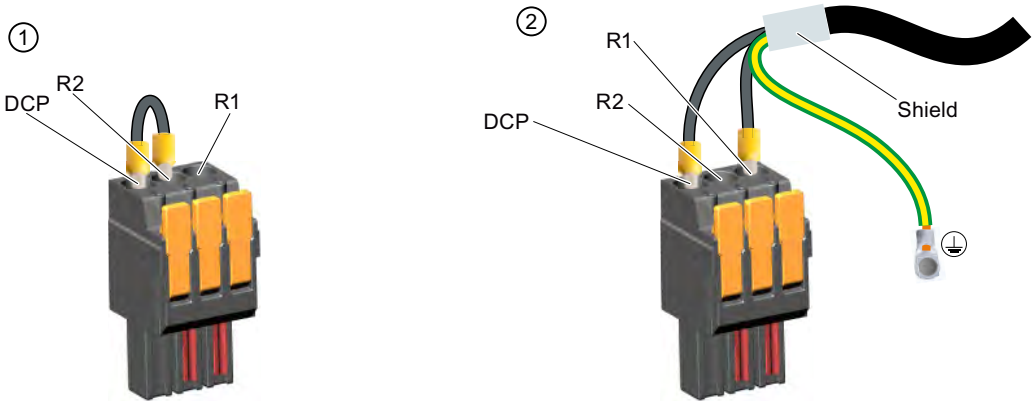
5.4.5.5 Connecting a braking resistor

DCP and R2 must be jumpered if you are not using an external braking resistor. Without the jumper, pre-charging of the converter will not take place.

If you are using an external braking resistor, DCP and R2 must not be jumpered. Connect the braking resistor via the DCP and R1 terminals. Pre-charging of the converter then takes place via the external braking resistor.

The terminals are spring-type terminals.

The permissible cable length is 10 m.



① Jumper between DCP and R2 when you use the internal braking resistor.
The jumper is included in the scope of delivery of the converter

② Connect an external braking resistor
Protective conductor connection and shield support via the back panel of the device

Figure 5-23 X4 - connection for an external braking resistor

Permissible conductor cross-sections for single-conductor connection or for connecting flexible cables with or without end sleeves:

- 0.75 mm^2 ... 6 mm^2
- AWG: 18 ... 10
- Insulation stripping length: 18 mm

5.4.6 Additional connections at 1 AC / 3 AC converters

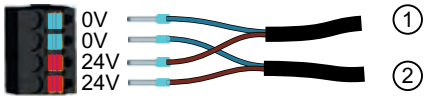
5.4.6.1 Connecting digital inputs and the external 24 V supply

Connecting the external 24 V supply

Connect a 24 V power supply to the converter.

The terminals are spring-type terminals

Permissible cable length: 30 m



① 24 V external

② Loop-through for additional converters

Figure 5-24 X124 - 24 V external (connection to 1 AC converters)

Note

Connection to 3 AC converters

For 3 AC converters, the mounting position of the connector is rotated 180°.

Permissible conductor cross-sections for single-conductor connection or for connecting flexible cables with end sleeves:

- 0.2 mm² ... 2.5 mm²
- AWG: 26 ... 12
- Insulation stripping length: 10 mm

Connecting digital inputs

Digital inputs DI 0 and DI 1 are high-speed digital inputs and can be used as measuring inputs.

Digital Inputs DI 2 and DI 3 form a Failsafe Digital Input.

You can connect the temperature monitoring for an external braking resistor to DI 4.
When you use the temperature monitoring function, the converter shuts down the motor if the external braking resistor temperature becomes too high.

The terminals are spring-type terminals

Permissible cable length: 30 m

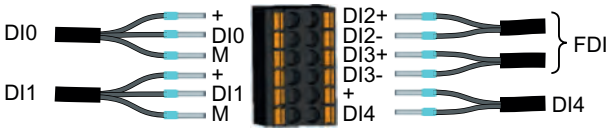


Figure 5-25 X130 - connector for digital inputs

Permissible conductor cross-sections:

- For single-conductor connection:
  - 0.2 mm² ... 1.5 mm²
  - AWG: 24 ... 16
- For flexible cables with end sleeves:
  - 0.25 mm² ... 1.5 mm²
  - AWG: 24 ... 16

- For flexible cables with end sleeves with plastic protection:
  - 0.25 mm^2 ... 0.75 mm^2
  - AWG: 24 ... 19
- Insulation stripping length: 10 mm

The three "+" terminals are provided as power supply for external sensors. They are short-circuit proof and provide a max. of 50 mA per sensor. A sensor short-circuit interrupts the power supply for all three sensors.

5.4.6.2 Connecting service interface and PROFINET

Connect your commissioning device using an Ethernet cable to the service interface (socket X127).

The transmission rates are 10 Mbit/s or 100 Mbit/s.

Connect the converter with PROFINET cables with RJ45 FastConnect connectors or with PROFINET patch cables (see accessories) via the sockets X150 P1 and X150 P2 to the PROFINET network.

Table 5-6 Pin assignment for X127, X150 P1 and X150 P2

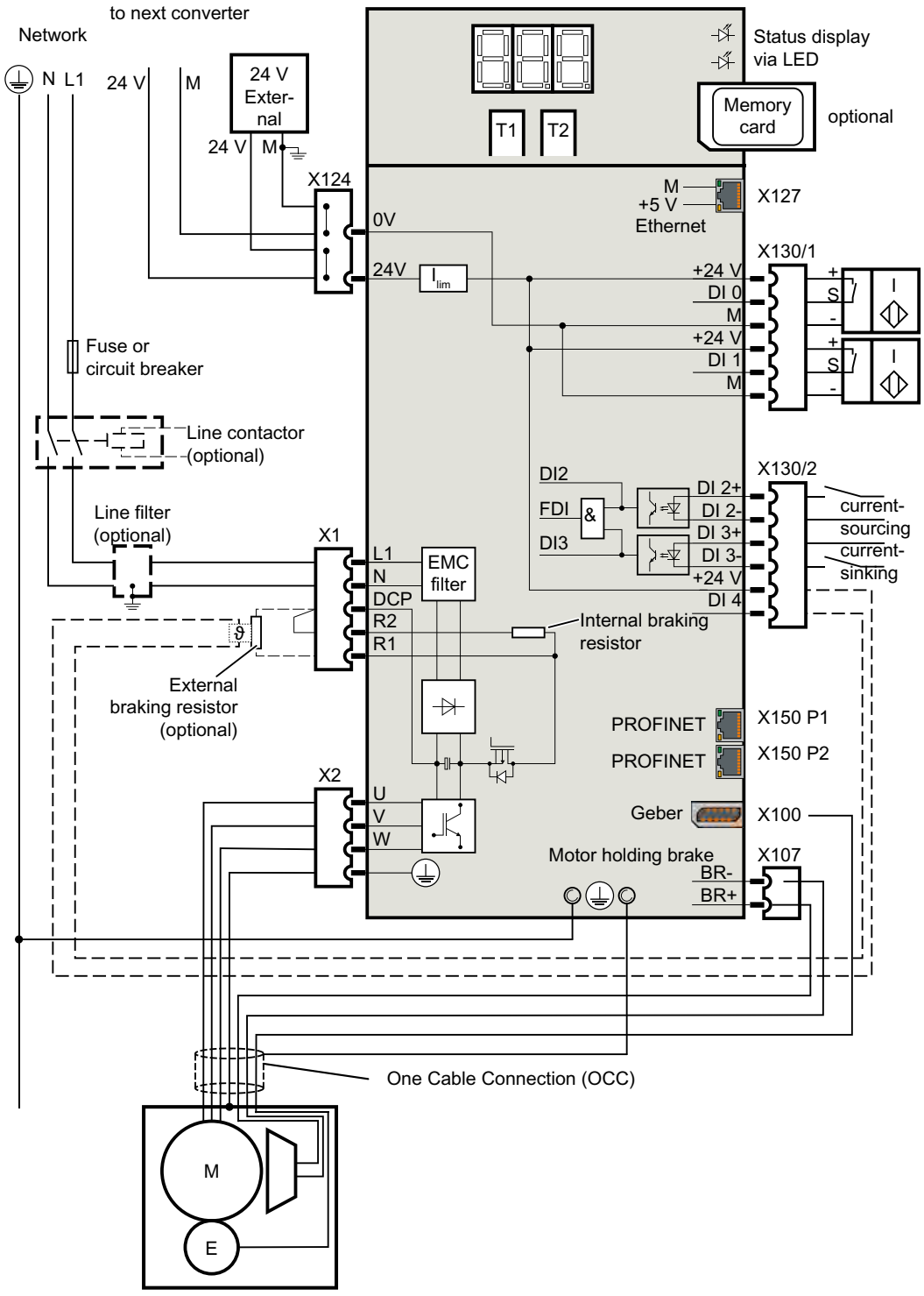
	Pin	Pin assignment	Explanation
	1	RXP	Receiving data +
	2	RXN	Receiving data -
	3	TXP	Sending data +
	4	Reserved	-
	5	Reserved	-
	6	TXN	Sending data -
	7	Reserved	-
	8	Reserved	-

Permissible cable length for PROFINET (terminals X150 P1 and X150 P2): 100 m

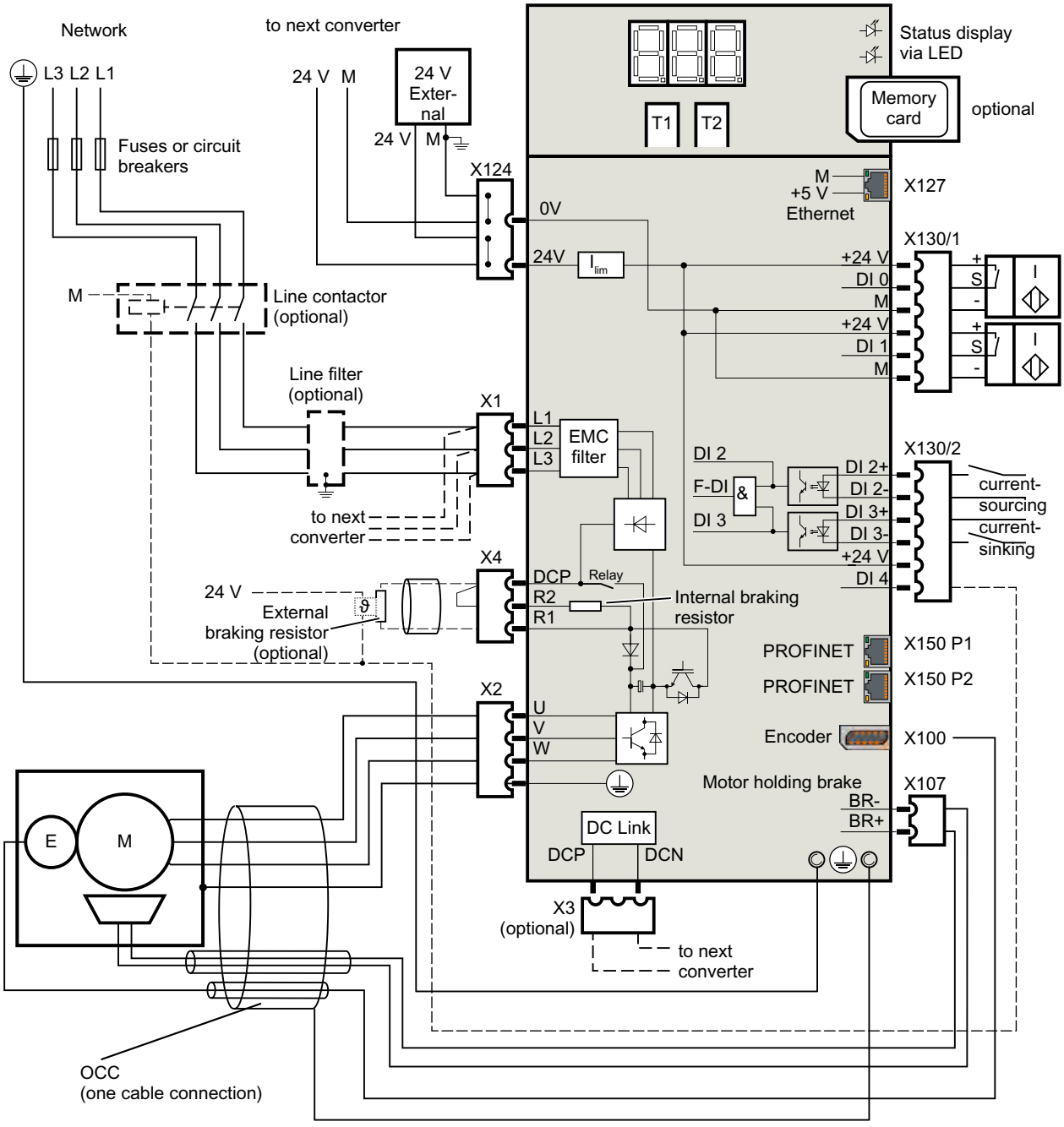
Permissible cable length for the service interface (terminal X127): 10 m

5.4.7 Connection examples

Connection example for converters with 1 AC line connection



Connection example for converters with 3 AC line connection



5.4.8 Connection examples of the fail-safe digital input

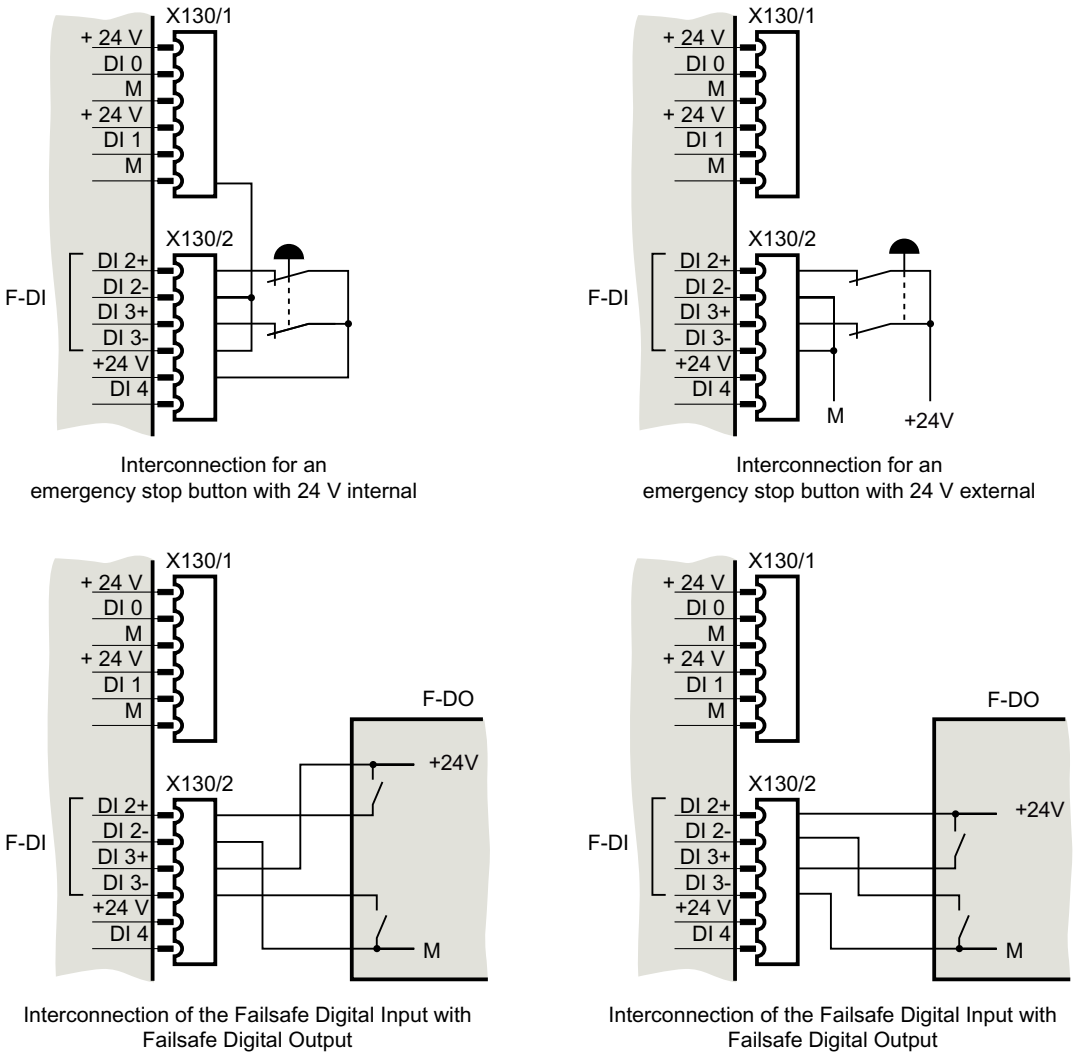


Figure 5-26 Connection examples of the fail-safe digital input

Commissioning and diagnostics using the web server

6

The web server integrated in the S210 converter is particularly suitable for online diagnostics as well as configuration if a separate engineering tool (e.g. Startdrive) will not be used. If the configuration is to take place completely in the TIA Portal, the Startdrive engineering tool integrated in the TIA Portal can be used.

To be able to perform commissioning and diagnostics, you need to physically (LAN cable) connect your PG/PC to the converter and establish an online connection between your PG/PC and the web server. As soon as you have connected your PG/PC to the converter and started the web server, all converter settings are made in the screen forms of the web server. The settings made are applied directly and transferred to the converter.

Supported browsers

You can display the contents of the web server either on a PC/laptop screen, a tablet PC or a smart phone. The web server integrated in the SINAMICS S210 drive supports the following browsers:

Commissioning device	Operating system	Supported browsers
PC	Windows (from Version 7)	• Microsoft Internet Explorer (Version 11) • Microsoft Edge (Version 14) • Mozilla Firefox (Version 62) • Google Chrome (Version 69)
	Note: We recommend the use of Windows 10, version 1803, dated April 2018 or later.	**Note:** We recommend the use of Google Chrome in the supported version 69.
Tablet / smartphone	Apple iOS (from Version 12.0)	• Google Chrome (Version 69) • Safari (Version 12.0)
	Android (from Version 4.4.4)	• Google Chrome (Version 69)

If the web server does not respond, or if buttons are inactive or are not labeled, although the converter is not fully utilized with internal calculations, load the web server pages again as follows:

- With the PC via <F5>
- With the smart phone or tablet via

6.1 Fundamentals

6.1.1 Accessing the web server

For access to the web server, the following interfaces are available on the converter:

- Service interface X127 (standard)
- PROFINET interface X150

Access via the service interface X127

The web server is accessed per default via the service interface X127.

The service interface has the following default setting:

- IP address: 169.254.11.22
- Subnet mask: 255.255.0.0

For commissioning or for diagnostics using mobile devices, interface X127 can be temporarily connected to an external WLAN access point, and an IP address can be sourced via DHCP.

Note

Using the X127 interface

Ethernet interface X127 is intended for commissioning and diagnostics, which means that it must always be accessible.

Carefully note the following restrictions for the X127 interface:

- Only local access is permissible
- No networking - or only local networking in a closed and locked electrical cabinet is permissible

If it is necessary to remotely access the electrical cabinet, then you must apply additional security measures so that misuse through sabotage, data manipulation by unqualified persons and intercepting confidential data is completely ruled out. Observe the information in section "Security information (Page 24)".

Access via PROFINET interface X150

As an alternative to access via X127, you can also access the web server via PROFINET interface X150.

You can find information on access via the PROFINET interface in the section "Configuring the IP connection (Page 244)".

The IP addresses of the service and PROFINET interfaces must not be in the same subnet.

6.1.2 Preparing the hardware

Preparations

1. Install the motor and converter according to the specifications in the section "Installing (Page 147)".
2. Mount the motor on the mechanical system. Connect the motor to the converter.
3. Connect the converter to your commissioning device via the service interface (X127).
4. Switch the converter on.
   The converter powers up and reads the motor data.
5. Start the browser for commissioning.
6. Enter the IP address of the converter in the input line of your browser.
   Default IP address: 169.254.11.22

Interfaces and connection type

Using the default configuration of the web server, you can access the SINAMICS frequency converter using the service interface (X127) - both via an HTTP connection as well as via an encrypted HTTPS connection.

In the standard configuration, interface X150 is deactivated for web server access operations. If the X150 interface is activated to access the web server, then access can only take place via a secure HTTPS connection.

You can find additional information in section "Configuring the IP connection (Page 244)".

NOTICE
Software manipulation when using non-encrypted connections (HTTP) The HTTP protocol transfers data without encryption. This facilitates password theft, for example, and can lead to data manipulation by unauthorized parties and thus ultimately to damage. • Limit access to HTTPS connections so that all data is transferred encrypted.

6.1.3 Users and access rights

There are 2 pre-defined users for access to the converter via the Web server:

- Administrator
  The "Administrator" user has full access to the converter data displayed in the web server. A password is always required for access as administrator.
- SINAMICS
  The "SINAMICS" user has restricted access rights, see the following table. Per default, a password is not assigned for the SINAMICS user.

Note

Configuring passwords for the users

You can configure the passwords for the two users in the system settings with administrator rights (see section "Setting or changing user accounts (Page 241)").

The following access rights apply for the users of the web server:

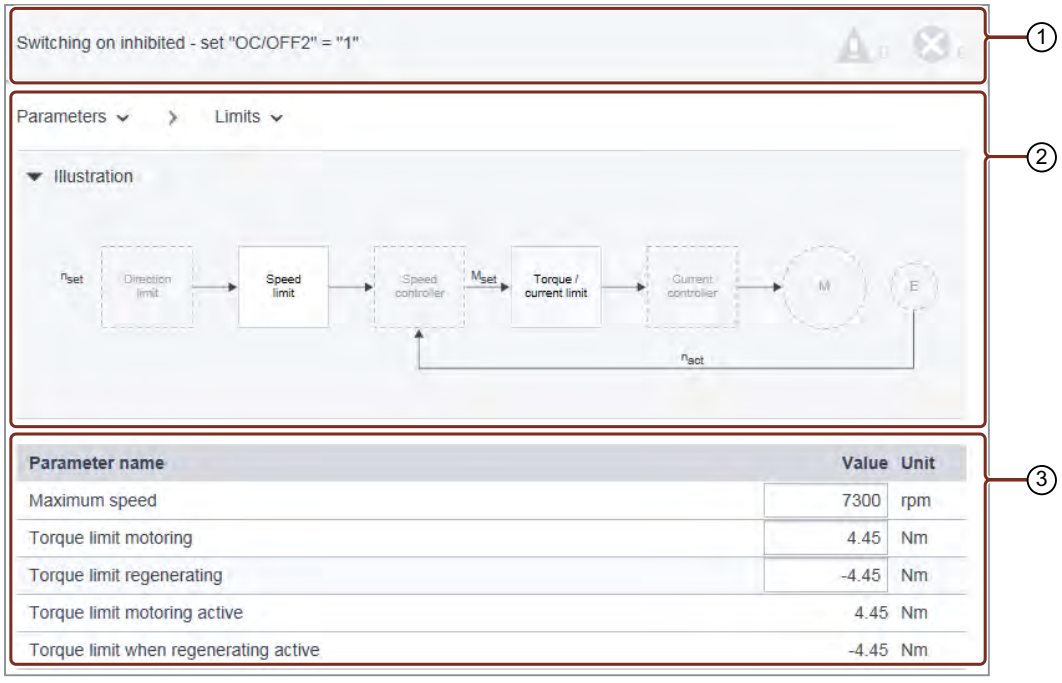
Functions of the web server	Access rights	
	Administrator	SINAMICS
Home page Password input	Write	Write
Perform commissioning • Change drive name • Perform One Button Tuning • Use control panel	Write	None[1)]
Safety settings • Make commissioning settings • Check commissioning in read-only mode • Diagnostics	 Write Read Read	 None[1)] None[1)] Read
Diagnostics • Display communication settings • Adapt message list • Acknowledge alarms	 Write Write Write	 Write Write Write
Settings • Set limits • Adapt brake control • Adapt digital inputs • Adapt parameter list • Change parameterization	 Write Write Write Write Write	 Read Read Read Write Read
Backup and restore • Back up parameter settings externally • Load externally backed-up parameter settings • Restoring factory settings	Write	None[1)]
Adapt system settings • Set user accounts • Configure IP connection • Configure system time	Write	None[1)]
Save permanently (copy RAM to ROM)	Write	None[1)]
Call support information	Read	Read

[1)] This function is not displayed for a "SINAMICS" user.

6.1.4 Dialog screen forms in the web server

You make most of the important converter settings in the dialog screen forms of the web server. The web pages are subdivided into an information part (①), a graphic part (②) and a table part (③) with parameters.

Example of a dialog screen form



Parameter name	Value	Unit
Maximum speed	7300	rpm
Torque limit motoring	4.45	Nm
Torque limit regenerating	-4.45	Nm
Torque limit motoring active	4.45	Nm
Torque limit when regenerating active	-4.45	Nm

In most cases you will be able to work with the parameters in the table directly below the diagram.

In some cases, you must make the parameter settings or read out values which can only be found in the parameter list of the converter.

Details are contained in section "Adapting parameters (Page 213)".

6.1.5 Changing parameter values

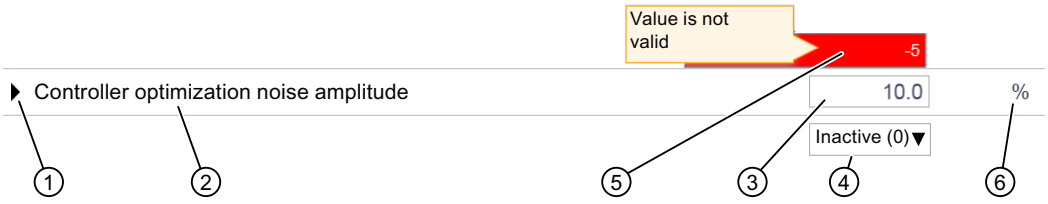
The parameters are subdivided into adjustable parameters and display parameters.

Individual parameters in the parameter list are shown in precisely the same way as in the dialog screen forms.

More information about adapting the parameter list is provided in section "Adapting parameters (Page 213)".

Adjustable parameters

Adjustable parameters are identified by a frame in which you can either enter values or select values via a drop-down menu. Invalid values have a red background and are rejected.



① Adjustable parameters with this icon have several indices or bit arrays
② Name of the parameter
③ Input field for the parameter value
④ Select the parameter value via the drop-down menu
⑤ Invalid value
⑥ Unit of the parameter

Figure 6-1 Example of the representation of an adjustable parameter

Display parameters

Display parameters are for information purposes only and cannot be changed.

① Display parameters with this icon have several indices or bit arrays

Figure 6-2 Example of the representation of a display parameter

6.1.6 Logging on for the first time and assigning an administrator password

When logging onto the converter for the first time you must assign the administrator password.

Accessing the converter when the administrator password has been lost

Note

Remember the password or store it in a secure place that cannot be accessed by unauthorized persons.

If the password is lost, you must reset the converter to the factory settings as described in the section "Reset converter/password - restore the state when originally delivered (Page 331)".

Assigning the administrator password

You must log in as administrator to obtain complete access to the converter. A password is required for access as administrator.

Proceed as follows to assign an administrator password:

1. Switch the converter on.
2. Connect the commissioning device to the service interface (X127) using a LAN cable.
3. Call the web server of the converter (standard IP address: 169.254.11.22).
   The following screen form is only displayed if an administrator password has still not been assigned.
   If, within ten minutes after the line cable was inserted, no password is assigned, then the display transitions into the login screen . In order to return to the "Initial Setup" screen form, you must withdraw the LAN cable from the service interface and reinsert again.

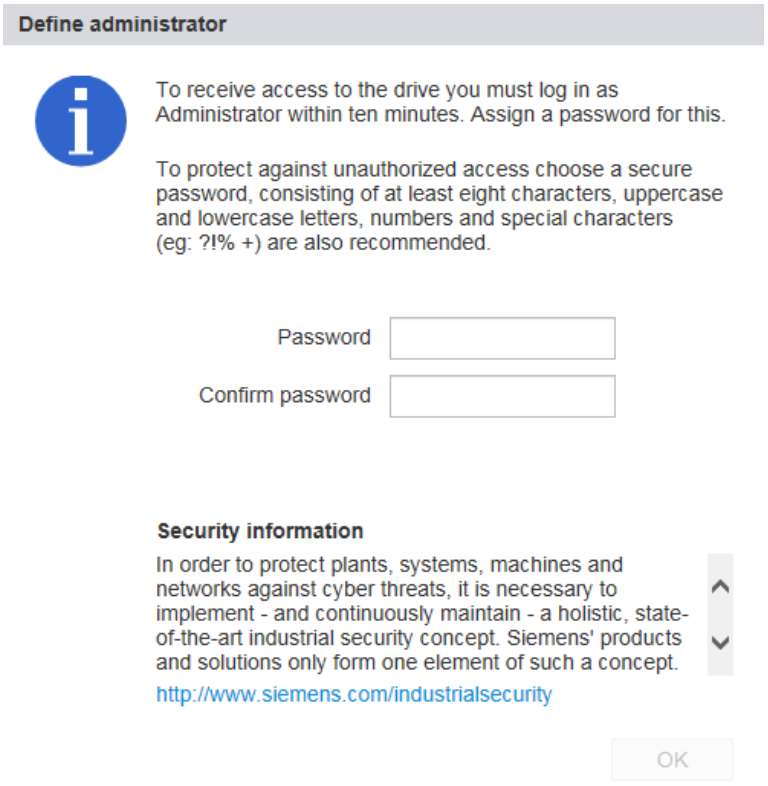


Figure 6-3 Prompt to enter the administrator password

4. Enter an administrator password in the "Password" field.

   Note

   To protect against unauthorized access, by an attacker, for example, select a secure password that consists of:

   - At least 8 characters
   - Upper and lower case letters
   - Numbers and special characters (e.g.: ?!%+ ...)

   It is not permissible that the password is used elsewhere.

   Checking the password

   The length of the password is checked by the converter. There is no check for special characters or upper and lower case letters.

5. Repeat the password in the "Confirm password" field.
   If the input is not identical in both fields, the "OK" button is not enabled.
6. Confirm the password that you entered with "OK".
7. The display changes to the Login screen form. Log in there with the administrator password.

6.1.7 Login/logout

In order to be able to work with the web server, you must be logged in as "SINAMICS" or "Administrator" user.

For commissioning, you must be logged in as "administrator".

Logging in to the web server

1. Enter the IP address for the converter in the entry line of your browser (default IP address: 169.254.11.22).
   The password prompt appears in the browser.

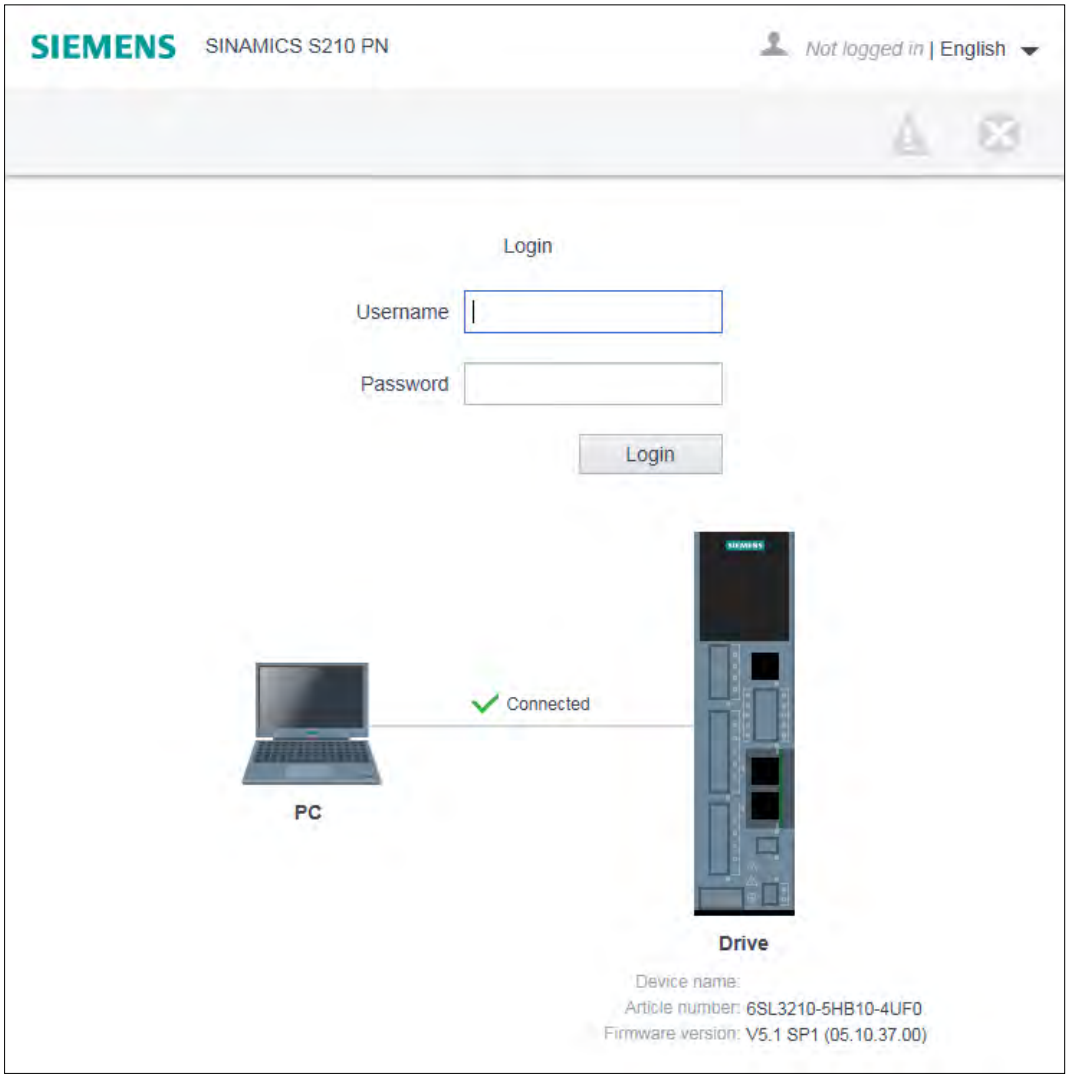


Figure 6-4 Login screen

2. Enter the name of the user (Administrator or SINAMICS) in the "User name" field.
3. Then enter the password of the user.
   Per default, a password is not assigned for the "SINAMICS" user. In this case, you can skip the password input.
4. Click "Login".
   When you have successfully logged in, the browser displays the user name at the top right.
   The most important elements of your drive system are shown centrally in the view:

Logging out from the web server

1. In the window, click the icon with the user name at the top right.
2. Click "Logout".
   If have changed the converter settings, a save prompt appears. You can select here whether to save or discard the changes.

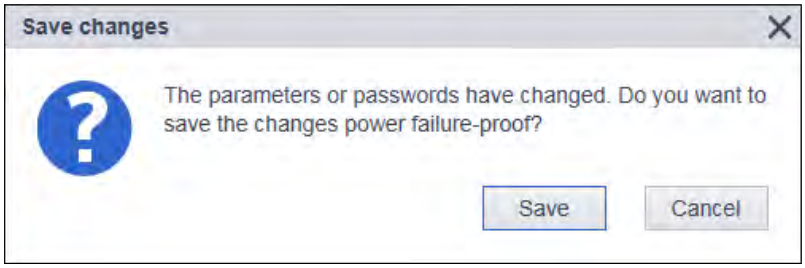


Figure 6-5 Save prompt when logging out

3. If you want to save the changes, click "Save changes".

Automatic logout

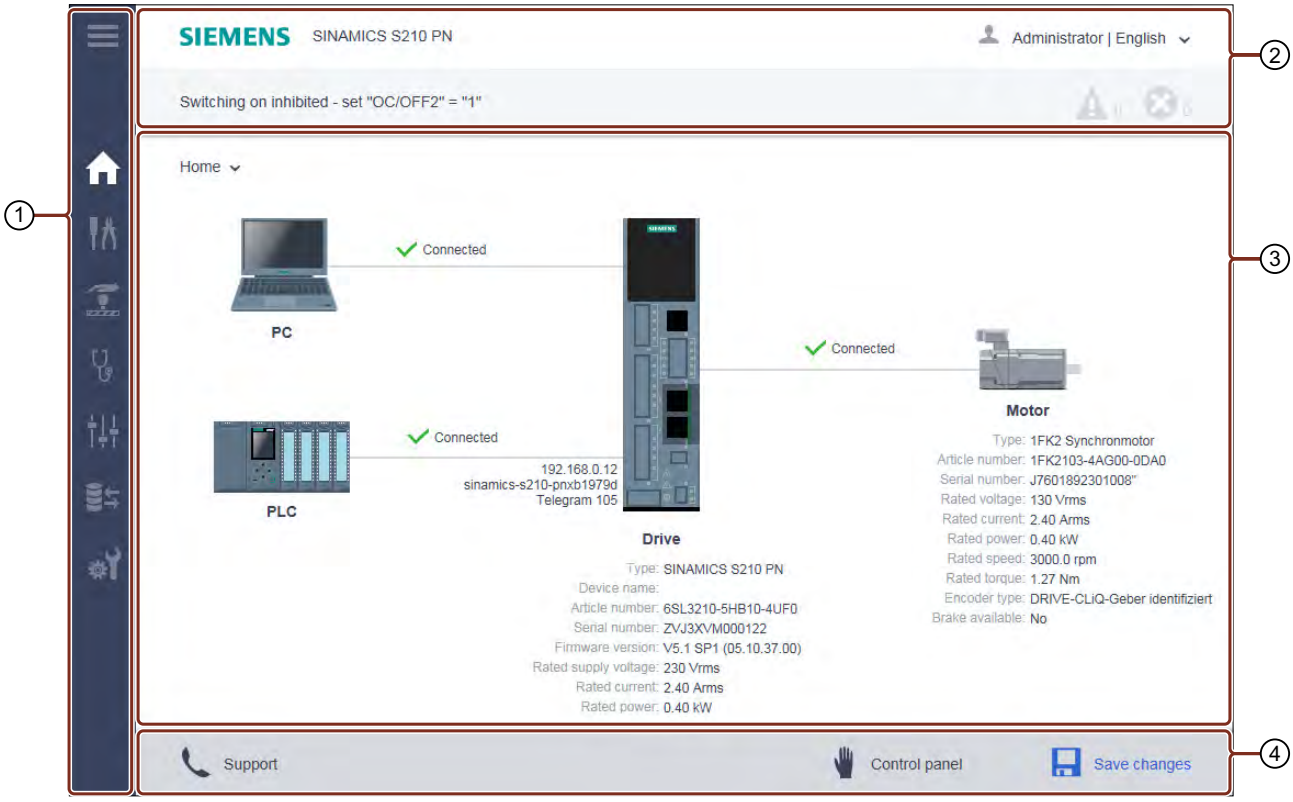
If you are not using the web server, access to the web server is automatically logged out after 10 minutes. You must log in again to access the web server.

Any changes that you made are not lost when automatically logging out. After logging in again, you have the option of opening a memory dialog via .

- You can find additional information in section "Saving data in a non-volatile fashion (Page 199)".

6.1.8 Start page of the web server

After you have logged in, the web server will display the following start page:



① Navigation bar

② Status bar with the following contents:
Top: Device designation / drop-down list for the language selection and to log out.
Bottom: Name of the converter (if entered) / Status of the converter / Fault and warning messages

③ Navigation-dependent main window

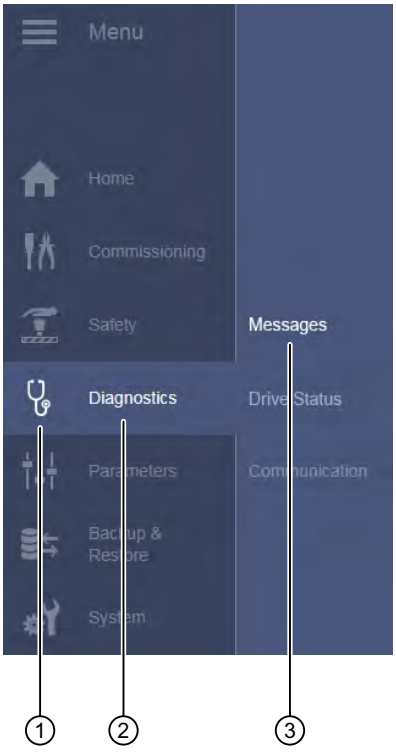
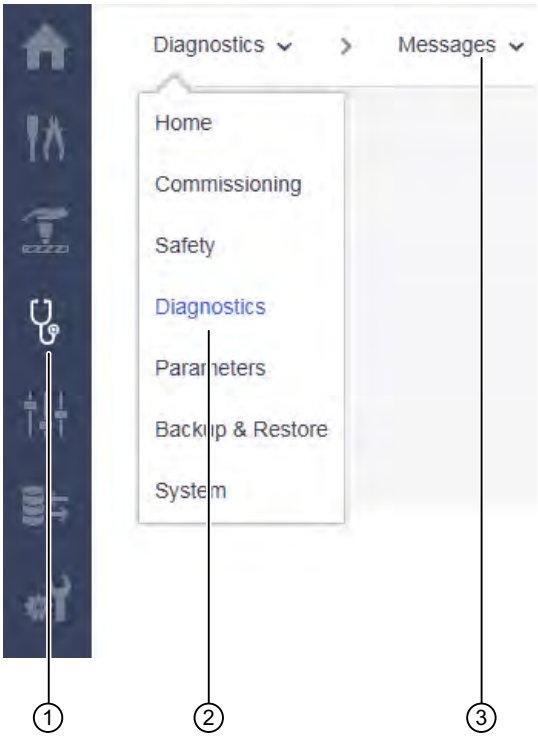
④ Action bar (from left to right): Support information / Call control panel / Save retentively (RAM to ROM)

Figure 6-6 Basic structure of the web server

6.1.8.1 Navigating in the web server

The web server provides the following options for navigating:

- Multi-level navigation bar of the web server
- In the active web server view via drop-down lists

Navigation via the navigation bar	Navigation via drop-down lists (drop-down menus)
The navigation bar of the web server has a multi-level structure. Example: 	Alternatively, the screen forms can also be called in the active view of the web server via drop-down lists (drop-down menus). This also allows easy navigation in small displays (smartphone). 

① Main menu as icon
② Main menu in text format
③ Submenus of the active main menu

6.1.8.2 Calling Support information

You can call the Support addresses for the SINAMICS S210 via the footer of the Web server.

1. Click "Support" in the footer of the Web server.
   The following information is displayed:

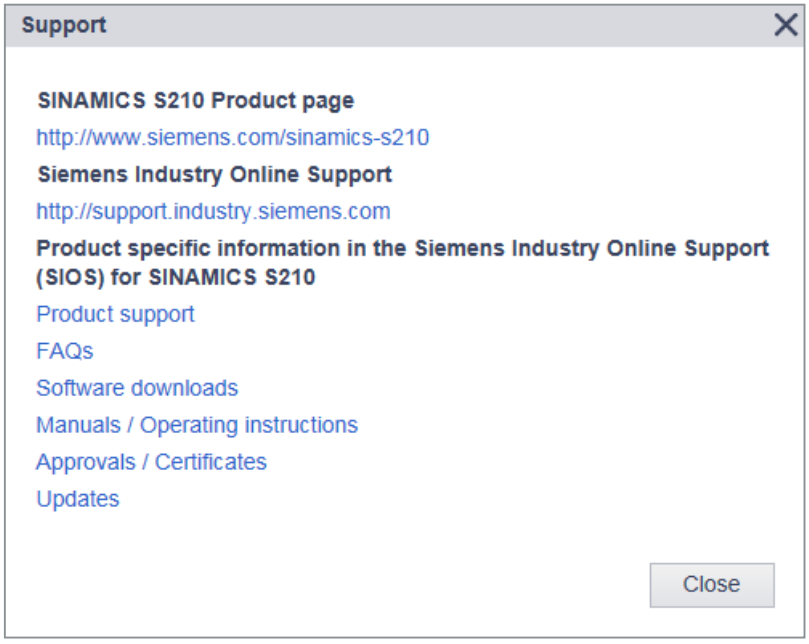


Figure 6-7 Support addresses

   Open or copy the required support addresses via the links.

2. Click "Close" to close the Support information.

6.1.8.3 Using the control panel

The control panel is used to control and monitor the drive during the commissioning phase. Apply the safety measures required when using the control panel. The control panel offers the following functions:

- Checking missing enables
- Testing drive movements or traversing manually
- Monitoring drive movements

Call the control panel

You can always call the control panel when you access the web server in the converter with your commissioning device.

1. To call the control panel, click "Control panel" in the footer of the web server.
   The control panel is started in monitoring mode.

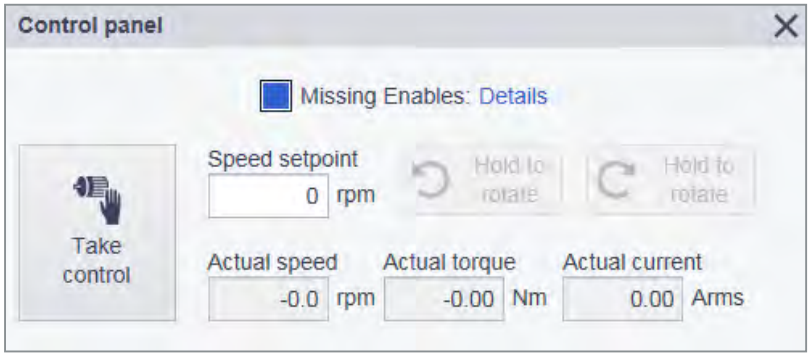


Figure 6-8 Control panel - Monitoring mode

2. To close the control panel again, click the "Control panel" button again in the footer of the web server or on the X at the top right in the header of the control panel.

Control panel in monitoring mode

When all enables are present, the "Missing Enables" line is not displayed and the "Actual speed value", "Actual torque" and "Actual current" display fields show the current values of the drive.

If enables are missing, the motor does not turn. In this case the "Missing Enables" LED lights up in blue.

1. Click the "Click here for details" link to display the details.
   The "Missing enables" dialog opens:
2. Click "Close" to close the display dialog.

Control panel in control mode

If you assume control, you can test the drive movements or traverse manually.

1. To call the control panel, click the "Control panel" button in the footer of the web server.
   The control panel is displayed in monitoring mode.
2. Click the "Assume control" button.

3. Confirm the "Assume control" confirmation prompt with "Confirm".
   The control panel now has master control over the drive. This is indicated by a broken orange line. All other control sources are switched off.

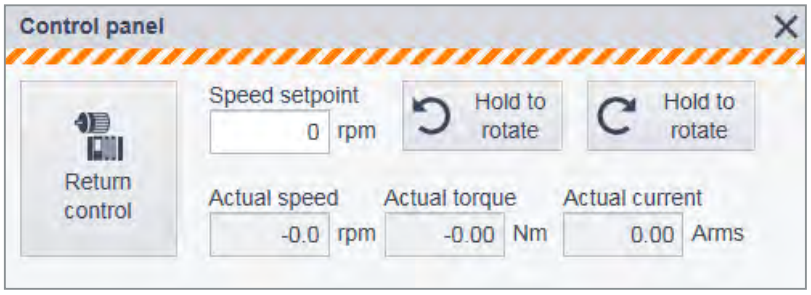


Figure 6-9 Control panel - Control mode

4. To specify a new speed for traversing, click in the "Speed setpoint " field.
   The "Speed setpoint" dialog is opened. Define the speed and acknowledge with "OK".
5. To traverse the drive manually, click the "Rotate" button with counterclockwise or clockwise arrow briefly and check the response in the display fields or at the missing enables.
   The traversing motion is only performed as long as you activate the button. Traversing motion stops as soon as the button is no longer activated.
   The arrow on the buttons indicates the direction of rotation of the motor when rotating clockwise when looking at the motor shaft from the front. For counter-clockwise direction of rotation, the motor runs in the other direction.
   Check the correct direction of rotation of the motor shaft.
6. To return master control, click "Return control".
   Confirm the confirmation prompt with "Confirm".
7. To close the control panel again, click the "Control panel" button again in the footer of the web server or the X at the top right in the "Control panel" dialog.

6.1.8.4 Saving data in a non-volatile fashion

The changed settings are only saved in the volatile memory of the converter. They are lost when you switch off the drive or close the Web server.

For this reason, it is important that the changes are regularly stored in a power-independent manner (also known as "Copy RAM to ROM"). You can either save the setting for each individual

commissioning step or save all the settings made and the tuning results at the end of the commissioning.

1. To save powerfail-proof, click in the footer of the Web server.
   A save prompt appears:

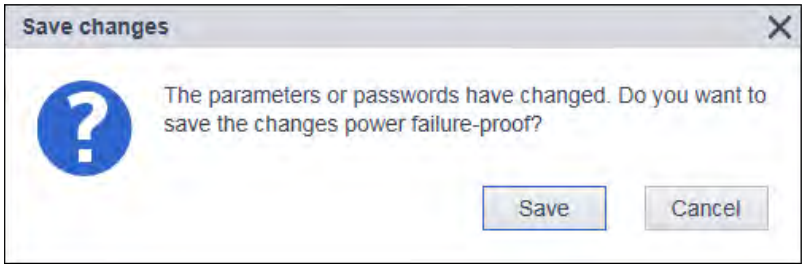


Figure 6-10 Permanent saving prompt

2. Click "Save" to save the data permanently.

Note:

Note

Operation with memory card

If a memory card in inserted in the converter, the settings are then not only saved powerfail-proof in the converter, but are also saved on the memory card. This allows you to easily replace the converter in a spare part scenario.

- You can find additional information in section "Replacing the converter with memory card (Page 335)".

6.1.9 SSL/TLS certificates for secure data transmission

Overview

You require a valid SSL/TLS certificate for a secure HTTPS connection between your commissioning device (PG/PC, tablet or smartphone) and the web server.

Additional information

You can find additional information about using SSL/TLS certificates in section "Use of SSL/TLS certificates for secure data transmission (Page 672)".

6.2 Commissioning using the web server

Overview

After being switched on, the converter starts extensive self-configuration. The most important data is read from the electronic rating plate of the motor connected using the OCC cable and used for the self-configuration routine.

Refer to the following flow diagram for additional commissioning steps.

Note

Rights required for commissioning

You must login as administrator, as administrator rights are required when commissioning the system.

- You can find additional information in section "Users and access rights (Page 187)".

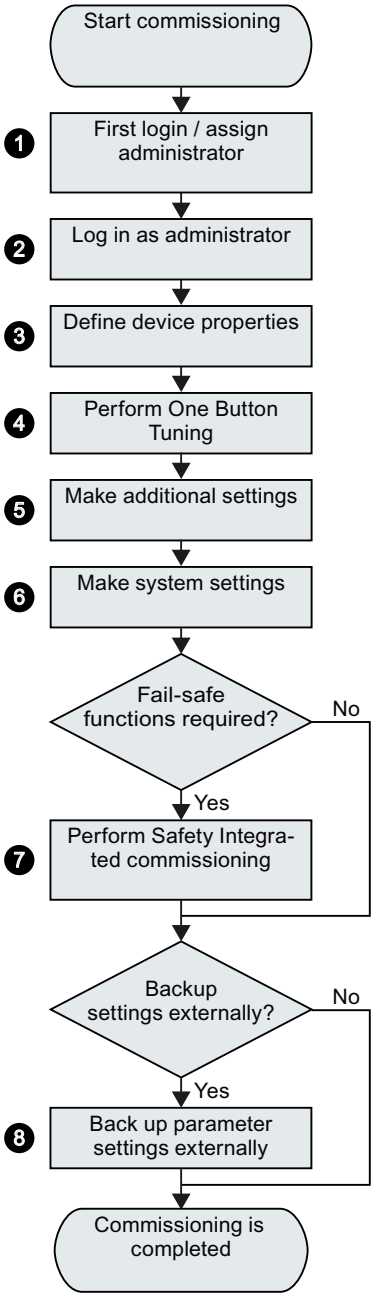
Requirements for commissioning

- The motor and converter have been installed according to the specifications in the following section.
  You can find additional information in section "Installing (Page 147)".
- The mechanical system is mounted onto the motor.
- The converter is connected to the commissioning device via the service interface (X127).
- You have assigned the administrator password.
  You can find additional information in section "Logging on for the first time and assigning an administrator password (Page 190)".

6.2.1 Overview

Commissioning sequence

Commissioning is carried out in the subsequently listed steps. The individual commissioning steps are optional, and can be carried out when required.



You can find additional information in these sections:

① "Logging on for the first time and assigning an administrator password (Page 190)"

② "Logging in as administrator"

③ "Defining device properties"

④ "Performing One Button Tuning (Page 206)"

⑤ "Additional settings"

Limits,
brake control,
digital inputs,
adapting parameters,
electronic weight compensation

⑥ "System settings"

⑦ "Commissioning Safety Integrated (Page 218)"

⑧ "Backing up parameters (Page 239) "

Note: You can also save the settings after each commissioning step. We recommend that you make a backup before starting to commission Safety Integrated.

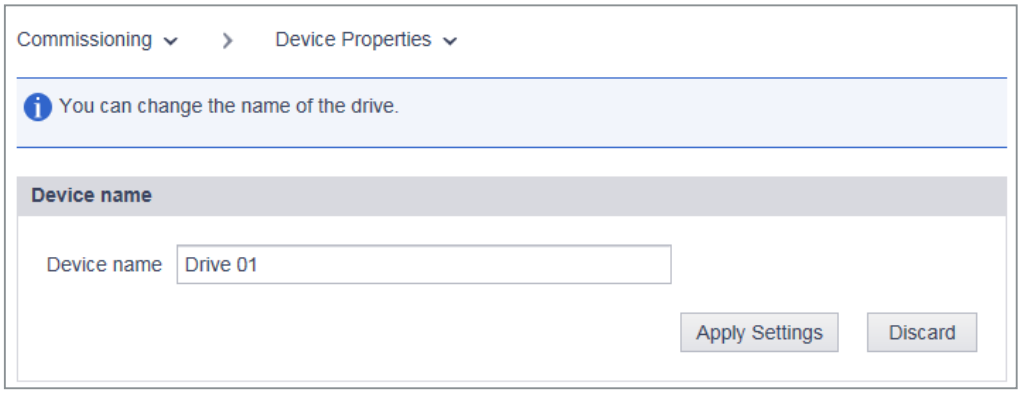
6.2.2 Defining device properties

6.2.2.1 Assigning the drive name

During converter commissioning you can allocate a specific system name.

Procedure

1. Select "Commissioning > Device properties " in the navigation.



2. Enter a new drive name in the "Drive name" field.
   Do not use special characters for the drive name. The name cannot be saved when special characters are used.
3. Click "Apply Settings" to save the changes in the RAM of the device.
   The assigned drive name is displayed in the status bar of the web browser, on the overview page for the converter data and on the tab of the browser window.
4. Click to save the data permanently.

You have assigned the drive name.

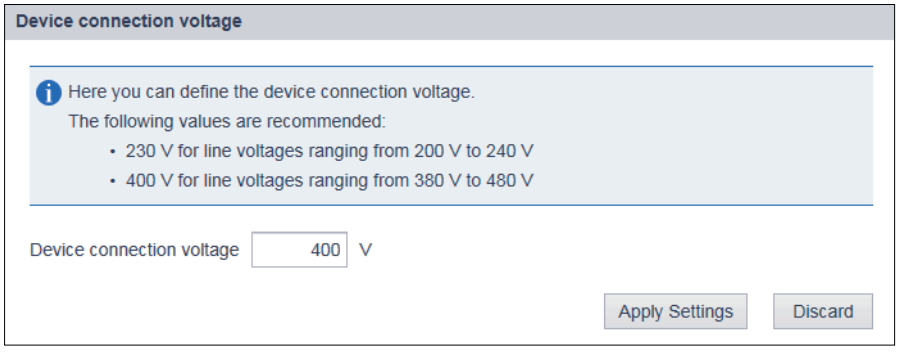
6.2.2.2 Defining the line supply voltage

The converters with 3AC line connection have a range from 200 to 480 V for line supply voltage.

You adapt the value for the line supply voltage in the following screen form.

Procedure

1. Enter the value of the line supply voltage.



2. Accept the value.
3. Store the value retentively with .

6.2.2.3 Adapting the direction of rotation of the motor

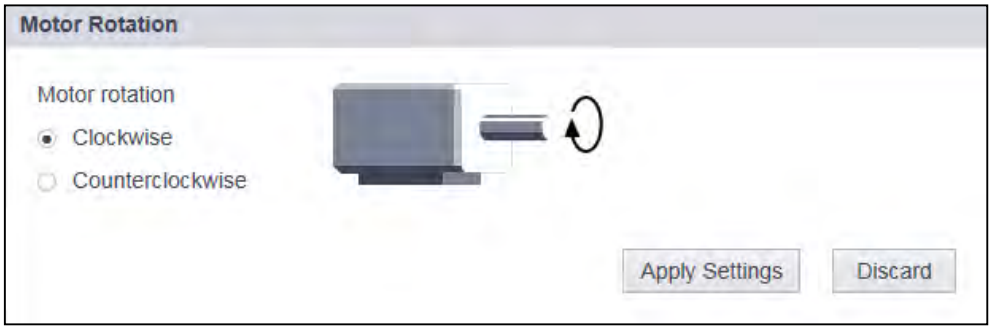
In the factory, the direction of rotation is set so that the motor rotates clockwise when you are looking at the motor shaft from the front.

If you enter a setpoint from the PLC, and the motor rotates with the incorrect direction of rotation, then you can change the direction of rotation as shown below.

Changing the direction of rotation of the motor via the web server

Procedure

1. Select "Commissioning > Device properties " in the navigation.
2. Change the direction of rotation in the dialog screen form.



3. Apply the changes.
4. Check the new setting.
5. Save the setting using .

You have changed the motor direction of rotation.

Note

Entering the setpoint from the web server control panel

If you change the direction of rotation as described above, this does not influence the setpoint input from the web server control panel.

This means that you must enter a setpoint for clockwise rotation (Hold to rotate) at the control panel, in order that the motor rotates counter-clockwise ( ).

6.2.3 Performing One Button Tuning

An important part of the basic commissioning is the "One Button Tuning" (OBT). The converter closed-loop control is optimally set using the One Button Tuning

Note

Movement in both directions of rotation

Please note that when performing One Button Tuning the motor rotates in both directions. If movement in both directions of rotation is not permissible due to your plant conditions, you cannot perform One Button Tuning.

Procedure

1. Select "Commissioning > Tuning" in the navigation.

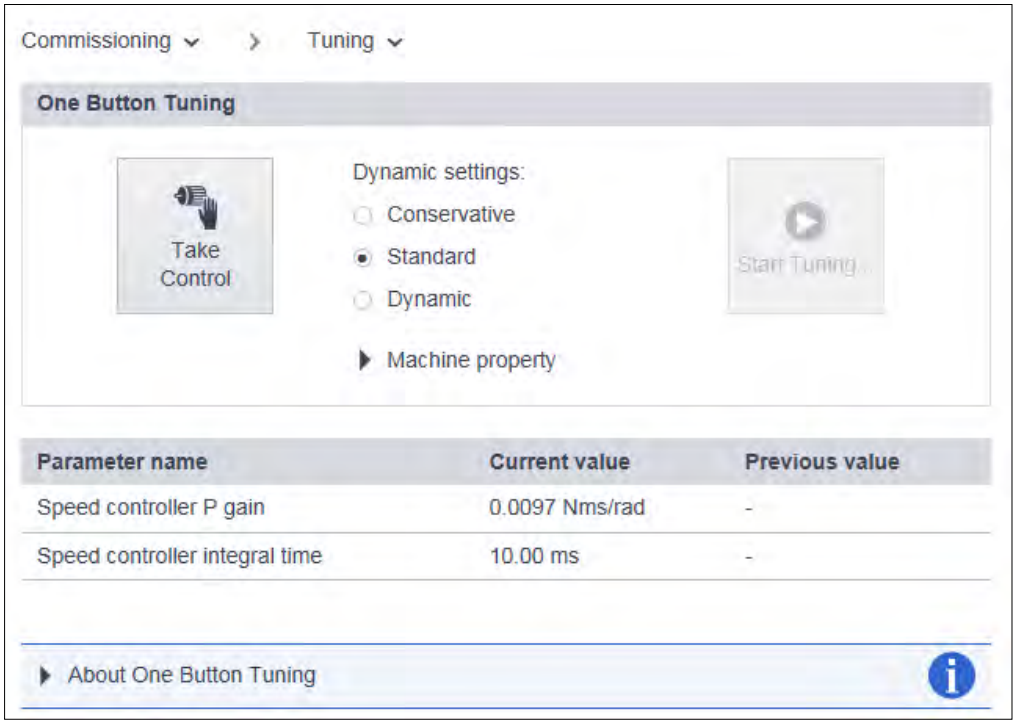


Figure 6-11 View before performing the One Button Tuning

2. Click "Take Control".
   Confirm the safety prompt.
   The master control is indicated by a broken orange bar.

3. Select the desired dynamic response setting for the One Button Tuning corresponding to the mechanical system of your machine.
   One Button Tuning optimizes the drive based on the selected dynamic response setting.
   - "Conservative":
     60 % speed control dynamic performance without precontrol
   - "Standard":
     80 % speed control dynamic performance with torque precontrol
   - "Dynamic":
     100 % speed control dynamic performance with fast torque precontrol

   You can activate the higher dynamic performance if your machine satisfies the conditions listed under "Machine property".
4. Click "Start Tuning...".
   A prompt for the permissible angle of rotation (rotation limit) of the motor shaft appears.

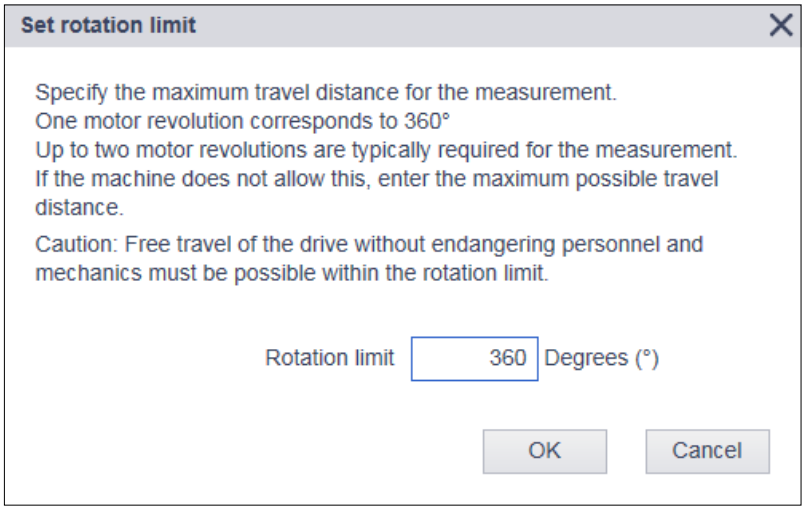


Figure 6-12 Rotation limit

5. Enter the angle through which the motor and the connected machine are permitted to turn for the required measurements (e.g. 360 °) without the mechanical system being damaged. Useful controller parameters result from an angle greater than 90 °.

Note

Input of a negative angle

If you enter a negative angle, then the motor moves in the opposite direction.

Generally, longer traversing distances result in better optimization results.

6. Click "OK".
   Tuning through One Button Tuning starts. No entries are possible during the tuning. After the tuning has been completed, a message appears as to whether the "One Button Tuning" was successful - or not. If the OBT was not successful, then optimization must be repeated, possibly with modified entries.

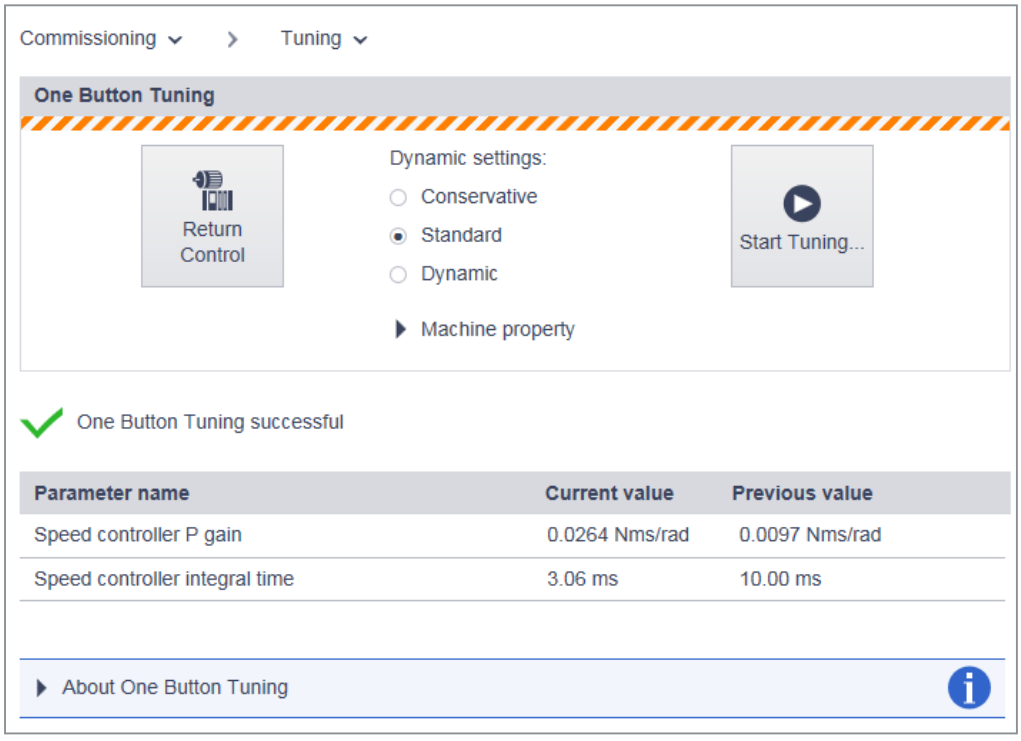


Figure 6-13 View after performing the One Button Tuning

A list in the lower part of the window shows how the settings have been changed by the One Button Tuning.

Note

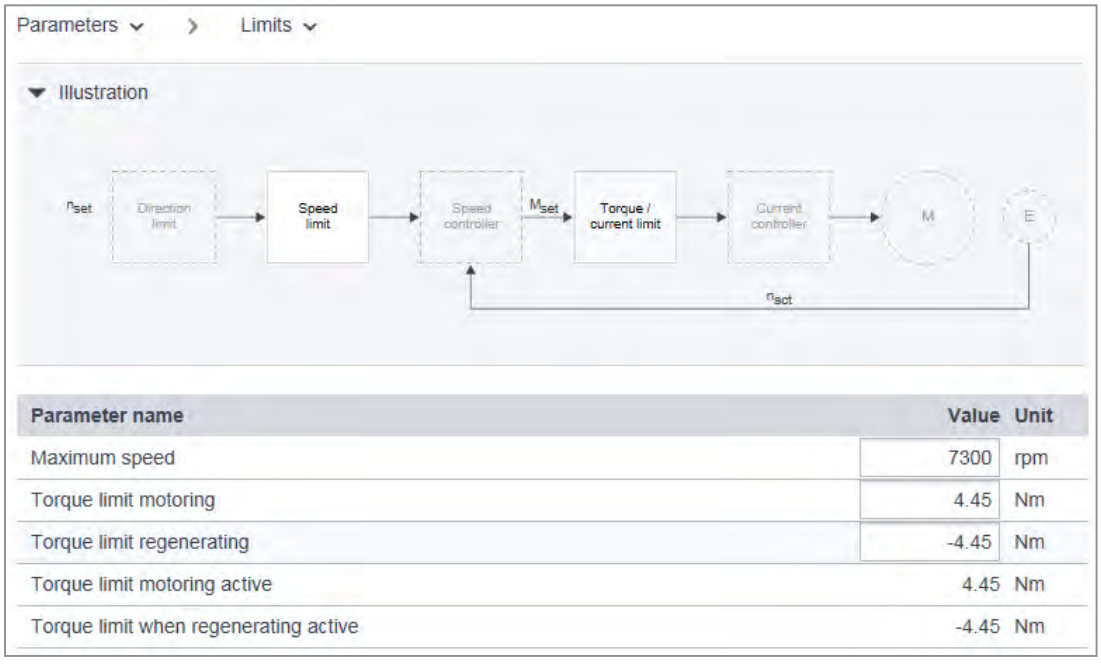
If the machine vibrates or whistles at certain speeds following One Button Tuning, then the dynamic response setting is too high. In this case, select a lower dynamic response and repeat the One Button Tuning.

7. After you have optimized the controller, you must relinquish master control to the converter. Click "Return control".
8. Confirm the confirmation prompt with "Confirm".
   The color bar is no longer displayed.
9. Click to save the data permanently.

You have now performed One Button Tuning.

6.2.4 Setting limits

When required, you can configure limits for elements of your S210 drive and adapt them to the requirements of your mechanical system in the "Parameters > Limits" view.



Parameter name	Value	Unit
Maximum speed	7300	rpm
Torque limit motoring	4.45	Nm
Torque limit regenerating	-4.45	Nm
Torque limit motoring active	4.45	Nm
Torque limit when regenerating active	-4.45	Nm

Figure 6-14 Parameters - Limits

Setting limits

1. Select "Parameters > Limits" in the navigation.
   The table below the graphic shows the "Maximum speed" line of the speed limitation.
2. Enter the maximum speed in the input field of the same name.
3. Enter the two torque limit values.
   - "Torque limit, upper"
   - "Torque limit, lower"
4. Click to save the data permanently.

6.2.5 Setting the brake control

The simple brake control is used exclusively for the control of holding brakes. The holding brake is used to secure drives against unwanted motion when deactivated.

Based on system-internal sequences, the converter checks and monitors the commands for opening and closing the holding brake and controls the output accordingly. The data required for the brake control is stored in the motor and only has to be corrected in exceptional circumstances.

You can find detailed information on the closing and opening times of the motor in the section "Brake data (Page 356)".

The start of the closing time for the brake depends on the end of the shorter of the two times "Standstill detection monitoring time" and "Pulse cancellation delay time".

Note

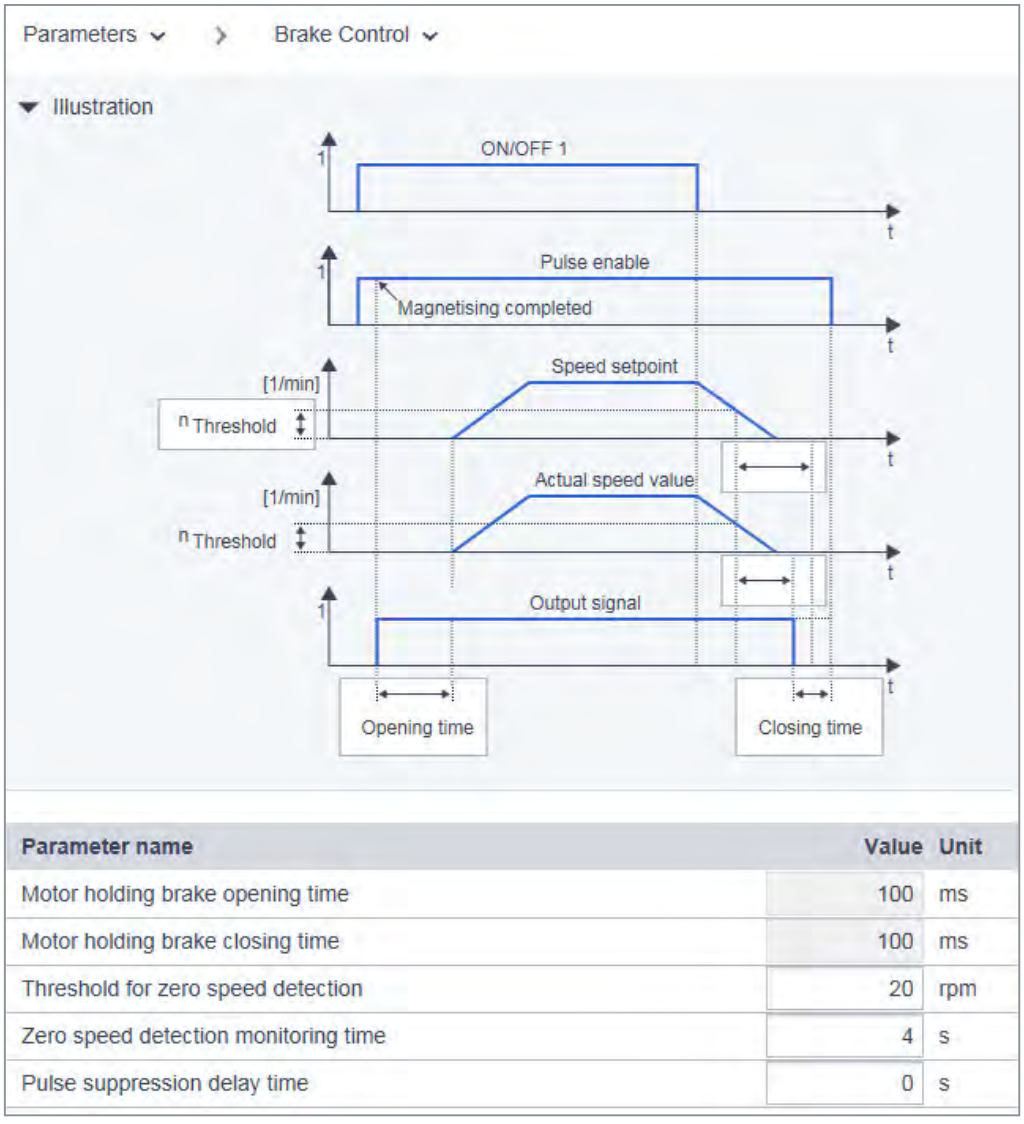
Automatic default setting

The values of the holding brake are automatically set correctly through the self-configuration of the converter in accordance with the electronic rating plate. As a consequence, generally the displayed values no longer have to be corrected.

- The values in this screen form serve more as a check. It may be necessary to adapt the values only for suspended axes.
  You can find additional information in section "Electronic weight counterbalance for a vertical axis (Page 81)".

Procedure

1. Select "Parameters > Brake control" in the navigation.



Parameter name	Value	Unit
Motor holding brake opening time	100	ms
Motor holding brake closing time	100	ms
Threshold for zero speed detection	20	rpm
Zero speed detection monitoring time	4	s
Pulse suppression delay time	0	s

Figure 6-15 Brake control

2. If required, adapt the brake control values in the "Value" column:
   - "Standstill detection speed threshold"
   - "Standstill detection monitoring time"
   - "Pulse cancellation delay time"
3. Click to save the data permanently.

6.2.6 Configuring digital inputs

The S210 converter offers, in addition to the fail-safe digital input (F-DI: DI 2 and DI 3), two high-speed digital inputs (DI 0 and DI 1) as measuring inputs for evaluation in the SIMATIC S7 controller.

The S210 converter also has digital input DI 4 for monitoring the temperature of an optional external braking resistor. You can find more detailed information about interconnecting digital input DI 4 in the section "Connection examples (Page 182)".

Preassignment of digital inputs DI 0 and DI 1

Digital inputs DI 0 and DI 1 are preset by default and do not need to be configured. Digital input DI 0 is preassigned the "Measuring input 1" function and digital input DI 1 is preassigned the "Measuring input 2" function. If you wish to use the digital inputs DI 0 and DI 1, you have to set a telegram in the controller that transfers the values (e.g. the PROFIdrive telegram 105).

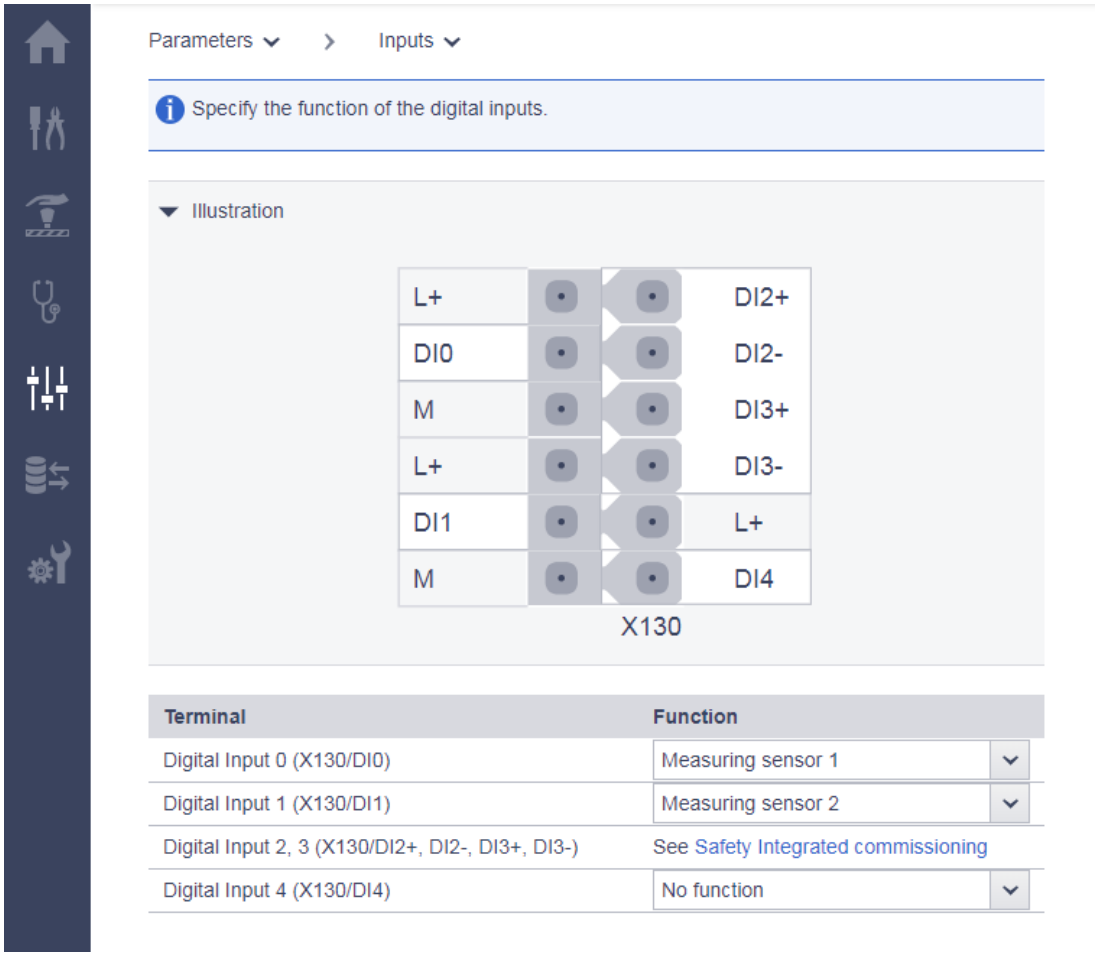


Figure 6-16 Presetting of the digital inputs

Configuring digital inputs DI 2, DI 3 and DI 4

To configure the digital inputs DI 2, DI 3 and DI 4, follow these steps:

1. Select "Parameters > Inputs" in the navigation.
2. Set the corresponding input signals for the digital inputs DI 2, DI 3 and DI 4:

Digital input	Input signal
DI 2+, 2-, 3+, 3-	Fail-safe digital input for the Safety Integrated Basic Functions "STO" or "SS1". **Note:** The configuration is performed via the Safety commissioning. By clicking "Safety", you open the Safety commissioning and can make the appropriate settings there (see section "Commissioning Safety Integrated (Page 218)").
DI 4	Monitoring the temperature of an external braking resistor

3. Click to save the settings permanently.

Using measuring inputs 1 (DI 0) and 2 (DI 1)

You can find additional information about using measuring inputs DI 0 and DI 1 in the section "Digital inputs (Page 275)".

6.2.7 Adapting parameters

You make most of the important converter settings in the dialog screen forms of the web server. In individual cases, it can be necessary to directly read out values from a parameter or enter these into a parameter.

The parameter list is used for this purpose, in which all device parameters are listed.

Select "Parameters > Parameter List" in the navigation to call up the parameter list.

This means, independent of previous settings, you always open the standard view of the parameter list.

The following sections describe how you can adapt the parameter list to address your specific requirements.

You will find a detailed description of the individual parameters and parameter types in the section "Parameters (Page 465)".

6.2.7.1 Configuring the parameter list

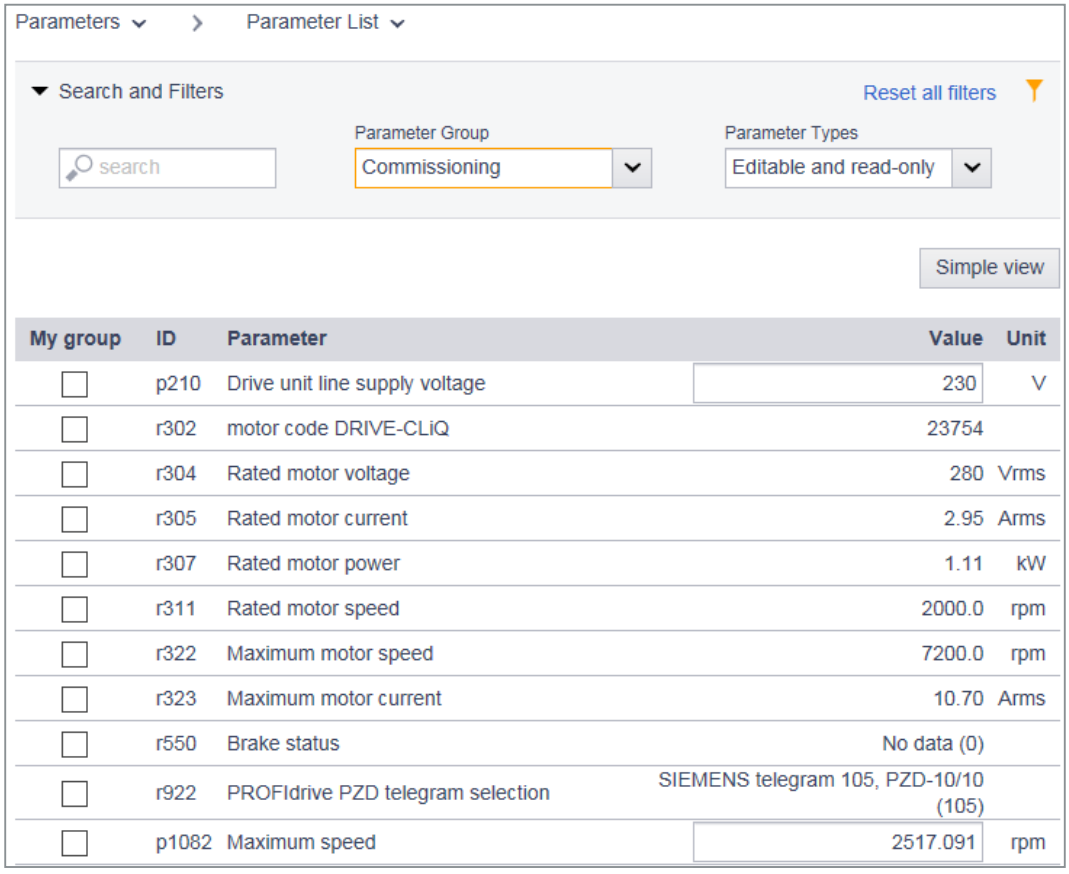
For a clear overview of the parameters, the web server shows the parameter list with all parameters in the simple view. A description of how to view details on individual parameters is provided below.

Displaying the advanced list view

To display the advanced view of the parameter list, click "Advanced view".

The "ID" and "My group" columns are now displayed to the left of the "Parameter" column.

The parameter ID facilitates the search for specific parameters. You can create an individual list using "My group"; see "Grouping parameters".



My group	ID	Parameter	Value	Unit
☐	p210	Drive unit line supply voltage	230	V
☐	r302	motor code DRIVE-CLiQ	23754	
☐	r304	Rated motor voltage	280	Vrms
☐	r305	Rated motor current	2.95	Arms
☐	r307	Rated motor power	1.11	kW
☐	r311	Rated motor speed	2000.0	rpm
☐	r322	Maximum motor speed	7200.0	rpm
☐	r323	Maximum motor current	10.70	Arms
☐	r550	Brake status	No data (0)	
☐	r922	PROFIdrive PZD telegram selection	SIEMENS telegram 105, PZD-10/10 (105)	
☐	p1082	Maximum speed	2517.091	rpm

Figure 6-17 Parameter list: Advanced view

The next time the web server is called, the simple view is displayed again.

Displaying parameter details

To display parameter details, click the ▶ icon in front of the parameter name.

☐	▼ p5271	One Button Tuning configuration 1	0001 1000 B	
☐	▼ p5271[0]	One Button Tuning configuration 1	0001 1000 B	
	p5271[0].3	Speed precontrol	Yes	
	p5271[0].4	Torque precontrol	Yes	
	p5271[0].7	Voltage feedforward control	No	
☐	r5274	One Button Tuning dynamic response estimated	0.00	ms

Figure 6-18 Example: Parameter details in the extended view

The parameter details are displayed. Depending on the parameter, they consist of:

- Values
- Index
- Bit array

The next time the web server is called, the simple view is displayed without details.

Grouping parameters

You can combine individual parameters of the parameter list into a personal group. You can activate the checkboxes in the "My group" column to assign the selected parameters to your personal group.

To combine individual parameters into a personal group, proceed as follows:

1. In the "My group" column, activate all checkboxes of the parameters that you want to take into your group.
2. Click to save the personal group permanently.

6.2.7.2 Changing the parameter value

You can change the parameter values of the parameters that can be written to (p parameters) in the parameter list.

To do this, you have one of the following options:

1. Overwrite the current parameter value with the new value.
2. Select a value via the drop-down list.

Invalid values will be rejected.

Click to save the data permanently.

6.2.7.3 Filtering the parameter list

You can set filters in the parameter list of the Web server and therefore limit the display of the parameters. You can make the filter settings via a filter bar above the parameter list. The filter settings can be combined.

Figure 6-19 Filter bar of the parameter list

Setting the filters of the parameter list

1. In the "Search" field, enter a search term (any number of characters) for which you want to search in the parameter list, e.g. "Current".
   The search term is applied to the "ID" (only in the advanced view) and "Parameter" columns in the parameter list.
2. Select a group from the "Parameter Group" drop-down list.
   - All groups
   - My groups (configured by the user)
   - Specific groups, such as motor parameters
3. In the "Parameter Types" drop-down list, select whether adjustable parameters ("Editable"), display parameters ("Write protected") - or both are to be displayed in the parameter list.

The parameter list is limited further after every further filter setting (the filters are linked via an AND operation). The filters can be set in any order.

Note

Collapsing the filter bar

The filter bar is opened per default. To collapse the filter bar, click the ▼ arrow next to "Search and Filters".

Resetting filters

As long as you are logged in to the Web server and the filter settings have not changed, the parameter list is always displayed with the last filter settings. To reset all filter settings in the parameter list, proceed as follows:

Click "Reset all filters" at the top right in the filter bar.

6.3 Commissioning Safety Integrated

⚠ WARNING

Unexpected movement of machines caused by inactive safety functions

Inactive or non-adapted safety functions can trigger unexpected machine movements that may result in serious injury or death.

If a card without safety functions is inserted instead of a memory card with active safety functions, when the drive is switched on the next time, the safety functions are deactivated.

- Only insert a memory card with the required settings into the drive.
- Prevent unauthorized persons accessing the drive.
- Password-protect configurations with active safety functions against changes.

Note

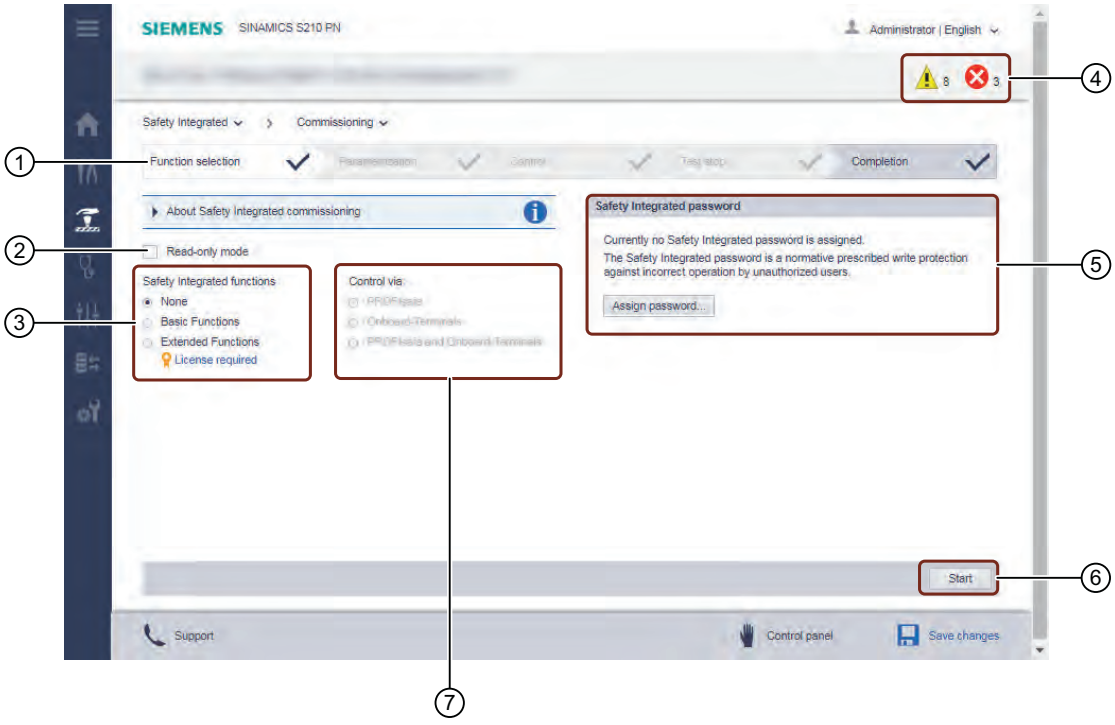
Faulty safety functions in case of non-EMC-compliant installation

A non-EMC-compliant installation of your machine/system can result in sporadic safety function faults.

- Install the drive so that it is EMC-compliant according to the specifications in the section:
  – "EMC-compliant installation of a machine or system (Page 47)"

Overview

The web server provides you with a commissioning Wizard that navigates you through all of the steps required during Safety commissioning.



① Wizard for Safety commissioning
② Activate read-only mode
③ Select function group (Basic or Extended Functions)
④ Access to faults and alarms
⑤ Define the Safety Integrated password
⑥ Start Safety commissioning
⑦ Select control type

Figure 6-20 Overview: Wizard for Safety commissioning

Basics of Safety commissioning

Note

The drive is in a safe state (STO active) as long as the commissioning mode is active.

Settings

- Safety settings can only be made in the "Safety Integrated commissioning" mode.
- The commissioning mode is activated in step "Function selection" using the "Start" button.
- You must completely run through the Safety commissioning. It is not possible to cancel commissioning.

Commissioning steps

- Safety settings are carried out step-by-step in the individual screen forms. A green checkmark indicates that a commissioning step has been completed.

Entries mandatory

- The commissioning steps marked with a checkmark do not require any entries. Entries are mandatory for the commissioning steps marked with a red pen.

Safety Integrated password

- A Safety Integrated password can be defined to protect against unauthorized changes to Safety settings. This can either be done at the beginning or at the end of the Safety commissioning.
- The drive issues an alarm if a password has not been defined.

Faults and alarms

Note

Access to faults and alarms is only possible after initial commissioning has been completed.

- You can find faults and alarms for Safety Integrated Functions in the general message window. It is not possible to access faults and alarms after you have started to commission Safety Integrated. In the web server you only see alarms such as A01698 as "gone".

Read-only mode

Note

When read-only mode is activated, the changed data is not written to the drive.

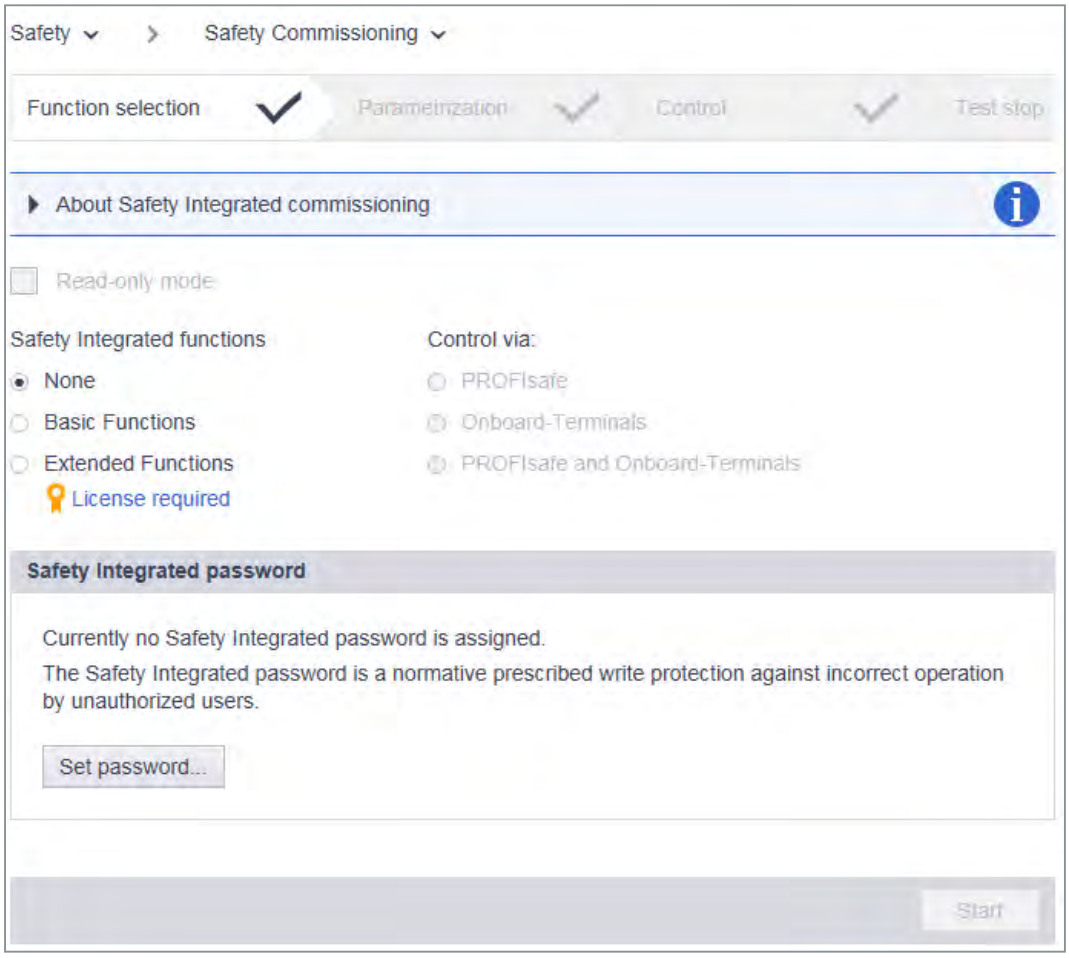
- You can check the Safety settings that have been made in read-only mode at a later time.
- The function is available to you as both "Administrator" and "SINAMICS" user.

Calling Safety commissioning

The individual commissioning steps are displayed in the header of the "Safety Commissioning" screen form.

To call Safety commissioning, proceed as follows:

1. Select "Safety Integrated > Commissioning" in the navigation.



2. Specify how you want to continue with the Safety commissioning. The following options are available for selection:
   - "Perform commissioning step-by-step (Page 223)"
   - "Check commissioning in read-only mode (Page 233)"

Basic information on the safety functions

You can find detailed information on the safety functions used in the section "Safety functions integrated in the drive (Page 85)".

6.3.1 Commissioning Safety Integrated

Overview

When commissioning the Safety Integrated functions, the following function groups requiring or not requiring a license are available to you:

- Basic Functions
- Extended Functions (**require a license**)

Safety commissioning sequence for Basic Functions

The following steps are involved in Safety commissioning of the Basic Functions:

1. Select function
2. Commissioning Basic Functions
3. Define control type of the Basic Functions via PROFIsafe or onboard terminals
4. Test stop (forced checking procedure)
5. Conclude commissioning
6. Define Safety password

Safety commissioning sequence for Extended Functions

The following steps are involved in Safety commissioning of the Extended Functions:

1. Select function
2. Commissioning Extended Functions
3. Define control of the Extended Functions via PROFIsafe
   Optional: Define control of Extended Functions via PROFIsafe and Basic Functions via onboard terminals
4. Test stop (forced checking procedure)
5. Conclude commissioning
6. Define Safety password

6.3.1.1 Function selection

Overview

Select the desired functions and the control method in the "Function selection".

Procedure

Proceed as follows to perform configuration of the Safety Integrated Functions:

1. Select the required Safety Integrated function group.
2. Select the control type of the Safety Integrated Functions:
   - **PROFIsafe**
     You can select the functions independently of one another using the individual bits via PROFIsafe.
   - **Onboard terminals** (only available with the use of Basic Functions)
     Depending on the setting of parameter p9652 "SS1 delay time“, select either SS1 or STO via the onboard F-DI.
3. Select axis type
   When you switch the axis type, the converter automatically saves the parameters and triggers a warm restart.
4. In addition to the preselected functions, select the additional functions that you require.
5. Assign a Safety password. You can also define a Safety password at a later time. The drive issues alarm A01637 as long as a Safety password is not defined.
   - You can find additional information in section "Safety password (Page 232)".
6. If a Safety password has been defined, then you must enter the Safety password in order to make additional settings.
7. To start the configuration of the individual Safety commissioning steps, click "Start" in the footer of the screen form.

6.3.1.2 Commissioning Basic Functions

Overview

Adapt the required settings of the Basic Functions in the "Parameterization" display area.

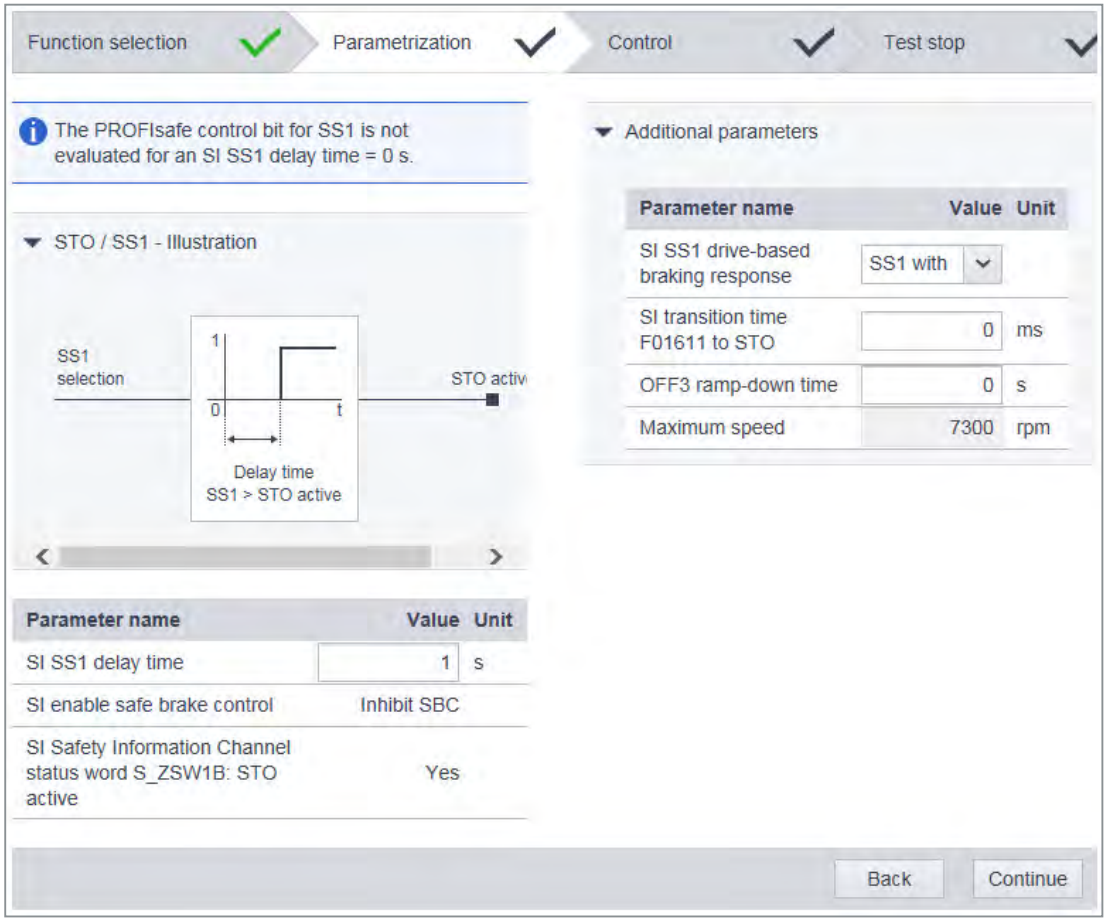


Figure 6-21 Display area: Parameterization (Basic Functions)

Procedure

Proceed as follows to make the settings for the Basic Functions:

1. In the "SI SS1 delay time" parameter, set the value for the emergency stop function.
2. In the "SI SS1 drive based braking response" parameter, select whether SS1 should be operated with OFF3 or with an external stop.
3. Click "Continue".

The "Control" commissioning step is activated.

6.3.1.3 Commissioning Extended Functions

Overview

You configure the selected Extended Functions in the "Parameterization" display area. All functions which you have selected are displayed in the lower section of the screen form.

Procedure

The procedure for setting the Extended Functions is described below based on the example of the SLS function. The description applies to all Extended Functions displayed in the "Parameterization" display area.

1. In the "Parameterization" display area, click on the function to be parameterized (in this case: SLS).

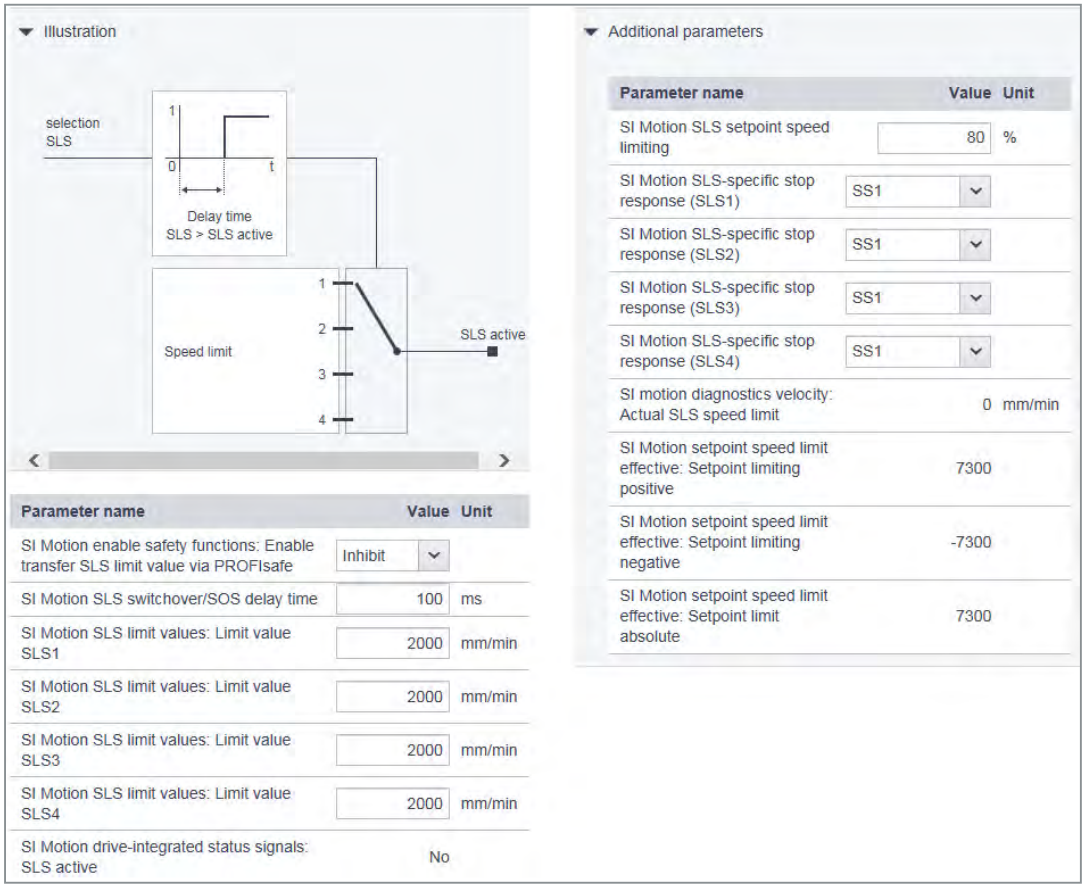


Figure 6-22 Example: Configuring SLS

2. Set the values for the selected function according to your requirements.
3. One by one, parameterize all of the selected functions and the "Actual value acquisition / mechanical system" of your application.
4. When you have parameterized all functions, click on "Continue".

The "Control" commissioning step is activated.

6.3.1.4 Commissioning the control

Control via PROFIsafe

Overview

Entry of a PROFIsafe telegram and a PROFIsafe address is required for control of the safety functions via PROFIsafe. The PROFIsafe telegram which was set in the device configuration for the S210 with the TIA Portal is written by the F-PLC into the converter and displayed as parameter r60022.

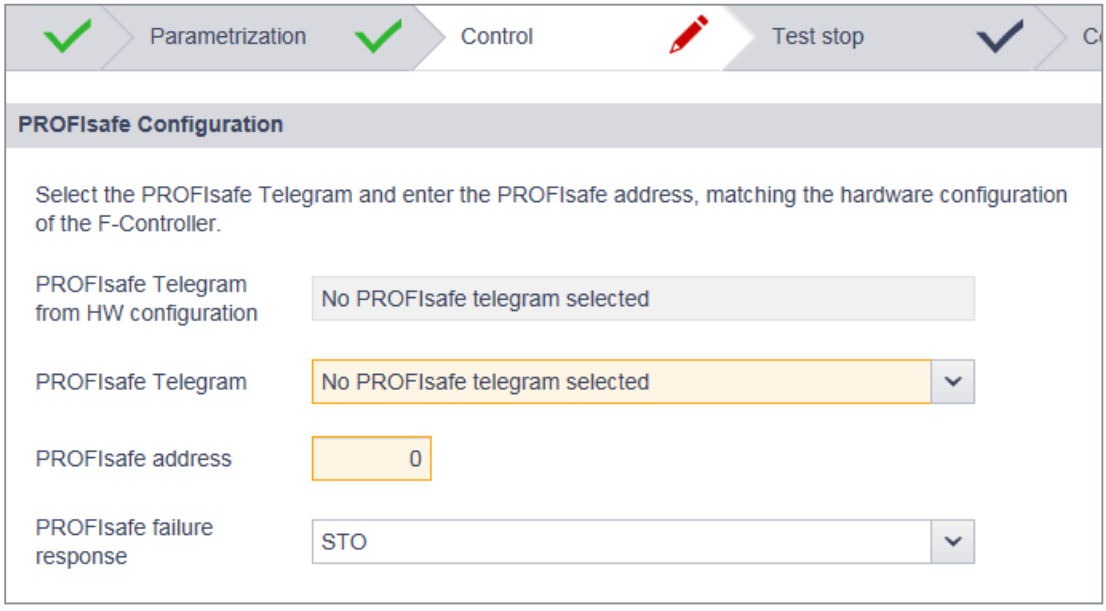


Figure 6-23 Example: Setting PROFIsafe telegram and PROFIsafe address

Procedure

To set the PROFIsafe telegram and the PROFIsafe address, proceed as follows:

1. Select the required PROFIsafe telegram in the "PROFIsafe telegram" drop-down list.
   The selected telegram must match the definitions in the device configuration.
2. Enter the PROFIsafe address in the "PROFIsafe address" input field.
   The entered address must match the definitions in the device configuration.
3. Click "Continue".

The "Test stop" commissioning step is activated.

Controlling via onboard terminals (only Basic Functions)

Overview

The Basic Functions STO and SS1-t can be controlled either via PROFIsafe or via onboard terminals. The following connections are supported for control via onboard terminals:

- Sourcing/sinking F-DI of external devices
- Sourcing/sourcing F-DI of external devices
- Self-monitoring sensors (OSSD)
- Non-self-monitoring sensors (e.g. emergency stop button)

Discrepancy and debounce time

The existing modules of external devices operate with different test pulses for the on/off test.

The debounce time is set in conjunction with the connected module. The debounce time specifies the duration of an interference pulse at the F-DIs, which does not change the state of the drive.

The signal states at the two terminals of an F-DI are monitored in order to determine whether these have assumed the same logical signal state within the discrepancy time (unavoidable time delay). The selection and deselection must be performed in both monitoring channels within this discrepancy time.

The discrepancy time and the debounce time are preassigned default values and do not have to be changed in most cases. The following figure shows an example of the default discrepancy and debounce time.

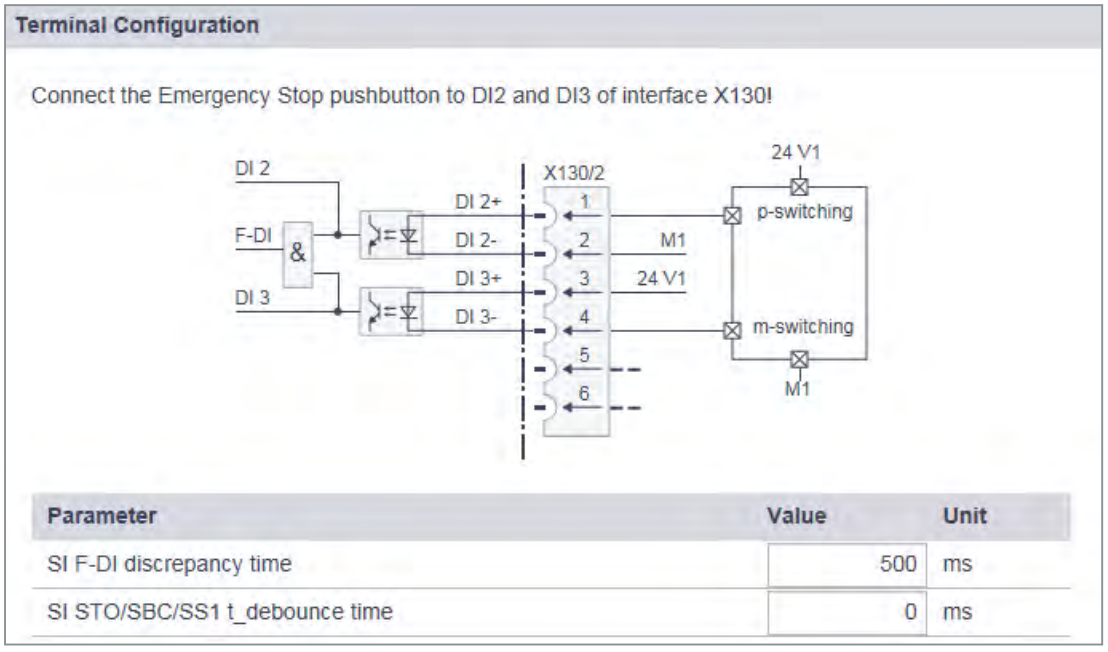


Figure 6-24 Example: Control via onboard terminals

Procedure

Proceed as follows to set the discrepancy and debounce time:

1. If you want to change the discrepancy time, click the "SI F-DI discrepancy time" field.
   An input dialog with the same name opens. Adjust the set discrepancy time and confirm with "OK".
2. If you want to change the debounce time, click the "SI STO/SS1 debounce time" field.
   An input dialog with the same name opens. Set the debounce time and confirm with "OK".
3. Click "Continue".

The "Test stop" commissioning step is activated.

Control via PROFIsafe and onboard terminals

With this selection, you combine both possibilities:

- Control via PROFIsafe (Page 226)
- Controlling via onboard terminals (only Basic Functions) (Page 227)

6.3.1.5 Test stop (forced checking procedure)

Test stop (forced checking procedure)

To meet the requirements of the DIN EN ISO 13849-1 and IEC 61508 standards in terms of timely fault detection, the drive must test its safety-related circuits regularly - at least once a year - for correct functioning.

The "Test stop timer" exists for the test stop; by default, it is set to 8760 hours = 1 year. After this time, the drive signals that a test stop is necessary by issuing error message ("`Acceptance test required`"). The remaining time up to the test stop is determined automatically and displayed on the diagnostics screen.

The test stop (forced checking procedure) for the Safety Integrated Basic Functions is performed by selecting STO or SS1-t and then deselecting it or by a device POWER ON. As a consequence, the timer is reset and the active message acknowledged.

If a different time interval is required for the test stop (e.g. as the result of a risk analysis), change the interval as described in the following.

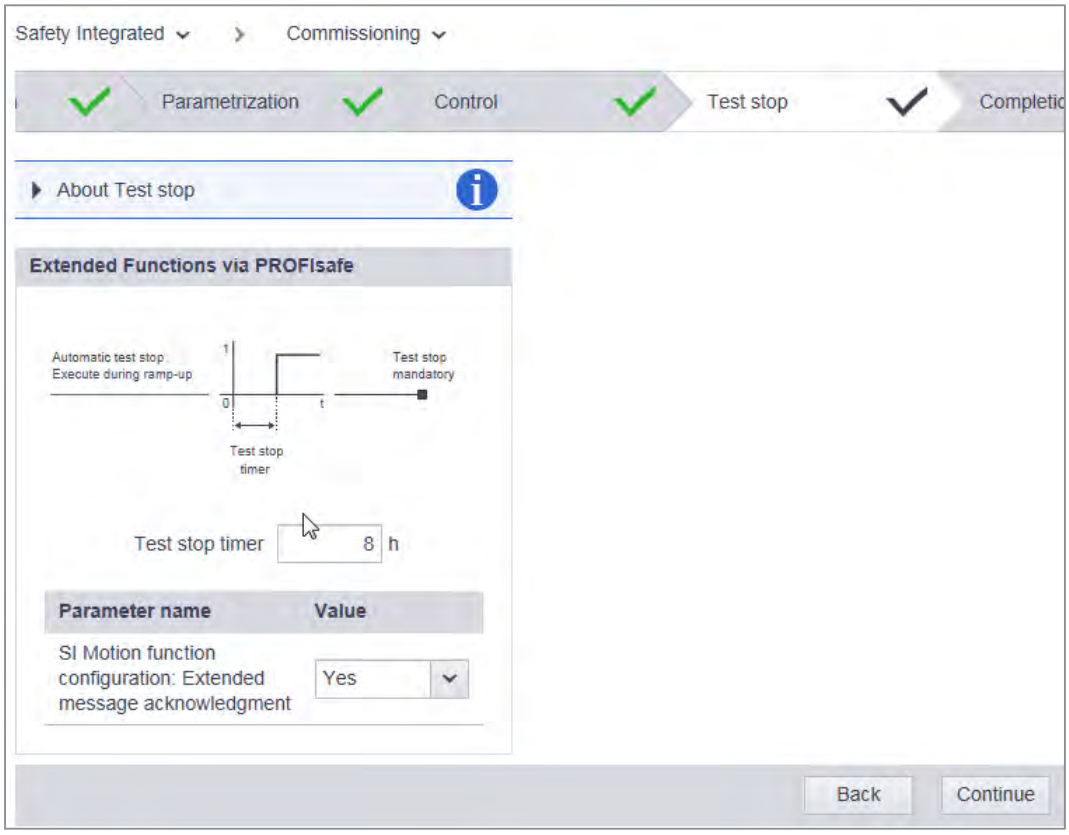


Figure 6-25 Configuring test stop (forced checking procedure)

1. To change the time interval, click in the "Timer test stop" field.
2. Set the time interval for the timer. Confirm with "OK".
   The remaining time up to the test stop is determined automatically and displayed.
3. For the Extended Functions, you can also select here whether you would like to use the "Extended message acknowledgment":
   You may then also acknowledge safety messages of the Safety Integrated Extended Functions with selection/deselection of STO.
4. Click "Continue".
   The "Completion" commissioning step is activated.

6.3.1.6 Acceptance test mode

Overview

It only makes sense to activate the acceptance test mode during the acceptance test of the SS2, SOS, SDI and SLS functions. The acceptance test mode has no effect on other functions.

Special features

- **Selecting the SOS / SS2 function**
  Normally, SOS can be selected directly or via SS2. To be able to trigger violation of the SOS standstill limits with acceptance test mode active (even in the "SS2 active" state), the setpoint is enabled again by the acceptance test mode after deceleration and transition to SOS to allow the motor to travel. When an SOS violation is acknowledged in the active acceptance test mode, the current position is adopted as the new stop position so that an SOS violation is not immediately identified again.
- **Time limit**
  Acceptance test mode can be activated for a configurable time. Acceptance test mode tolerates intentional limit value violations for the acceptance test. For instance, the setpoint speed limits are not active in the acceptance test mode. To ensure that this state is not accidentally kept, the acceptance test mode is automatically ended after the time set.

6.3.1.7 Conclude commissioning

Completion

You have made all of the settings for commissioning the drive-integrated Safety functions. If no Safety password has yet been configured, the password can be defined in this step (refer to following section).

1. Click "Finish".
   The following prompt appears. Click "Finish" again to confirm the prompt.

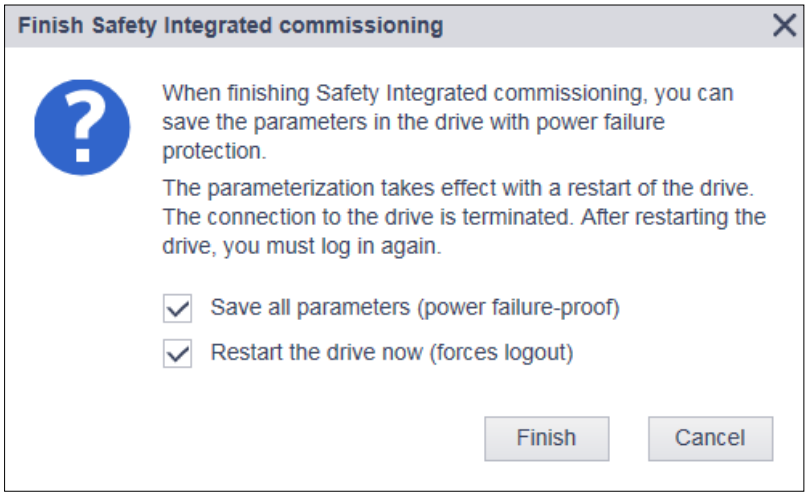


Figure 6-26 Completing Safety commissioning

2. Click "Finish":
3. When both options are selected:
   – The drive adopts the settings of Safety commissioning.
   – The drive performs a restart.

   Following the restart, commissioning of the drive-integrated Safety functions is concluded. The browser displays the home page of the web server again.

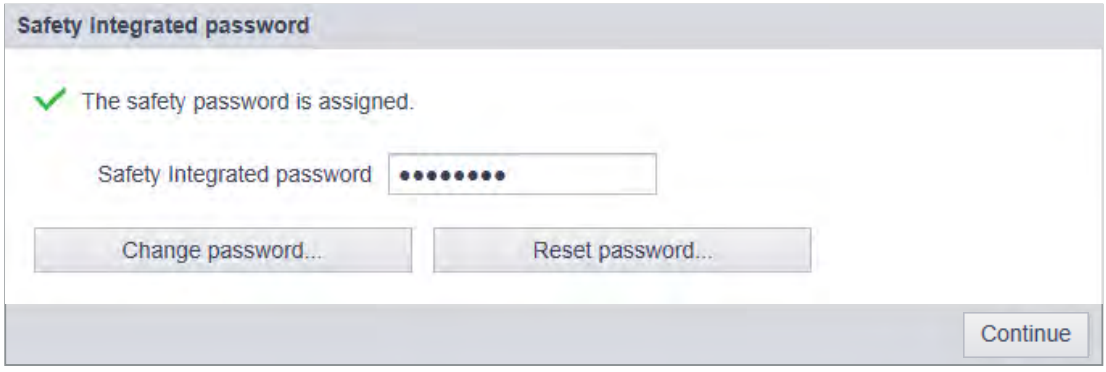
See also

Safety password (Page 232)

6.3.1.8 Safety password

With the Safety password, you protect the settings of the drive-integrated safety functions from changes by unauthorized users.

You can assign the Safety password either before starting to commission the Safety functions or at the end. The drive issues an alarm as long as a password is not assigned.



Note

The Safety password is write protection specified in the appropriate standards to prevent against maloperation by unauthorized users.

The password must include the following elements to provide better protection against unauthorized access, e.g. by hackers:

- At least 8 characters
- Upper and lower case letters
- Numbers and special characters (e.g.: ?!%+ ...)

The Safety password must not be used anywhere else.

Checking the password

The drive checks the length of the password. There is no check for special characters or upper and lower case letters.

6.3.2 Checking existing Safety settings in the read-only mode

If one of the drive-integrated safety functions is enabled (p9601 ≠ 0), then check the performed settings in read-only mode. This allows you to run through the complete Safety commissioning step-by-step without being able to perform changes.

The read-only mode is not available if you have not selected any Safety Integrated functions.

1. Activate the "Read-only mode" option.

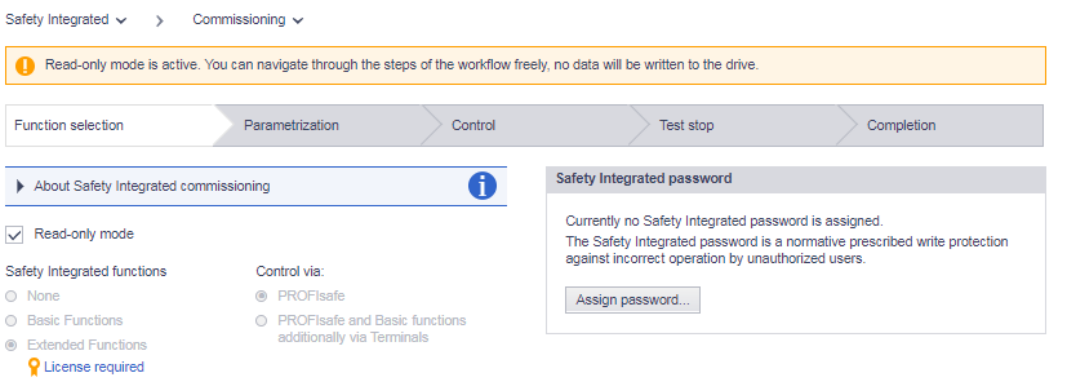


Figure 6-27 Safety commissioning in read-only mode

The individual commissioning steps are displayed in the header of the "Safety Commissioning" screen form.

2. Click the "Continue" button each time and check the values which you have set during Safety commissioning.

6.3.3 Changing Safety settings

In order to change Safety settings, you must run through all commissioning steps as with commissioning.

1. Select "Safety Integrated > Commissioning" in the navigation.
   If you have set a Safety Integrated password, you must enter the password in order to access the Safety settings:

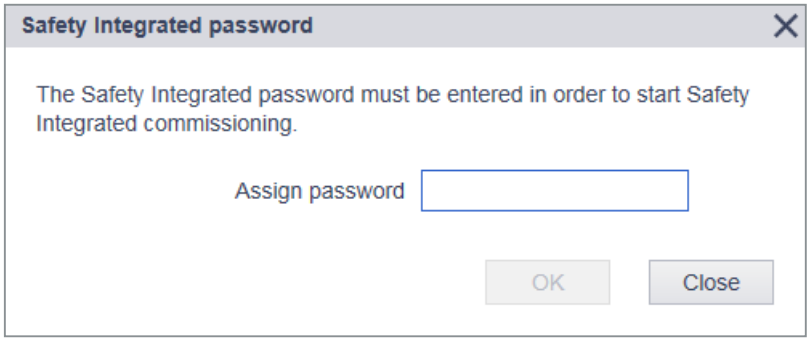


Figure 6-28 Safety password

6.3.4 Safety Integrated: Diagnostics

The most important information on the Safety settings and the states of the converter are displayed using the Safety diagnostics.

Select "Safety > Safety Diagnostics" in the navigation to view the safety settings and states of the converter:

Individual items of information are then displayed in the following display areas of the screen form:

- **Safety Integrated function status**
  Shows the activated Safety functions in the converter.
- **Status**
  Shows information on the status of the converter.
  If a test stop is required, then this is displayed. The times for the test stop of the timer and the remaining time up to the test stop are displayed. The display area also shows whether internal events (e.g. software errors in the converter or a discrepancy in the monitoring channels) have taken place and whether the communication is OK.
- **Safety logbook**
  This function is used to detect changes to Safety parameters that affect the associated CRC sums. CRCs are only generated when p9601 (SI enable, functions integrated in the drive) is > 0.
  Data changes are detected when the CRCs of the SI parameters change. Each SI parameter change that is to become active requires the reference CRC to be changed so that the drive can be operated without SI fault messages. In addition to functional Safety changes, Safety changes as a result of hardware being replaced can be detected when the CRC has changed.
  Functional changes are recorded in the checksum r9781[0]:
  - Functional CRC of motion monitoring
  - Functional CRC of the drive-integrated basic safety functions
  - Enable drive-integrated functions

  Hardware-specific changes are recorded in the checksum r9781[1]:
  - Hardware-dependent CRC of motion monitoring
- **Acceptance test mode**
  You can find more information about acceptance test mode here: "Acceptance test mode (Page 229)".

6.4 Diagnostic functions

6.4.1 Messages

6.4.1.1 Displaying messages

Overview

To call up the list of messages, proceed as follows:

1. Select "Diagnostics > Messages" in the navigation.
   OR
2. Click the or icon in the header of the web server.
   The appropriate view is displayed.

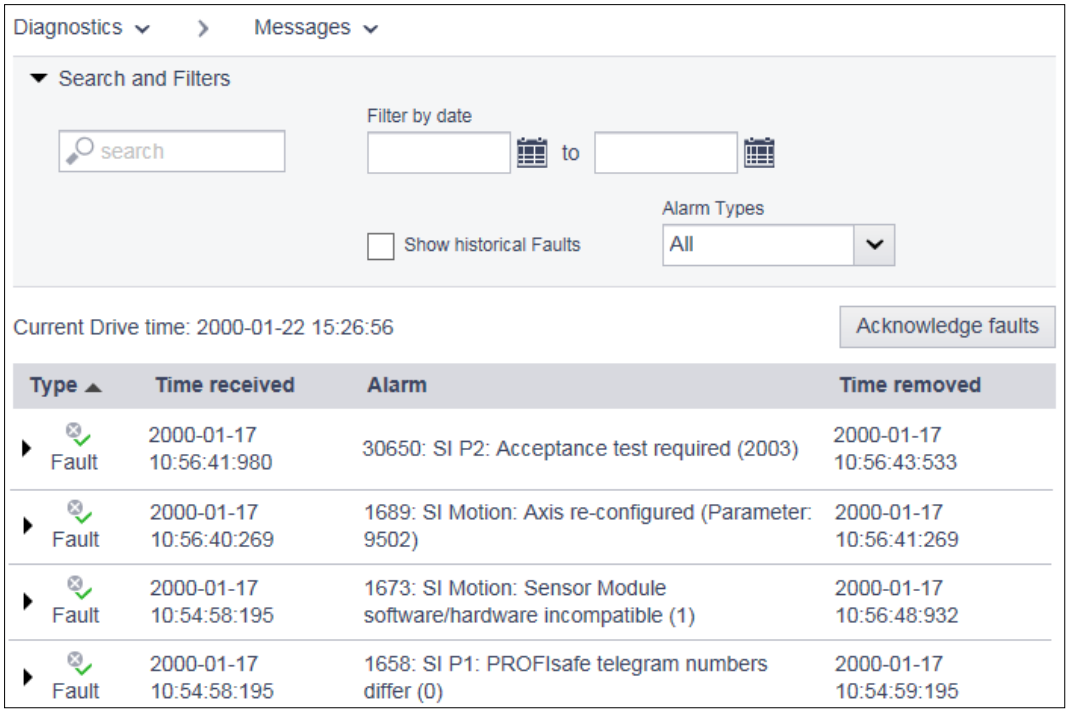


Figure 6-29 Example: Message list

Description of symbols

Alarm
Fault
OK (acknowledged fault)

Additional information

You can find more information on S210 messages in the section "Faults and alarms (Page 535)".

6.4.1.2 Filtering messages

Overview

You can set filters in the message list of the Web server and therefore limit the display of the messages. You can make the filter settings via a filter bar above the message list. All filters are linked by an AND connection.

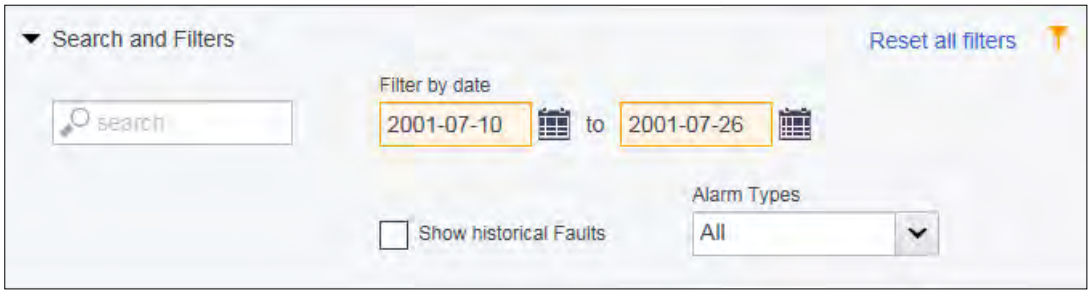


Figure 6-30 Filter bar of the message list

Setting filters

1. In the "Search" field, enter a search term (any number of characters) for which you want to search in the message list.
   The search term is also active in the "Alarm" column in the message list.
2. In the two "Filter by Date" fields, enter a period for which the messages are to be displayed.
   The message list is limited further after every filter setting. The filters can be set in any order.

Note

Collapsing the filter bar

The filter bar is opened per default. To collapse the filter bar, click the ▼ arrow next to "Search and Filters".

Resetting filters

As long as you are logged in to the Web server and the filter settings have not changed, the message list is always displayed with the last filter settings. To reset all filter settings in the message list, proceed as follows:

Click "Reset all filters" at the top right in the filter bar.

The message list then displays the unfiltered view of the messages again.

6.4.2 Display drive status

Select "Diagnostics > Drive status" to display the converter state in the web server.

You receive more detailed information by clicking on the arrow symbol ▶.

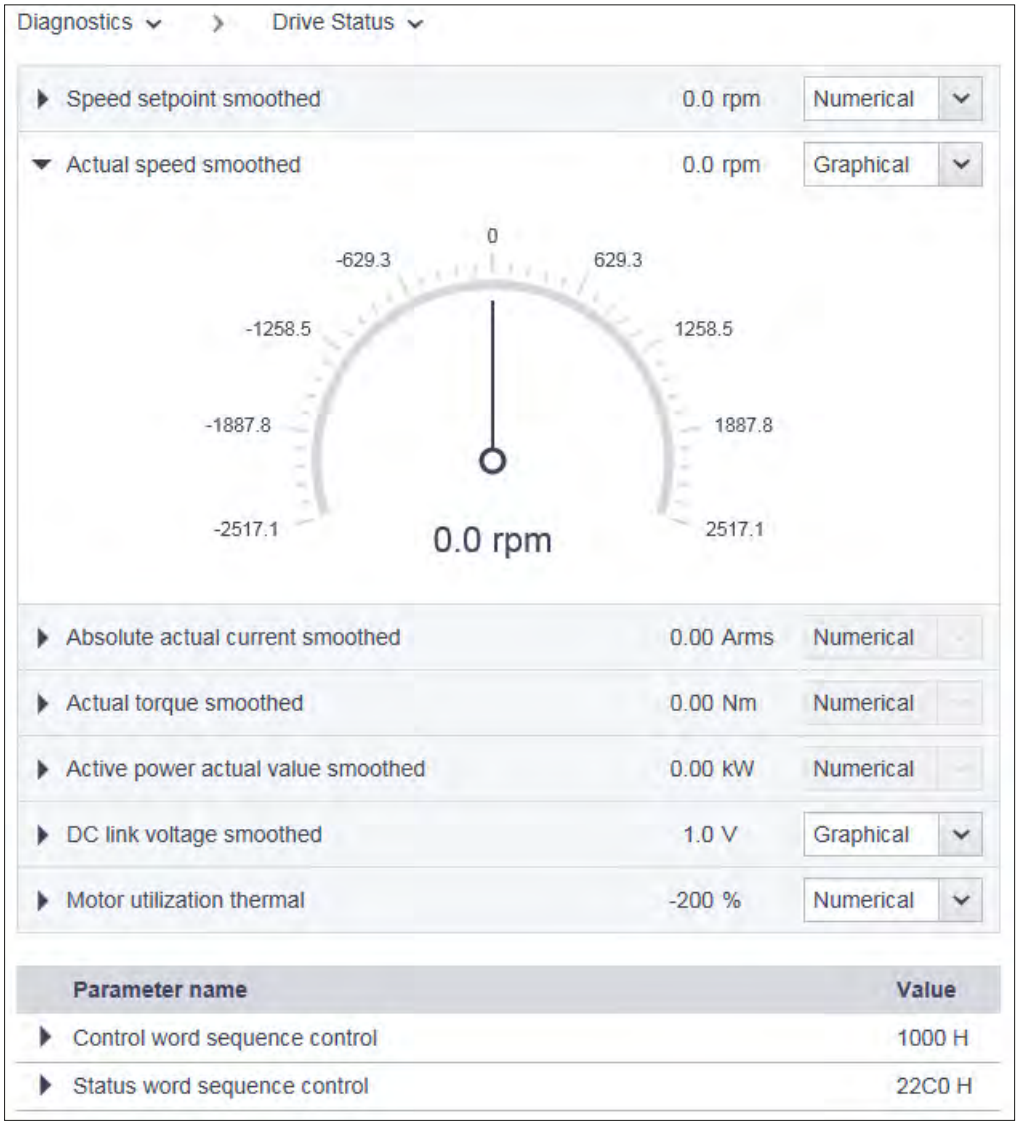


Figure 6-31 Example: Drive status

The settings are not saved. The window is displayed in the basic setting if you log out and then log in again.

Graphical display of the states

For states where the drop-down list is not grayed out, a graphic representation is shown in the detailed view. The graphic representation has the advantage that, in addition to the actual values, the limits are also displayed.

6.4.3 Displaying communication settings

Select "Diagnostics > Communication" in the navigation to display the communication settings.

The web server shows a view with the following contents:

- PROFINET address of the converter
- PROFINET name of the station
- Information as to whether the connection between the controller and the converter is active
- The standard telegram
- Table with process data for the transfer direction "controller > converter"
- Table with process data for the transfer direction "converter > controller"
  The values are displayed in hexadecimal format in the default setting. You can switch the display of individual values between binary and hex format by clicking on the button to the right of the value.

6.5 Backup and restore

The following functions are available in the "Backup and restore" view:

- Back up parameters
- Restore parameters from file
- Reset to factory settings

6.5.1 Backing up parameters

Overview

You can back up the converter settings externally using this function.

Time of backup

You can back up the converter settings at any time. However, we recommend a data backup **after commissioning of the converter**.

Procedure

To back up the converter settings externally, proceed as follows:

1. Save the settings in a non-volatile fashion using .
   OR
2. Click "Back up parameters" in the "Parameter Backup" setting area.
   The data backup of the parameters is performed. A message is displayed when the data backup is successful.
3. If necessary, define the path at which you want to save the backup file.
4. Correct the automatically generated name (e.g. "Backup.zip") of the data backup so that the required data backup can be clearly identified by the name.

Note

Checking and editing externally saved parameters

The converter settings are saved in a format that cannot be edited; they cannot be checked or changed.

6.5.2 Restore parameters from file

Overview

If you load the externally backed-up converter settings to the converter again, you restore the converter state at the time of the data backup. You can also use the externally backed-up files for a series commissioning.

Procedure

To load the externally backed-up converter settings to the converter, proceed as follows:

1. Click "Browse" in the "Restore Parameters From File" setting area.
2. Select the data backup file in your file system.
   The data backup file is now displayed in the view.
3. Click "Restore" in the "Restore Parameters From File" setting area.
   The data backup is loaded. The converter is then restarted. You must log in to the Web server again.
4. Log in to the Web server again.

6.5.3 Restoring factory settings

Overview

The motor must be connected in order to restore the factory settings using the web server.

Procedure

To restore the factory settings, proceed as follows:

1. In "Backup and Restore", click on "Restore Factory Settings".
2. Acknowledge the confirmation prompt. The converter is reset and then restarted.
   When both LEDs are lit green, the reset has been completed.

You have now reset the converter to the factory settings and carried out the basic motor commissioning.

Additional information

You can find more information on restoring to factory settings in the section "Reset converter/ password - restore the state when originally delivered (Page 331)".

6.6 System settings in the web server

6.6.1 Setting or changing user accounts

For SINAMICS S210, both user accounts - "SINAMICS" and "Administrator" - are permanently defined, and cannot be changed by users.

You can make the following settings in the user accounts:

- Changing the Administrator password
- Authorize or inhibit "SINAMICS" user
- Defining a new password for the "SINAMICS" user
- Changing/deleting the password for the "SINAMICS" user

Password requirements

To protect against unauthorized access, by an attacker, for example, generate a secure password that consists of:

- At least 8 characters
- Upper and lower case letters
- Numbers and special characters (e.g.: ?!%+ ...)
- Different passwords for different types of access (administrator / user)

Checking the password

The length of the password is checked by the converter. There is no check for special characters or upper and lower case letters.

Remember the passwords or store the passwords in a safe place that cannot be accessed by unauthorized persons.

6.6.1.1 Changing the password

Overview

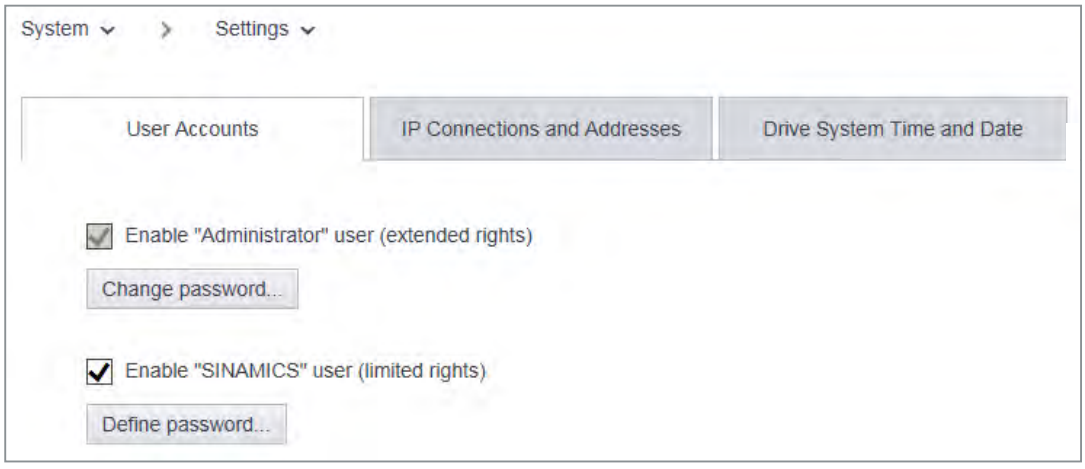


Figure 6-32 Changing the password

Perform the following steps to configure the user accounts in the web server:

Changing the password for the "Administrator" user

The "Administrator" cannot be deactivated.

To change the password for the "Administrator" user, proceed as follows:

1. Select "System > Settings" in the navigation.
2. Select the "User Accounts" tab.
3. To change the password, click "Change password" at the "Administrator" user.
   The corresponding dialog opens.
4. Enter the old password.
5. Enter a new password.
6. Enter the new password again.
7. Confirm the password change with "Change".
   The dialog closes.
8. Click to save the data permanently.

You have redefined the password for the "SINAMICS" user.

Creating the password of a "SINAMICS" user

To create a password for the "SINAMICS" user, proceed as follows:

1. Select "System > Settings" in the navigation.
2. Select the "User Accounts" tab.

3. Select the "Enable SINAMICS user" option.
4. Click "Define password..." at the "SINAMICS" user.
   A password dialog opens.
5. Enter a new password.
6. Enter the new password again.
7. Confirm the password input with "OK".
   The dialog closes.
8. Click to save the data permanently.

You have created the password for the "SINAMICS" user.

Changing/deleting the password for the "SINAMICS" user

To change or delete the password for the "SINAMICS" user, proceed as follows:

1. Select "System > Settings" in the navigation.
2. Select the "User Accounts" tab.
3. If you want to change the password of the "SINAMICS" user, proceed as for the "Administrator" user.
   OR
4. If you want to delete the password of the "SINAMICS" user, click "Delete password...".
   A prompt appears. Enter the old password and click "Delete".
5. Click to save the data permanently.

You have changed/deleted the password for the "SINAMICS" user.

6.6.2 Configuring the IP connection

The X127 and X150 interfaces have the following defaults:

- **Service interface X127**
  Access to the web server via the service interface is always active. Communication is performed in the factory setting via an HTTP connection.

NOTICE
Software manipulation when using non-encrypted connections (HTTP) The HTTP protocol transfers data without encryption. This facilitates password theft, for example, and can lead to data manipulation by unauthorized parties and thus ultimately to damage. • Limit access to HTTPS connections so that all data is transferred encrypted.

- **PROFINET interface X150**
  Access to the web server via the PROFINET interface is deactivated by default. Communication via the PROFINET interface is always performed via the secure HTTPS connection.

Note

Security measures for communication via PROFINET interface X150

In accordance with the Defense in Depth concept, the PROFINET interface must be isolated from the remaining plant network (see Industrial Security (Page 24)).

Protection must be provided against access to the cables and possible open connections, for example, by installing in a control cabinet.

You can make the connection between the converter and the commissioning device more secure through the settings described in the following.

Procedure

1. Select "System > Settings" in the navigation.
2. Select the "IP Connections and Addresses" tab.

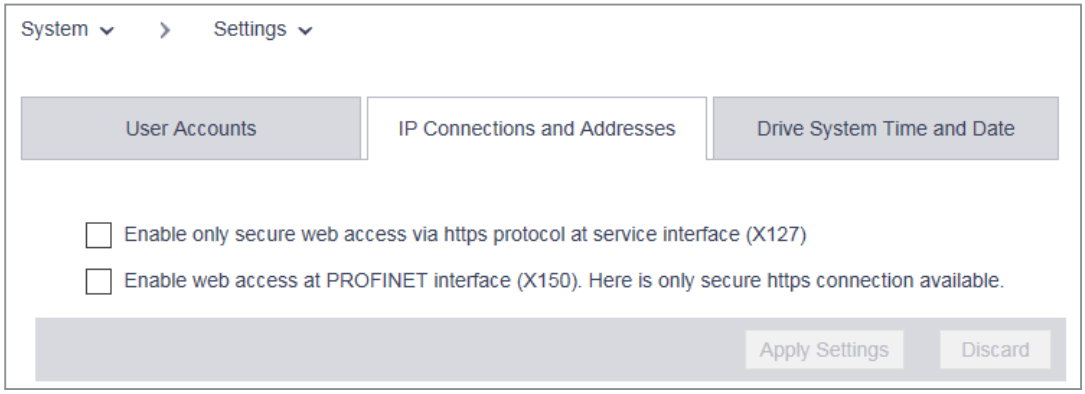


Figure 6-33 IP connections

3. Activate the desired connection options.

4. Click "Apply Settings" to save the changes in the RAM of the device.
5. Click to save the data permanently.

You have configured the IP connection.

Note

Switchover from HTTP to HTTPS

If you were logged-in via HTTP, then after activating option "Only use HTTPS connection", you will be logged-out. To log in again, you must set a secure HTTPS connection (https://...) to the converter.

Note

Certificates for the secure data transfer

To secure an HTTPS connection, it requires security certificates for the encryption of the access. Detailed information on working with these security certificates can be found in section "Use of SSL/TLS certificates for secure data transmission (Page 672)".

6.6.3 Configuring the system time

By default, NTP time synchronization (NTP = Network Time Protocol) is activated for the system time of the converter. The converter then synchronizes its system time with a central NTP server in the PROFINET network.

A library for use as SNTP server is available for the SIMATIC controllers. You will find these on the Support pages:

- Library for the SNTP server functionality in SIMATIC S7 CPUs (https://support.industry.siemens.com/cs/ww/en/view/82203451)

If you want to deactivate this time synchronization or activate it again, proceed as follows:

1. Select "System > Settings" in the navigation.
2. Select the "Drive date and time" tab.

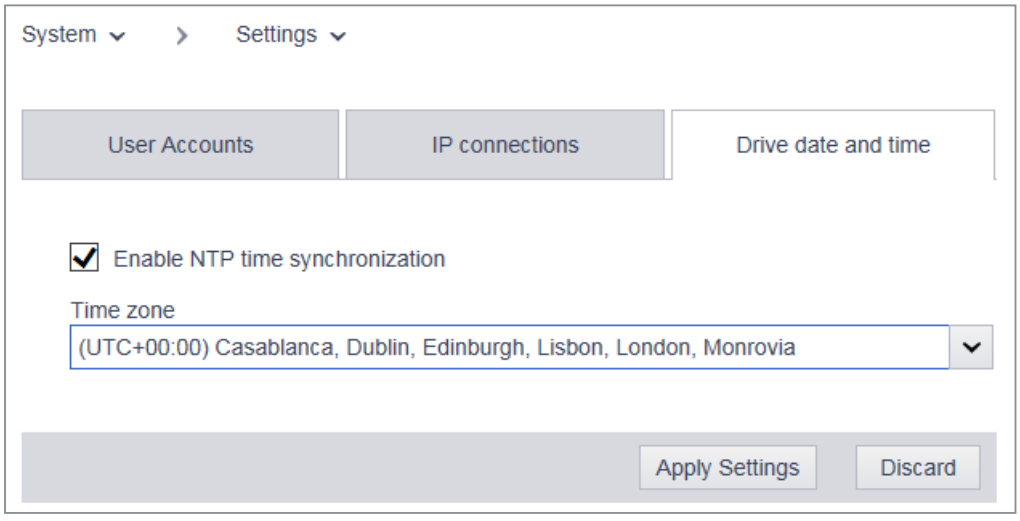


Figure 6-34 System time

3. Deactivate/activate "Activate NTP time synchronization".
4. Select the time zone (for Central Europe UTC+01:00) – only possible if NTP time synchronization has been activated.
5. Click "Apply Settings" to save the changes in the RAM of the device.
6. Click to save the data permanently.

6.6.4 Updating the firmware via the web server

Carefully ensure that when upgrading, the converter settings are kept. For a downgrade, the converter is reset to the factory settings.

You can find the firmware versions available at the following link:

- "Firmware versions (https://support.industry.siemens.com/cs/ww/en/view/109744577)"

Requirements

You have saved the zip file with the firmware to a drive, which you can access using the commissioning device.

A firmware update is possible as of Version 5.1 SP1.

Note

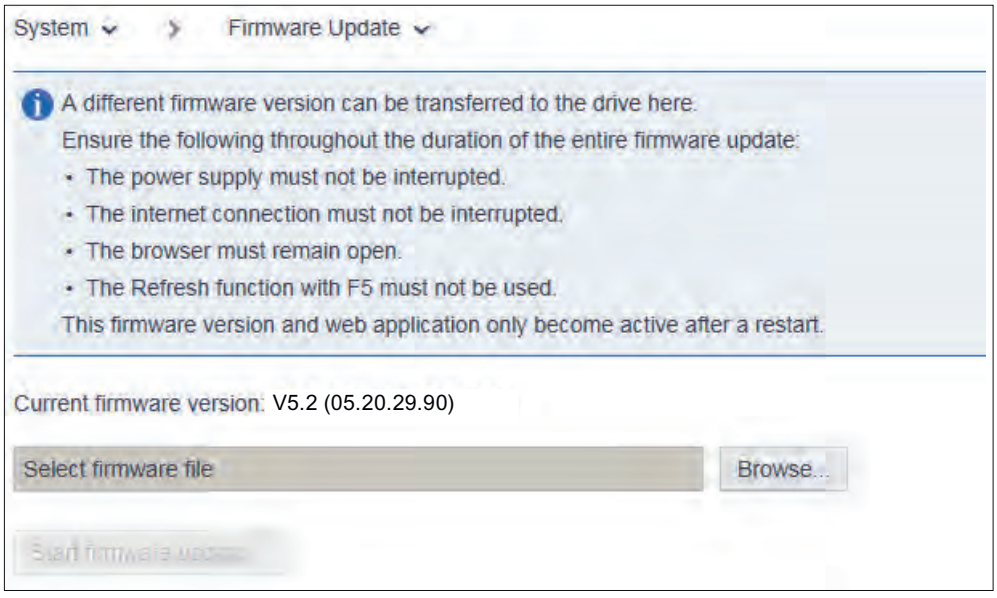
Converter with memory card containing the firmware

If you operate the converter with a memory card containing the firmware, remove the memory card and update the firmware as described in the section "Converter firmware update (Page 329), Firmware update via memory card".

If you operate the converter without a memory card or with a memory card without firmware, proceed as described below.

Procedure

1. Select "System > Firmware update" in the navigation.



2. Select the zip file with the firmware version that you wish to load to the converter
3. Start the firmware update.

4. The new firmware is installed – this can take up to five minutes or longer. The update is complete when both LEDs flash red at 1 Hz in sync with each other.

RDY	COM	Explanation of LED displays
		Firmware update is active • Do not switch off the power supply. • Do not disconnect the motor from the converter.
		LEDs are flashing synchronously: Converter waits until the power supply is switched off and switched on again after a firmware update.

5. Switch the converter off and on again. The firmware of the connected DRIVE-CLiQ components is updated. This may require a restart (see alarm messages in the web server).

RDY	Explanation of LED displays
	Firmware update in progress for the connected DRIVE-CLiQ components. • Do not switch off the power supply. • Do not disconnect the motor from the converter.
	DRIVE-CLiQ component firmware update has been completed. Waiting for POWER ON of the respective component. **Remedy**: Switch the component off and on again.

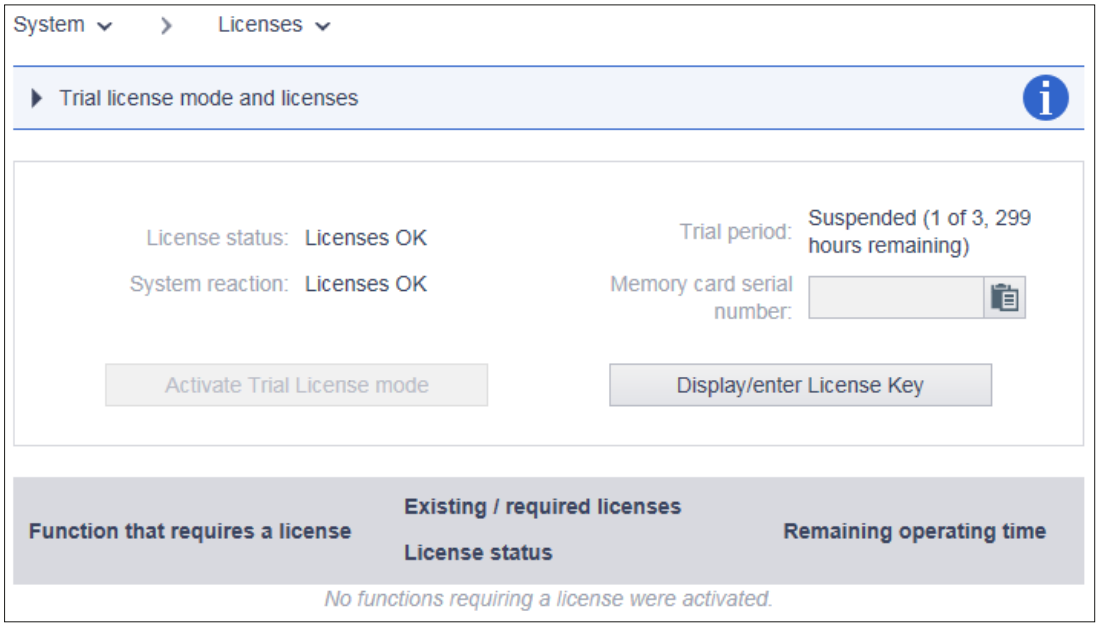
6. Check whether the new version is installed. The firmware version of the converter is displayed on the home page of the web server under the converter.

6.6.5 Using functions that require a license

To display the license status, in the navigation, select "System > Licenses".

Using this page, also enter a license key that you purchased through the Web License Manager.

If you still do not have a license - however, you wish to set up and test functions that require a license, then you have the option of activating the Trial License Mode. Details are contained in section "Using functions that require a license (Page 249)".



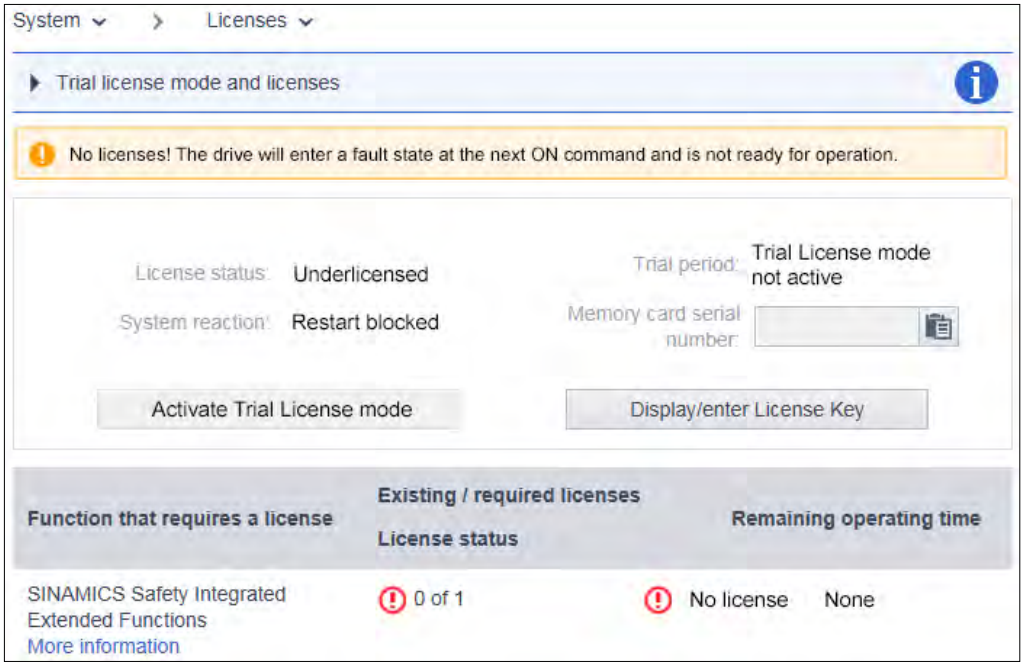
System reactions if there is a not a sufficient license

A license that is not completely sufficient is displayed as follows:

If there is no license - and a Trial License Mode has not been activated

- At the converter
  - Displayed when the RDY-LED flashes red with a frequency of 2 Hz.

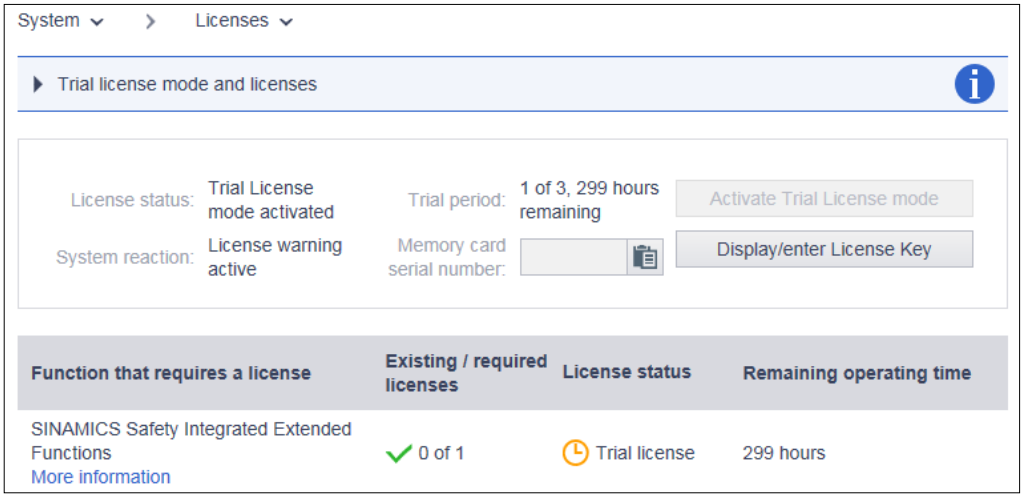
  - Display using the fault display with F18
- Via the web server
  - Fault F13000, "Licensing is insufficient"
  - System > Licenses



If there is no license - however, a Trial License Mode has been activated

- At the converter
  - Displayed when the RDY-LED flashes red/green with a frequency of 2 Hz.

- Via the web server
  - Message A13030 "Trial License activated"
  - System > Licenses



Note

Operation without an adequate license is only permissible when commissioning the drive and when carrying out service work. To do this, activate the Trial License Mode

The drive requires a sufficient license in order for it to operate.

Trial License

There is a common Trial License Mode for most functions requiring a license. Using the Trial License Mode, you can try out these functions until you actually purchase the licenses.

The Trial License Mode encompasses three periods, each with 300 operating hours of the drive. You must separately start each period of the Trial License Mode.

If the last period of the Trial License Mode has elapsed, the drive goes into a fault condition the next time that it is switched on. To be able to switch on the drive again, you must either activate the functions that require a license - or you must enter a valid license key.

Use the Trial License

Procedure:

1. Select "System > Licenses" in the navigation.
2. Click "Activate Trial License Mode".
3. .Acknowledge the confirmation prompt

Message A13030 indicates that the Trial License has been activated.

After the Trial License has expired, alarm A13031 "Trial License Period expired" is output.

Repeat steps 1 and 3 if you want to activate the Trial License for another trial period.

License key

You can view the current license key on the license overview page of the web server and enter a new key as required.

1. Select "System > Licenses" in the navigation.
2. In the license overview page, click on "Display/enter license key".
   The current license key of your drive is visible in the upper field of the following dialog (if already present).
3. To use a new license key, enter it in the "New License Key" field (example: E1MQ-4BEA).
   This allows you to replace a Trial License with a full license.
4. Click on "Activate" to activate the license key that has just been entered.
   The dialog closes. The new license key becomes active the next time that the system runs-up.

Commissioning and diagnostics with Startdrive 7

Overview

You commission your S210 drive in the TIA Portal with the integrated engineering tool Startdrive.

Configuring an S210 drive in Startdrive gives you the option to create and complete a project in offline mode. Physical access to an S210 drive is not absolutely necessary. In addition, because all user parameters (e.g. speed and torque limits) are preassigned, configuration can be completed even before on-site commissioning.

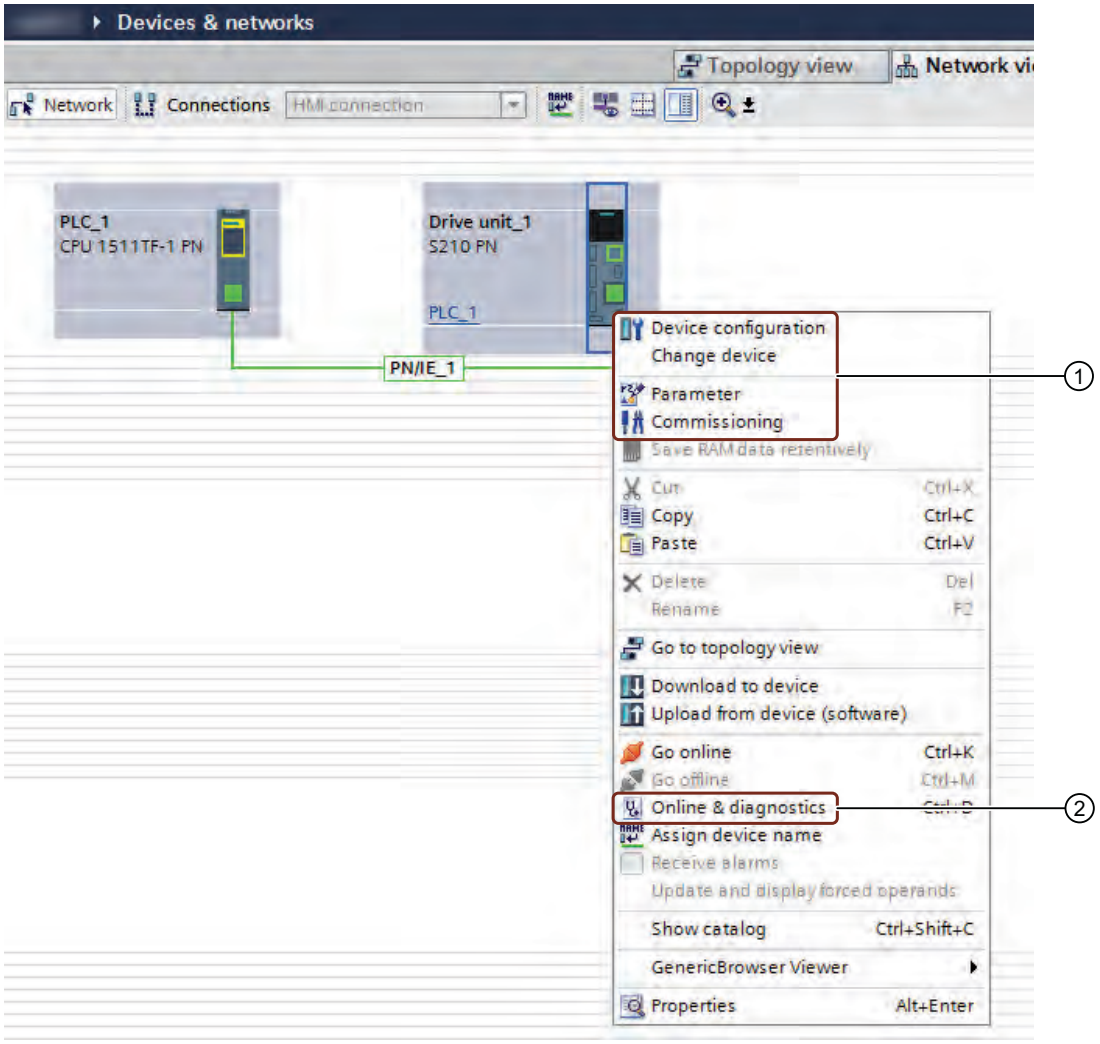
Characteristics and special features

Configuration in Startdrive has the following special features:

- Optimized for operation of an S210 drive in a network with a SIMATIC S7 controller and with integration of a Motion Control technology object
- Direct calling of the drive configuration from the configuration screen form of the integrated Motion Control technology object
- Complete configuration of the drive in a single configuration screen form
- Automated configuration of the drive with preassignment of the user parameters depending on the configured motor
- Configuration and diagnostic screen forms for using Safety Integrated

In addition to the features mentioned above, the following user-friendly functions are available for commissioning and diagnostics with the Startdrive engineering tool:

- **Calling the commissioning and diagnostics of the S210 drive from the network view**
  You can call the basic parameter assignment, commissioning and diagnostics of the S210 drive directly from the network view via the shortcut menu. You can also call other important functions (e.g. replace device).



① • "Device configuration"
Opens the drive device view.

• "Replace device"
Also possible by means of drag-and-drop via the hardware catalog.

• "Parameters"
Opens the basic parameter assignment of the drive.

• "Commissioning"
Opens the basic commissioning of the drive.

② • "Online & diagnostics"
Opens the diagnostic functions for the drive.

- **Replacing power units**

You can replace configured power units in your project at any time, for example by selecting the relevant power unit in the hardware catalog and inserting it in the existing configuration using drag-and-drop. You can then make additional settings and complete the device replacement in the "Replace device" dialog.

- **Calling component-specific information**
  You can call the following component-specific information directly via the shortcut menu in the hardware catalog:
  - Support information (e.g. firmware versions)
  - FAQs
  - Manuals

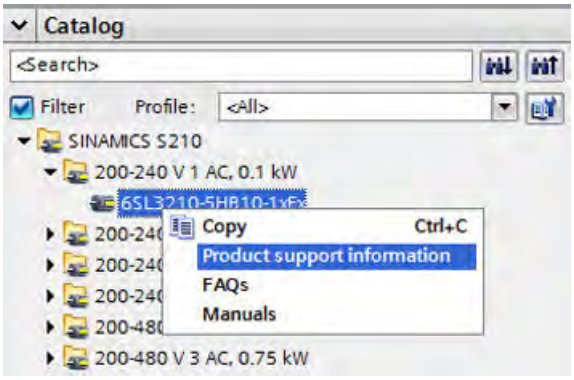


Figure 7-1 Example: Call support information

Requirements

- TIA Portal **version 15.1 or higher** is installed on your PG/PC.
- **Firmware version 5.2 or higher** is installed on your S210 converter.
- You have all licenses required to use the TIA Portal without restrictions.
- Your SINAMICS S210 converter is connected to a SIMATIC S7 controller.

Commissioning sequence

The following steps are involved in commissioning a drive configuration consisting of a SIMATIC S7 controller and a SINAMICS S210 drive:

1. Inserting a SIMATIC S7 controller into the project (Page 263)
2. Inserting a SINAMICS S210 converter into the project (Page 265)
3. Networking a SIMATIC S7 controller and S210 drive (Page 267)
4. Inserting a technology object into the SIMATIC S7 controller (Page 269)
5. Interconnecting the technology object and S210 drive (Page 271)

6. Configuring a SINAMICS S210 drive (Page 273)
   - Basic parameter assignment of the S210 drive and motor selection (Page 273)
   - Checking the pre-assignment of the digital inputs (Page 275)
   - Activating the Safety Integrated (Page 277)
7. Commissioning the S210 drive (Page 277)
8. Commissioning Safety Integrated (Page 282)
9. Using diagnostics functions (Page 299)

Video tutorial

In the video series "Mister Automation" on the TIA Portal, you are shown, among other things, commissioning in the TIA Portal.

You will find the link to the video series on YouTube in SIOS (https://support.industry.siemens.com/cs/ww/en/view/109764401).

From there, you can call up the video episode 26 "Tips & tricks - Motion with SINAMICS S210".

7.1 Basics

7.1.1 Communication interfaces

Overview

SINAMICS S210 converters have two interfaces which enable online communication between the PG/PC and the drive.

The table below gives you an overview of the available interfaces and the factory pre-assignment of the interfaces in the converter.

Table 7-1 Factory pre-assignment of the communication interfaces

Interface	IP address	Subnet mask
Ethernet interface X127	169.254.11.22	255.255.0.0
PROFINET interface X150	0.0.0.0	0.0.0.0

You can find additional information on online mode in the TIA Portal under the keyword "Connecting devices online" in the TIA Portal information system.

Pre-assignment in the project

When an S210 converter is inserted into a project, the IP addresses of the interfaces are automatically preassigned. The pre-assignment of the X127 interface corresponds to the factory pre-assignment in the converter. In contrast, an IP address in the subnet of the CPU is assigned to the PROFINET interface X150. The assigned IP address may be changed if necessary.

Notes on using the communication interfaces

Observe the following notes when using the communication interfaces.

Note

- Ethernet commissioning interface X127
  Ethernet interface X127 is intended for commissioning and diagnostics, which means that it must always be accessible (e.g. for service).
  In addition, the following restrictions apply to X127:
  - Only local access is permitted.
  - No networking or only local networking in a closed control cabinet is permitted.
- PROFINET interface X150
  The network with which interface X150 is connected must be separated from the rest of the plant network in accordance with the Defense in Depth concept. Manual access to cables and possibly open connections must take place in a protected fashion, for example, in a control cabinet.

If remote access to the control cabinet is necessary, additional security measures must be taken so that misuse through sabotage, data manipulation by unqualified persons and interception of confidential data is completely ruled out (see also "Security information (Page 24)").

7.1.2 Checking the firmware consistency

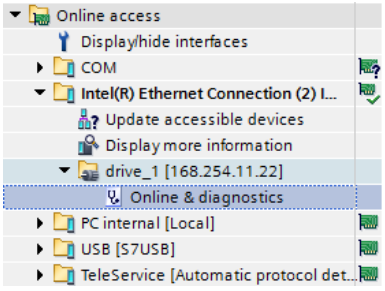
Overview

An online connection with your S210 drive is only possible when the configured drive uses the same firmware version as the drive in your hardware configuration.

Procedure

Proceed as follows to check the firmware consistency between the configured drive and the drive in your hardware configuration:

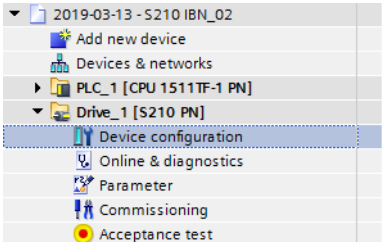
1. Check the firmware version of your drive using the "General" diagnostics screen form.
   - Connect your PG/PC to the S210 drive using a LAN cable and switch on the drive.
   - Open the "Online access" entry in the project navigation.
   - Select the network interface of your PG/PC.
   - Double-click "Update accessible devices".
     The accessible device is displayed with the IP address in the project tree.
   - In the project tree call the "Online & diagnostics" function for the displayed device.
     An online connection to the selected device is established and the "Online access" screen form opens.



   - Expand the "Diagnostics" entry in the secondary navigation.
   - Click the "General" entry.
     The corresponding screen form opens.

Figure 7-2 Example: Firmware version of the hardware

2. Check the firmware version in the catalog information of the drive in your current project.
   - Click on the "Device configuration" entry for the S210 drive in the project navigation.



– Click the S210 drive in the device view and select the entry "General > Catalog information" in the Inspector window.

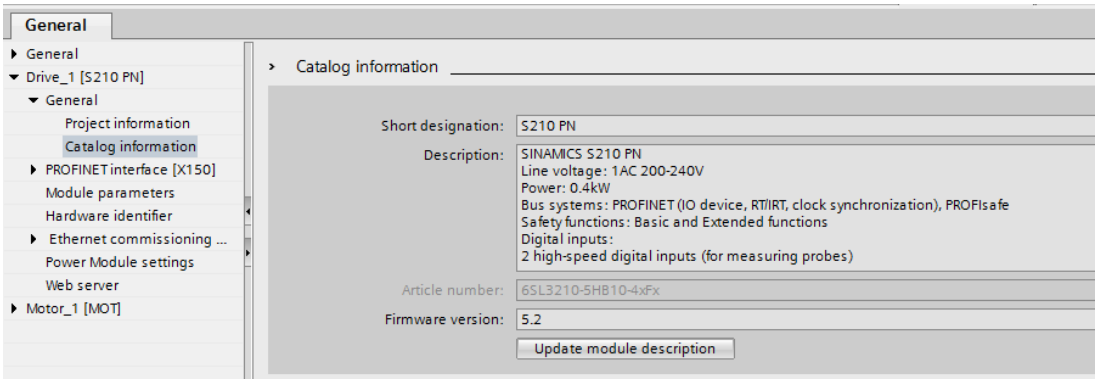


Figure 7-3 Example: Firmware version of the software

An online connection is possible when the firmware versions are identical.

If the firmware versions are not identical, then the versions must be aligned in order to establish an online connection. You usually upgrade the older version.

Remedy:

Perform a firmware update on your S210 drive (see "Updating the firmware (Page 307)").

Note

Supported firmware versions

The Startdrive commissioning tool in version 15.1 or higher integrated in the TIA Portal only supports S210 drives with **firmware version 5.2 or higher**.

7.1.3 Loading data from the drive into the project

Overview

Uploading data from an S210 drive is only necessary when the drive contains a configuration that is to be applied to the project.

Requirement

- The S210 drive and SIMATIC S7 controller are in offline mode.

Procedure

Proceed as follows to load data from an S210 drive into your project:

1. Call the "Upload from device (software)" shortcut menu.
   OR
2. Click the (Upload from device) icon in the toolbar.
   The "Upload preview" dialog opens. The system checks whether all requirements for loading have been met. In the event of any obstructions, these are displayed as messages in the dialog.
3. Check the messages and, where necessary, enable the actions in the "Action" column.
   As soon as uploading becomes possible, the "Upload from device" button is enabled.
4. Click the "Upload from device" button.

The data is loaded from the drive into your project.

7.1.4 Permanently saving project data

Overview

In the Startdrive engineering tool, settings are predominantly made via screen forms. The entire project must be saved in order for the settings made to take effect permanently.

Procedure

Proceed as follows to save the settings permanently in your project:

1. In the toolbar, click on the icon .
   OR
   Select the "Project > Save" or "Project > Save as" menu.

The settings are saved permanently in the project.

7.1.5 Loading project data into the drive

Procedure

Proceed as follows to load the project data to your S210 drive:

1. Select one or more drives in the project tree.
2. Call the "Download to device" shortcut menu.
   OR

3. Click the (Download to device) icon in the toolbar.
   - **Online connection is already established**
     If you have already established an online connection, the "Load preview" dialog opens. This dialog displays alarms and proposes actions necessary for loading.
   - **No online connection**
     If you have not yet established any online connection, the "Extended loading" dialog opens and you must first select the interfaces with which the online connection to the device should be established. You have the option of showing all compatible devices by selecting the corresponding option and clicking the "Start search" command.
4. Check the messages in the "Load preview" dialog.
   The "Save parameterization retentively" action is enabled by default.
5. Click "Load".

The project data are downloaded into the drive.

7.1.6 Saving data non-volatilely

Procedure

You have the following options to non-volatilely save changes made in the drive:

1. Click on the memory card icon .
   OR
2. Execute a "RAM to ROM" (see section "Backup and restore (Page 303)").

The changes made in the drive are saved non-volatilely in the drive's ROM.

7.2 Commissioning with a SIMATIC S7-1500

To commission an S210 drive with a SIMATIC S7 controller, you need to follow the instructions described in this section.

7.2.1 Inserting a SIMATIC S7 controller into the project

Overview

Insert a SIMATIC S7 controller in your project as the first component.

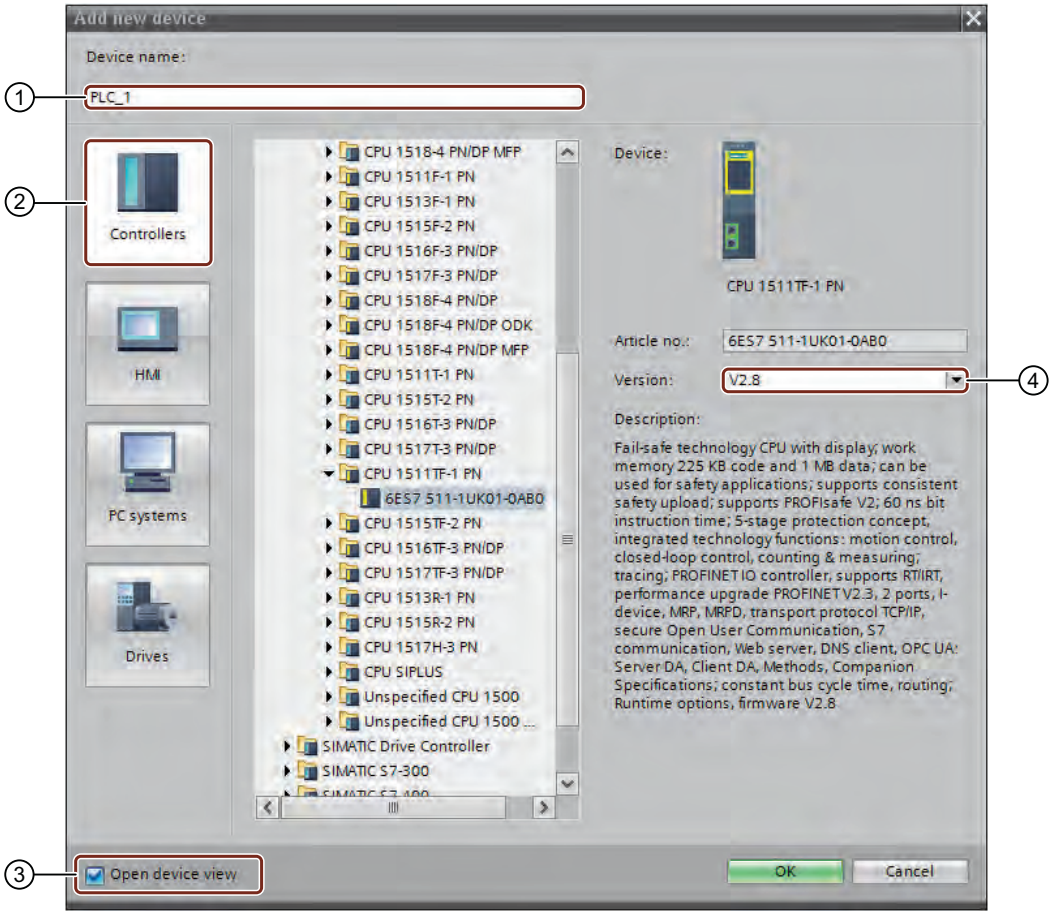
Requirement

- A project has been created in the TIA Portal or an existing project has been opened in the TIA Portal.

Procedure

Proceed as follows to insert a SIMATIC S7 controller in the project view:

1. Double-click "Add new device" in the project navigation.
   The corresponding dialog opens.



① "Device name" input field (default: PLC_xx)
② "Controller" button
③ Enable/disable the "Open device view" option
④ Firmware version drop-down list

Figure 7-4 Dialog: Add new device

2. Click the "Controllers" button ② to show the available controllers.

3. Expand the desired controller type (e.g. SIMATIC S7-1500) and select the desired CPU (e.g. CPU 1511TF-1 PN) in the list.
   When the CPU is expanded, the component is displayed with its article number or MLFB.

   Note

   Comparing and possibly changing version numbers

   When a SIMATIC S7 controller is created, the latest firmware version is always suggested. It is possible that the suggested firmware version does not match the version number on the memory card of your SIMATIC S7 controller. If the version numbers do not match, it will not be possible to go online later. Therefore, please observe the following notes:

   - Pay attention to the version number displayed in the "Version" drop-down list ④ and make sure that the displayed version number matches the version number on the memory card of your SIMATIC S7 controller.
   - If necessary, change the version number via the "Version" drop-down list ④.

4. Assign a different device name in the input field ① if required.
5. Click "OK".
   If the "Open device view" option ③ is enabled, the SIMATIC S7 controller is automatically created in the project and then displayed in the device view.

The inserted SIMATIC S7 controller is displayed in the device view and can be configured.

7.2.2 Inserting a SINAMICS S210 converter into the project

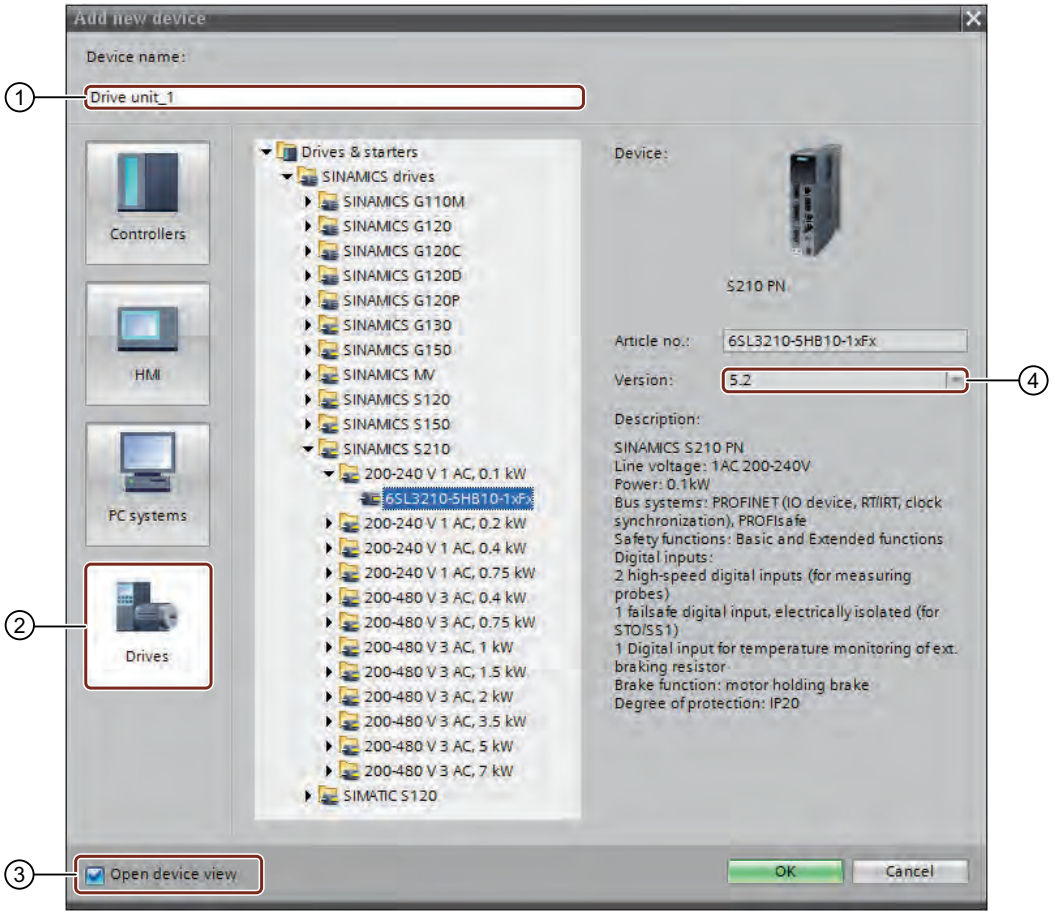
Overview

Insert a SINAMICS S210 converter in your project as an additional component.

Procedure

Proceed as follows, for example, to insert a SINAMICS S210 converter:

1. Double-click "Add new device" in the project navigation.
   The corresponding dialog opens.



① "Device name" input field (default: drive unit_x)
② "Drives" button
③ Enable/disable the "Open device view" option
④ Firmware version drop-down list

Figure 7-5 Dialog: Add new device

2. Click the "Drives" button ② to display the available S210 converters.
3. Expand the "SINAMICS S210" entry in the displayed list.
   A list of all available SINAMICS S210 converters is displayed.
4. Expand the entry (e.g. 200-240 V 1AC, 0.1 kW) for the relevant S210 converter.
   The selected S210 converter is displayed with the corresponding article number or MLFB.

5. Click on the desired SINAMICS S210 converter.

Note

Comparing and possibly changing version numbers

When a SINAMICS S210 converter is created, the latest firmware version is always suggested. It is possible that the suggested firmware version does not match the version number of your SINAMICS S210 converter. If the version numbers do not match, it will not be possible to go online later. Therefore, please observe the following notes:

- Pay attention to the version number displayed in the "Version" drop-down list ④ and make sure that the displayed version number matches the version number on the memory card of your S210 converter.
- If necessary, change the version number via the "Version" drop-down list ④.
  OR
  Install the corresponding firmware version on your converter.

6. Assign a different device name in the input field ① if required.
7. Click "OK".
   If the "Open device view" option ③ is enabled, the S210 converter is automatically created and displayed in the device view.

The inserted S210 converter is displayed in the device view and can be configured.

7.2.3 Networking a SIMATIC S7 controller and S210 drive

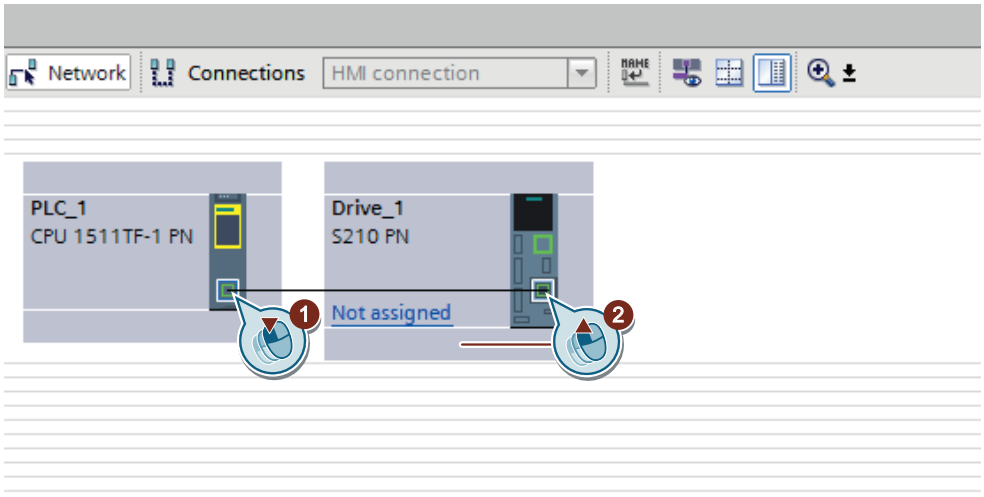
Overview

After you have inserted a SIMATIC S7 controller and a SINAMICS S210 converter into your project, you need to network the controller with the converter. You need to network the components both in the network view and in the topology view.

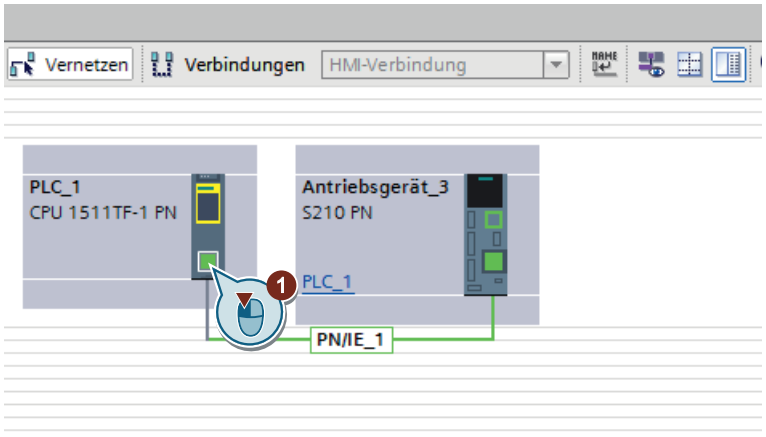
Procedure

Proceed as follows to establish the connection between the SIMATIC S7 controller and the SINAMICS S210 converter:

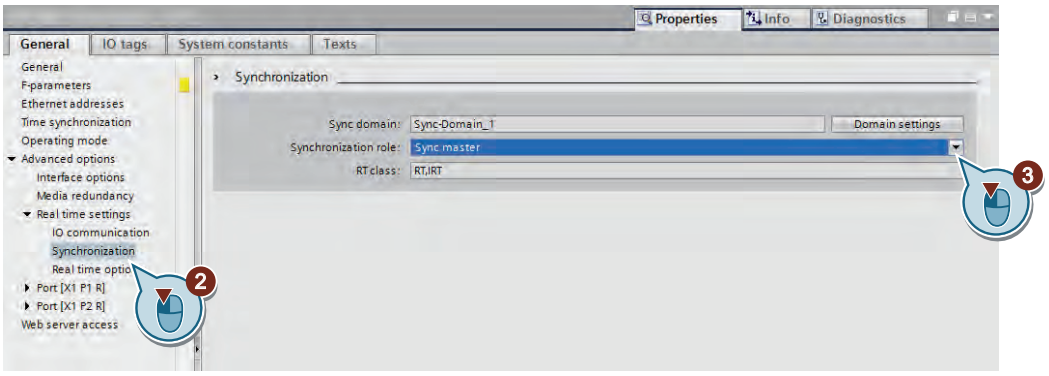
1. To open the network view, double-click the "Devices & Networks" entry in the project navigation.
   The network view opens.
2. Draw a connection between the PROFINET interface of the controller and the PROFINET interface X150 of the converter.



   The PROFINET connection is established, and the converter is assigned to the controller.
3. Click the PROFINET interface_1 [X1] ①.

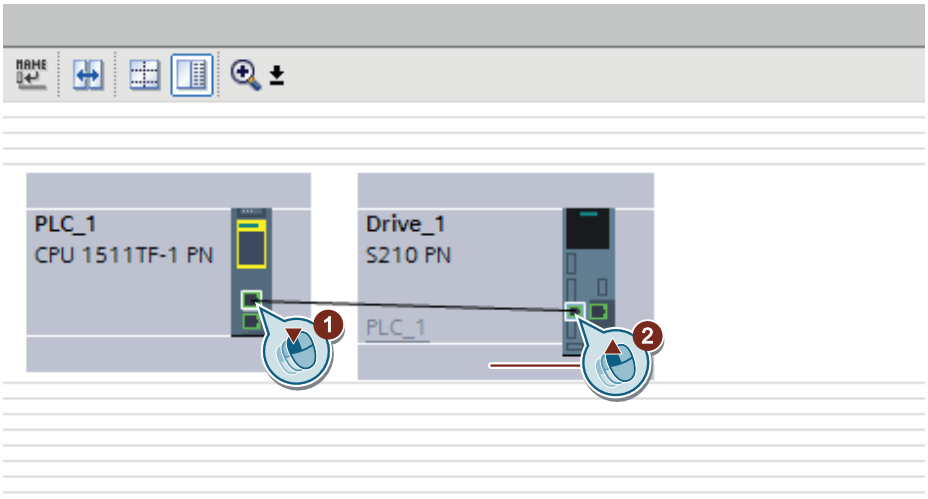


4. In the secondary navigation under "Advanced options" and then under "Real time settings", double-click the setting "Synchronization" ②.



The "Synchronization" display area appears.

5. Select the "Sync master" setting ③ from the "Synchronization role" drop-down list.
6. Switch to the topology view.
7. Draw a connection between Port_1 [X1.P1] of the controller and Port_1 [X150.P1] of the converter.



The SIMATIC S7 controller and the SINAMICS S210 converter are networked with one another in the network and topology view.

7.2.4 Inserting a technology object into the SIMATIC S7 controller

Overview

Insert a new technology object (TO) in the SIMATIC S7 controller as the last component. Through the technology object, Motion Control functions such as positioning and synchronous axes are available to you. In the "Configuration" screen form, you can assign the inserted S210 drive directly and go to the configuration of the drive.

The most frequent application of the S210 drives is positioning. To be able to perform positioning tasks in the SIMATIC S7 controller, you need to insert the Motion Control function "TO_PositioningAxis". Inserting a TO is described below based on the example of the Motion Control function "TO_PositioningAxis".

Procedure

To insert a technology object in the SIMATIC S7 controller, proceed as follows:

1. Make sure that the list with available functions for the SIMATIC S7 controller in the project tree is expanded.

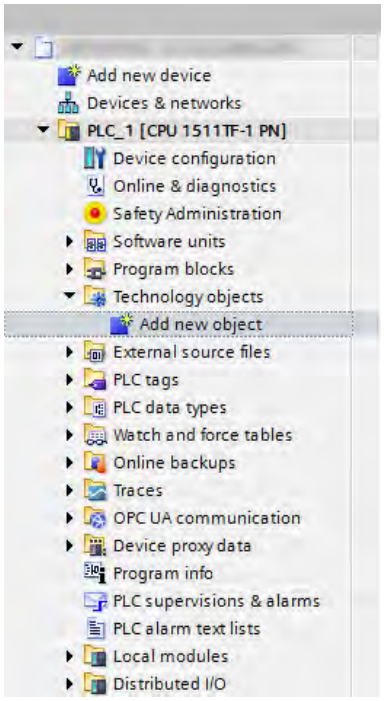
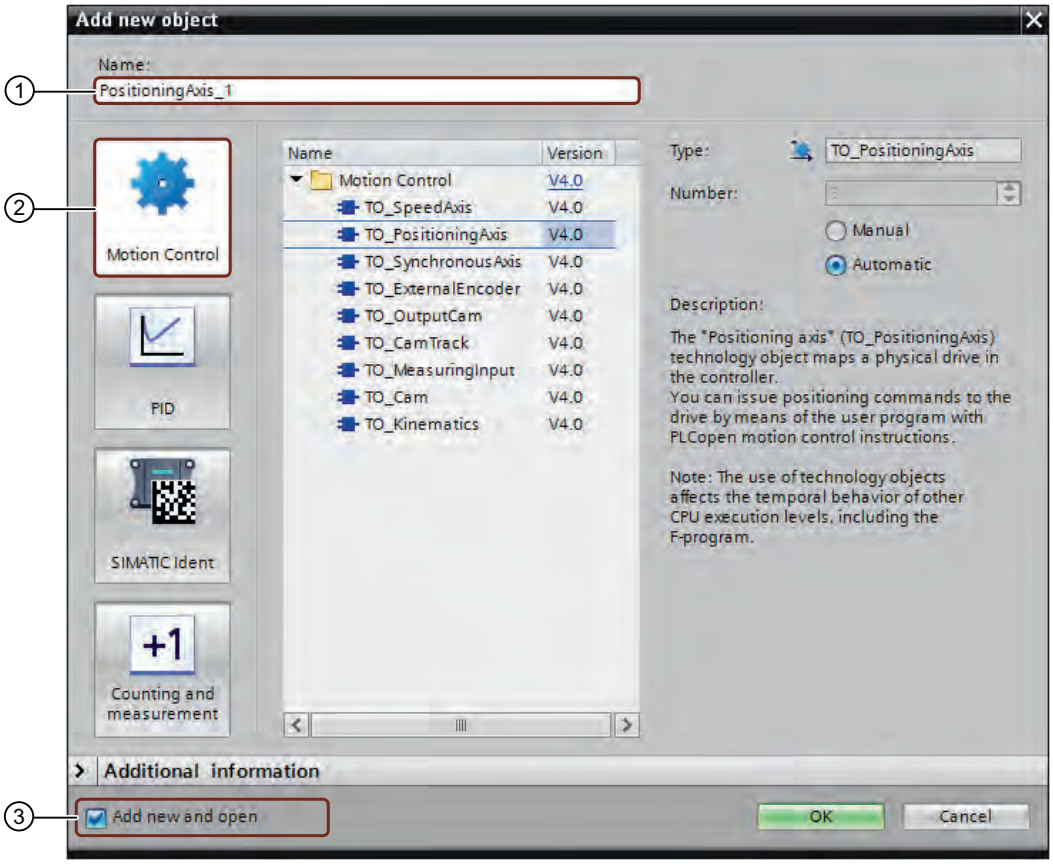


Figure 7-6 Inserting a technology object

2. Expand the "Technology objects" entry.

3. Double-click the "Add new object" entry.
   The corresponding dialog opens.



① "Object name" input field
② "Motion Control" button
③ Enable/disable "Add new and open" option

Figure 7-7 Dialog: Add new object

4. Click the "Motion Control" button ② to show the available technology objects.
5. Select the "TO_PositioningAxis" object from the "Motion Control" list.
6. If necessary, assign a different name for the TO in the input field ①.
7. Click "OK".

The "TO_PositioningAxis" technology object has been inserted and can be configured.

7.2.5 Interconnecting the technology object and S210 drive

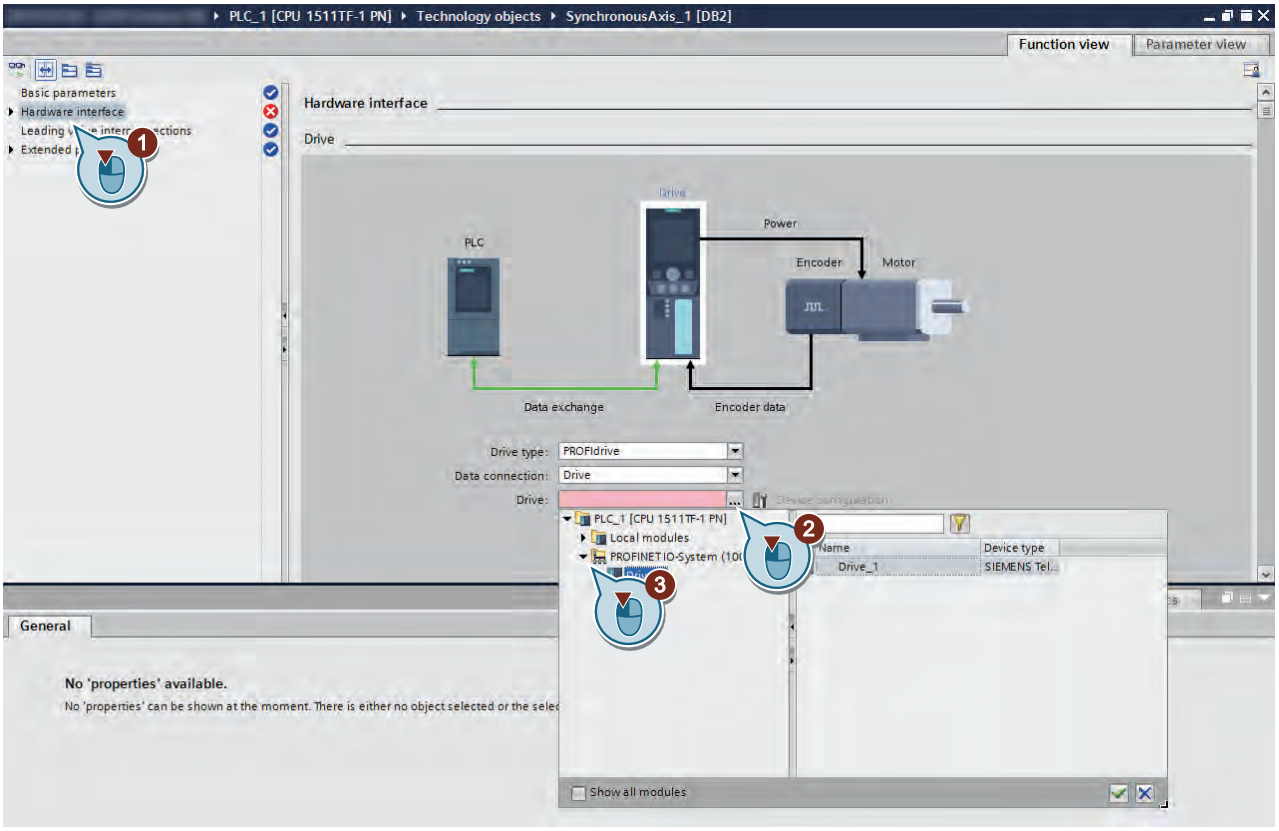
Overview

A description of how to interconnect the inserted "TO_PositioningAxis" technology object with the S210 converter is provided below.

Procedure

To manually interconnect the S210 converter with the inserted TO, proceed as follows:

1. In the project tree, double-click the "Configuration" entry under the created technology object.
   The "Basic parameters" screen form opens.
2. Select the entry "Hardware interface" ① in the secondary navigation.
   The corresponding screen form opens.



3. Open the selection list in the "Drive" selection box ②.
   A selection list opens.
4. Expand the "PROFINET IO system (100)" entry ③.
5. Click on the displayed converter (in this case: "Drive unit_1").
   Telegram 105 is automatically preset.
6. Click on the checkmark icon to confirm the selection.
   The "Device configuration" setting option is enabled. In addition, the "Drive configuration" setting option is displayed and enabled.
7. To get to the basic parameter assignment of the converter, click the green arrow icon .

The "Basic parameter assignment" screen form in the "Drive configuration" display area opens.

7.2.6 Configuring a SINAMICS S210 drive

After you have called the configuration of the S210 converter from the "Hardware interface" display area of the inserted technology object, you go directly to the basic parameterization of the converter. The "Drive configuration" display area, in which you can view the basic parameter assignment and make settings, is divided into the following areas:

- **Basic parameter assignment**
  Here you can view the preassigned basic parameters of the SINAMICS S210 converter and can change individual values, if necessary.
  You can also select the motor of the S210 drive via the Inspector window. The basic parameters are preassigned appropriately depending on the selected motor. If necessary, you can adjust preassigned parameters, e.g. for the maximum speed and torque limits.

  Note

  Only adjust the preassigned parameters after selecting a motor. Previously made settings are overwritten by the selection of a motor.

- **Activating Safety Integrated**
  Here, you can view the available safety functions and enable and commission the required functions. The following function groups are available:
  - Basic Functions
  - Extended Functions
- **Displaying and configuring digital inputs**
  Here you can configure the digital inputs of the converter.

7.2.6.1 Basic parameter assignment of the S210 drive and motor selection

Overview

The motor data is displayed in the "Basic parameter assignment" screen form. In addition, you can make the following drive-specific settings:

- Setting the direction of rotation of the motor.
- Setting the ambient temperature of the motor.
- Adapting the speed and torque limits of the drive if required.
- 3AC converters:
  - Adapting the device supply voltage as a function of the supply network.

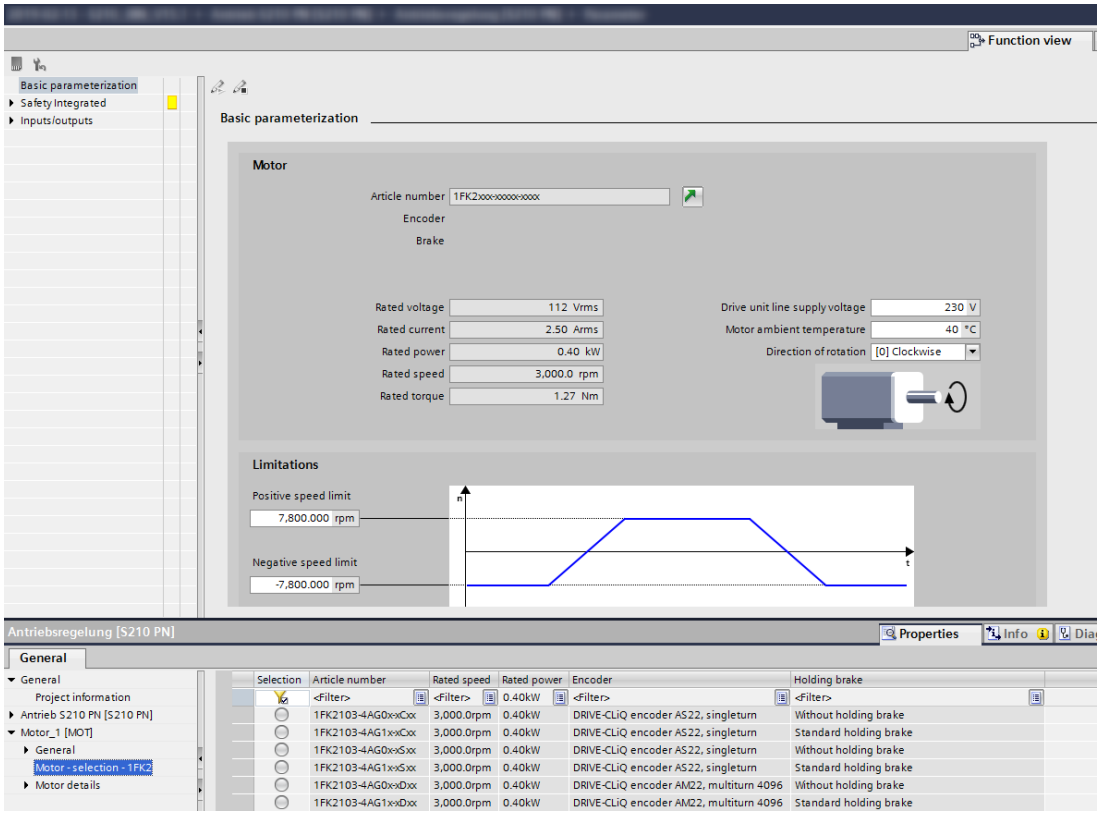


Figure 7-8 Example: "Basic parameter assignment" screen form

To complete the configuration of an S210 drive, it is necessary to specify a motor according to an existing article number or MLFB (e.g. 1FK2203-2AG00-0SA0).

Procedure

Proceed as follows to specify an S210 motor:

1. Open the "Properties" dialog in the Inspector window.
2. Expand the "Motor_1 [MOT]" entry.
3. Select the "Motor - Selection - 1FK2" entry.
   A filtered list with available 1FK2 motors is displayed.
   For all 1FK2 motors to be displayed, you need to disable the filter function of the list.
4. Select your motor with the corresponding motor encoder in the selection list based on the article number.

The motor has been inserted and specified.

The parameters in the basic parameterization are preassigned appropriately depending on the selected motor. Previously made settings (e.g. speed and torque limits of the drive) are overwritten by selecting a motor. Therefore, only adjust the preassigned parameters after selecting a motor.

7.2.6.2 Digital inputs

To configure the digital inputs of the S210 drive, select the entry "Digital inputs" under "Inputs/ outputs".

Pre-assignment of the digital inputs DI 0, DI 1 and DI 4

You can view the preset settings of the digital inputs in the "Digital inputs" screen form.

Version 5.2 and higher

As of version V5.2, the function of the digital inputs DI 0 (≙ Measuring input 1) and DI 1 (≙ Measuring input 2) is already pre-configured and activated. No further settings are required.

The following figure shows the presetting of the digital inputs in offline mode.

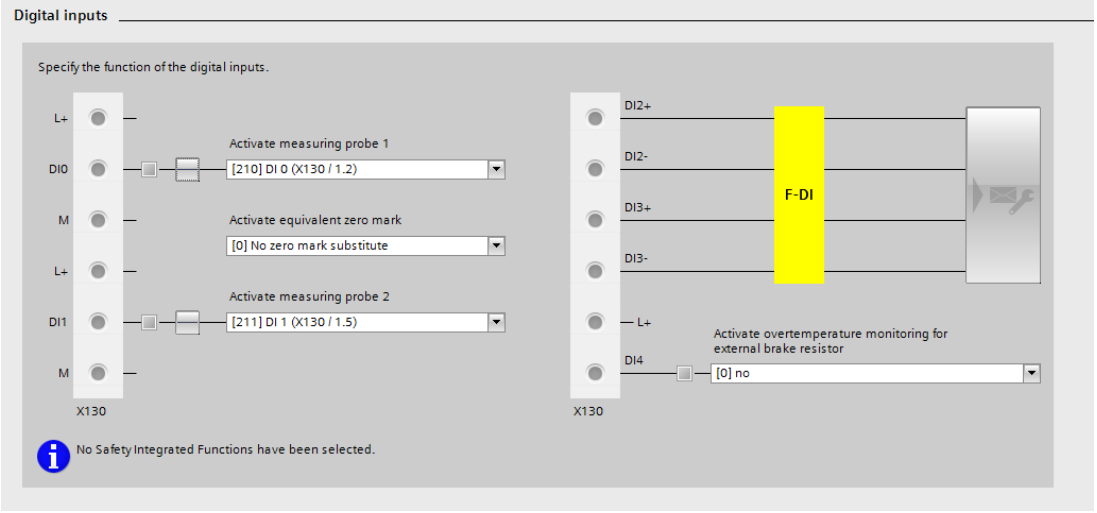


Figure 7-9 Presetting of the digital inputs

Homing the axis via the equivalent zero mark

To home the axis, the technology object of the SIMATIC S7 controller can query the zero mark of the S210 drive via the encoder interface (PROFIdrive), if required. In the default setting, the encoder zero mark of the drive is selected. As an alternative to the encoder zero mark, you can select a high-speed input terminal on the drive as equivalent zero mark.

Temperature monitoring via DI 4

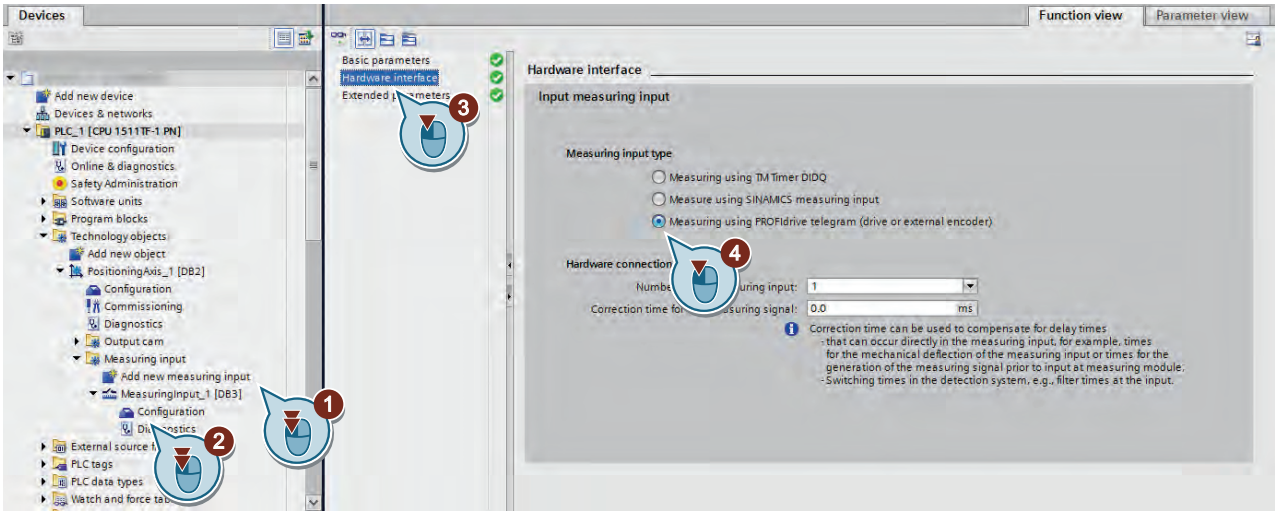
The digital input DI 4 is available for monitoring the temperature of an external braking resistor.

Using measuring inputs 1 and 2

To use a measuring input, proceed as follows:

1. In the project navigation, expand the follow entries in the order specified below:
   - Technology objects
   - PositioningAxis_1
   - Measuring inputs

   The "Add new measuring input" entry is displayed.
2. Double-click the "Add new measuring input" entry ①.
   A new measuring input is created and additional functions are displayed.



3. Double-click the "Configuration" entry ②.
   The corresponding screen form opens in the device view.
4. Click the "Hardware interface" option ③ in the secondary navigation.
   The corresponding screen form opens.
5. Select the measuring input type "Measuring using PROFIdrive telegram (drive or external encoder)" ④.
   A measuring input of the type "Measuring using PROFIdrive telegram (drive or external encoder)" is created.
   With measurement using a PROFIdrive telegram, only one measuring input can be active at the same time on an actual value or encoder in the PROFIdrive telegram. A maximum of two measuring inputs can be configured using PROFIdrive on an actual value or encoder in the PROFIdrive telegram.
6. To correct the measuring time point, set a correction time.

A measuring input of the type "Measuring using PROFIdrive telegram (drive or external encoder)" is created and can be used.

7.2.6.3 Activating the Safety Integrated

Overview

In the "Safety Integrated" display area, you can select and parameterize the required safety functions.

Additional information

You can find more detailed information here: "Commissioning Safety Integrated (Page 282)".

7.2.7 Commissioning the S210 drive

7.2.7.1 Establishing an online connection to the S210 drive

Overview

Before you traverse your S210 drive with the control panel or perform optimization of the axis, you need to connect to your S210 drive online. A description of how to connect to your S120 drive via the configured PROFINET network is provided below based on an example.

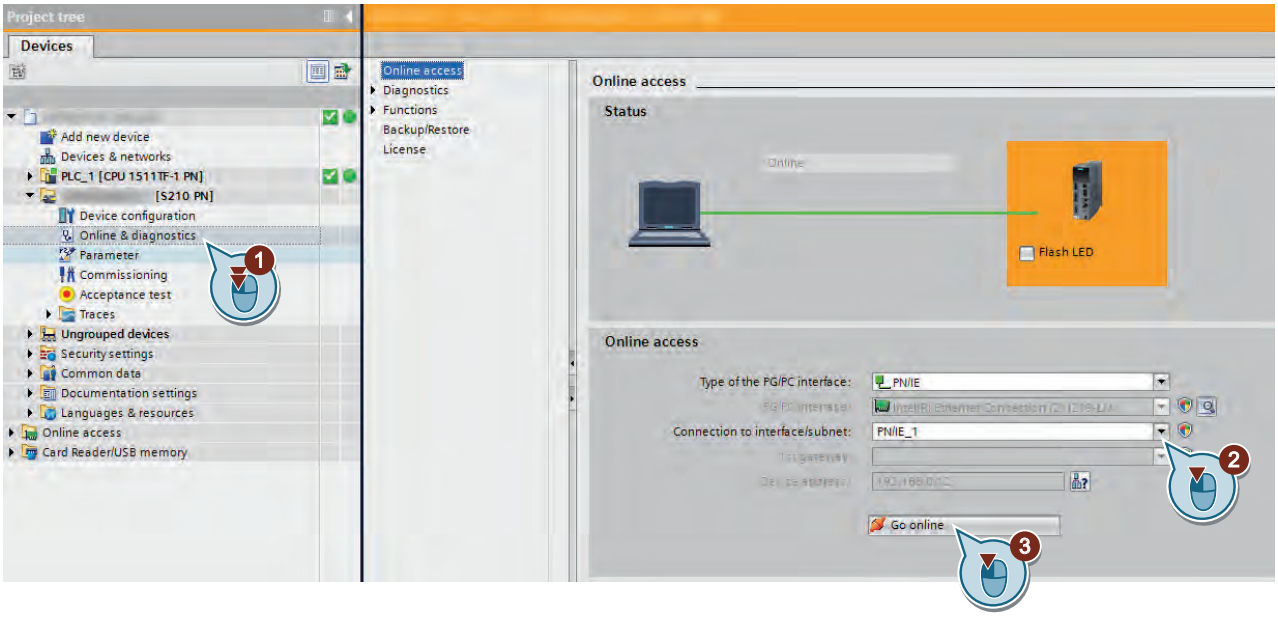
Requirement

- The configuration is loaded into the SIMATIC S7 controller.
  The S210 drive can thus be reached in the PROFINET network via the SIMATIC S7 controller and the PG/PC is connected to the corresponding PROFINET interface of the controller (e.g. X1).

Connecting to the S210 drive online

To establish an online connection to your S210 drive, proceed as follows:

1. Double-click the Online & diagnostics entry in the project navigation under the S210 drive.
   The "Online access" screen form of the drive is displayed.



2. Select the PROFINET network in the "Connection with interface/subnet" drop-down list.
3. Click the button Go online.
   The online connection to the drive is established.

Terminating the online connection

Proceed as follows to disconnect the online connection to the S210 drive:

1. Click on the S210 drive in the project navigation.
2. Click in the menu bar on button Go offline.
   The online connection to the drive is disconnected.

7.2.7.2 Using the control panel

Overview

You can use the control panel to traverse the S210 drive and thereby test the settings that have been made. By activating the control panel, you assume master control of the drive. The control panel can only be activated for one drive.

⚠ WARNING

Non-observance of the safety instructions for the drive control panel

The safety shutdowns from the higher-level controller have no effect with this function. The "Stop with space bar" function is not guaranteed in all operating states. Incorrect operation by untrained personnel – without taking into account the appropriate safety instructions – can therefore result in death or severe injury.

- Make sure that this function is only used for commissioning, diagnostic and service purposes.
- Make sure that this function is only used by trained and authorized skilled personnel.
- Make sure that a hardware device is always available for the EMERGENCY OFF circuit.

Note

Drive reacts immediately

Although all enables are removed before returning the master control, the setpoints and commands still come from the original parameterized sources after the master control is returned.

Procedure

You can traverse an S210 drive using both the control panel of the technology object and the control panel of the drive. Proceed as follows to traverse an S210 drive using the control panel of the drive:

1. Double-click the Commissioning entry for the converter in the project navigation.
   The "Control panel" and "One Button Tuning" functions are displayed in the secondary navigation.
2. Select the "Control panel" function in the secondary navigation.
   The corresponding screen form is displayed.
3. Click the "Activate" button to enable master control for the drive.
   The "Activate master control" message window is displayed.
4. Read the warnings carefully and check the value for the monitoring time.
   The monitoring time specifies the time during which the connection from the PG/PC to the drive is cyclically monitored. The monitoring time is preset to 2000 ms and should only be changed if required.
5. Confirm the monitoring time with "OK".
   The message window closes and the control panel is enabled. The drive enables are set automatically.

6. In the "Speed" input field, enter a value ≤ the maximum speed.
7. Traverse the drive in the desired direction using the controller buttons.
8. Click the "Deactivate" button to disable master control.
   The "Deactivate master control" dialog window is displayed.
9. Confirm deactivation of master control with "Yes".

7.2.7.3 Performing optimization

Overview

With the One Button Tuning (OBT) function, you have the option to automatically optimize the controller parameters for your drive.

Procedure

To be able to perform One Button Tuning, proceed as follows:

1. Double-click the "Commissioning" entry for the converter in the project navigation.
   The "Control panel" and "One Button Tuning" functions are displayed in the secondary navigation.
2. Select the "One Button Tuning" function in the secondary navigation.
   The corresponding screen form is displayed.
3. Select the desired setting (e.g. Conservative) in the "Dynamic settings" area.
   The "Standard" setting is selected by default.
4. Enter a value (e.g. 360) in the input field "Stroke limiting from 0 to".
   Useful controller parameters result from an angle greater than 90 °.
5. Confirm the entry with "Enter".
   The error icon is then hidden.
6. Click the "Activate" button to enable master control for the drive.
   The "Activate master control" message window is displayed.
7. Read the warnings carefully and check the value for the monitoring time.
   The monitoring time specifies the time during which the connection from the PG/PC to the drive is cyclically monitored. The monitoring time is preset to 2000 ms and should only be changed if required.
8. Confirm the monitoring time with "OK".
   The message window is closed and One Button Tuning is activated.

9. Click the "Start" button to start the optimization.
   Optimization of the drive is performed. After optimization is completed successfully, the green status icon appears and the changed values are shown in the "Current value" column in the "Result of optimization" area.

NOTICE
Unpredictable behavior of the drive Manual changes of the calculated values can lead to unpredictable behavior of the drive. This can damage the drive.

10. Click the "Deactivate" button to disable master control.
    The "Deactivate master control" dialog window is displayed.
11. Confirm deactivation of master control with "Yes".
12. Click the memory card icon to store the result of the optimization permanently in your drive.
13. To load the data from your drive into the project, first select the drive unit in the project tree and then click the (Upload from device) icon in the toolbar.
14. Click the icon (Save project) to store the result of the optimization permanently in your drive.

You have performed optimization and stored the result of the optimization permanently in your drive and project.

7.3 Commissioning Safety Integrated

⚠ WARNING

Unexpected movement of machines caused by inactive safety functions

Inactive or non-adapted safety functions can trigger unexpected machine movements that may result in serious injury or death.

If a card without safety functions is inserted instead of a memory card with active safety functions, when the drive is switched on the next time, the safety functions are deactivated.

- Only insert a memory card with the required settings into the drive.
- Prevent unauthorized persons accessing the drive.
- Password-protect configurations with active safety functions against changes.

Note

Faulty safety functions in case of non-EMC-compliant installation

A non-EMC-compliant installation of your machine/system can result in sporadic safety function faults.

- Install the drive so that it is EMC-compliant according to the specifications in the section:
  – "EMC-compliant installation of a machine or system (Page 47)"

7.3.1 Requirements

- To commission Safety Integrated, you need to have inserted the drive in Startdrive and connected it to the PLC.
- In the "Basic parameter assignment", you have applied the motor data to the motor screen form.
- To use the Safety Integrated Extended functions, you need a license that costs a fee.

7.3.2 Offline commissioning

Sequence

Work through the commissioning steps in the secondary navigation from top to bottom.

Select the safety functionality

1. Click "Function selection" in the secondary navigation.
2. Select the required functionality in the first drop-down list:
   - No Safety Integrated Function
   - Basic Functions
   - Extended Functions

   When you select Basic or Extended Functions, additional setting options are displayed in each case.

Select functions

1. Select the required functions.
   Some functions are pre-selected. You cannot deselect these functions.

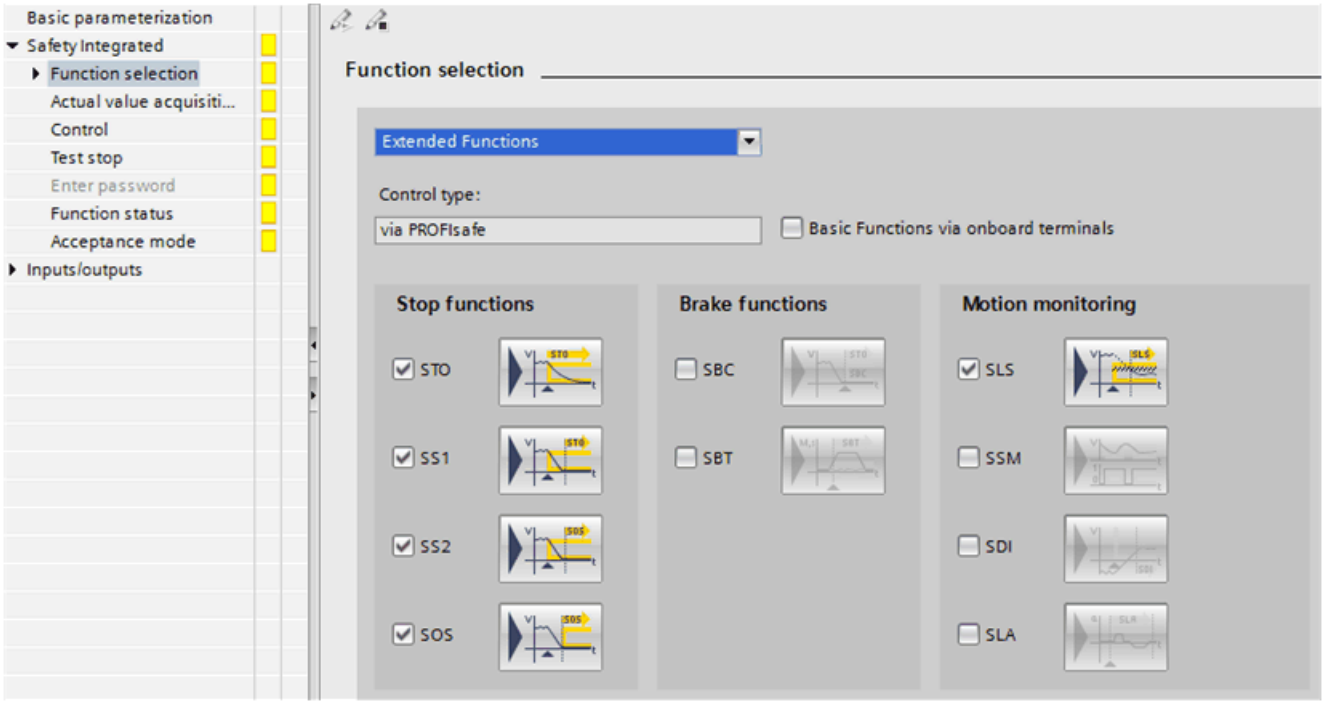


Figure 7-10 Function selection (example)

2. Select one of the following settings for "Control type":
   - Basic Functions: "via PROFIsafe" or "via onboard terminals"
   - Extended Functions: "via PROFIsafe"

   In addition, with the "via PROFIsafe" control type, you can control the "Basic Functions via onboard terminals".
3. In the secondary navigation, you will see the selected functions under "Function selection".

7.3.2.1 Assign parameters to functions offline

Parameterizing functions

1. Parameterize the functions in the order of the secondary navigation from top to bottom.
2. You will get to the "Function view" screen form in each case where you set all important data for the respective function.

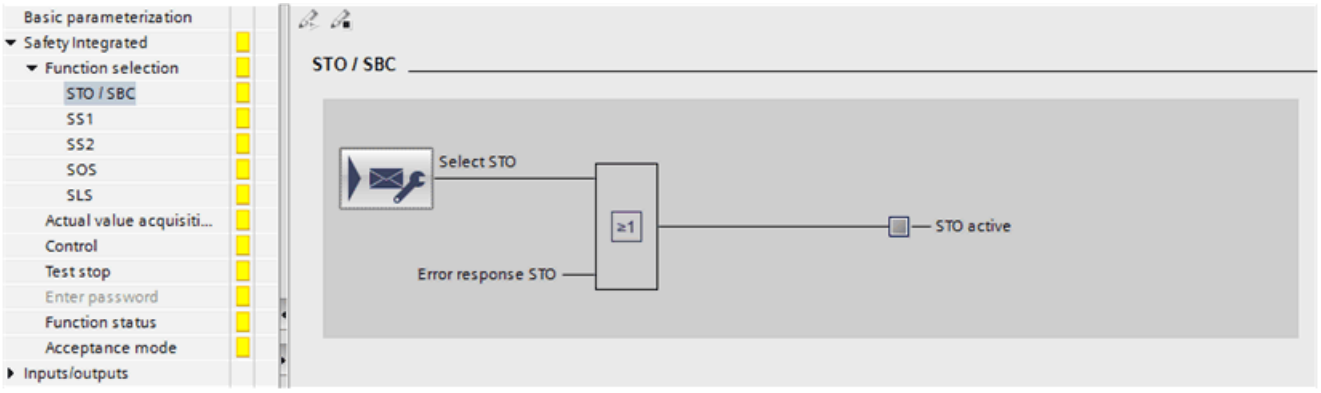


Figure 7-11 Parameterizing function (example)

Note

"Parameter view" and "Function view"

- You can see all parameters in the "Parameter view". The "Function view" shows the most important parameters for the respective function.
- In the "Parameter view", you can change all changeable parameters.
- The list of parameters is divided into groups that you select in the secondary navigation of the "Parameter view".

3. Assign parameters to all selected functions in the corresponding screen forms.

Notes on the functions

Function	Special notes on parameterization
STO	No special settings required.
SBC	SBC is selected as a function and is always activated together with STO.
SS1	• Select the type of monitoring under "SS1 with OFF3": – SAM You can find notes on the setting in the section "Safe Acceleration Monitor (SAM) (Page 123)". – SBR You can find notes on the setting in the section "Safe Brake Ramp (SBR) (Page 125)". • Important for "SS1E external stop": Set the delay time to suit your application.

Function	Special notes on parameterization
SS2	• Select the type of monitoring under SS2: – SAM You can find notes on the setting in the section "Safe Acceleration Monitor (SAM) (Page 123)". – SBR You can find notes on the setting in the section "Safe Brake Ramp (SBR) (Page 125)". • Important for "SS2": Set the tolerance window of standstill monitoring to suit your application.
SOS	• Important for "SOS": Set the tolerance window of standstill monitoring to suit your application.
SBT	• SBT is selected only via Safety Control Channel (SCC). For this purpose, you need to insert a supplementary Safety Integrated telegram (telegram 700/701). • You can find additional information in the following sections: – "Configuring the control (Page 287)" – "Supplementary telegrams (Page 663)" • Set the specifications for the brake test (duration, torque, tolerance, etc.) to suit your application. These specifications apply to the "Test sequence 1". To store a second test sequence with other test data, open the "Parameter view". Then set the values for the second test sequence in the "Parameter view".
SLS	• Set the speed limits and stop responses for the required SLS levels. • In the SLS screen form, enable the PROFIsafe override of SLS level 1. With this, you transfer variable SLS limits via PROFIsafe to the drive.
SSM	• Set the setting values to suit your application.
SDI	• Set the setting values and the stop reaction to suit your application.
SLA	• Set the setting values and the stop reaction to suit your application.

7.3.2.2 Parameterizing the actual value acquisition / mechanical system

Parameter assignment of actual value acquisition/mechanical system is only necessary for the Extended Functions.

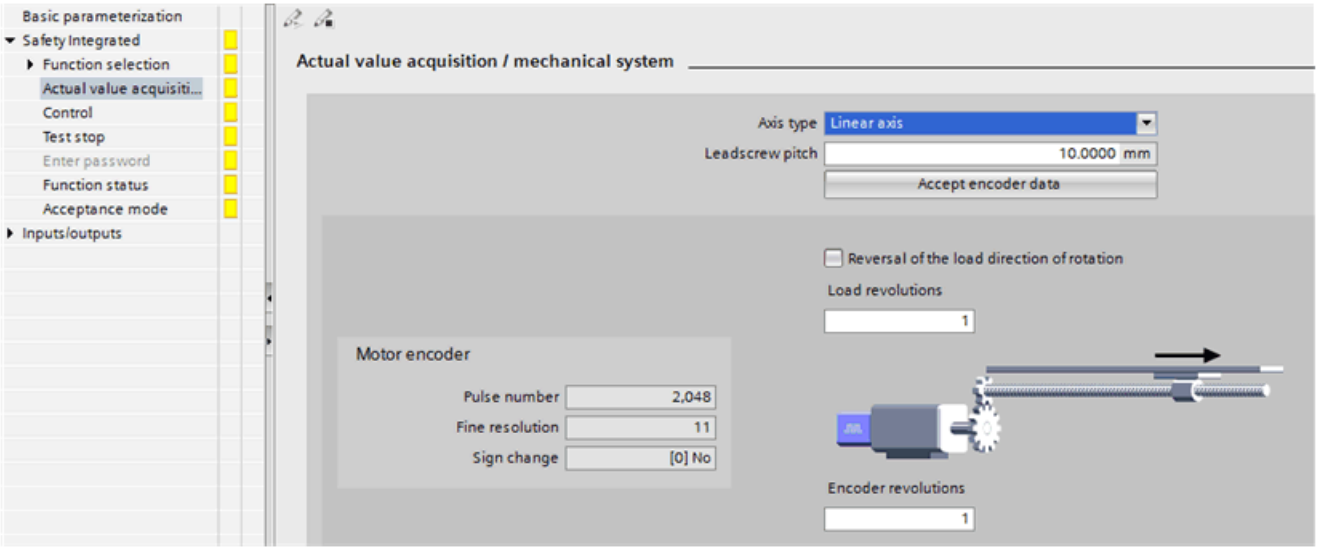


Figure 7-12 Actual value acquisition/mechanical system

For precise parameter assignment of the actual value acquisition, only the parameters required for your configuration are offered:

- Axis type
  Select the "Linear axis" or "Rotary axis / spindle" axis type. The required entries depend on this selection.
  The unit switch for setting the safety functions also depends on the axis type.

  Note

  Checksum error after modification of the axis type

  If you change the axis type, the checksums will be recalculated the next time the drive is started up. These checksums differ from the predecessor values by the unit conversion required when the axis type is changed. The drive outputs checksum errors.

  - To acknowledge these errors, click "Edit" and then "Finish editing".

- Accept encoder data
  The "Accept encoder data" button is only available online and allows you to update the safety parameters. The appropriate encoder parameters are copied from the basic system to the corresponding Safety parameters. This data is displayed here as motor encoder.
- Direction reversal of the load
  Here, you can set whether a direction of rotation reversal is involved for the particular gearbox.
- Modulo range (for rotary axis)
  This setting is exclusively for the correct display of the diagnostics information of the actual value on the load side.
- Leadscrew pitch (for linear axis)
  Here, you set the transmission ratio between the encoder and load in mm (linear axis with rotary encoder).
- Load revolutions/encoder revolutions
  With these values, you can parameterize a gear ratio for the encoders used. The gear ratio is the ratio of encoder revolutions to revolutions of the drive shaft (load revolutions).

7.3.2.3 Configuring the control

Overview

In the "Control" screen form, you parameterize the settings of the SINAMICS S210 for the fail-safe inputs and outputs or control via PROFIsafe.

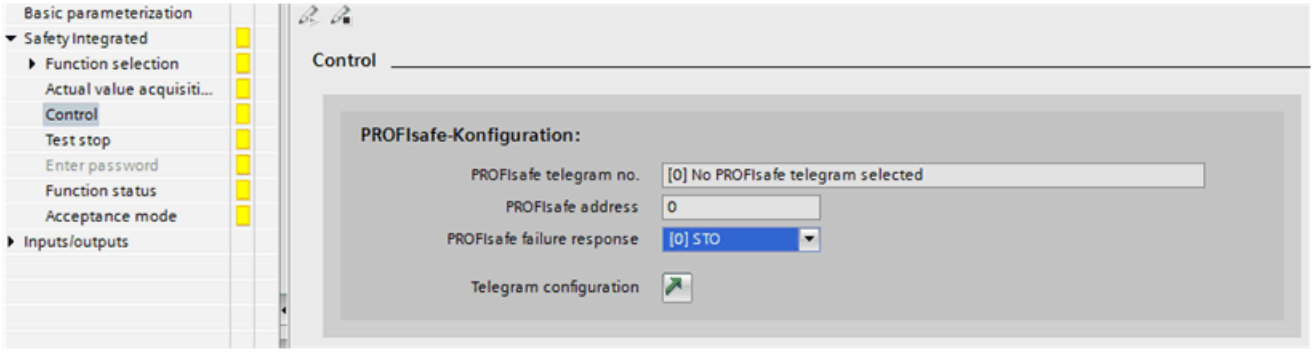


Figure 7-13 Example: Control via PROFIsafe and F-DI

A PROFIsafe telegram is required to control the functions. You get to the relevant setting screen form with the jump label to the telegram configuration.

- Insert a Safety Integrated telegram and then select:
  - Telegram 30 for Basic Functions
  - Telegram 901 for Extended Functions
- Set the F-address in the screen forms for sending and receiving.

  Note

  Uniqueness and consistency of the F-address

  - Make sure that every F-address within your network is unique and assigned only once.
  - Make sure that the F-address of a drive is assigned in a consistent manner.
  - Check that your drive is addressed correctly via PROFIsafe.

- If you are using SBT, insert the supplementary telegram 700 or 701. Then, select the desired telegram.

F-DI configuration

The signal states on the two terminals of the F-DI are then monitored for whether they reach the same logical signal state within the discrepancy time.

For example, the unavoidable delay caused by mechanical switching operations can be adapted via parameters. The time within which the selection or deselection must be performed in both monitoring channels in order to qualify as "simultaneous" is specified with "F-DI discrepancy time".

The drive-internal safety function issues safety faults for internal errors or limit value violations.

1. Enter a discrepancy time in the "F-DI discrepancy time" field.
2. Enter a time for the input filter (debounce time) in the "F-DI input filter" field.
   The debounce time is rounded up to whole ms and applied. This debounce time applies for the F-DIs and the readback input for the forced checking procedure. The debounce time specifies the maximum time an interference pulse can be present at F-DIs before being interpreted as a switching operation.

7.3.2.4 Test stop

Important information on the "test stop"

- The test stop meets the requirement from ISO 13849-1 and IEC 61508 (on-time fault detection).
- The test stop checks the internal shutdown paths and functionality for correct operation.
- You need to perform the test stop at least once per year. However, the test stop may be required more frequently due to the risk analysis. An adjustable timer is available for this purpose.

Requirements

The drive triggers STO during the test stop: For this reason, STO cannot be active when the test stop is selected.

Test stop

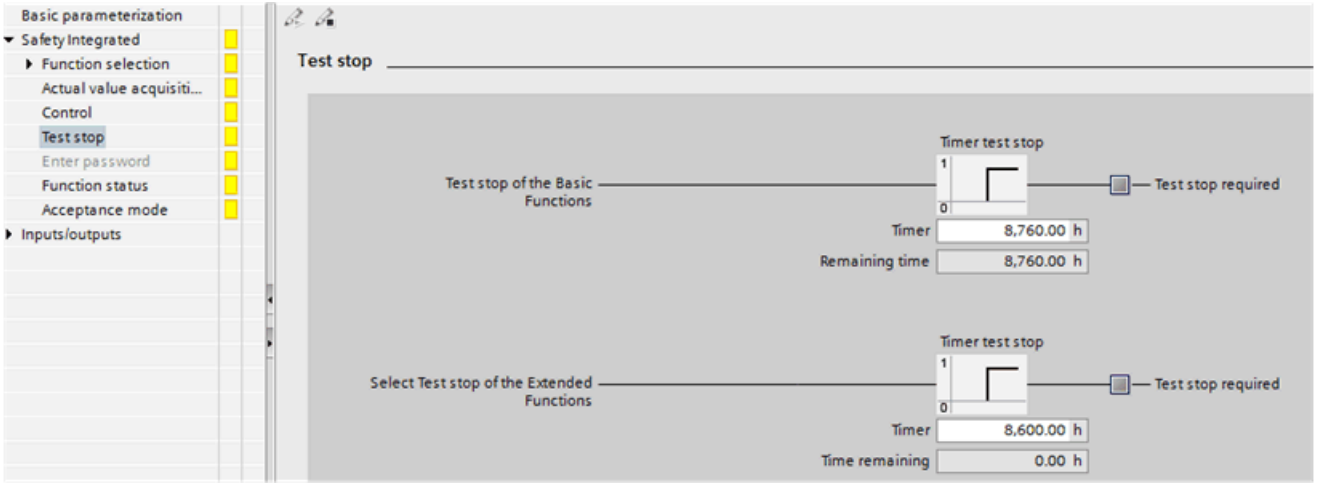


Figure 7-14 Test stop (example)

Startdrive offers both "Test stop timers" depending on whether you use Basic or Extended Functions.

Possible execution times

- When the drives are at a standstill after the system has been switched on (POWER ON)
- At defined intervals (e.g. after every shift)
- In automatic mode, time- and event-dependent (e.g. when the protective door is opened)

Basic Functions

- Possibilities for activating the test stop
  - Selection of STO, SS1
  - POWER ON
- After the timer elapses
  - Output of alarm "Motion monitoring test required"
  - Re-activation of test stop necessary

Extended Functions

- Possibilities for activating the test stop
  - Automatically on startup of the drive system (factory setting)
  - Via SCC
- After the timer elapses
  - Output of alarm "Motion monitoring test required"
  - Re-activation of test stop necessary

7.3.2.5 Changing the password

With the Safety password, you protect the settings of the drive-integrated safety functions from changes by unauthorized users.

Always assign a strong password, to enable protection. To reset the password to the factory setting, you require the valid password.

Note

The Safety password is write protection specified in the appropriate standards to prevent against maloperation by unauthorized users.

The password must include the following elements to provide better protection against unauthorized access, e.g. by hackers:

- At least 8 characters
- Uppercase and lowercase letters
- Numbers and special characters (e.g.: ?!%+ ...)

The Safety password must not be used anywhere else.

Checking the password

The drive checks the length of the password. There is no check for special characters or upper and lower case letters.

Requirement

- The S210 drive is online.
  The safety password can only be read or changed in online mode.

Procedure

Proceed as follows to change the safety password:

1. Enter the current password at the top.
   During initial commissioning, no password is assigned yet and this step is omitted.

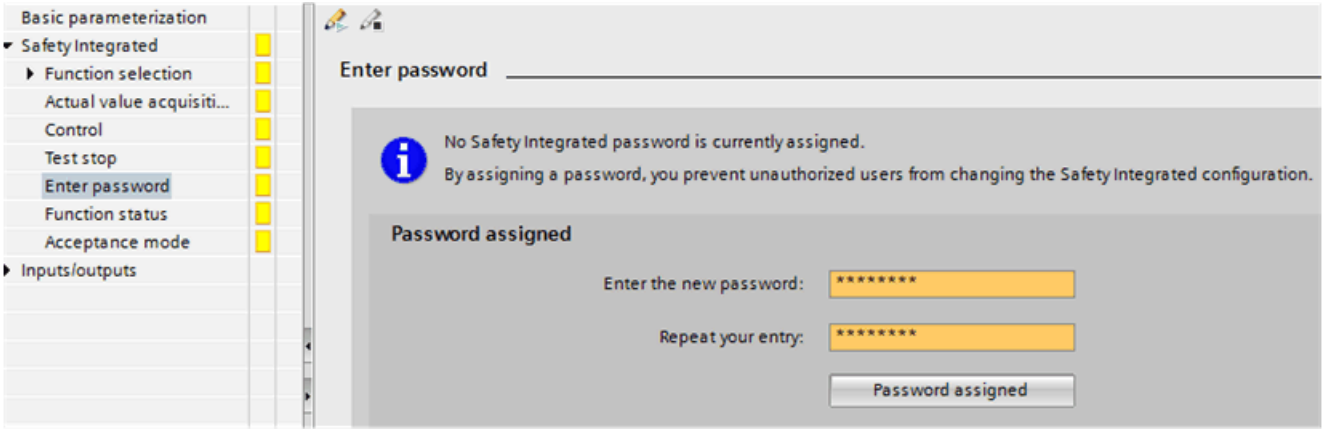


Figure 7-15 Password input

2. Enter the new password at the bottom.

3. Enter the new password again at the bottom.
4. Click "Assign password" or "Change password" to accept the new password.

7.3.2.6 Function status

The "Function status" screen form shows you the status of all configured safety functions.

Note

Update

If you have established an online connection to the drive, the information is up to date (see section "Function status online (Page 293)").

7.3.2.7 Acceptance mode

Acceptance mode can be activated for a configurable time. Acceptance mode allows intentional limit violations during the acceptance test. For instance, the setpoint velocity limits are no longer active in acceptance mode. To ensure that this state is not accidentally retained, acceptance mode is automatically ended again after the set time.

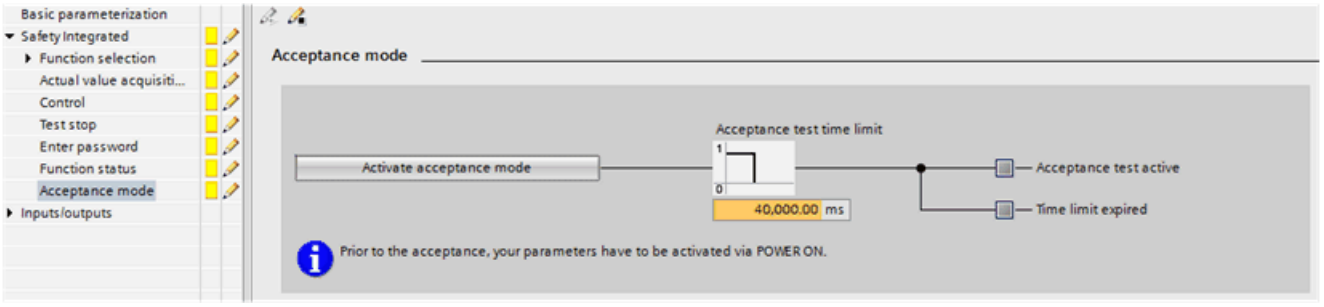


Figure 7-16 Acceptance mode

It only makes sense to activate acceptance mode during the acceptance test of the SS2, SOS, SDI and SLS functions. The acceptance mode has no effect on other functions.

Normally, SOS can be deselected directly or via SS2. To enable triggering of a violation of the SOS standstill limits while acceptance mode is active (also in the "SS2 active" state), the setpoint is enabled again by the acceptance mode after deceleration and transition to SOS to allow the motor to move. When an SOS violation is acknowledged in active acceptance mode, the current position is adopted as the new standstill position so that an SOS violation is not immediately detected again.

7.3.2.8 Accepting the settings in the drive

You have made all settings required for commissioning the drive-integrated Safety functions.

1. Load the settings onto the drive.
2. Activate the settings in the drive through POWER ON.

7.3.3 Online commissioning

7.3.3.1 Assign parameters to functions online

1. Establish an online connection to the drive.
2. Click the icon in the toolbar of the parameterization editor.
   - Safety commissioning is activated.
   - S210 shows the message F10.
3. Select the required functions in the function selection.
4. Make the settings in the screen forms for the selected functions. See also the description in the section "Offline commissioning (Page 282)".

5. Make the settings for control, test stop and password.
   - The "Function status" shows you the status of all configured safety functions. For safety reasons, STO is selected by the system during Safety commissioning and shown in "Function status" active.
   - With Extended Functions, the screen forms for "Actual value acquisition / mechanical system" and "Acceptance mode" are displayed in addition.
6. Exit Safety commissioning mode after you have finished making all settings. To do this, click the icon in the toolbar of the parameterization editor.
7. To save the Safety Integrated parameters permanently in the drive, retentive saving is necessary. In the toolbar of the function view, click on the icon .
8. Observe the messages in the diagnostics window. If, for example, you have not entered a password, Startdrive issues a warning.
9. Carry out a warm restart/POWER ON, if necessary.
10. Then establish consistency between the drive and Startdrive project:
    - Load the settings from the drive into the Startdrive project. To do this, click the icon .
    - Disconnect the online connection Go offline.
    - Save the Startdrive project.

7.3.3.2 Function status online

The "Function status" screen form shows you the status of all configured safety functions.

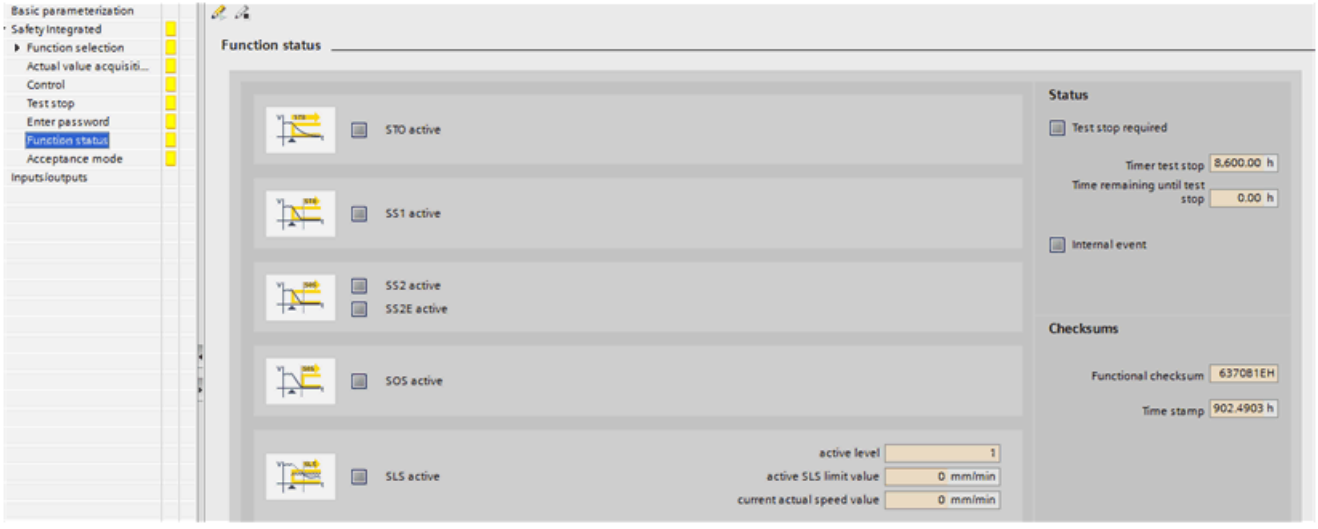


Figure 7-17 Example: Safety Integrated function status screen display

Display

Note

Update

If you have established an online connection to the drive, the information is up to date.

You will see the following information in this screen form:

- Safety functions active in the drive
  - With SLS, you receive some additional information.
- Remaining time of the test stop timer
  Startdrive starts the appropriate test stop timer depending on whether you are using Basic or Extended Functions.
- Internal event
  An internal event is displayed when one of the fault reactions STO, SS1, SS2, SS2E or A01711 is active.
- Checksums
  - Display of functional checksums
    The functional checksum changes as soon as Safety parameters change.
  - Time stamp for the functional checksum

7.3.4 Acceptance test

Note

Conditions for the acceptance test

As far as possible, the acceptance tests are to be carried out at the maximum possible machine speed and acceleration rates to determine the maximum braking distances and braking times that can be expected.

Note

Acceptance test for Basic and Extended Functions

In the function selection, the Safety Integrated acceptance test offers you the testable functions for selection, depending on the device type and its settings (Basic or Extended Functions, control via PROFIsafe or terminals).

Note

Trace recordings

The trace recordings for the Extended Functions allow the analysis of the machine behavior during the test execution. Here you use the signal characteristics to check whether the machine behavior meets your expectations. The recorded signals can be used to evaluate delay times and over-travel distances, for example.

Note

Non-critical alarms

When evaluating the alarm buffer you can tolerate the following alarms:

- A01697 SI Motion: Motion monitoring test required
- A01699 SI CU: Shutdown path test required
  This alarm occurs after the test stop timer elapses.

You do not need to include these alarms in the acceptance report.

Note

No acceptance test with alarm A01796

If the alarm A01796 is active, the pulses are safely canceled, and an acceptance test is not possible.

7.3.4.1 Preparing the acceptance test

In the "Drive_x - Function selection" screen form, the acceptance wizard offers all safety functions available in the drive, or for which a license exists, for selection. Startdrive takes your selection into consideration:

- Basic Functions
- Extended Functions
- Control

Requirement

Startdrive is connected online to the drive to be tested.

Procedure

To prepare the acceptance test, proceed as follows:

1. Parameterize the drive to be tested completely and commission it.
2. Click "Acceptance test" in the project navigator.
3. Select all safety functions to be tested for the desired drive in the secondary navigation. The active functions are automatically preselected. You can change this preselection and select or deselect functions.
4. To define the function selection for the Safety Integrated acceptance test, click "Apply". Entries are displayed in the secondary navigation for the functions to be tested. Navigate with these settings to the individual tests.

Resetting test results

1. To delete all tests performed for this drive so far, click the "Reset test results" button. This restores the initial state from which the acceptance tests can be run again.

7.3.4.2 Performing the acceptance test (example)

Description

After accepting the function selection in the "Preparing the acceptance test (Page 295)" step, the functions to be tested are displayed in the secondary navigation.

Work through the tests from top to bottom or in any order.

Starting and performing the acceptance test

1. Click on a function to be tested.
2. Enter a test designation. This designation also appears later in the acceptance report.
3. You can change the trace settings for this test or use the preassignment. The preassignment is adequate for most applications.
   A change makes it possible to adapt to the mechanical conditions of the machine, e.g. if the axis mechanics have a very high moment of inertia and thus longer ramp times are required for acceleration and braking.
4. Start the acceptance test wizard.
5. Follow the safety instructions and notes on the acceptance test wizard screens until the test has been (successfully) completed.

Result

The test status in the secondary navigation is updated.

Execute the wizards of all further functions similarly through the tests.

7.3.4.3 Completing the acceptance test with report

Description

The acceptance report can be created at any time, for example, even when individual tests have not yet been performed or completed with faults. In this way, you document intermediate states.

Creating an acceptance report

1. The overview under "Create report" lists all drives and their current test status.
2. In the "Completion" screen form, select the drives for which you would like to create the report.
   You can select any number of drives, regardless of their test status.
   The drive instances to which the results were transferred are also displayed in the list as drop-down sub-entries. These drive instances are always included in the acceptance report with the selection of the respective main drive.
3. If you select multiple drives, you need to specify the directory for protocol storage. For each drive selected, a report is saved in it with the name of the drive.

Optional: Creating a function table

You can use the function table to create a user-defined overview that is documented in the acceptance report in addition to the results of the acceptance test.

Column	Explanation
Operating mode	Select one of the specified operating modes from the drop-down list to map the desired scenario.
Description	Enter an explanatory comment for the selected operating mode.
Protective device	Select the protective mechanism to be used in the applicable scenario from the drop-down list.
Version	Enter an explanatory comment on the protective device being used.
Axis	Select the relevant S210 drive from the drop-down list.
Monitoring	Select the safety function being used from the drop-down list.

Result

The acceptance report is created as a table in "xlsx" format and can thus be opened in Microsoft Excel and other spreadsheet programs (e.g. LibreOffice).

The report comprises several individual tables:

- Cover page: Introduction with the machine description
- Drive_x - overview: Documentation of parameters for this drive
- Drive_x - function test: Documentation of all test data and traces for this drive
  Test status color coding:
  - Red: Failed
  - Yellow: Not tested
  - Green: Test successful
- Completion: Summary and signatures

Note

Correct display of the acceptance report

How the acceptance report is displayed is dependent on the Windows settings and spreadsheet program used to call up the file.

- Microsoft Excel
  The acceptance report is displayed correctly in Microsoft Excel when the following is configured in the Windows display settings:
  Control Panel > Appearance and Personalization > Display > Make text and other items larger or smaller > Option "Smaller – 100%"
- LibreOffice
  The acceptance report is displayed independently of the Windows settings and is thus always correct.

7.3.4.4 Transferring acceptance test results

To simplify further acceptance tests, you can transfer the results of successful tests to drives with the same functionality.

1. Open the "Result transfer" screen form for a drive for which you have successfully completed the acceptance test.
2. Click on the "Determine" button to determine suitable drives.
   – After initial determination, the button changes to "Refresh".
   – The Safety Integrated acceptance test wizard lists the suitable drives.
     The suitable drives are determined based on the Safety Integrated parameterization.
     Other properties (e.g. the mechanics of the axis) are not considered in this decision.
3. Select the drives to which you want to transfer the results.
   The selected drives become instances of the tested drive.
4. Click the "Accept" button.
   The transfer status is displayed in the screen form.
5. By deselecting and accepting, you disconnect instances from the tested drive.

7.4 Diagnostic functions

7.4.1 Device diagnostics

Faults, alarms and maintenance required are indicated by corresponding icons in the project. The icons have different colors according to the seriousness of the situation. The icons are displayed both in the network and in the topology view so that diagnostics is possible in all views.

Description of icons

The diagnostics icons are displayed in the following areas of the TIA Portal:

- Project tree
- Device view
- Device overview

The following table provides an overview of the possible diagnostic icons.

Icon	Meaning
	No fault or maintenance required
	Maintenance required
	Maintenance requirement for a subordinate component
	Maintenance request
	Maintenance request for a subordinate component
	Fault/error
	Fault/error on a subordinate component
	Connection error to the device
	Establish a connection
	The diagnostic status is determined
	The configured device and the actual device have incompatible types.
	The device is only available in the offline configured device configuration and has been deactivated.

Display messages

Proceed as follows to display messages that have been assigned to a diagnostics icon:

1. Double-click on a diagnostics icon.
   The Inspector window opens.
2. Click the "Message display" tab.

All current messages are displayed.

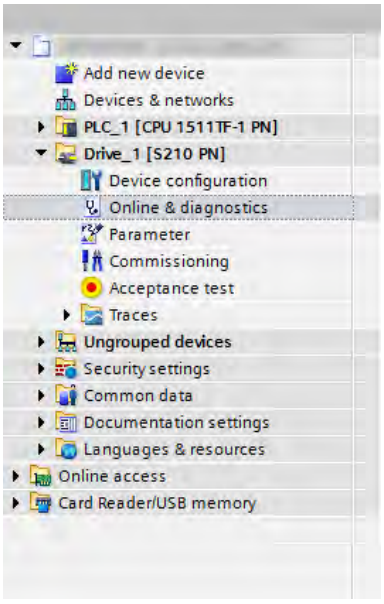
7.4.2 Online & diagnostics

Overview

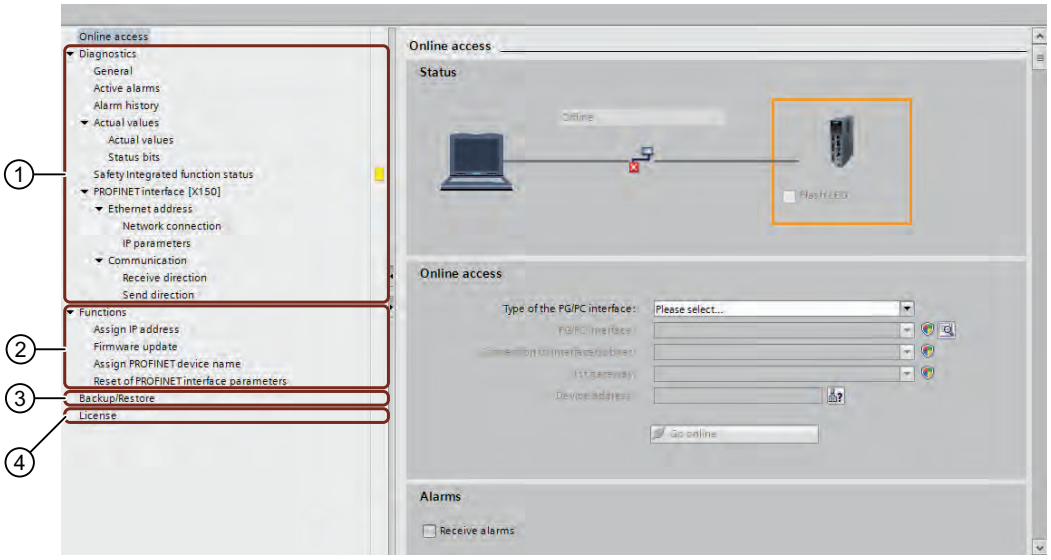
In the diagnostics view, you can see important information about the S210 drive or make important basic settings.

Calling diagnostic functions

To display diagnostics and diagnostic functions for your S210 drive, double-click the "Online & Diagnostics" entry in the project tree.



- The "Online access" screen form is displayed.
- The diagnostics and diagnostic functions are displayed in the secondary navigation and can be called from here.
  The following figure shows an example of the layout of the diagnostics view and the functions it contains.



① "Diagnostics" (information on the condition of the drive)
② "Functions" (configuration of the physical interfaces)
③ "Backup / Restore"
④ Overview of licenses

Figure 7-18 Overview: Diagnostic functions

Online access

You can connect to the S210 drive online via the "Online access" screen form. Proceed as follows to connect to the drive online:

1. Select the "Online access" entry in the secondary navigation.
2. Select the network interface of your PG/PC.
3. Click "Go online" .

The online connection to the drive is established.

Click "Go offline" in the menu bar to terminate the online connection.

Additional information

Additional information on online and diagnostic functions in the TIA Portal is available in the TIA Portal information system under "Using online and diagnostic functions".

7.4.2.1 Diagnostics

In the "Diagnostics" area, you will receive the following information on the condition of the connected converter:

- **General**
  Information about component, module and manufacturer
- **Active alarms** and **Alarm history**
  Information on active alarms and faults, as well as their history
- **Actual values**
  Information about the most important parameter actual values and status bits.
- **Safety Integrated functional status**
  Information on the current status of the safety functions.
- **PROFINET interface (X150)**
  - Ethernet address
    Information about IP parameters (IP address and subnet mask) and network connection (MAC address)
  - Communication
    Information on transmit and receive direction (PZDs of the telegrams).

You call the individual diagnostic information in the secondary navigation of the diagnostics view.

Overview

In the "Functions" area, you can call the following functions via the secondary navigation of the diagnostic view and make settings within them:

- Assign IP address
- Assign PROFINET device name
- Reset PROFINET interface parameters

A description of how you can reset the PROFINET interface parameters on your S210 drive is provided below.

Resetting PROFINET interfaces

To return the S210 converter to the factory state, you need to reset the PROFINET interfaces of the converter in addition to restoring the factory settings (see section "Backup and restore (Page 303)").

Note

Disconnect the connection between S210 converter and controller

If the S210 converter is connected to a controller (CPU) while the PROFINET interfaces are being reset, the controller assigns new interface parameters to the converter immediately after the reset. To prevent this, switch the controller to "Stop" mode before the reset or terminate the connection between controller and converter.

Procedure

Proceed as follows to reset the parameter assignment of the PROFINET interfaces to the factory settings:

1. Expand the "Functions" entry in the secondary navigation.
2. Click the "Reset of PROFINET interface parameters" entry.
   The corresponding screen form opens.
3. Select one of the following options:
   - Retain I&M data
     The "Retain I&M data" option is activated as default setting. This means that the IM0 to IM3 data is retained in the event of a reset and is not deleted. If you want to reset this data, too, enable the "Delete I&M data" option.
   - Delete I&M data
4. Click the "Reset" button.

The parameters of the PROFINET interfaces are reset to the factory settings. The reset data is displayed in the "Online access" screen form.

7.4.2.2 Backup and restore

Overview

The following options are available to you with the "Backup/Restore" function:

- You can save the drive data (parameter assignment) retentively in the S210 drive.
- You can restart the S210 drive.
- You can reset the S210 converter to the factory settings.

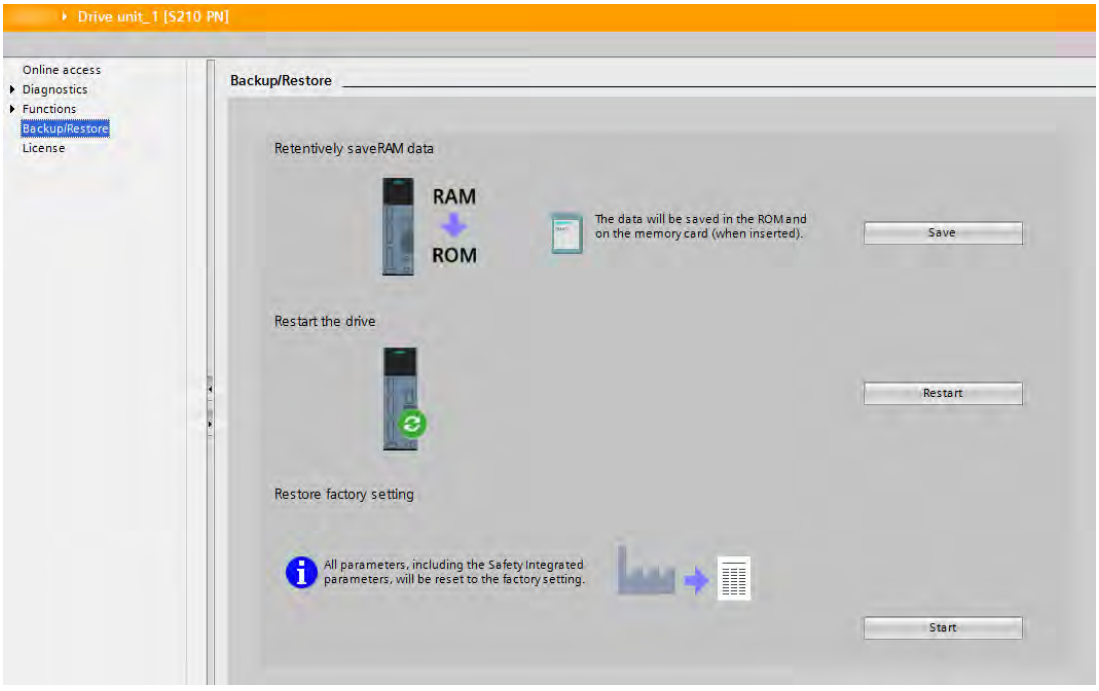


Figure 7-19 Overview: Backup and restore

Requirements

- There is an online connection between the project and the S210 drive (see section "Establishing an online connection to the S210 drive (Page 277)").

Saving RAM data retentively (RAM to ROM)

Proceed as follows to save the drive data (parameter assignment) retentively:

1. Click the "Backup/Restore" entry in the secondary navigation.
   The corresponding screen form opens.
2. Click on the "Save" button in the "Save RAM data retentively" field.

The drive data is saved retentively in the drive's ROM. If you have inserted an SD memory card in the drive, the drive data is stored on the memory card in addition.

Restarting the drive

Proceed as follows to restart the S210 drive:

1. Click the "Backup/Restore" entry in the secondary navigation.
   The corresponding screen form opens.
2. In the "Restart the drive" field, click on "Restart".

The drive is restarted. The restart is finished when the RDY and COM LEDs on the drive light up green.

Restoring factory settings

If you want to delete the configuration, you can restore the converter to the factory settings. This is necessary if, for example, you want to connect a different motor.

Proceed as follows to restore the factory settings on your S210 converter:

1. Click the "Backup/Restore" entry in the secondary navigation.
   The corresponding screen form opens.
2. Click the "Start" button in the "Restore factory setting" field.

The converter is reset to the factory settings.

Note

Resetting all parameters

Restoring the converter to factory settings resets **all** parameters (except the PROFINET interface parameters). You can find more information on resetting the PROFINET interface parameters on the converter in the section "Diagnostics (Page 302)".

7.4.2.3 Overview of licenses

Overview

In the "License" screen form in online mode, you can view information on options/functions requiring a license and perform the following actions:

- View status of individual licenses
- Display and enter license key.
- Display and copy serial number of the memory card being used.
- Activate Trial License mode

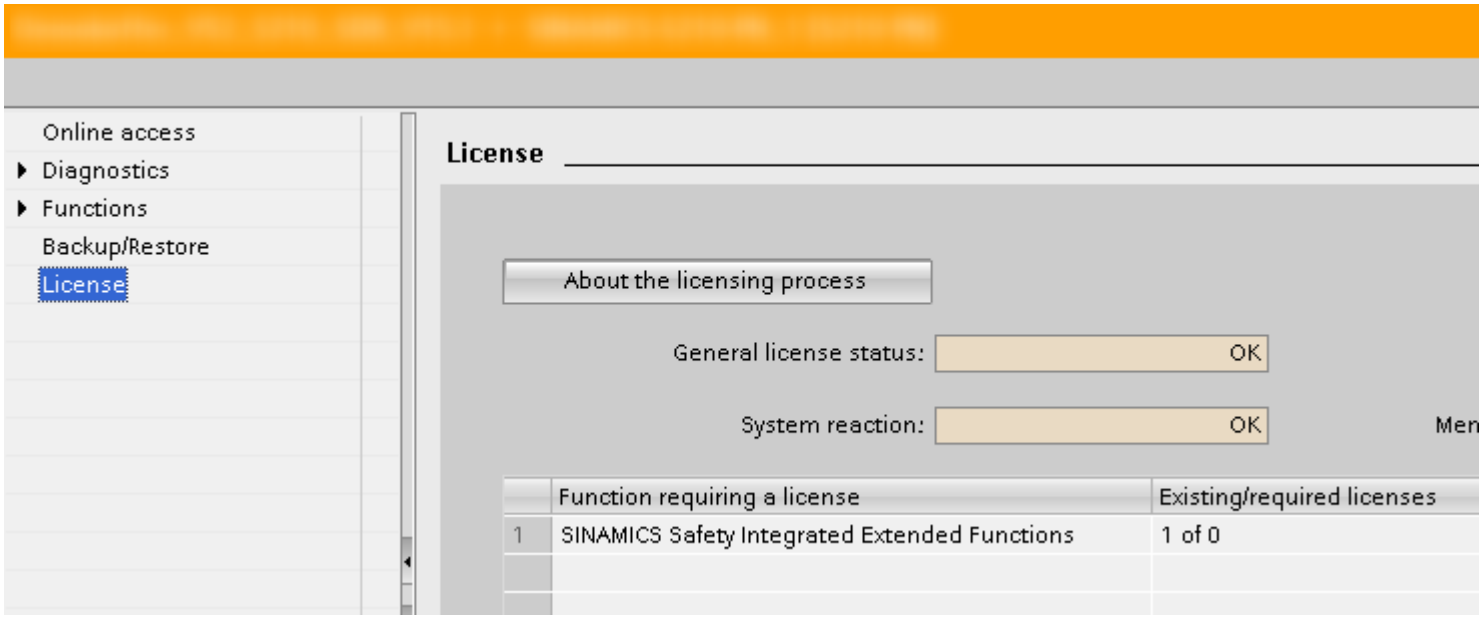


Figure 7-20 Overview of licenses

Element	Description
"About the licensing process"	Opens a dialog window with basic information and notes on the license overview page and on the licensing process.
"General license status"	Indicates the current license status (e.g. you do not have all of the licenses you need).
"System reaction"	Indicates the system response to the current license status (e.g. "blocks new power-on of a drive").
"Activate Trial License mode"	Button for activating Trial License mode.
"Trial period"	Shows the status of a trial period (e.g. "Trial License mode not active").
"Show/enter license key"	Button to display and enter the license key.
"Memory card serial number"	Displays the serial number of the memory card. Button for copying the serial number.
"Function requiring a license"	List of all used options/functions that require a license.
"Existing/required licenses"	The required number of licenses compared with the number of licenses included with the license key. **Note:** For operation, the number of available licenses must be ≥ the number of requested licenses.
"License status"	Displays the current status of the function requiring a license.
"Remaining operating time"	Displays the remaining operating time of the trial period.

Trial License mode

Licenses for functions requiring a license can either be ordered together with an SD memory card for an S210 drive or, when ordered later, can be assigned to an existing SD memory card via the "Web License Manager". However, most of the SINAMICS functions requiring a license can also be operated for a limited period of time in Trial License mode.

Before you activate Trial License mode, make sure to read the information and notes in the "About the licensing process" dialog.

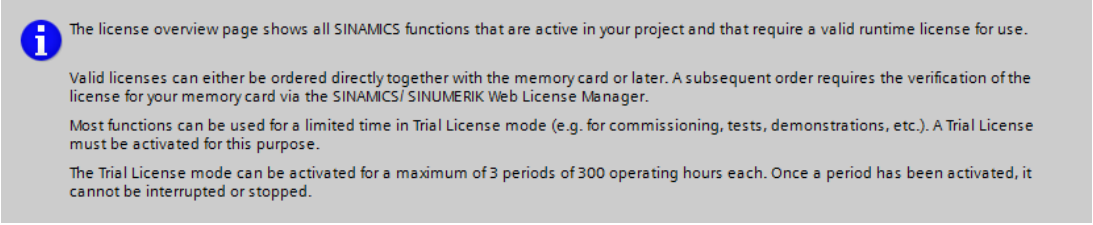


Figure 7-21 Licensing process: Information and notes

Additional information

You can find additional information on options/functions requiring a license, on the licensing process or on trial license mode in the TIA Portal information system under the key word "Licensing".

7.4.3 Updating the firmware

Overview

If you want to upgrade the firmware of the converter, you can perform the firmware update directly from your project.

Note

Firmware version in the S210 drive and in the configured drive identical?

An online connection between your TIA Portal project and your S210 drive is only possible when both communication partners have the same firmware version (see "Checking the firmware consistency (Page 258)").

You can find additional information on the available SINAMICS S210 firmware versions on this web page (https://support.industry.siemens.com/cs/ww/en/view/109744577):

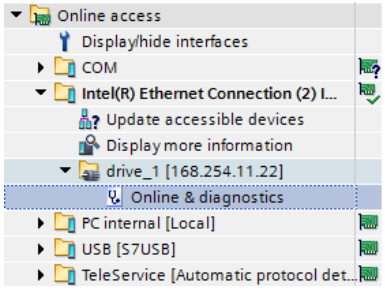
Performing a firmware update via online connection

If you want to upgrade the firmware of the converter, you can perform the firmware update directly from your project.

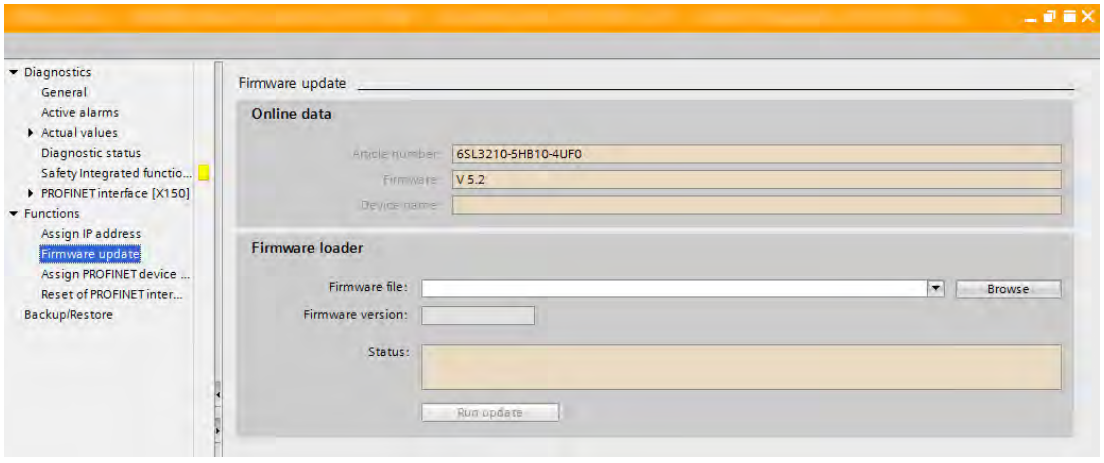
To perform a firmware update directly from your project, proceed as follows:

1. Open the Online access entry in the project navigation.
2. Select the network interface of your PG/PC.
3. Double-click "Update accessible devices".
   The accessible device is displayed with the IP address.

4. Call the "Online & diagnostics" function for the displayed device.
   An online connection to the selected device is established and the "Online access" screen form opens.



5. Expand the "Functions" entry in the secondary navigation.
6. Click the "Firmware update" entry.
   The corresponding screen form opens.



7. Click the "Browse" button in the "Firmware loader" area.
   A selection dialog opens.
8. Select the firmware file with the required version in the file system of your PG/PC.
   The firmware file is displayed in the line with the same name in the "Firmware loader" area.
9. Check in the "Firmware version" field whether you have selected the required firmware version.
10. To start the update, click the "Perform update" button.
    The status of the firmware update is displayed in the "Status" field. The new firmware is installed. This may take up to 5 minutes and longer. The update is complete when the RDY and COM LEDs flash red synchronously at 1 Hz.

RDY	COM	Explanation of LED displays
		Firmware update is active: • Do not switch off the power supply. • Do not disconnect the motor from the converter.
		LEDs flash synchronously (1 Hz): • Converter is waiting for the power supply to be disconnected and reconnected after the firmware update.

11. Switch the S210 drive off and then on again.
    The firmware of the connected DRIVE-CLiQ components is updated. A restart may be required (see alarm messages).

RDY	Explanation of LED displays
(0.5 Hz)	Firmware update of the connected DRIVE-CLiQ components in progress: • Do not switch off the power supply. • Do not disconnect the motor from the converter.
(2 Hz)	Firmware update of the DRIVE-CLiQ components is complete: • Waiting for POWER ON of the respective component. **Remedy**: Switch the component off and on again.

12. Call the catalog information via the secondary navigation in the Inspector window and check whether the new firmware version is installed.

Performing a firmware update using a memory card

Alternatively, you can also perform the firmware update using a memory card (see section "Firmware update via memory card (Page 329)").

7.5 Trace function

Overview

You specify the signals to be recorded, the duration of the recording and the trigger conditions in a trace configuration depending on the SINAMICS S drive used. The special features of the trace configuration for S210 drives and the drive-specific default settings are described below. You can find additional information on the trace function in the TIA Portal in the TIA Portal information system.

Special features

The trace configuration for S210 drives is characterized by the following special features and device-specific default settings:

- **Preset trace signals**
  For the first trace that you create for an S210 drive, the first four signals are preassigned with the following parameters, which are typical for Motion Control applications:
  - r0062 (speed setpoint after filter)
  - r0061[0] (unsmoothed speed actual value, encoder 1)
  - r0080 (actual torque value)
  - r0479[0] (encoder actual position value Gn_XIST1 diagnostics: Encoder 1)

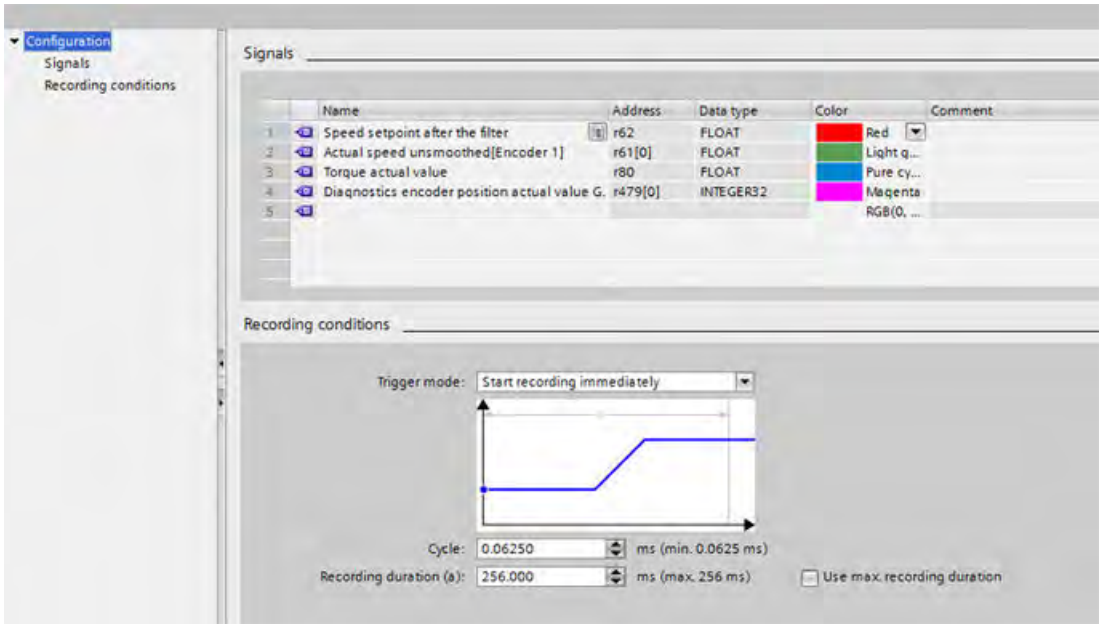


Figure 7-22 S210 trace called

No signals are preset for other traces you create for an S210 drive.

Note

Other lines are not preassigned. When further signals are inserted, the cycle is changed to 4 ms.

- **Possible cycle times**
  In the "Cycle" input field of the trace configuration, you can enter the cycle time with which trace recording is to take place. The possible cycle times for an S210 drive depend on the number of signals to be recorded:
  - Up to four signals: 0.0625 ms minimum recording cycle
  - As of five signals: 4.0 ms minimum recording cycle
- **Selecting signal bits based on plain text descriptions**
  By selecting a trigger variable, you can display individual signal bits based on plain text descriptions (e.g. "Drive control.control word sequence control.ON / OFF1") in the trace

configuration and select them directly. A description of how you can select an individual signal bit and set a trigger event is provided below using the "Drive control.control word sequence control" trigger variable as an example.

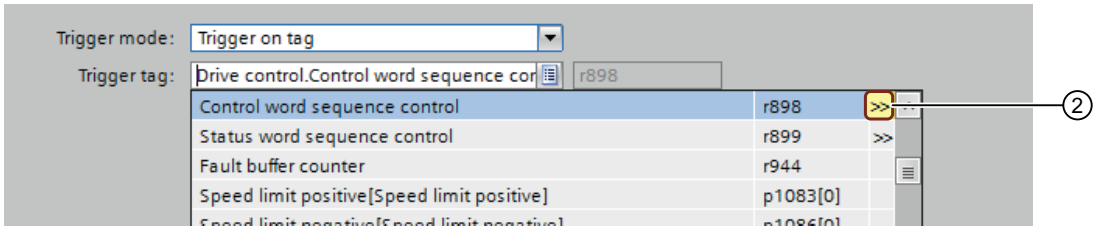
Selecting signal bits and setting the trigger event

Proceed as follows to select individual bits and set a trigger event:

1. Define a trigger mode (e.g. "Trigger on tag") via the "Trigger mode" drop-down list.
2. To open the signal selection table, click on the icon in the "Trigger tag" input field.

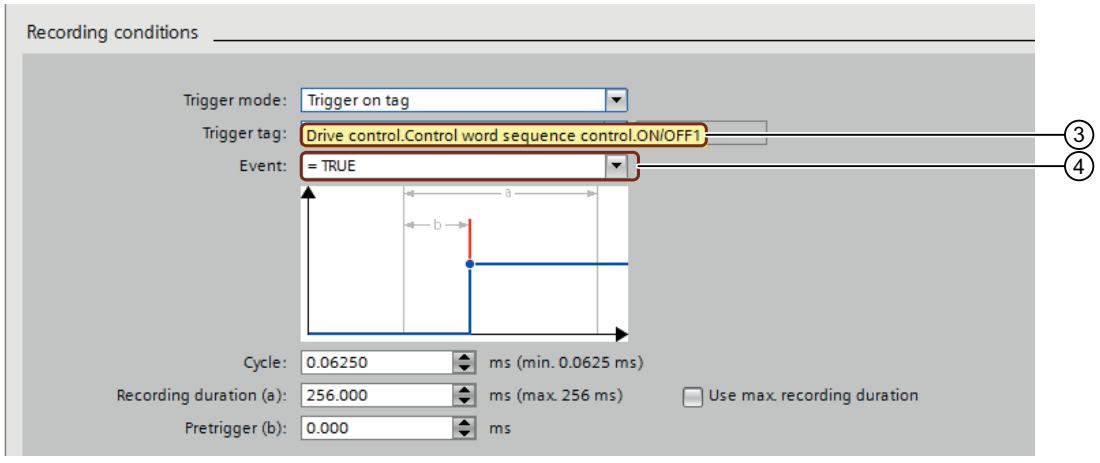
The signal selection table is displayed.

3. In the signal selection table, scroll to the desired signal (e.g. "control word sequence control").
4. To open the bit selection table, click on the >> icon ② in the row with the desired signal.



The bit selection table shows the bits of the selected signal in plain text (e.g. "control word sequence control.ON / OFF1").

5. Select the required bit.
   The selected bit is displayed in the "Trigger tag" input field ③.



6. To show the "Event" input field, press "Enter".
   The "Event" input field is displayed with a preset trigger event ④.
7. Select the desired trigger event, if necessary, using the drop-down list in the "Event" input field.
   The selected trigger event is displayed in the "Event" input field.

Series commissioning

8

Overview

If you want to transfer the same settings to multiple machines, you have the option of carrying out series commissioning.

Note

PROFINET IP address and PROFINET device name are not transferred during series commissioning. You must configure the PROFINET IP address and the PROFINET device name in the PLC. The converter takes the settings from the PLC.

There are two options when carrying out series commissioning of the converter:

- **Series commissioning with memory card**
  All settings on the memory card (including the administrator password) are transferred to the converter.
- **Series commissioning using the web server**
  All settings from the parameter backup (including the administrator password) are transferred to the converter.
  When performing series commissioning, also observe the fundamental principles for working with the web server (see section "Fundamentals (Page 186)").

Requirement

- The machines that are commissioned via series commissioning are identical in terms of the application, converter and motor.

Series commissioning with a memory card

Proceed as follows to perform series commissioning using a memory card:

1. Insert an empty SD card with a maximum capacity of 2 GB (e.g.: 6SL3054-4AG00-2AA0) into the card slot of the converter that has been switched off.
2. Switch on the converter and perform commissioning.
   You can find additional information in section "Commissioning using the web server (Page 201)".
3. Save the settings at the end of commissioning via .
   This saves the settings in a non-volatile manner not only on the converter but also to the memory card.
4. Switch off the converter and remove the memory card from the converter.
5. Insert the memory card into the next, switched off converter.

6. Switch on the converter and wait until it has run up - the RDY LED lights green.
   When running up, the converter takes the settings from the memory card - including the administrator password.
7. Switch off the converter and remove the memory card from the converter.

Repeat steps 5 to 7 for all converters to which you want to transfer these settings.

Series commissioning using the web server

Proceed as follows to perform series commissioning using the web server:

1. Switch on the converter and perform commissioning.
   You can find additional information in section "Commissioning using the web server (Page 201)".
2. Save the settings at the end of commissioning via .
3. Select "Backup and Restore" in the navigation - and back up the parameter settings in a file using "Back up parameters".
4. Connect your commissioning device with the next converter.
5. Switch on the converter and assign an administrator password.
6. In the navigation, select "Backup and Restore" - and load the parameter settings using "Restore parameters via file" to the converter.
   The converter accepts the parameters, including the administrator password, from the backup and restarts.

Repeat steps 4 to 6 for all converters to which you want to transfer these settings.

Diagnostics

9

9.1 Status displays and operating elements on the converter

9.1.1 Overview of display and operating elements on the converter

The status of the converter is displayed via the three-digit display as well as by the "RDY" and "COM" LEDs.

① LED display
② Three-digit display
③ OK button

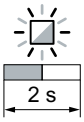
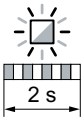
Display and operating elements on the converter

- Status display via LEDs
  The converter displays the current operating state via two LEDs.
  - RDY: converter state
  - COM: communication state

  During ramp-up, the LEDs assume different states.
  The converter is ready for operation when the "RDY" LED is permanently green.
  The LEDs always operate independently of one another, except when updating the firmware.
- Status display via the three-digit display
  Normally, the display is dark.
  Faults are shown according to the message classes defined in PROFIdrive. If PROFIdrive diagnostics is active, then they are simultaneously transferred to the control system.
  More detailed information about alarms and faults is provided by the web server of the converter.
  You can find additional information in section "Diagnostic functions (Page 235)".
- OK button
  You can acknowledge the faults whose cause has been corrected with the OK button.

9.1.2 Status display via LEDs

Table 9-1 Explanation of symbols for the following tables

	LED is ON
	LED is OFF
	LED flashes slowly
	LED flashes quickly
	LED flashes with variable frequency

Please contact Technical Support for LED states that are not described in the following.

Table 9-2 Explanation of the states of the LEDs RDY and COM as the converter starts up

RDY	COM	State, description, cause
		POWER ON All LEDs light up for approx. 1 s.
		BIOS loaded
		BIOS error: "An error occurred while loading the BIOS."
		Loading firmware: RDY LED lights up red, COM LED flashes orange without fixed frequency.
	-	Firmware has been loaded.
		File error: • Memory card not available or faulty. • Software on memory card not available or faulty.
-		Firmware has been checked. No CRC error detected.
		Firmware has been checked. CRC error detected.
	-	Initializing firmware

Table 9-3 Status explanation of the RDY LED during operation

RDY	Explanation
	The electronics power supply is missing or outside the permissible tolerance range. **Remedy**: Check the power supply.
	Temporary status after the supply voltage is switched on.
	The device is ready for operation. Cyclic DRIVE-CLiQ communication is in progress.
	Writing to the memory card
	Commissioning or reset to factory settings
	PROFIenergy energy-saving mode is active. Switch-on/off ratio: On: 0.5 s Off: 3 s
	Active fault or missing license **Remedy**: • Check the converter settings/configuration. • Activate the required license
	Firmware update is active
	Converter waits until the power supply is switched off and switched on again after a firmware update
	Firmware update in progress for the connected DRIVE-CLiQ components. • Do not switch off the power supply. • Do not disconnect the motor from the converter.
	DRIVE-CLiQ component firmware update has been completed. Waiting for POWER ON of the respective component. **Remedy**: Switch the component off and on again.
 or 	CU detection via DCP flashing. **Remark**: Both options depend on the LED status when activating via DCP.
	Missing license: There is no license, however, the Trial License Mode has been activated.

Table 9-4 Explanation of the states of LED COM during operation

COM	Explanation
☐	No bus fault is present. When the RDY LED lights up green and the COM LED is off, the converter is ready for communication.
	Temporary status after the supply voltage is switched on.
	Bus ok. cyclic communication running perfectly
	• Bus ok, however no setpoints (PLC in stop) • In the isochronous mode: Bus ok, no synchronization
	No bus connection **Remedy**: Make sure that the bus cables are connected and are not damaged.
	Bus error, possible causes: • Incorrect configuration in the PLC (the same supplementary telegram has been set twice?)

9.2 Message classes in accordance with PROFIdrive

The message classes according to PROFIdrive are shown in the converter display.

Example: Message class 4: F04

Message class	PN[1] (hex)	Explanation of the message class according to PROFIdrive - cause and remedy.
1	9000	**Hardware fault/software error** A hardware or software malfunction has been identified. • Carry out a POWER ON for the relevant component. • If it occurs again, replace again.
2	9001	**Line fault** A line supply fault has occurred (phase failure, voltage level, etc.). • Check the line supply/fuses • Check the supply voltage. • Check the wiring.
3	9002	**Supply voltage fault** An electronics power supply fault (24 V) has been identified. Check the wiring. • Check the voltage level.
4	9003	**DC link overvoltage** The DC-link voltage has assumed an inadmissibly high value. • Check the dimensioning of the system (line supply, voltages). • Check the infeed settings.
5	9004	**Power electronics fault** An inadmissible operating state of the power electronics has been identified (overcurrent, overtemperature, IGBT failure,...). • Check compliance with the permissible load cycles. • Check the ambient temperatures (fan).
6	9005	**Electronic component overload** The temperature in the component has exceeded the highest permissible limit. • Check the ambient temperature / control cabinet ventilation.
7	9006	**Ground fault / inter-phase short-circuit detected** A ground fault / inter-phase short-circuit has been identified in the power cables or in the motor windings. • Check the power cables (connection). • Check the motor.
8	9007	**Motor overload** The motor was operated outside the permissible limits (temperature, current, torque...). • Check the load cycles and set limits. • Check the ambient temperature / motor cooling.

Message class	PN[1] (hex)	Explanation of the message class according to PROFIdrive - cause and remedy.
9	9008	**Communication error to the higher-level controller** The communication to the higher-level controller is faulted or interrupted. Check the state of the higher-level controller. • Check the communication connection/wiring. • Check the bus configuration / clock cycles.
10	9009	**Safety monitoring channel has identified an error** A safe operation monitoring function (Safety) has detected an error.
11	900A	**Actual position value / actual speed value incorrect or not available** An illegal signal state has been detected while evaluating the encoder signals (track signals, zero marks, absolute values...). • Check the encoder / state of the encoder signals. • Observe the maximum permissible frequencies.
12	900**B**	**Internal (DRIVE-CLiQ) communication error** The internal communication between the SINAMICS components is faulted or interrupted. Check the DRIVE-CLiQ wiring. • Ensure an EMC-compliant design.
13	900C	**Infeed fault** The infeed is faulted or has failed. • Check the infeed and environment (line supply, filters, fuses...). • Check the infeed control.
14	900D	**Braking controller / Braking Module faulted** The internal or external Braking Module is faulted or overloaded (temperature). • Check the connection/state of the Braking Module. • Comply with the permissible number of braking operations and their duration.
15	900E	**Line filter faulted** The line filter monitoring has identified an excessively high temperature or other inadmissible state. • Check the temperature / temperature monitoring. • Check the configuration to ensure that it is permissible (filter type, infeed, thresholds).
16	900F	**External measured value / signal state outside of the permissible range** A measured value / signal state read in via the input area (digital/analog/ temperature) has assumed an inadmissible value/state. • Identify and check the relevant signal. • Check the set thresholds.
17	9010	**Application / technology function faulted** The application / technological function has exceeded a (set) limit (position, velocity, torque...). • Identify and check the relevant limit. • Check the setpoint specification of the higher-level controller.

Message class	PN[1] (hex)	Explanation of the message class according to PROFIdrive - cause and remedy.
18	9011	**Error in the parameterization/configuration/commissioning sequence** An error has been identified in the parameterization or in a commissioning procedure, or the parameterization does not match the actual device configuration. • Determine the precise cause of the fault using the commissioning tool. • Adapt the parameterization or device configuration.
19	9012	**General drive fault** Group fault. • Determine the precise cause of the fault using the commissioning tool.

1) "Channel Error Type" of the PROFINET channel diagnostics. When channel diagnostics is activated, then the fault texts are indicated in the PLC.

9.3 Alarms

Alarms

Alarms have the following properties:

- Alarms have no direct influence on the drive.
- Alarms disappear again when the cause is eliminated.
- Alarms cannot be acknowledged.
- Alarms are displayed as follows:
  - In the PLC according to the PROFIdrive message class
  - On the drive via LEDs
  - At the drive using the three-digit display according to the PROFIdrive message class
  - In the Web server via the "Diagnostics - Messages" view

Alarm code or alarm value describe the cause of the alarm.

Reference

You can find additional information on alarms in section "Overview of faults and alarms (Page 535)".

9.4 Faults

Faults

Faults have the following properties:

- The fault causes the motor to be switched off.
- Faults must be acknowledged.
- Faults are displayed as follows:
  - In the PLC according to the PROFIdrive message class
  - On the drive via LEDs
  - At the drive using the three-digit display according to the PROFIdrive message class
  - In the Web server via the "Diagnostics - Messages" view

Acknowledge fault

Before you can acknowledge a fault, you must have resolved the cause of the fault.

To acknowledge, you have the following options:

- Acknowledging via the PLC
- Acknowledging via the OK button under the front cover
- Switch off the converter power supply and switch on again
- Acknowledging via the Web server
- The Safety Integrated error is acknowledged by selecting/deselecting the STO function. Any active messages of additional Safety Integrated Functions are acknowledged simultaneously with extended message acknowledgment (p9507.0 = 1). In addition, you must execute the standard acknowledgment mechanism.

Faults detected during the converter-internal monitoring of hardware and firmware can be acknowledged only by switching the power supply off and on again. In the list of faults, you will find the information on limitations when acknowledging at the corresponding fault codes.

Reference

You can find additional information on faults in Chapter "Overview of faults and alarms (Page 535)".

Service and maintenance 10

10.1 Service and maintenance for the motor

If there are deviations from normal operation or if faults occur, proceed as follows.

- Identify the fault using the "Possible faults" table.
  Also observe the converter messages.
- Try to correct the fault using the "Fault causes and remedial measures" key table.

⚠ WARNING

Operation without functioning protective devices

Operation without functioning protective devices can cause death or severe injury.

- Operate the motor, even in test operation, only with functioning protective devices.

Table 10-1 Possible faults

Fault	Fault cause (see "Fault causes and remedial measures" key table)														
Motor does not start	A	B													
Motor starts slowly	A		C		F										
Humming sound when starting			C		F										
Humming sound in operation	A		C		F										
High temperature rise under no-load operation				D		I									
High temperature rise under load	A		C			I									
High temperature rise of individual winding sections					F										
Uneven running							J	K							
Grinding sound, running noise									L						
Radial vibrations										M	N	O	P		R
Axial vibrations												O		Q	R

Table 10-2 "Fault causes and remedial measures" key table

No.	Fault cause	Remedial measures
A	Overload	Reduce load
B	Interruption of a phase in the supply cable / motor winding	Check the frequency converter and supply cables, measure the winding resistances and insulation resistances, repair after consultation with manufacturer

No.	Fault cause	Remedial measures
C	Interrupted phase in the feeder cable after switching on	Check the frequency converter, supply cables and the winding resistances
D	Converter output voltage too high, frequency too low	Check the settings on the frequency converter, perform automatic motor identification
F	Winding short-circuit or phase short-circuit in stator winding	Measure the winding resistances and insulation resistances, repair after consultation with the manufacturer, if required, replace the motor
I	Heat dissipation impeded by deposits	Clean the surface of the drives and ensure that the cooling air can flow in and out unimpeded
	Cooling air inlet/outlet is blocked by foreign bodies	Remove the reason for the blocking and ensure that the cooling air can flow in and out unimpeded
J	Insufficient shielding for motor and/or encoder cable	Check the shielding and grounding
K	Excessive drive controller gain	Adjust the controller
L	Rotating parts are grinding	Determine cause and adjust parts
	Foreign bodies inside the motor	Replace the motor
	Bearing damage	For SH20... SH50, replace the motor; for SH63 ... SH100, replace the bearings and encoder
M	Rotor not balanced	Replace the motor
N	Rotor out of true, shaft bent	Consult the manufacturer
O	Poor alignment	Align motor set, check coupling
P	Coupled machine not balanced	Re-balance coupled machine
Q	Shocks from coupled machine	Check coupled machine
R	Fault originating from the gearbox	Adjust/repair gearbox

If the fault still cannot be resolved after taking the measures stated above, please contact the manufacturer or the Siemens Service Center.

10.1.1 Replacing the motor bearings

Motor bearings are wearing parts. They must be replaced after a defined number of operating hours.

At medium loads, the motor bearings last approx. 25000 h.

The procedure for replacing the motor bearing depends on the size of the motor.

For 1FK2□03 ... 1FK2□05 motors, it is not possible to replace the motor bearings. Replace these motors in their entirety.

Replacement of the motor bearings is only intended as from 1FK2□06.

Especially favorable ambient conditions, such as low average speed, low radial force (transverse force) and vibration load can prolong the interval until motor replacement.

Note

Premature bearing and motor replacement

Harsh operating conditions, e.g. continuous operation at n_{max}, high vibration/shock loads, frequent reversing duty reduce the bearing or motor replacement interval by up to 50 %.

10.1.2 Replacing the motor

Requirement

The new motor has the same article number as the motor to be replaced.

Note

A motor with a singleturn encoder AS22DQC (1FK2□□□_□□□□□-□S□□) can be replaced by an otherwise identical motor with a multiturn encoder AM22DQC (1FK2□□□_□□□□□-□M□□) without having to recommission the drive system.

- Replace the motor following steps 1 to 3 as explained below.

Replacing a motor with a motor with another article number

If the converter has already been operated with a motor, and you wish to replace this motor by another motor with a different article number, then after replacing the motor, you must commission the converter again.

Procedure

1. Verify absence of operating voltage to the converter.

⚠ WARNING

Danger to life due to unintentional starting of the drive unit

Unintentional starting of the drive unit can cause death or severe injury.

- Make sure that the drive unit cannot be started accidentally.
- Post a warning notice to this effect at the point where the switch is located.

2. Replace the motor.

⚠ CAUTION

Burns as a result of touching hot surfaces

In operation, the motor enclosure can reach high temperatures, which can cause burns if touched.

- Do not touch any hot surfaces.
- Allow the motor to cool down before starting any work.
- Use the appropriate personnel protection equipment, e.g. gloves.

   – Release the motor connector. You can find detailed information in the section "Notes for connecting the round connector at the motor (Page 156)".

   – Release the motor mounting screws.

   – Remove the motor.

   – Mount and install the new motor. You can find detailed information in the section "Installing the motor (Page 148)".

3. Switch the converter on.

If you are using a different motor type, then you must also carry out the following steps:

1. Start the web server and log in as administrator.
   You can find additional information in section "Login/logout (Page 192)".
2. Reset the converter to the factory settings.
   You can find additional information in section "Reset converter/password - restore the state when originally delivered (Page 331)".
   If message A1007 is displayed in the web server, then you must update the DRIVE-CLiQ components.
   Switch the converter off and on again.
3. Commission the converter. You can find additional information in the following sections:

   – "Commissioning using the web server (Page 201)"

   – "Series commissioning (Page 313)"

4. Save the settings in a non-volatile fashion using .

You have replaced the motor.

10.2 Service and maintenance for the converter

10.2.1 Converter firmware update

You have the option of upgrading your converter (upgrade) to a newer firmware version. You can also install an older firmware version (downgrade) to always provide the same machine configurations.

For an upgrade, the settings previously made are kept.

For a downgrade, the converter is reset to the factory settings.

NOTICE
Malfunctions due to interruption of the power supply or disconnecting the motor when updating the firmware If the firmware is being updated, interrupting the power supply or disconnecting the motor, can result in defects or cause the devices to malfunction. • Observe the information provided about the LEDs.

The following options are available for a firmware update:

- **TIA Portal**
  If you want to upgrade the firmware of the converter, you can perform the firmware update directly from your TIA Portal project (see section "Updating the firmware (Page 307)").
- **Web server**
  You can find more information on updating the firmware using the web server in the section "Updating the firmware via the web server (Page 247)".
- **SD memory card**
  As an alternative to a firmware update in the TIA Portal project or in the web server, you can also perform a firmware update using an SD memory card (see section "Firmware update via memory card (Page 329)").

10.2.2 Firmware update via memory card

Overview

If you have physical access to your S210 drive, you can perform the firmware update directly on the S210 drive using a memory card.

Requirement

- You have an SD card with the appropriate firmware, e.g. 6SL3054-4FC00-2BA0.
- You have an empty SD card with a maximum capacity of 2 GB (e.g. 6SL3054-4AG00-2AA0) onto which you can load the firmware.
  You can find the available firmware versions at the following link: "Firmware versions (https://support.industry.siemens.com/cs/ww/en/view/109744577)".

Procedure

Proceed as follows to perform a firmware update using a memory card:

1. Switch off the converter.
2. Insert the SD card into the converter and switch on the converter.
   The new firmware is installed.
   This process may take up to 5 minutes and longer. The update is complete when both LEDs flash red at 1 Hz in sync with each other.

RDY	COM	Explanation of LED displays
		Firmware update is active: • Do not switch off the power supply. • Do not disconnect the motor from the converter.
		LEDs flash synchronously (1 Hz): • Converter is waiting for the power supply to be disconnected and reconnected after the firmware update.

3. Switch the converter off and remove the memory card.
4. Switch on the converter again. The firmware of the connected DRIVE-CLiQ components is updated. This may require a restart (see alarm messages in the web server).

RDY	Explanation of LED displays
	Firmware update of the connected DRIVE-CLiQ components in progress: • Do not switch off the power supply. • Do not disconnect the motor from the converter.
	Firmware update of the DRIVE-CLiQ components is complete: • Waiting for POWER ON of the respective component. **Remedy**: Switch the component off and on again.

5. Check whether the new version is installed. The firmware version of the converter is displayed on the home page of the web server under the converter.

10.2.3 Reset converter/password - restore the state when originally delivered

Note

If you have reset the converter to the factory settings, and you wish to operate it again in the machine, then you must first commission the converter.

For the following use cases, you must restore the factory settings for the converter.

- You wish to delete the complete parameterization
- You wish to connect another motor
- You have forgotten the administrator password
- You wish to restore the device to its state when originally delivered

The procedure differs depending on the particular use case.

- Proceed as follows corresponding to your particular use case.

Note

Communication settings

If you reset the converter to the factory settings, the IP address of the service interface, the PROFINET IP address and the PROFINET device name are not cleared.

Use PRONETA or the TIA Portal if you wish to clear these settings.

PRONETA (https://support.industry.siemens.com/cs/de/en/view/67460624).

Clearing the complete parameterization

- Clear the complete parameterization using the web server by restoring the converter to its factory settings.
  The appropriate information is provided in section "Restoring factory settings (Page 240)"

Connecting another motor

If you wish to replace the motor with a motor with a different article number, proceed according to the sequence of steps in the section "Replacing the motor (Page 327)".

You have forgotten the administrator password

If you have forgotten the administrator password, then you cannot restore the factory settings of the converter via the web server.

You must reset the converter with a memory card.

Procedure

1. Use a text editor to create a file with the following content: UPDATE_FORMAT_RW 0 1
   Save the file under the following name: updater.inf
   Alternatively, you can download this file from the Internet via the following link:
   Updater (https://support.industry.siemens.com/cs/ww/de/view/109755657).
2. Copy the file "updater.inf" to an empty SD card (max. 2 GB, e.g. 6SL3054-4AG00-2AA0).
3. Switch the converter off and insert the SD card into the card slot of the converter.
4. Switch the converter on.
5. Wait until the converter has run up. The RDY LED is then continuously green.
6. Switch the converter off and remove the SD card.
7. Switch the converter on. The RDY LED is then continuously green.

You have finished resetting the converter to factory settings.

You can now assign a new administrator password and recommission the converter in the web server. You can find additional information in the following sections:

- "Logging on for the first time and assigning an administrator password (Page 190)"
- "Commissioning using the web server (Page 201)"

Restoring the original settings

You can only restore the factory settings using a memory card.

For this procedure, it is not permissible that a motor is connected.

- Disconnect all of the electrical connections to the motor (encoder, power and brake cables).
- Disconnect the PROFINET connection to the control system and other devices.

The factory settings are restored in 2 steps.

1. Clear the communication settings of the converter. To do this, use the commissioning and diagnostics tool for PROFINET - PRONETA - for example..
   PRONETA (https://support.industry.siemens.com/cs/de/en/view/67460624).
2. Reset the converter to its original settings.

Carry out steps 1 and 2 as described below.

Clearing the communication settings

Procedure

1. Establish a connection with the service interface (X127).
2. Clear the converter IP address.
3. Establish a connection with the PROFINET interface (X150).
4. Clear the PROFINET communication settings.

You have now cleared all the converter communication settings.

Restoring the original settings of the converter

Procedure

1. Use a text editor to create a file with the following content: UPDATE_FORMAT_RW 0 1
   Save the file under the following name: updater.inf
   Alternatively, you can download this file from the Internet via the following link:
   Updater (https://support.industry.siemens.com/cs/ww/de/view/109755657).
2. Copy the file "updater.inf" to an empty SD card (max. 2 GB, e.g. 6SL3054-4AG00-2AA0).
3. Switch the converter off and insert the SD card into the card slot of the converter.
4. Switch the converter on.
5. Wait until the converter has run up. The RDY LED flashes green with 0.5 Hz
6. Switch the converter off and remove the SD card.

You have now reset the converter to the delivery state.

If you wish to operate the converter again in the machine, then you must first commission the converter. You can find additional information in the following sections:

- "Commissioning using the web server (Page 201)"
- "Series commissioning (Page 313)"

10.2.4 Replacing fans - only for converters with 3 AC line connection

The fan module is installed in the lower section of the converter.

Service life of the fan

The average service life of the fan is 40,000 hours. However, in practice the service life may be shorter. Especially a dusty environment can block up the fan.

The fan must be replaced in good time to ensure that the converter remains ready for operation.

You can find the article number for the replacement fan in the section "Spare parts (Page 452)".

Replacing fans

⚠ CAUTION

Injury caused by a rotating fan

Touching a fan while it is rotating can result in injury.

- Switch off the device.
- Wait until the fan is stationary before work on it.

Proceed as follows to remove the fan module:

Procedure

1. Switch off the converter power supply.
2. Remove the converter if necessary. To do so, loosen all connections at the converter.

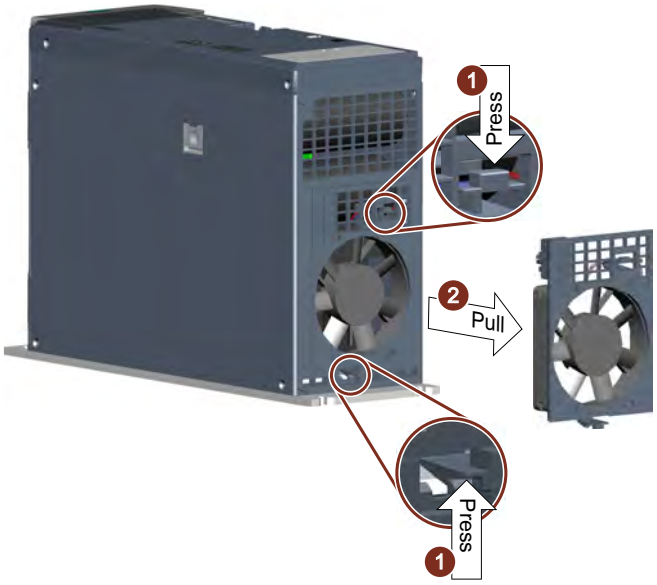
⚠ WARNING

Electric shock as a result of a residual charge in power components

After the power supply has been switched off, it takes up to 5 min. until the capacitors in the inverter have discharged so that the residual charge is at a non-hazardous level.

- Check the voltage at the converter connections before releasing the connections at the converter.

3. Remove the fan as shown in the diagram.



4. Install the new fan in the reverse order.
5. Set the operating hours counter (p0251) for the fan to 0 via the web server.
   – "Changing parameter values (Page 189)"

You have now replaced the fan.

10.2.5 Replacing the converter in a spare part scenario

When replacing converters in a spare part scenario, it is imperative that the same converter type with the same power output is used.

In order to simply replace a converter when necessary, we recommend operating the converter with an SD card, which in addition to the converter settings (parameterization), also includes the converter firmware.

In this case, you only have to replace the converter, insert the SD card and switch it on.

All of the replacement options are described in detail below.

10.2.5.1 Replacing the converter with memory card

If you operate the converter with an SD card, and the converter configuration was saved after commissioning, then the configuration data is also saved in the "User" file folder on the memory card.

Operation with SD card with firmware

How can you identify as to whether the SD card contains the firmware?

In addition to the "USER" folder, the SD card also includes other files and the "ADDON" and "SIEMENS" folders.

Procedure

1. Switch off the converter.
2. Remove the card from the converter.
3. Release all of the connections at the converter, replace the converter and re-establish the connections. You can find additional information in the following sections:
   - "Installing the converter (Page 151)"
   - "Connecting the converter (Page 161)"
4. Insert the memory card into the converter.
5. Switch the converter on.
   The converter possibly upgrades/downgrades the firmware and must be switched off and switched on again.

You have now replaced the converter.

Operation with SD card without firmware

Procedure

1. You replace the converter as described above in steps 1. ... 5.
2. Case 1, the new converter has the same or a higher firmware version:
   - When it runs up, the converter takes the settings from the card, and after it has run up commissioning has been completed. For a higher firmware version, then the DQ components are updated (encoder).
   - Switch the converter off and on again.

   Case 2, the new converter has an older firmware version:
   - The converter is reset to the factory settings once it has run up. You can recognize this as the dialog screen form is displayed in the web server for the first login.
     In this case, switch off the converter without saving – and withdraw the SD card from the converter.
     Restore the firmware to the version that was on the replaced converter.

     Note

     Review the machine documentation, or check which version is installed on the other S210 converters in the machine.

     You can find additional information in section "Converter firmware update (Page 329)".
     Switch off the converter, insert the SD card with converter settings into the converter and switch the converter on again.
     When it runs up, the converter takes the settings from the card, and after it has run up commissioning has been completed.
     Save the settings in the web server in a non-volatile fashion using .

You have now replaced the converter.

10.2.5.2 Replacing the converter without memory card

Operation without SD card, data backup is not available

Basic information on working with the web server is provided in the section:

- " Fundamentals (Page 186)"

Procedure

1. Switch off the converter.
2. Release all of the connections at the converter, replace the converter and re-establish the connections.
   - "Installing the converter (Page 151)"
   - "Connecting the converter (Page 161)"
3. Switch the converter on.
4. Carry out a complete commissioning procedure
   - "Commissioning using the web server (Page 201)"

You have now replaced the converter.

Operation without SD card, data backup is available

Procedure

1. Switch off the converter.
2. Release all of the connections at the converter, replace the converter and re-establish the connections:
   - "Installing the converter (Page 151)"
   - "Connecting the converter (Page 161)"
3. Switch the converter on.
4. Assign the administrator password.
5. Log in as administrator.
6. Select "Backup and Restore" in the navigation, then "Restore parameters from file".
7. Download the data backup to the converter.
   Case 1, the new converter has the same or a higher firmware version:
   - When it runs up, the converter takes the settings from the data backup, and after it runs up, commissioning is completed.
   - For a higher firmware version, then the DQ components are updated (encoder). The converter must be switched off and switched on again.

- Case 2, the new converter has an older firmware version:
  - The converter is reset to the factory settings once it has run up.
    You can recognize this as the dialog screen form for the first log in is displayed.
    Restore the firmware to the version that was on the replaced converter.

    Note

    Review the machine documentation, or check which version is installed on the other S210 converters in the machine.

    You can find additional information in section "Converter firmware update (Page 329)".
    Download the data backup to the converter.
    When it runs up, the converter takes the settings from the data backup, and after it runs up, commissioning is completed.
    Save the settings in the web server in a non-volatile fashion via .

You have now replaced the converter.

Technical specifications

11

11.1 Technical data and properties of the motor

11.1.1 Technical features

Property	Version
Type of motor	Permanent-magnet synchronous motor
Rotor inertia	1FK21 - High Dynamic - motor with low rotor inertia 1FK22 - Compact - motor with average rotor inertia
Cooling	Natural cooling
Insulation of the stator winding according to EN 60034-1 (IEC 60034-1)	1FK2□02, 1FK2□03: Temperature class 130 (B) for a winding temperature of ΔT = 80 K at an ambient temperature of +40 °C 1FK2□04, 1FK2□05, 1FK2□06, 1FK2□08, 1FK2□10: Temperature class 155 (F) for a winding temperature of ΔT = 100 K at an ambient temperature of +40 °C
Pulse voltage insulation class according to EN 60034-18-41 (IEC 60034-18-41)	IVIC: C
Operating range	-15 to +40 °C, derating at higher temperatures
Installation altitude (according to EN 60034–1 and IEC 60034–1)	≤ 1000 m above sea level, otherwise power derating
Type of construction according to EN 60034-7 (IEC 60034-7)	IM B5 (IM V1, IM V3)
Degree of protection according to EN 60034-5 (IEC 60034-5)	IP64, optional IP65
Temperature monitoring	Thermal motor model
Paint finish	Anthracite (RAL 7016)
Shaft extension according to DIN 748-3 (IEC 60072-1)	Plain shaft, optionally with feather key and half-key balancing,
Shaft extension run-out, concentricity, and perpendicularity according to DIN 42955 (IEC 60072–1) [1)]	Tolerance N (normal)
Vibration severity grade according to EN 60034-14 (IEC 60034-14)	Grade A is maintained up to rated speed
Sound pressure level L_{pA} (1 m) according to DIN EN ISO 1680, max. tolerance + 3 dB(A)	55 dB(A)
Encoder systems, built-in with DRIVE-CLiQ interface	• AS22DQC, absolute encoder singleturn 22 bit (code letter: S) • AM22DQC, absolute encoder 22 bit + 12 bit multiturn (code letter: M)
Connection	One cable system (OCC), rotatable
Holding brake	Optional integrated holding brake

[1] Shaft extension run-out, concentricity of centering edge, and perpendicularity of the mounting flange to the axis of the shaft extension.

11.1.2 Permissible environmental conditions for the motor

Environmental conditions for transport in the transport packaging according to Class 2K3 to EN 60721-3-2, except for the "air temperature" and "condensation" environmental factors	
Climatic environmental conditions	-15 °C ... +70 °C
Highest relative humidity	< 95% at 40 °C, condensation not permissible
Mechanical environmental conditions	Shock and vibration permissible according to 3M8 to EN 60721-3-3: Single shocks (6 ms) max. 250 m/s^2
Protection against chemical substances	Protected according to Class 2C2
Biological environmental conditions	Suitable according to Class 2B2

Environmental conditions for long-term storage in the transport packaging according to Class 1K3 to EN 60721-3-1, except for the "air temperature", "highest relative humidity" and "condensation" environmental factors	
Climatic environmental conditions	-15 °C ... +55 °C
Highest relative humidity	< 60%, condensation not permissible
Mechanical environmental conditions	Vibration-free storage space, v_{rms} < 0.2 mm/s
Protection against chemical substances	Protected according to Class 1C2
Biological environmental conditions	Suitable according to Class 1B2
Duration	• Six months for the above-mentioned conditions. • Special preservation measures are required for storage periods of 6 months up to a maximum of two years. You can find additional information in section "Calling Support information (Page 197)".

Ambient conditions during operation according to 3K4 to EN 60721-3-3, except for the "low air temperature", "condensation" and "low air pressure" environmental factors	
Installation altitude	Up to 1000 m above sea level without limitations You can find additional information in section "Derating factors (Page 344)".
Climatic environmental conditions[1]	• Temperature range: -15 °C[1] ... +40 °C • Relative humidity: 5 ... 95%, condensation not permitted • Absolute air humidity: 1 ...29 g/m³ • Rate of temperature change[2]: 0.5°/min • Atmospheric pressure: 89[1, 3] ... 106 kPa[4] • Solar radiation: 700 W/m² [2] • Movement of the air: 1.0 m/s • Water (other than rain): See protection class
Mechanical environmental conditions	• Vibration levels permissible according to Class 3M8 to EN 60721-3-3: Max. 50 m/s² • Shock permissible according to Class 3M8 to EN 60721-3-3
Protection against chemical substances	Protected according to 3C2 to EN 60721-3-3
Biological environmental conditions	Suitable according to 3B2 to EN 60721-3-3
Pollution	Suitable for environments with degree of pollution 2 according to EN 61800-5-1
Cooling air	Clean and dry air
The motors are not suitable for operation • In a vacuum[5] • In salt-laden or aggressive atmospheres • Outdoors	

1) Increased ruggedness with regard to low air temperature and low atmospheric pressure better than 3K3 according to EN 60721-3-3

2) Averaged over a period of 5 min

3) The limit value of 89 kPa covers applications at altitudes up to 1000 m.

4) Conditions in mines are not considered.

5) Operation in a vacuum is not permissible because of the low dielectric strength and poor heat dissipation.

11.1.3 Cooling

The 1FK2 is a non-ventilated motor.

To ensure sufficient heat dissipation when installed, the motor requires a minimum clearance of 100 mm from adjacent components on three sides.

- Maintain theses clearances irrespective of the following mounting variants.

Non-thermally insulated mounting

Some of the motor power loss is dissipated through the flange when the motor is connected to the mounting surface.

- Observe the following mounting conditions for the specified motor data:

Shaft height	Steel plate, width x height x thickness (in mm)
1FK2□02	200 x 200 x 6
1FK2□03	250 x 250 x 6
1FK2□04	
1FK2□05	300 x 300 x 12
1FK2□06	450 x 370 x 30
1FK2□08	
1FK2□10	

The data in the table refers to an ambient temperature of 40 °C and an installation altitude up to 1000 m above sea level.

If the environmental conditions are different, derating may be required. You can find information on this in the section "Derating factors (Page 344)".

For larger mounting surfaces, the heat dissipation conditions improve.

Thermally insulated mounting without additional mounted components

The subsequent description is only applicable for motors, frame sizes 1FK2□02 ... 1FK2□04.

For naturally cooled motors, you must reduce the S1/characteristic as follows:
Reduce the motor static torque by 20 % to 30 %.

Reduce the torque at 3000 rpm by 40 % to 50 %.

Thermal motor protection

The converter monitors the motor temperature based on a thermal motor model and issues the alarm "Motor overtemperature" before the maximum temperature is reached. If the motor exceeds the maximum temperature, the converter switches off the motor with the error message "Motor overtemperature".

If the ambient temperature exceeds 40 °C, you need to set the ambient temperature at the converter so that the motor is reliably protected.

- To do this, select parameter p0613 at the converter.

Parameter r0034 indicates the thermal load of the motor as a percentage. The reading is influenced by the ambient temperature selected in parameter p0613.

You can find additional information in the parameter lists "Parameters (Page 465)".

11.1.4 Derating factors

The specified characteristics of the motor refer to an ambient temperature of 40 °C and an installation altitude of 1000 m above sea level.

With ambient temperatures > 40 °C or installation altitudes > 1000 m above sea level, you need to reduce the permissible S1 characteristic regarding speed and torque.

Table 11-1 Derating as a function of the installation altitude and ambient temperature

Installation altitude above sea level in m	Ambient temperature in ° C			
	30	40	45	50
1000	1.08	1.00	0.96	0.91
2000	1.02	0.93	0.89	0.84

Calculate the derating value for ambient temperatures that are not shown here and installation altitudes below the maximum values by interpolating. For example: 40 °C at 1500 m above sea level = derating factor 0.975

Calculate the reduced S1 characteristic according to the following formula

$S1_{red}(n) = x_d \bullet S1_{40°C;\ 1000m}(n / x_D)$

$S1_{red}$ = Reduced S1 characteristic for the required installation altitude and ambient temperature

$S1_{40°C;\ 1000\ m}$ = S1 characteristic for 40 °C ambient temperature and 1000 m installation altitude

n Motor speed in rpm

x_D Derating factor from the table "Derating as a function of the installation altitude and ambient temperature"

11.1.5 Degree of protection

IP = International Protection
1st digit = protection against the ingress of foreign bodies
2nd digit = protection against water

DIN 60034-5 is valid for water as potentially occurring medium, not for oil or other creeping fluids.

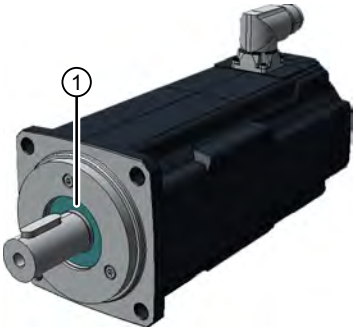
Configure the motor in the required degree of protection.

Degrees of protection available for the 1FK2

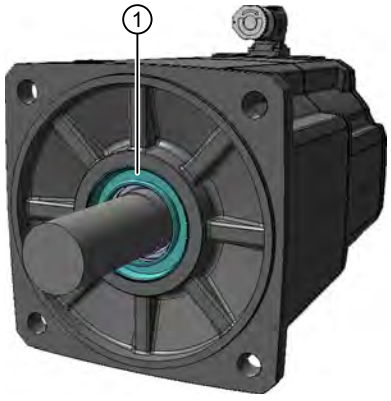
1FK2 motors are available with IP64 or IP65 degree of protection.

The degree of protection is specified on the rating plate.

The motors with IP65 degree of protection have a radial shaft seal.



1FK2☐02 ... 1FK2☐04



1FK2☐05 ... 1FK2☐10

① radial shaft seal ring

For 1FK2☐02, 1FK2☐03 and 1FK2☐04, the radial shaft sealing ring shortens the shaft extension that can be used.

Note

It is permissible that the radial shaft sealing ring runs dry.

With degree of protection IP65, it is not permissible for liquid to collect in the flange.

The service life of the radial shaft sealing ring is approximately 25000 operating hours.

You can find additional information in section "Shaft extension (Page 347)".

11.1.6 Balancing

The motors are balanced according to EN 60034-14.

Motors with featherkey in the shaft are half-key balanced.

A mass equalization for the protruding half key must be taken into account for the output elements.

11.1.7 Vibration response

Vibration severity grade

The vibration response of the system at the location of use is influenced by output elements, any built-on parts, the alignment, the installation, and external vibrations. This can change the vibration values of the motor.

The motors conform to vibration severity grade A according to EN 60034-14 (IEC 60034-14).

The specified values refer only to the motor. The installation-dependent system vibration behavior can increase these values at the motor.

The vibration severity grade is maintained up to the rated speed (n_N).

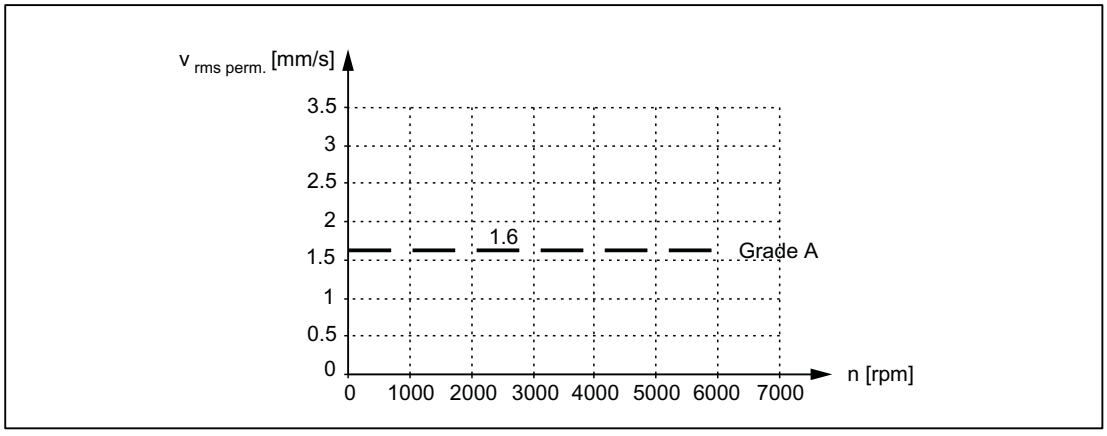


Figure 11-1 Vibration severity levels

11.1.8 Permissible vibration in operation

Permissible vibration in operation

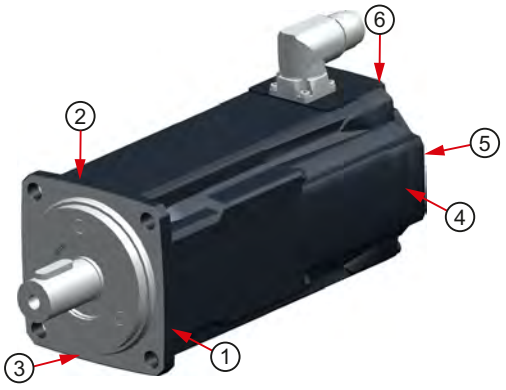
In order to guarantee the proper function of the motor and not to impair the lifetime of the bearing, the following vibration values must be observed during operation.

- Vibration velocity[1] V_{rms} according to ISO 10816 Max. 4.5 mm/s
- Vibration acceleration a_{peak} axial[2] 50 m/s²
- Vibration acceleration a_{peak} radial[2] 50 m/s²

[1] To assess the vibration velocity, the measuring equipment must fulfill the requirements of ISO 2954.

[2] The vibration acceleration is evaluated in the frequency range of 10 Hz to 2000 Hz. The maximum peak in the measurement time range is considered.

Select the measuring points according to ISO 10816-1 section 3.2. The vibration values must not exceed the specified limits at any measuring point.



Measuring points for vibration values

1 End shield DE radial
2 End shield DE radial
3 End shield DE axial
4 End shield NDE radial
5 End shield NDE axial
6 End shield NDE radial

11.1.9 Shaft extension

The motors are supplied with cylindrical shaft extensions. The shaft extension usually has a centering thread according to DIN 332, form DR.

Optionally, a shaft extension with keyway and fitted key is available.

With motors 1FK2□02 ... 1FK2□04 the useable shaft extension is reduced by the radial shaft sealing ring with the IP65 degree of protection.

Motor	Shaft dimensions Diameter x length in mm	Shaft dimensions with IP65 Diameter x length in mm	Feather key Width x height x length in mm	Centering thread
1FK2❑02	8 (h6) × 25	8 (h6) × 18	2 × 2 × 10	M3
1FK2❑03	14 (h6) × 30	14 (h6) × 21.5	5 × 5 × 16	M5
	11 (k6) × 23 [1]	-	-	M4

Motor	Shaft dimensions Diameter x length in mm	Shaft dimensions with IP65 Diameter x length in mm	Feather key Width x height x length in mm	Centering thread
1FK2❑04	19 (k6) × 40	19 (k6) × 32	6 × 6 × 22	M6
	14 (k6) x 30	-	-	M5
1FK2❑05	19 (k6) × 40		6 × 6 × 32	M6
1FK2❑06	24 (k6) × 50		8 × 7 × 40	M8
1FK2❑08	32 (k6) × 58		10 × 8 × 45	M12
1FK2☐10	38 (k6) × 80		10 × 8 × 70	M12

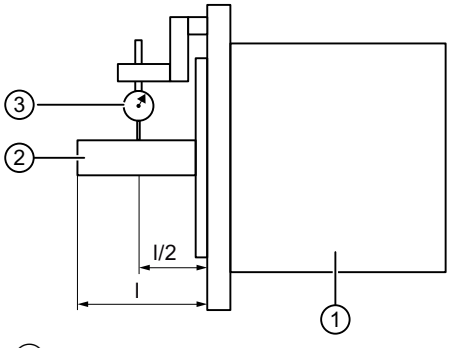
[1)] The optional 11 mm x 23 mm shaft extension is only available without a keyway and without a shaft sealing ring (IP65).

11.1.10 Radial eccentricity, concentricity and axial eccentricity

The shaft and flange accuracies for the 1FK2 motors are implemented to DIN 42955 (IEC 60072-1) as standard (Normal class).

Table 11-2 Radial eccentricity tolerance of the shaft to the frame axis (referred to cylindrical shaft ends)

Motor	Standard (Normal class)
1FK2☐02	0.03 mm
1FK2☐03	0.035 mm
1FK2☐04 1FK2☐05 1FK2☐06	0.04 mm
1FK2☐08 1FK2☐10	0.05 mm

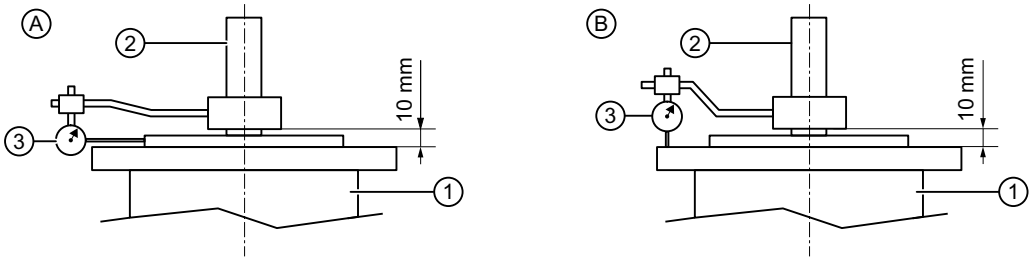


① Motor
② Motor shaft
③ Dial gauge

Figure 11-2 Checking the radial eccentricity

Table 11-3 Concentricity and axial eccentricity tolerance of the flange surface to the shaft axis (referred to the centering diameter of the mounting flange)

Motor	Standard (Normal class)
1FK2□02 1FK2□03 1FK2□04 1FK2□05	0.08 mm
1FK2□06 1FK2□08 1FK2□10	0.1 mm



A Check for concentricity
B Check for axial eccentricity
① Motor
② Motor shaft
③ Dial gauge

Figure 11-3 Checking the concentricity and axial eccentricity

11.1.11 Axial and radial forces

Permissible axial forces

Type	Axial force, dynamic [1] $F_{A\,dyn}$ / N	Axial force, static [1] $F_{A\,stat}$ / N
1FK2□02	20	30
1FK2□03	40	75
1FK2□04	60	100
1FK2105	75	120
1FK2106	125	200
1FK2205	75	120
1FK2206	125	200
1FK2208	250	300
1FK2210	400	450

[1] The specified axial forces are determined by the spring loading and therefore also apply for motors with holding brake.

Note

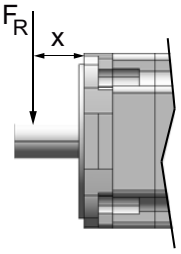
Applications with an angular toothed pinion directly on the motor are not permitted with standard bearings because the permissible axial forces are exceeded.

Permissible radial forces

As a result of the bearing arrangement, 1FK2 is designed for aligned forces. Forces such as these occur for belt drives, for example.

All radial forces always refer to aligned forces.

NOTICE
Motor damage caused by circulating forces Circulating forces can cause bearing motion, and therefore damage the motor. • Circulating forces are not permissible.



F_R Point of application of the radial force

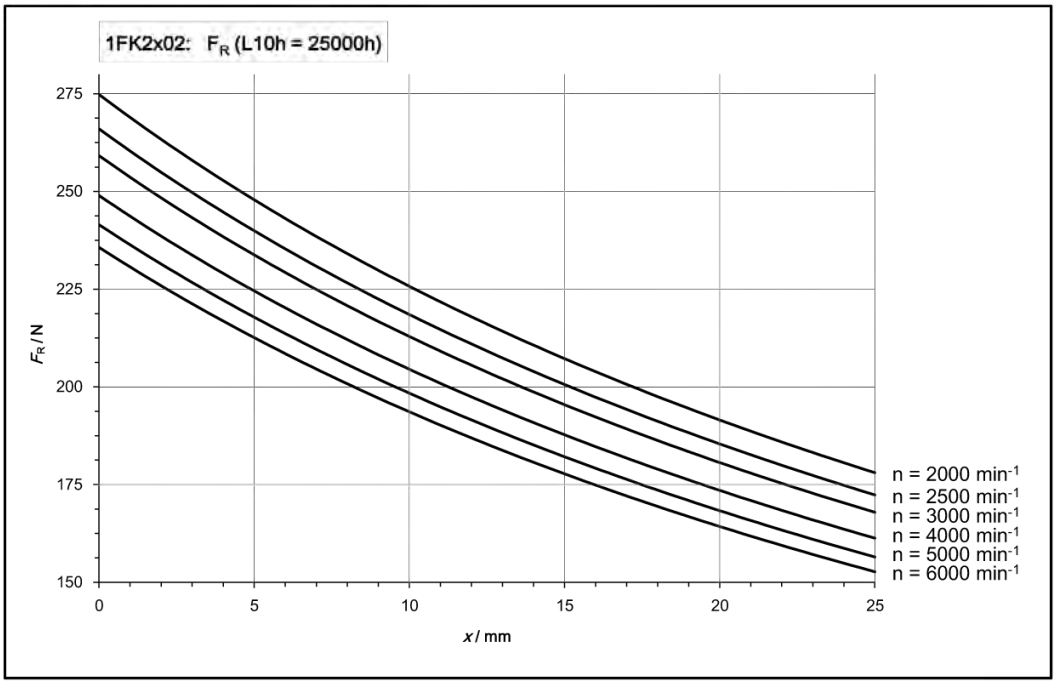
x Distance between where the radial force is applied and the shaft shoulder in mm

Figure 11-4 Force application point at the DE (A side)

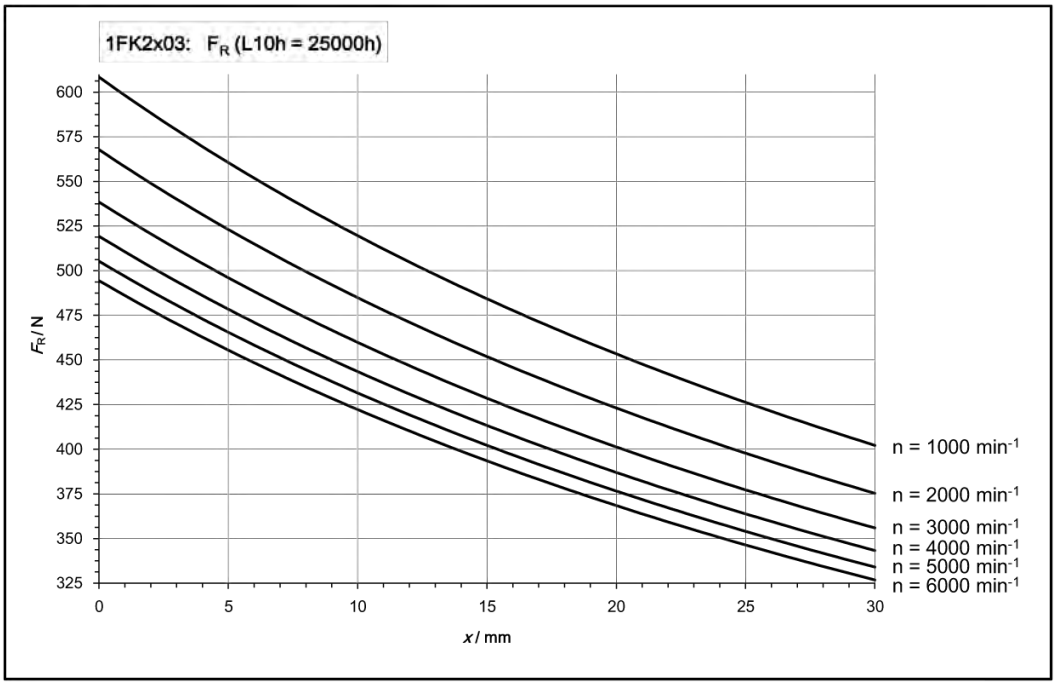
Point of application of radial forces F_R at the shaft extension

The following diagrams indicate the maximum permissible radial force for the corresponding motor frame size. It depends on the force application point and the average speed for a nominal bearing service life (L10h) of 25000 h.

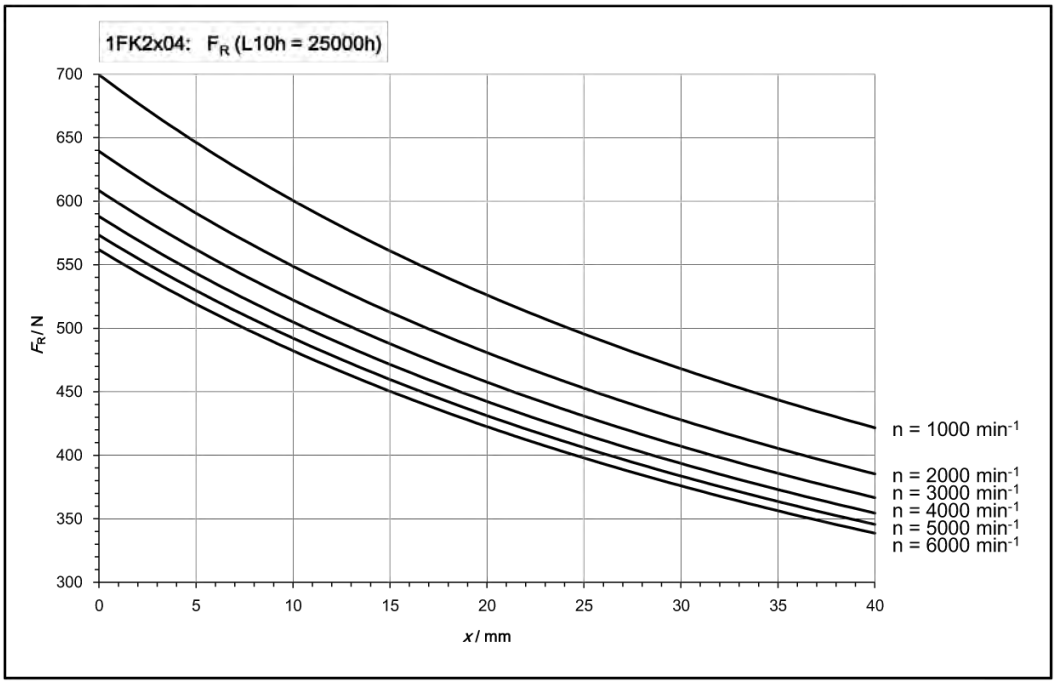
Radial force diagram 1FK2x02



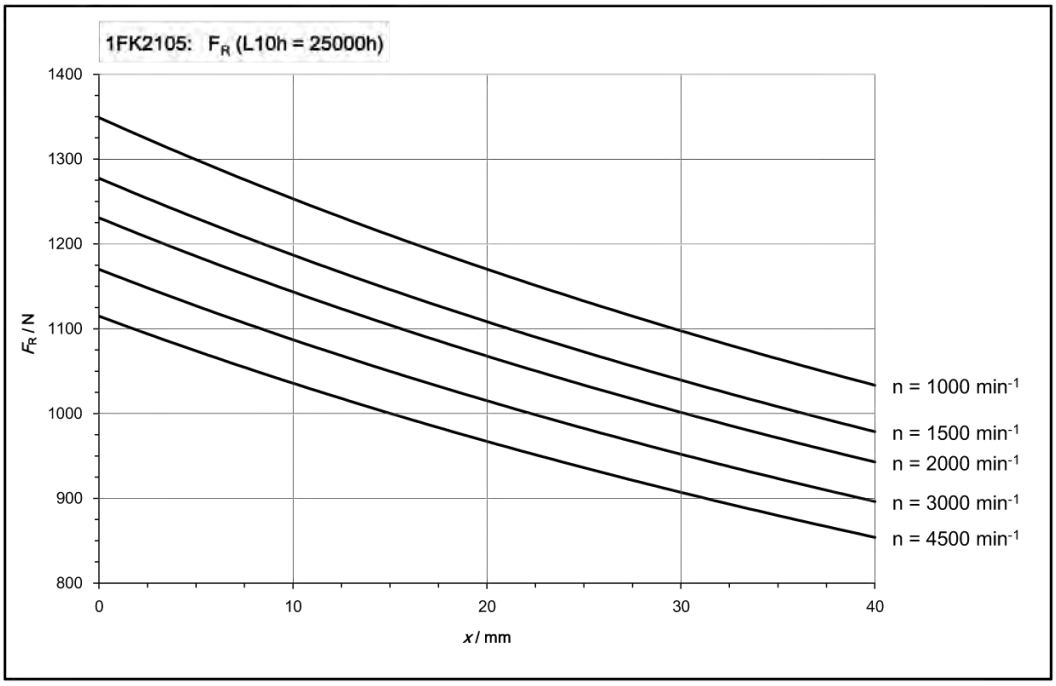
Radial force diagram 1FK2x03



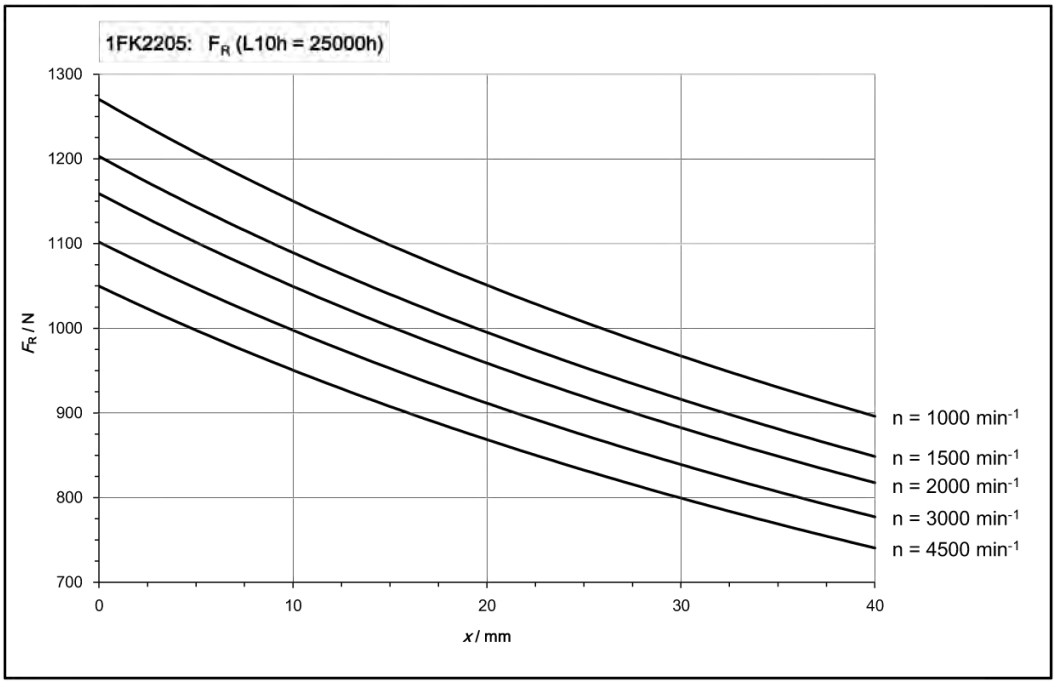
Radial force diagram 1FK2x04



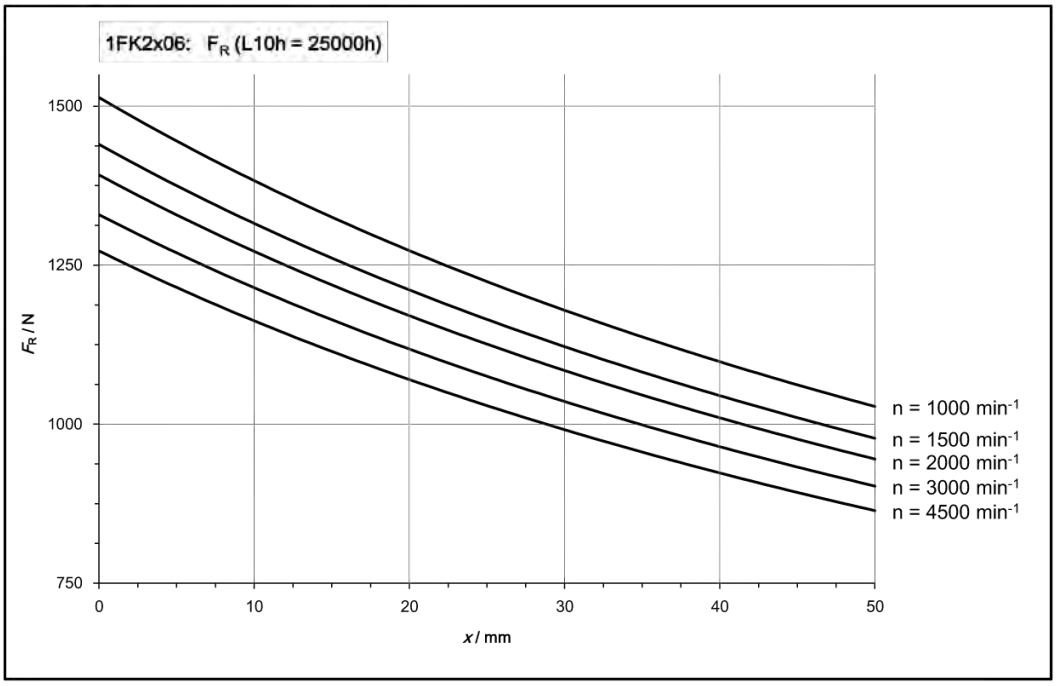
Radial force diagram 1FK2105



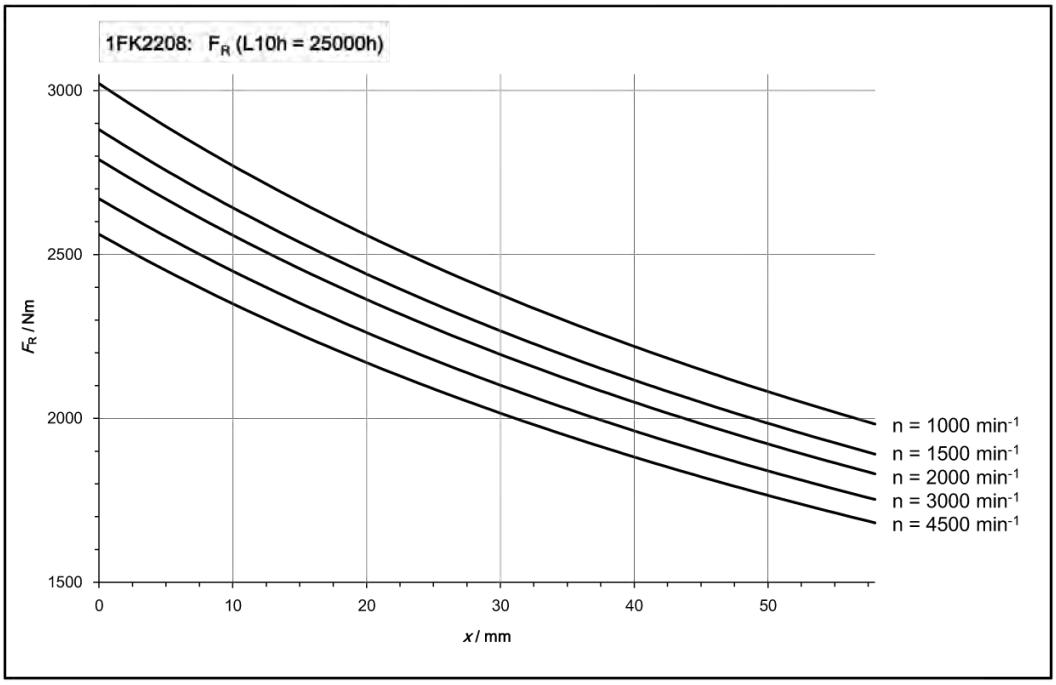
Radial force diagram 1FK2205



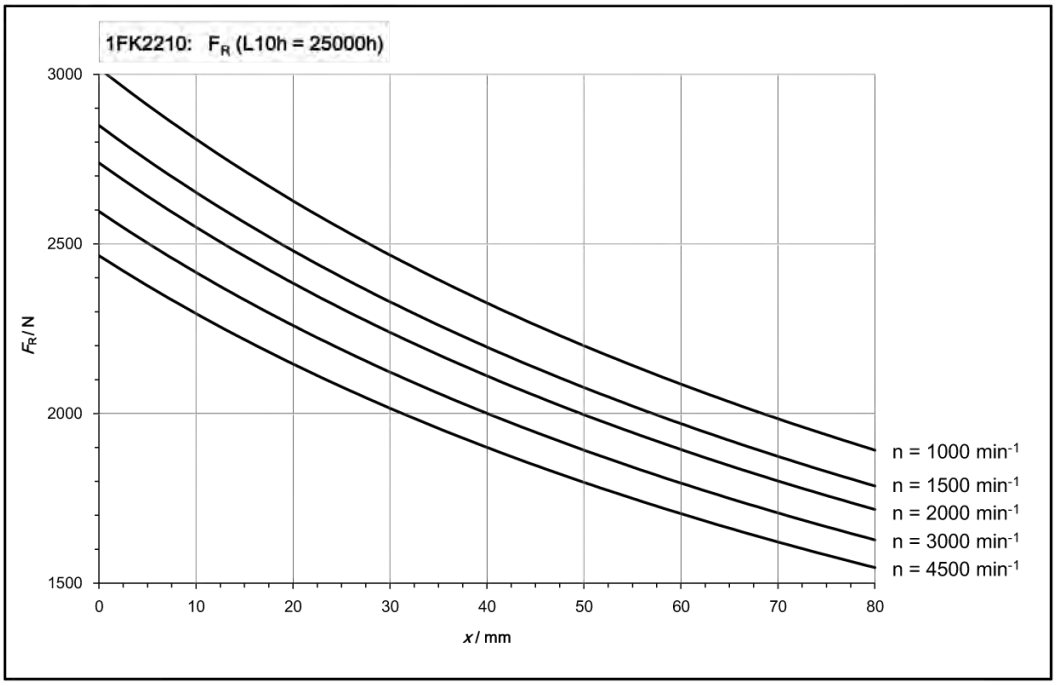
Radial force diagram 1FK2x06



Radial force diagram 1FK2208



Radial force diagram 1FK2210



11.1.12 Available encoders

	Encoders that can be ordered for the 1FK2:	
	Absolute encoder, singleturn, 22 bit	Absolute encoder 22 bit +12 bit multiturn
Encoder designation	**AS22DQC**	**AM22DQC**
Identification in the article number	S	M
Resolution	4,194,304 = 22 bit	4,194,304 = 22 bit
Absolute position	Yes, one revolution	Yes, 4096 revolutions (12 bits)
Angular error	± 100"	± 100"

11.1.13 Brake data

The holding brake is used to clamp the motor shaft when the motor is at a standstill. The holding brake is not a working brake for braking the rotating motor. When the motor is at a standstill, the holding brake is designed for at least 5 million switching cycles.

Limited EMERGENCY STOP operation is permissible. Take into account the maximum permissible single operating energy as well as service life, total operating energy of the brake.

⚠ WARNING

Unintentional movements through inadequate braking effect

If you use the holding brake incorrectly, e.g. as an operating brake or you ignore the permissible operating energy of the brake, then the brake will be subject to excessive and impermissible wear. As a consequence, there may be no brake effect. Unintentional movements of the machine or system can result in death or serious injury.

- Observe the permissible number of operating cycles and EMERGENCY STOP properties.
- Operate the motor only in conjunction with an intact brake.
- Avoid repeated brief acceleration of the motor against a holding brake that is still closed.

The holding brakes of the 1FK2 have a torsional backlash of less than 1.5°.

Technical data of the holding brake

The following table contains technical data relating to the holding brakes for operation on a SINAMICS S210 (for 1AC devices as of hardware version 2) and as of firmware version 5.2.

Motor type	Holding torque at 120 °C	Dyn. braking torque	Maximum dyn. braking torque	Opening time	Closing time	Maximum permissible single operating energy [1]	Total operating energy (service life)	Holding current	Break-induced current typical for overexcitation time	
	M_4 / Nm	M_{1m} / Nm	M_{1max} / Nm	t / ms	t / ms	W_{max} / J	W_{Tot} / kJ	I_h / A	I_{o_n} / A	t_{oex} / ms
For spring-loaded brake										
1FK2□02	0.32	0.32	1	25	8	7.4	1.75	0.1	0.6	50
1FK2□03	1.3	1.3	3.9	40	10	62	17.5	0.15	0.8	60
1FK2□04	3.3	3.3	9	50	15	270	120	0.2	1.2	80
For permanent-magnet brake										
1FK2□05	8	5	18	35	15	570	284	0.3	1.1	120
1FK2206	13	6.5	35	70	30	1550	774	0.35		
1FK2106	16	9				1000				
1FK2□08-3	19	12	37		20	2000	1800	0.4	1.2	

Motor type	Holding torque at 120 °C	Dyn. braking torque	Maximum dyn. braking torque	Opening time	Closing time	Maximum permissible single operating energy [1]	Total operating energy (service life)	Holding current	Break-induced current typical for overexcitation time	
	M_4 / Nm	M_{1m} / Nm	M_{1max} / Nm	t / ms	t / ms	W_{max} / J	W_{Tot} / kJ	I_h / A	I_{o_n} / A	t_{oex} / ms
1FK2□08-4 1FK2□08-5	32	17	75	120	35	4800	2400	0.5	1.4	180
1FK2□10-3						6500				
1FK2□10-4 1FK2□10-5	55	26	100	130	35	8700	3800	0.5	1.5	200

[1] Maximum of three consecutive EMERGENCY STOP procedures. Maximum 25% of all EMERGENCY STOP procedures as high-energy stops with W_{max}.

Holding torque M_4

The holding torque M_4 is the highest permissible torque for the closed brake in steady-state operation without slip (holding function when motor is at standstill). The data applies for the state at operating temperature (120 °C).

Dynamic braking torque M_{1m}

The dynamic braking torque M_{1m} is the smallest mean dynamic braking torque that can occur for an EMERGENCY STOP.

Maximum dynamic braking torque M_{1max}

The maximum dynamic braking torque M_{1max} is the greatest dynamic braking torque that can occur for an EMERGENCY STOP.

Based on M_{1max}, you can assess whether mounted mechanical elements, e.g. a gearbox, can withstand the maximum possible peak torques occurring on EMERGENCY STOP.

Opening time $t_0$and closing time t_{c1}

The delay times that occur when switching the brake t_o and t_{c1} are saved in the motor and are automatically taken into consideration.
After activation of the holding brake (opening), the speed/velocity setpoint remains at "Zero" during the opening time t_o. The speed/velocity setpoint is only enabled after the opening time t_0 has elapsed.

After OFF1 or OFF3 and activation of the holding brake (closing), the drive still remains in closed-loop control with speed/velocity setpoint "Zero" during closing time t_{c1}. The pulses are only deleted after this.

Maximum permissible single operating energy W_{max}

The maximum permissible single operating energy of an individual EMERGENCY STOP operation.

After an EMERGENCY STOP with the maximum single operating energy, allow a cooling time of at least 3 minutes before you operate the motor again.

Total operating energy (service life) W_{total}

The total operating energy is the sum of the single operating energy (operating energy for each EMERGENCY STOP procedure). If you exceed the total operating energy, problem-free functioning of the brake can no longer be guaranteed.

- Refurbish the motor.

Holding current I_h

The holding current I_h keeps the holding brake open. The holding current I_h continues to load the 24-V power supply of the converter after time t_{oex} until the brake is released.

Break-induced current, typical I_o for overexcitation time t_{oex}

After activation of the holding brake (opening), the break-induced current I_0 places a load on the 24 V power supply of the converter for the specified overexcitation time t_{oex}. This break-induced current applies to a brake temperature of approx. 20 °C.
At a brake temperature of -15 °C, the break-induced current can increase by up to 30%.

Formula to calculate the operating energy per braking operation

$$W_{BR} = (J_{Mot\ Br} + J_{load}) \bullet n_{mot}^2 / 182.4$$

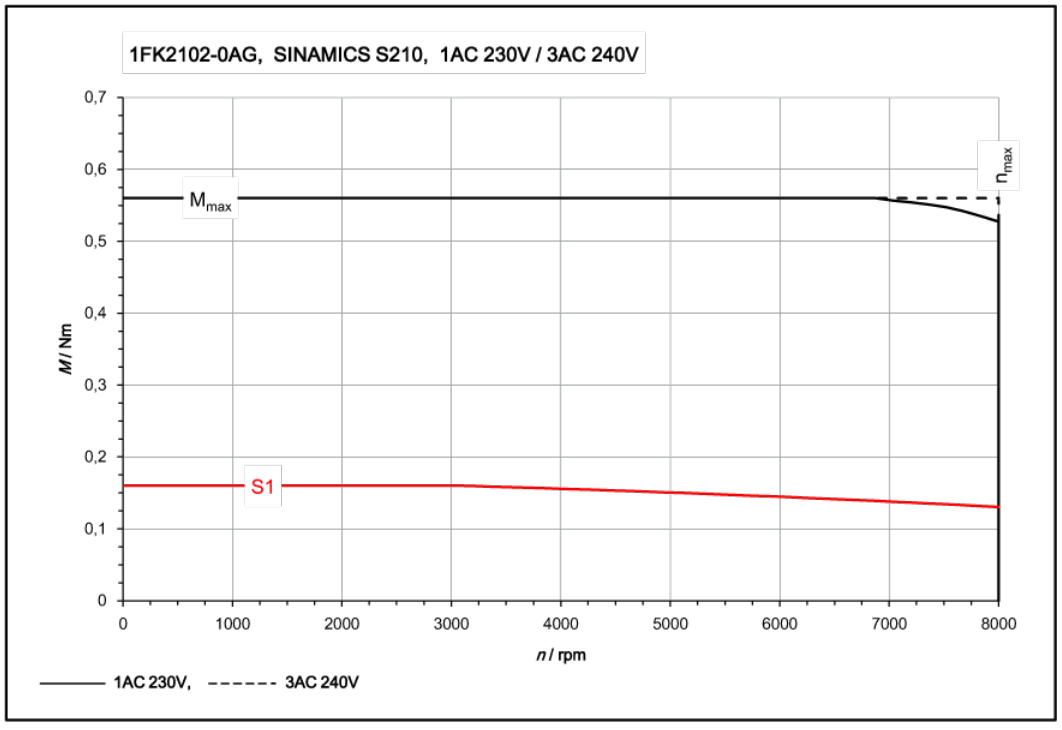
W_{Br} / J	Operating energy per braking operation
n_{Mot} / rpm	Speed at which the brake is engaged
$J_{Mot\ Br}$ / kgm²	Rotor moment of inertia of the motor with brake You can find this information in the sections: • "Technical data and characteristics of the 1FK2 connected to 1AC 230 V, 3AC 240 V (Page 358)" • "Technical data and characteristics of the 1FK2 connected to 3AC 400 V, 3AC 480 V (Page 383)"
J_{load} / kgm²	Load moment of inertia of the mounting part on the motor with brake (kgm²)
182.4	Constant for calculating the circular frequency and SI units

11.1.14 Technical data and characteristics of the 1FK2 connected to 1AC 230 V, 3AC 240 V

11.1.14.1 1FK2102-0AG connected to 1 AC 230 V / 3 AC 240 V

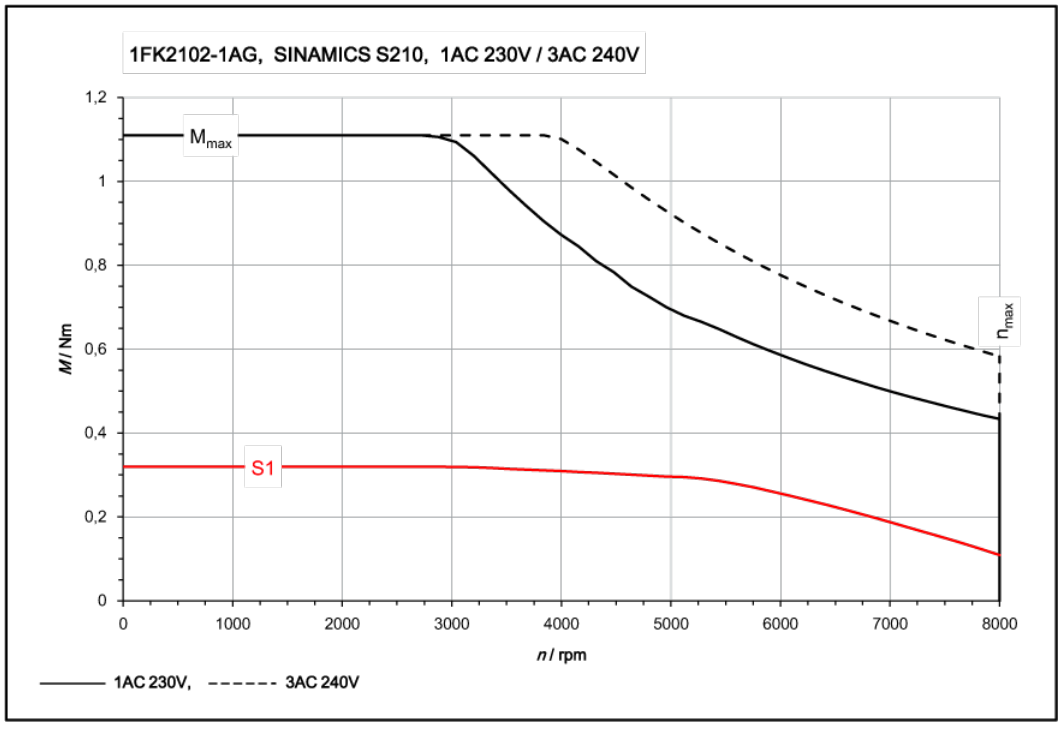
1FK2102-0AG	For 1 AC 230 V, 3 AC 240 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	0.16
Stall current	I_0	A	0.75
Maximum permissible speed	n_{max}	rpm	8000

1FK2102-0AG	**For 1 AC 230 V, 3 AC 240 V**		
Maximum torque	M_{max}	Nm	0.56
Maximum current	I_{max}	A	3.1
Thermal time constant	T_{th}	min	14
Moment of inertia	J_{mot}	$kgcm^2$	0.0245
Moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	0.0285
Weight	m_{mot}	kg	0.47
Weight (with brake)	$m_{mot\ br}$	kg	0.73
Rated data for S210 connected to 1 AC 230 V, 3 AC 240 V			
Rated speed	n_{rated}	rpm	3000
Rated torque	M_{rated}	Nm	0.16
Rated current	I_{rated}	A	0.75
Rated power	P_{rated}	kW	0.05



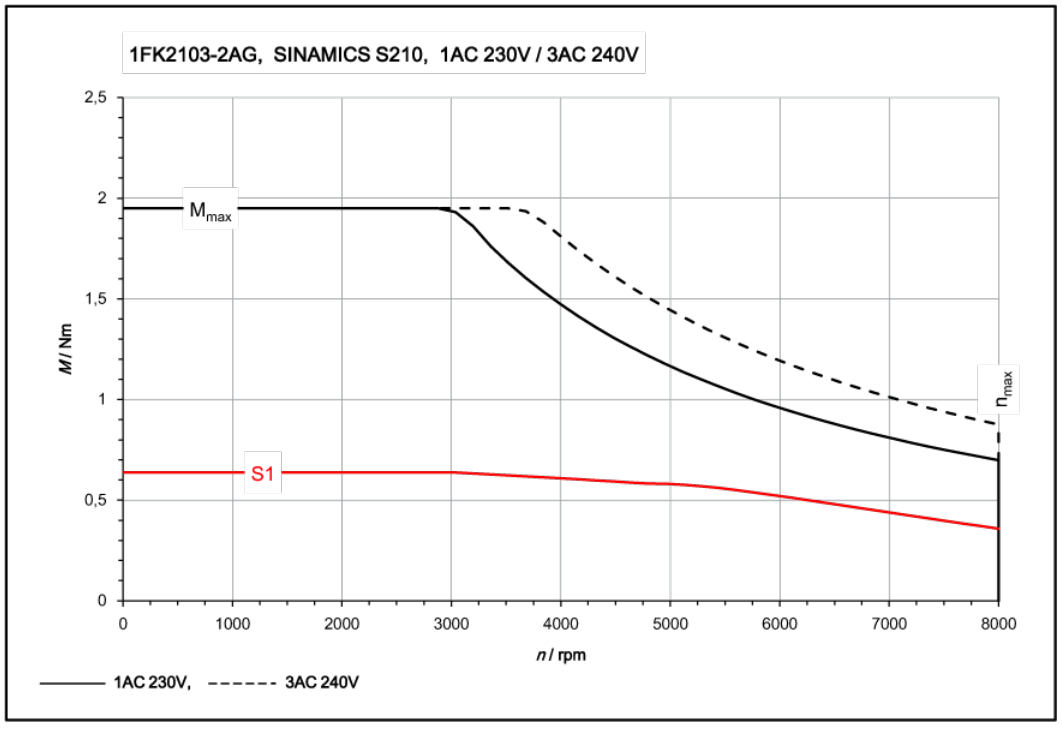
11.1.14.2 1FK2102-1AG connected to 1 AC 230 V / 3 AC 240 V

1FK2102-1AG	For 1 AC 230 V, 3 AC 240 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	0.32
Stall current	I_0	A	0.76
Maximum permissible speed	n_{max}	rpm	8000
Maximum torque	M_{max}	Nm	1.11
Maximum current	I_{max}	A	2.95
Thermal time constant	T_{th}	min	16
Moment of inertia	J_{mot}	$kgcm^2$	0.036
Moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	0.04
Weight	m_{mot}	kg	0.6
Weight (with brake)	$m_{mot\ br}$	kg	0.86
Rated data for S210 connected to 1 AC 230 V, 3 AC 240 V			
Rated speed	n_{rated}	rpm	3000
Rated torque	M_{rated}	Nm	0.32
Rated current	I_{rated}	A	0.76
Rated power	P_{rated}	kW	0.1



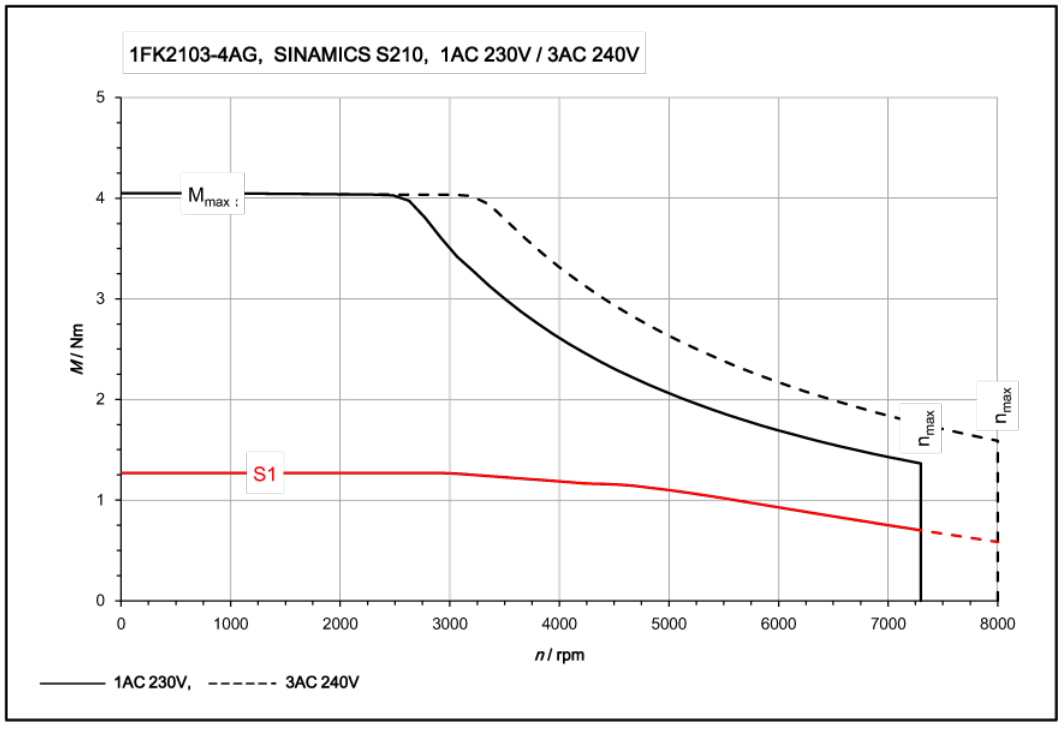
11.1.14.3 1FK2103-2AG connected to 1 AC 230 V / 3 AC 240 V

1FK2103-2AG	For 1 AC 230 V, 3 AC 240 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	0.64
Stall current	I_0	A	1.36
Maximum permissible speed	$n_{max\ mech}$	rpm	8000
Maximum torque	M_{max}	Nm	1.95
Maximum current	I_{max}	A	4.8
Thermal time constant	T_{th}	min	17
Moment of inertia	J_{mot}	$kgcm^2$	0.093
Moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	0.112
Weight	m_{mot}	kg	1.16
Weight (with brake)	$m_{mot\ br}$	kg	1.66
Rated data for S210 connected to 1 AC 230 V, 3 AC 240 V			
Rated speed	n_{rated}	rpm	3000
Rated torque	M_{rated}	Nm	0.64
Rated current	I_{rated}	A	1.36
Rated power	P_{rated}	kW	0.2



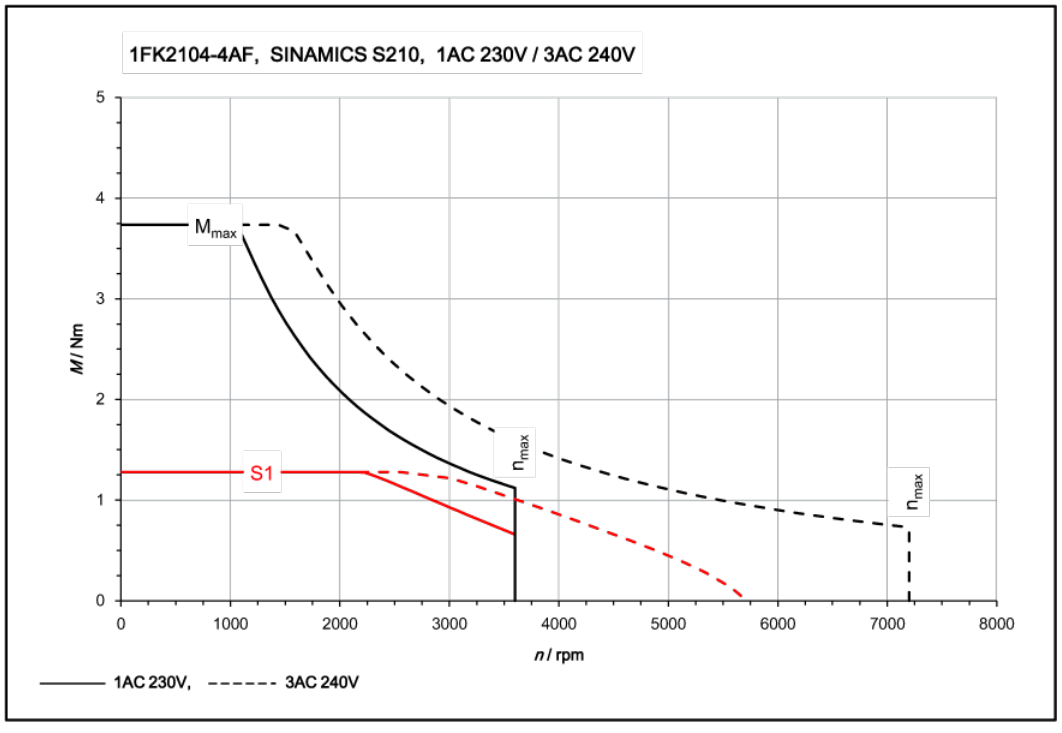
11.1.14.4 1FK2103-4AG connected to 1 AC 230 V / 3 AC 240 V

1FK2103-4AG	For 1 AC 230 V, 3 AC 240 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	1.27
Stall current	I_0	A	2.4
Maximum permissible speed	$n_{max\ mech}$	rpm	7300
Maximum torque	M_{max}	Nm	4.05
Maximum current	I_{max}	A	8.7
Thermal time constant	T_{th}	min	21
Moment of inertia	J_{mot}	$kgcm^2$	0.139
Moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	0.158
Weight	m_{mot}	kg	1.63
Weight (with brake)	$m_{mot\ br}$	kg	2.15
Rated data for S210 connected to 1 AC 230 V, 3 AC 240 V			
Rated speed	n_{rated}	rpm	3000
Rated torque	M_{rated}	Nm	1.27
Rated current	I_{rated}	A	2.4
Rated power	P_{rated}	kW	0.4



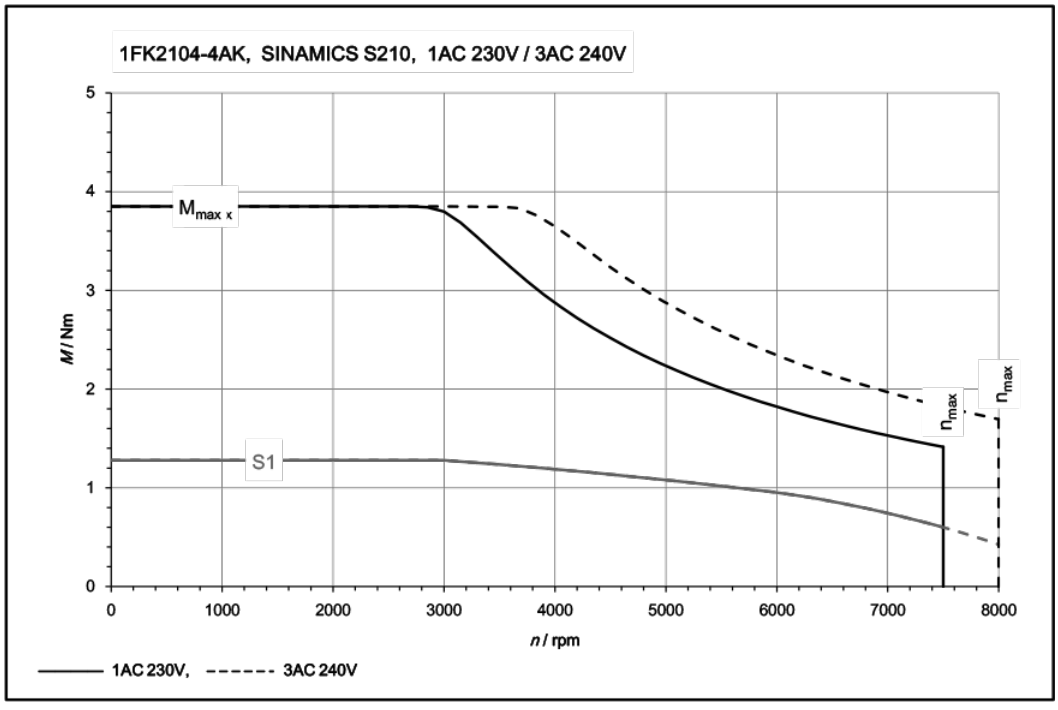
11.1.14.5 1FK2104-4AF connected to 1 AC 230 V / 3 AC 240 V

1FK2104-4AF	For 1 AC 230 V ... 3 AC 240 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	1.27
Stall current	I_0	A	1.19
Maximum permissible speed	n_{max}	rpm	7200
Maximum torque	M_{max}	Nm	3.75
Maximum current	I_{max}	A	4.2
Thermal time constant	T_{th}	min	33
Rotor moment of inertia	J_{mot}	kgcm²	0.35
Rotor moment of inertia (with brake)	$J_{mot\ br}$	kgcm²	0.43
Weight	m_{mot}	kg	2.05
Weight (with brake)	$m_{mot\ br}$	kg	2.9
Rated data for S210 connected to 1 AC 230 V, 3 AC 240 V			
Rated speed	n_{rated}	rpm	1500
Rated torque	M_{rated}	Nm	1.27
Rated current	I_{rated}	A	1.19
Rated power	P_{rated}	kW	0.2



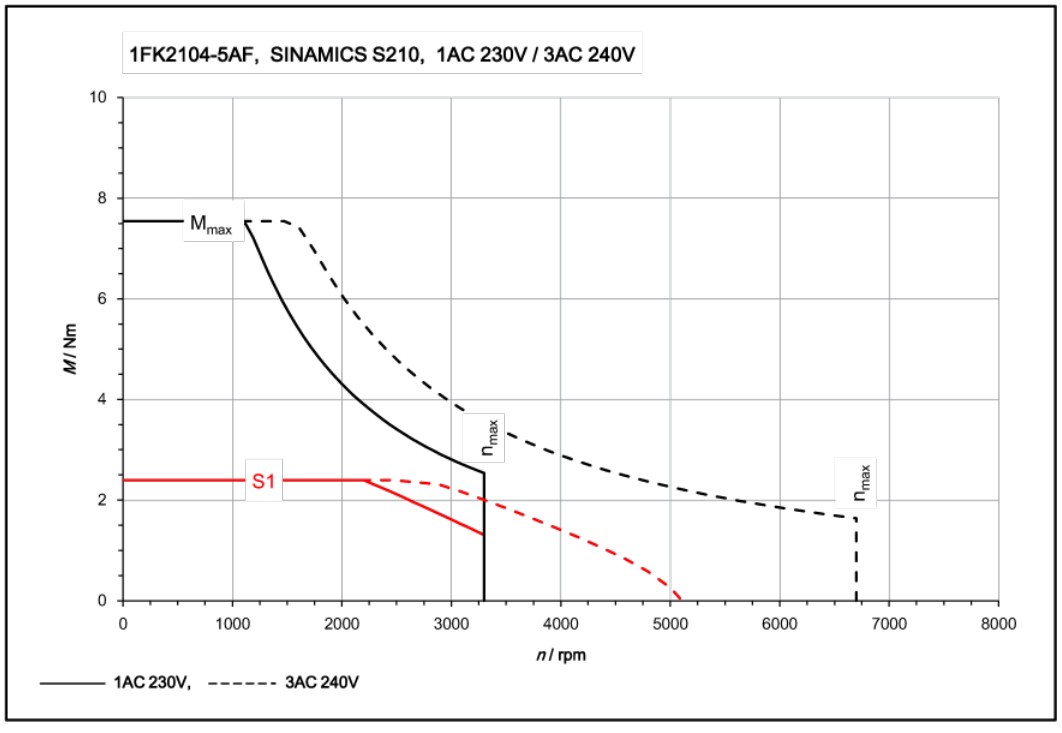
11.1.14.6 1FK2104-4AK connected to 230 V 1 AC / 240 V 3 AC

1FK2104-4AK	For 1 AC 230 V ... 3 AC 240 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	1.27
Stall current	I_0	A	2.4
Maximum permissible speed	n_{max}	rpm	8000
Maximum torque	M_{max}	Nm	3.85
Maximum current	I_{max}	A	8.7
Thermal time constant	T_{th}	rpm	33
Rotor moment of inertia	J_{mot}	$kgcm^2$	0.35
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	0.43
Weight	m_{mot}	kg	2.05
Weight (with brake)	$m_{mot\ br}$	kg	2.9
Rated data for S210 connected to 1 AC 230 V, 3 AC 240 V			
Rated speed	n_{rated}	rpm	3000
Rated torque	M_{rated}	Nm	1.27
Rated current	I_{rated}	A	2.4
Rated power	P_{rated}	kW	0.4



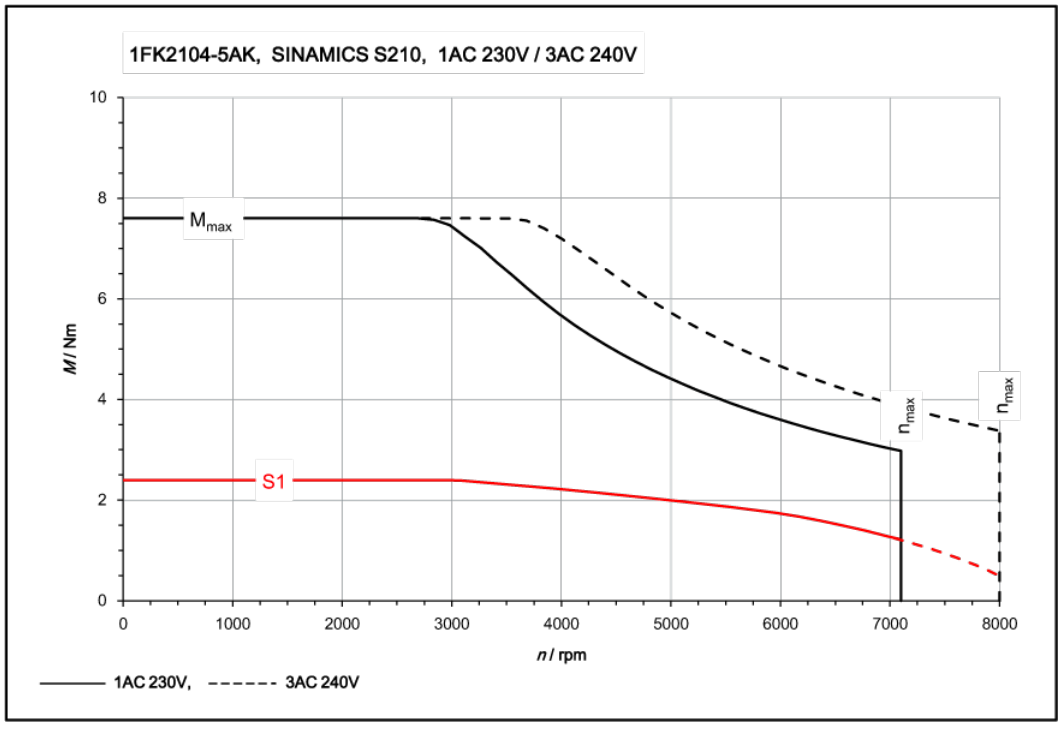
11.1.14.7 1FK2104-5AF connected to 1 AC 230 V / 3 AC 240 V

1FK2104-5AF	For 1 AC 230 V ... 3 AC 240 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	2.4
Stall current	I_0	A	2.1
Maximum permissible speed	n_{max}	rpm	6700
Maximum torque	M_{max}	Nm	7.5
Maximum current	I_{max}	A	7.6
Thermal time constant	T_{th}	min	35
Rotor moment of inertia	J_{mot}	kgcm²	0.56
Rotor moment of inertia (with brake)	$J_{mot\ br}$	kgcm²	0.65
Weight	m_{mot}	kg	2.85
Weight (with brake)	$m_{mot\ br}$	kg	3.7
Rated data for S210 connected to 1 AC 230 V, 3 AC 240 V			
Rated speed	n_{rated}	rpm	1500
Rated torque	M_{rated}	Nm	2.4
Rated current	I_{rated}	A	2.1
Rated power	P_{rated}	kW	0.375



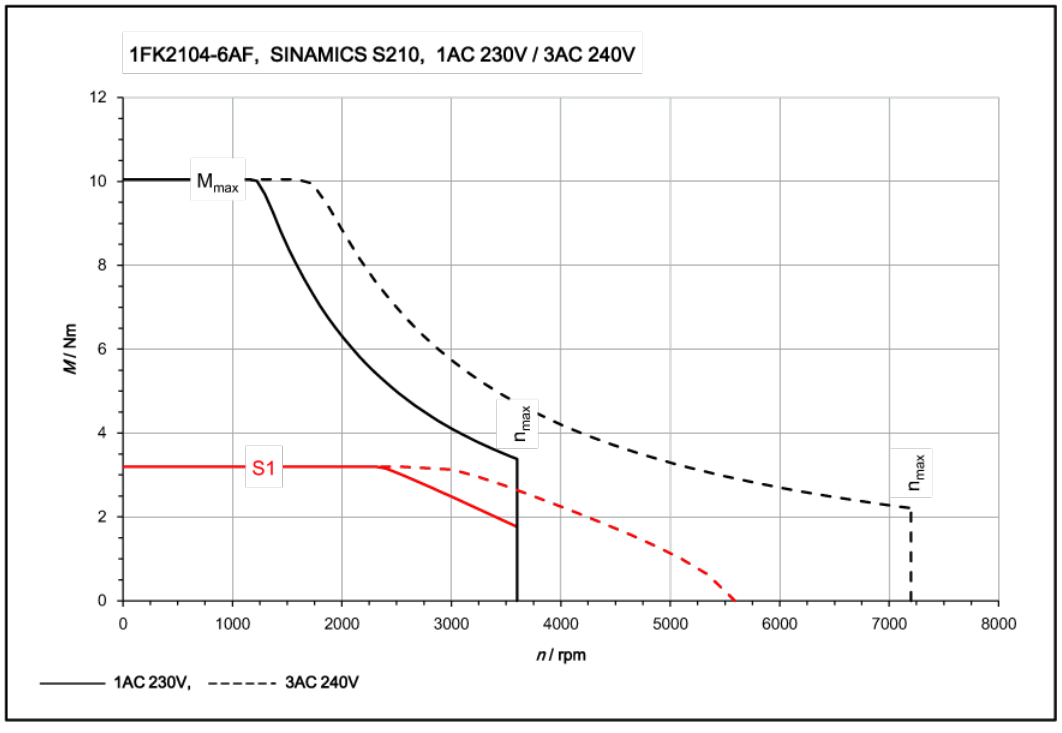
11.1.14.8 1FK2104-5AK connected to 1 AC 230 V / 3 AC 240 V

1FK2104-5AK	For 1 AC 230 V ... 3 AC 240 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	2.4
Stall current	I_0	A	4.4
Maximum permissible speed	n_{max}	rpm	7100
Maximum torque	M_{max}	Nm	7.6
Maximum current	I_{max}	A	16
Thermal time constant	T_{th}	min	35
Rotor moment of inertia	J_{mot}	$kgcm^2$	0.56
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	0.65
Weight	m_{mot}	kg	2.85
Weight (with brake)	$m_{mot\ br}$	kg	3.7
Rated data for S210 connected to 1 AC 230 V, 3 AC 240 V			
Rated speed	n_{rated}	rpm	3000
Rated torque	M_{rated}	Nm	2.4
Rated current	I_{rated}	A	4.4
Rated power	P_{rated}	kW	0.75



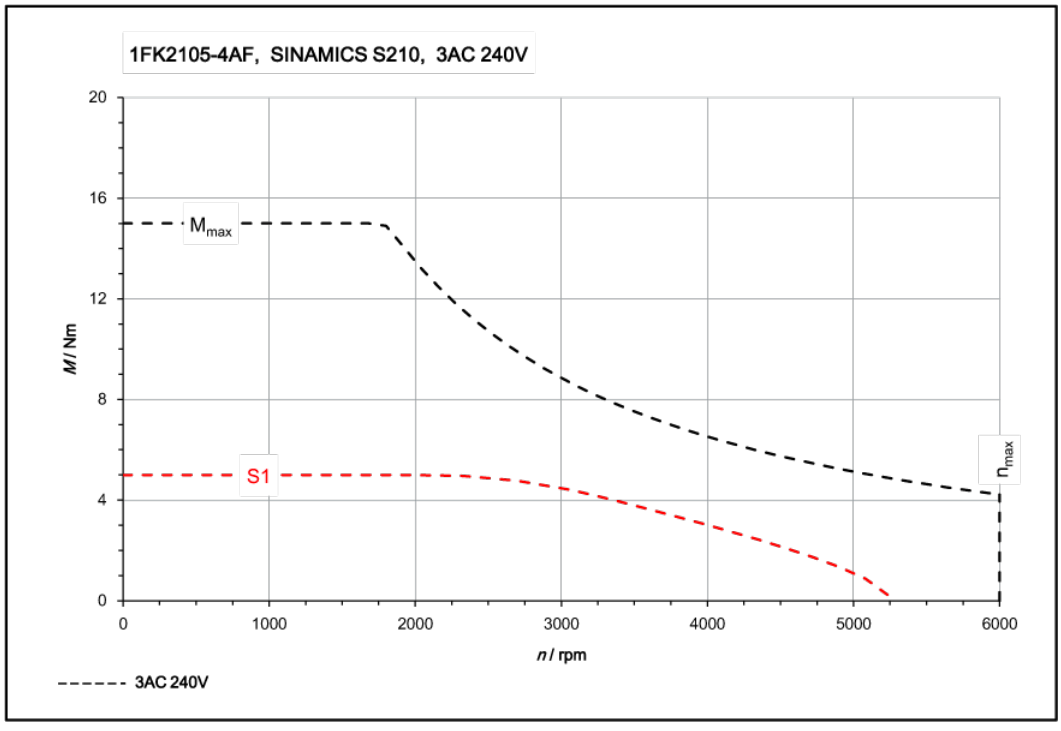
11.1.14.9 1FK2104-6AF connected to 1 AC 230 V / 3 AC 240 V

1FK2104-6AF	For 1 AC 230 V ... 3 AC 240 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	3.2
Stall current	I_0	A	3
Maximum permissible speed	n_{max}	rpm	7200
Maximum torque	M_{max}	Nm	10
Maximum current	I_{max}	A	10.9
Thermal time constant	T_{th}	min	38
Rotor moment of inertia	J_{mot}	kgcm²	0.76
Rotor moment of inertia (with brake)	$J_{mot\ br}$	kgcm²	0.84
Weight	m_{mot}	kg	3.4
Weight (with brake)	$m_{mot\ br}$	kg	4.25
Rated data for S210 connected to 1 AC 230 V, 3 AC 240 V			
Rated speed	n_{rated}	rpm	1500
Rated torque	M_{rated}	Nm	3.2
Rated current	I_{rated}	A	3
Rated power	P_{rated}	kW	0.5



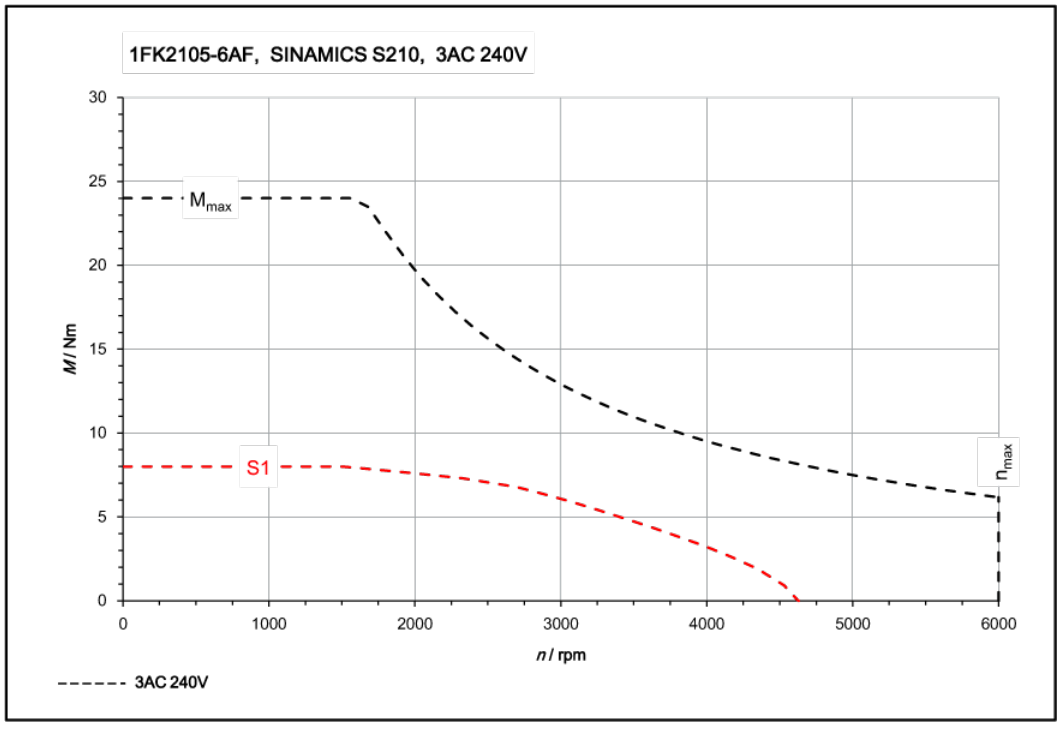
11.1.14.10 1FK2105-4AF connected to 3 AC 240 V

1FK2105-4AF	For 240 V 3 AC		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	5
Stall current	I_0	A	4.65
Maximum permissible speed	n_{max}	rpm	6000
Maximum torque	M_{max}	Nm	15
Maximum current	I_{max}	A	18
Thermal time constant	T_{th}	min	37
Rotor moment of inertia	J_{mot}	$kgcm^2$	1.71
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	2.55
Weight	m_{mot}	kg	5.6
Weight (with brake)	$m_{mot\ br}$	kg	6.6
Rated data for S210 connected to 3 AC 240 V			
Rated speed	n_{rated}	rpm	1500
Rated torque	M_{rated}	Nm	5
Rated current	I_{rated}	A	4.65
Rated power	P_{rated}	kW	0.79



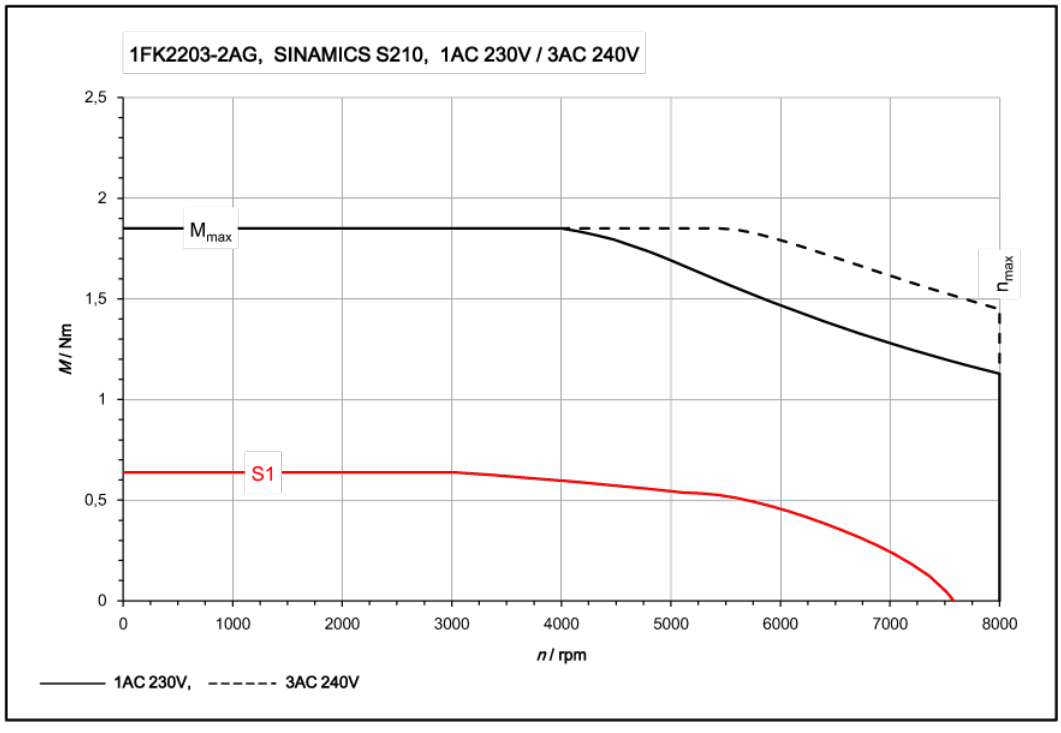
11.1.14.11 1FK2105-6AF connected to 3 AC 240 V

1FK2105-6AF	240 V 3 AC		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	8
Stall current	I_0	A	6.7
Maximum permissible speed	n_{max}	rpm	6000
Maximum torque	M_{max}	Nm	24
Maximum current	I_{max}	A	24
Thermal time constant	T_{th}	min	40
Rotor moment of inertia	J_{mot}	kgcm²	2.65
Rotor moment of inertia (with brake)	$J_{mot\ br}$	kgcm²	3.5
Weight	m_{mot}	kg	7.7
Weight (with brake)	$m_{mot\ br}$	kg	8.7
Rated data for S210 connected to 3 AC 240 V			
Rated speed	n_{rated}	rpm	1500
Rated torque	M_{rated}	Nm	8
Rated current	I_{rated}	A	6.7
Rated power	P_{rated}	kW	1.26



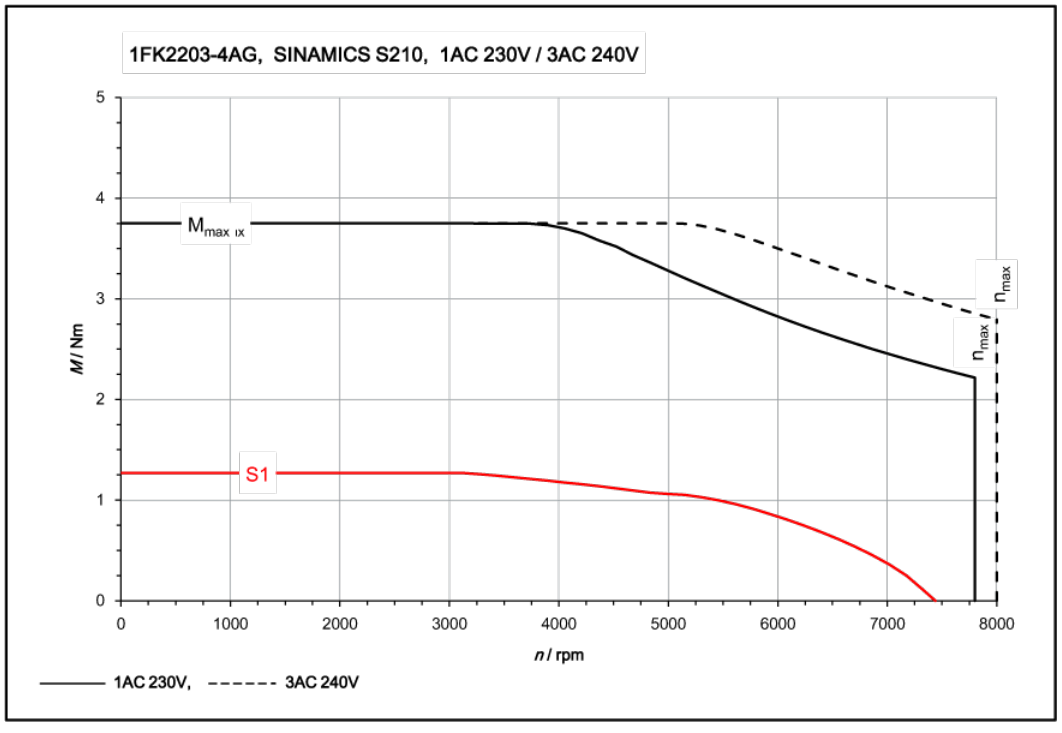
11.1.14.12 1FK2203-2AG connected to 1 AC 230 V / 3 AC 240 V

1FK2203-2AG	For 1 AC 230 V, 3 AC 240 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	0.64
Stall current	I_0	A	1.38
Maximum permissible speed	n_{max}	rpm	8000
Maximum torque	M_{max}	Nm	1.85
Maximum current	I_{max}	A	4.2
Thermal time constant	T_{th}	min	21
Rotor moment of inertia	J_{mot}	$kgcm^2$	0.2
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	0.22
Weight	m_{mot}	kg	1.1
Weight (with brake)	$m_{mot\ br}$	kg	1.6
Rated data for S210 connected to 1 AC 230 V, 3 AC 240 V			
Rated speed	n_{rated}	rpm	3000
Rated torque	M_{rated}	Nm	0.64
Rated current	I_{rated}	A	1.38
Rated power	P_{rated}	kW	0.2



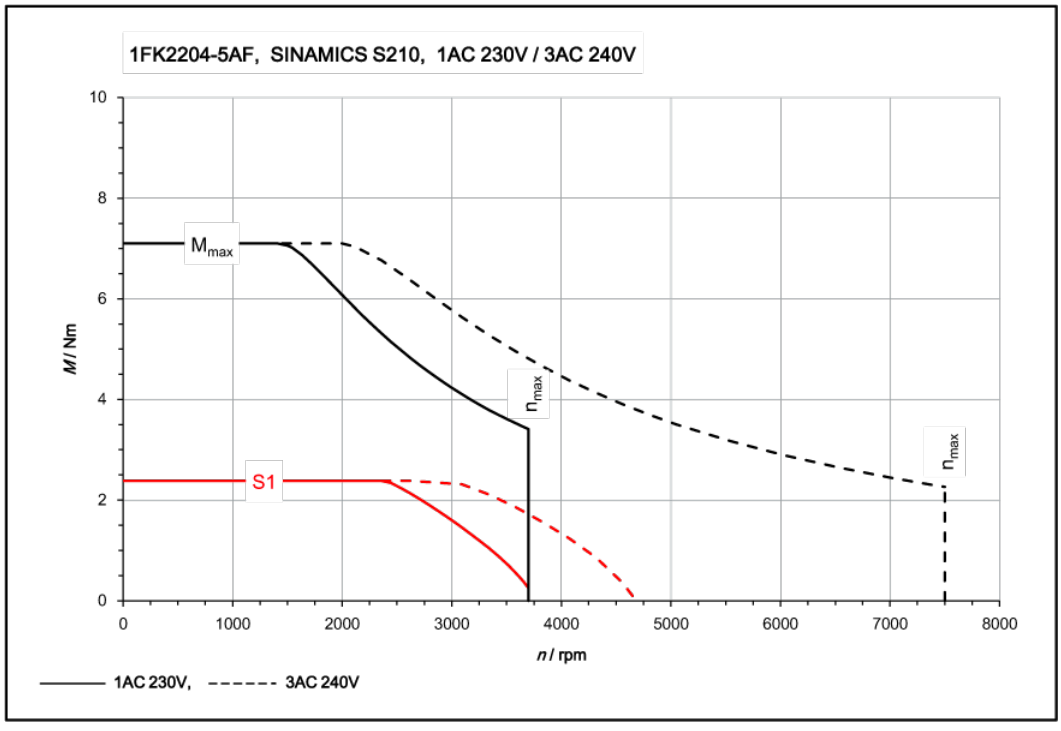
11.1.14.13 1FK2203-4AG connected to 1 AC 230 V / 3 AC 240 V

1FK2203-4AG	For 1 AC 230 V, 3 AC 240 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	1.27
Stall current	I_0	A	2.52
Maximum permissible speed	n_{max}	rpm	8000
Maximum torque	M_{max}	Nm	3.75
Maximum current	I_{max}	A	7.8
Thermal time constant	T_{th}	min	28
Rotor moment of inertia	J_{mot}	kgcm²	0.35
Rotor moment of inertia (with brake)	$J_{mot\ br}$	kgcm²	0.37
Weight	m_{mot}	kg	1.57
Weight (with brake)	$m_{mot\ br}$	kg	2.1
Rated data for S210 connected to 1 AC 230 V, 3 AC 240 V			
Rated speed	n_{rated}	rpm	3000
Rated torque	M_{rated}	Nm	1.27
Rated current	I_{rated}	A	2.52
Rated power	P_{rated}	kW	0.4



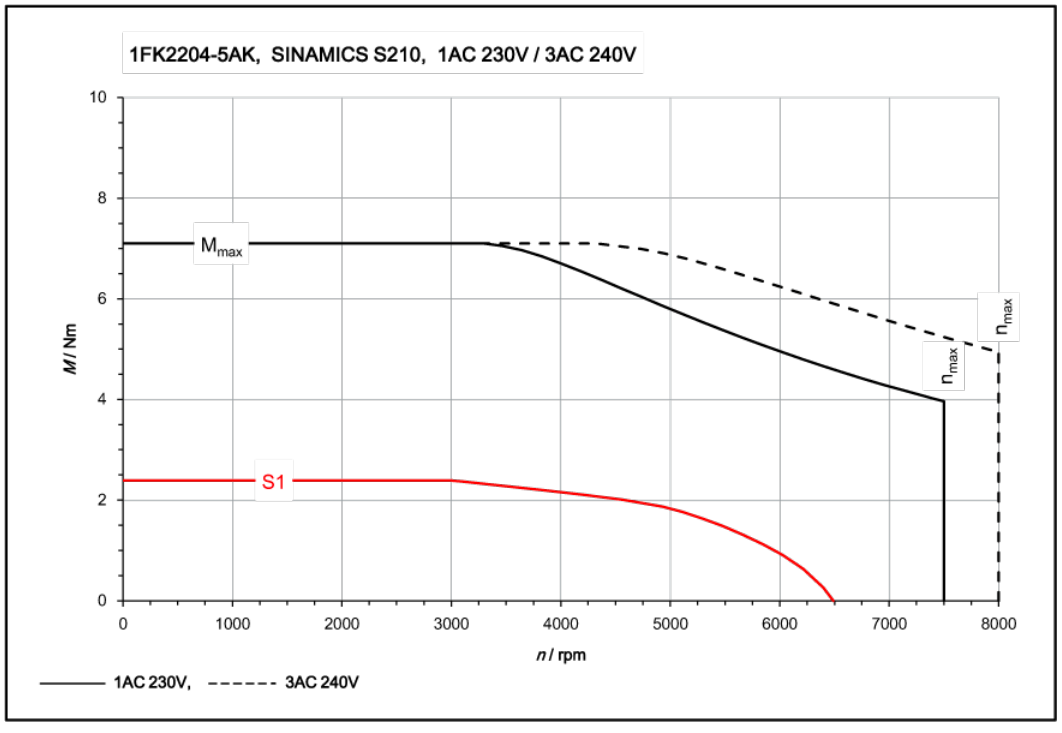
11.1.14.14 1FK2204-5AF connected to 1 AC 230 V / 3 AC 240 V

1FK2204-5AF	For 1 AC 230 V, 3 AC 240 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	2.4
Stall current	I_0	A	2.25
Maximum permissible speed	n_{max}	rpm	7500
Maximum torque	M_{max}	Nm	7.1
Maximum current	I_{max}	A	7.1
Thermal time constant	T_{th}	min	29
Rotor moment of inertia	J_{mot}	kgcm²	1.23
Rotor moment of inertia (with brake)	$J_{mot\ br}$	kgcm²	1.31
Weight	m_{mot}	kg	2.9
Weight (with brake)	$m_{mot\ br}$	kg	3.75
Rated data for S210 connected to 1 AC 230 V, 3 AC 240 V			
Rated speed	n_{rated}	rpm	1500
Rated torque	M_{rated}	Nm	2.4
Rated current	I_{rated}	A	2.25
Rated power	P_{rated}	kW	0.375



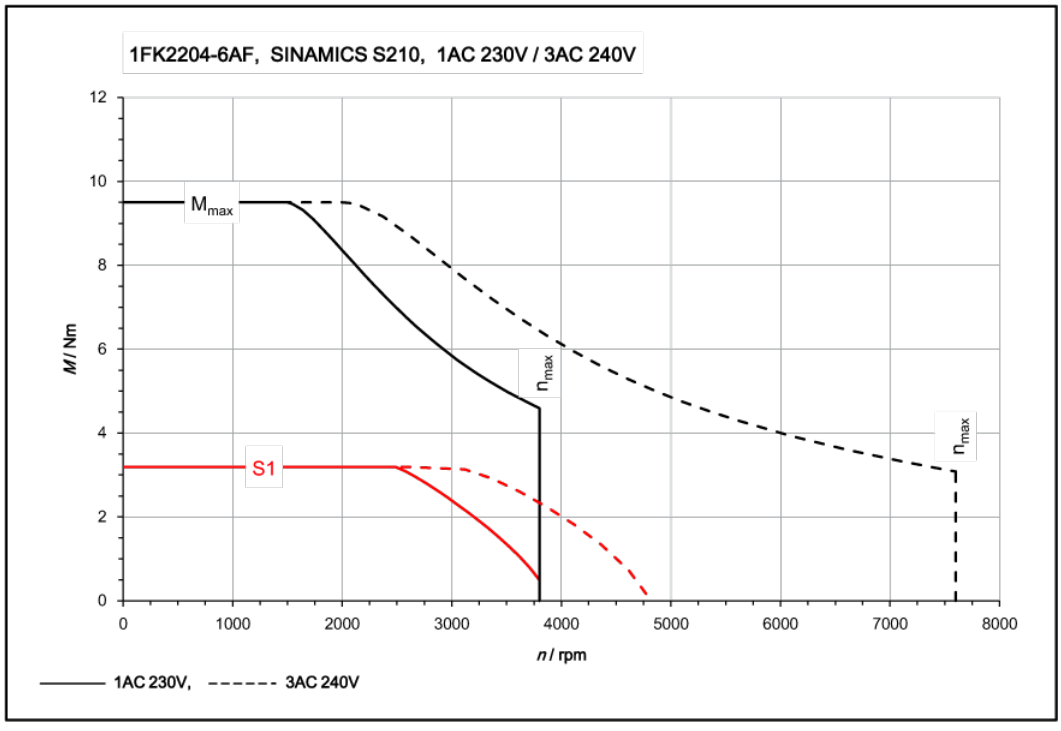
11.1.14.15 1FK2204-5AK connected to 1 AC 230 V / 3 AC 240 V

1FK2204-5AK	For 1 AC 230 V, 3 AC 240 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	2.4
Stall current	I_0	A	4.4
Maximum permissible speed	n_{max}	rpm	8000
Maximum torque	M_{max}	Nm	7.1
Maximum current	I_{max}	A	14.2
Thermal time constant	T_{th}	min	29
Rotor moment of inertia	J_{mot}	kgcm²	1.23
Rotor moment of inertia (with brake)	$J_{mot\ br}$	kgcm²	1.31
Weight	m_{mot}	kg	2.9
Weight (with brake)	$m_{mot\ br}$	kg	3.75
Rated data for S210 connected to 1 AC 230 V, 3 AC 240 V			
Rated speed	n_{rated}	rpm	3000
Rated torque	M_{rated}	Nm	2.4
Rated current	I_{rated}	A	4.4
Rated power	P_{rated}	kW	0.75



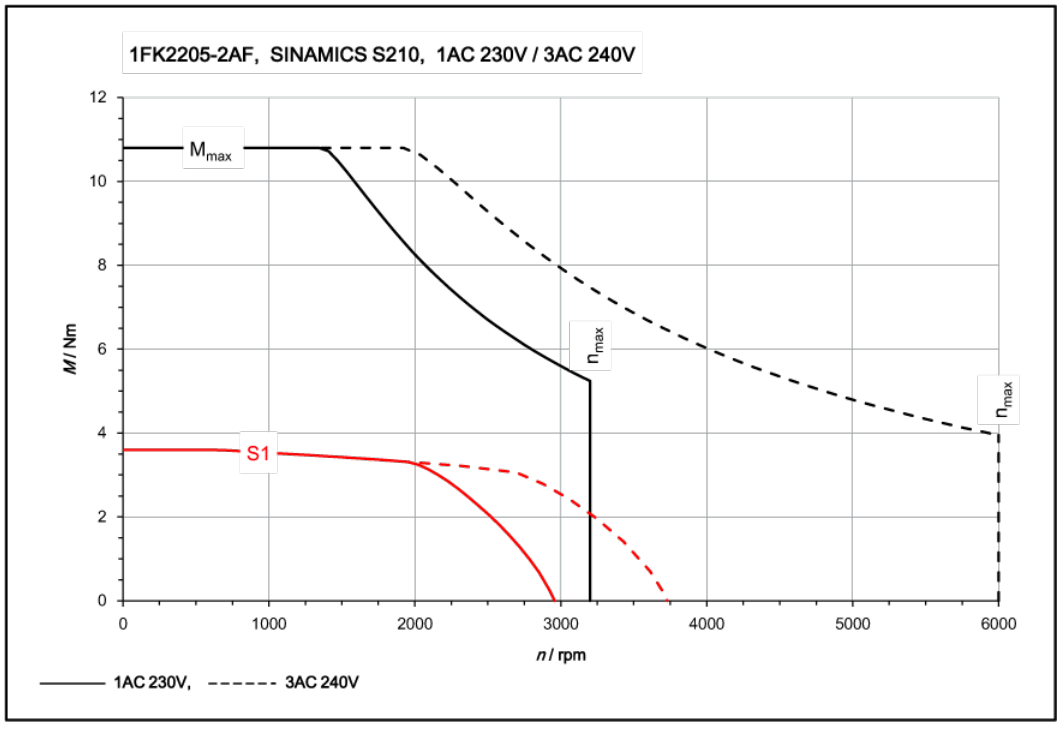
11.1.14.16 1FK2204-6AF connected to 1 AC 230 V / 3 AC 240 V

1FK2204-6AF	For 1 AC 230 V, 3 AC 240 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	3.2
Stall current	I_0	A	3
Maximum permissible speed	n_{max}	rpm	7600
Maximum torque	M_{max}	Nm	9.5
Maximum current	I_{max}	A	9.9
Thermal time constant	T_{th}	min	35
Rotor moment of inertia	J_{mot}	kgcm²	1.61
Rotor moment of inertia (with brake)	$J_{mot\ br}$	kgcm²	1.69
Weight	m_{mot}	kg	3.5
Weight (with brake)	$m_{mot\ br}$	kg	4.35
Rated data for S210 connected to 1 AC 230 V, 3 AC 240 V			
Rated speed	n_{rated}	rpm	1500
Rated torque	M_{rated}	Nm	3.2
Rated current	I_{rated}	A	3
Rated power	P_{rated}	kW	0.5



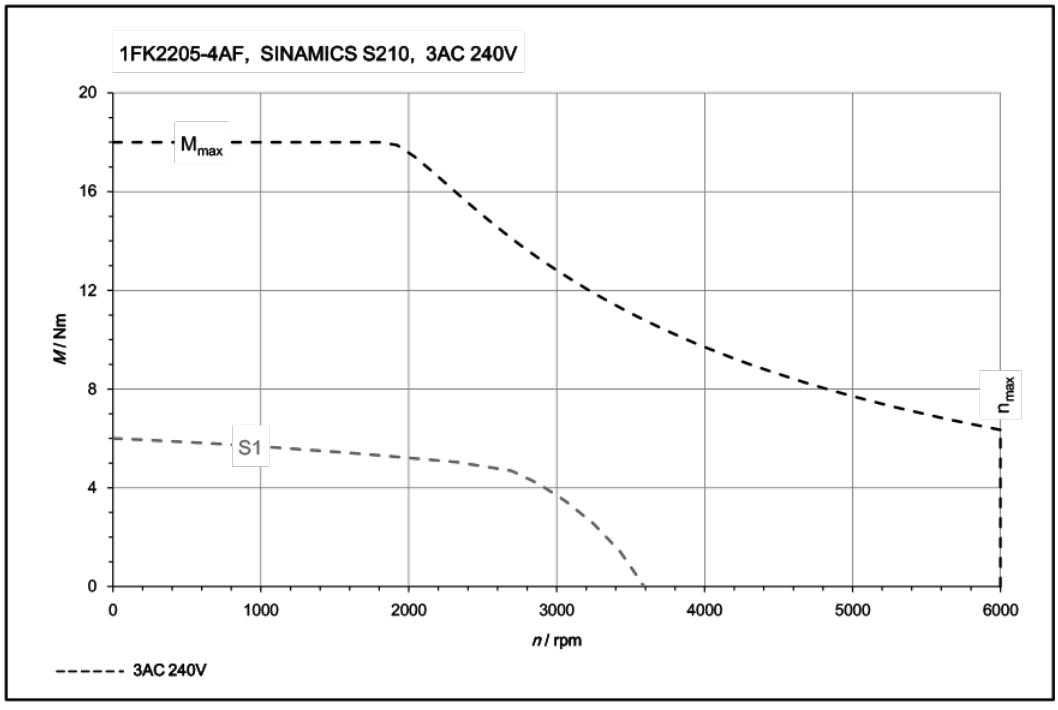
11.1.14.17 1FK2205-2AF connected to 1 AC 230 V / 3 AC 240 V

1FK2205-2AF	For 1 AC 230 V ... 3 AC 240 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	3.6
Stall current	I_0	A	2.9
Maximum permissible speed	n_{max}	rpm	6000
Maximum torque	M_{max}	Nm	10.8
Maximum current	I_{max}	A	9.5
Thermal time constant	T_{th}	min	22
Rotor moment of inertia	J_{mot}	kgcm²	3.15
Rotor moment of inertia (with brake)	$J_{mot\ br}$	kgcm²	4.05
Weight	m_{mot}	kg	3.75
Weight (with brake)	$m_{mot\ br}$	kg	4.75
Rated data for S210 connected to 1 AC 230 V, 3 AC 240 V			
Rated speed	n_{rated}	rpm	1500
Rated torque	M_{rated}	Nm	3.4
Rated current	I_{rated}	A	2.8
Rated power	P_{rated}	kW	0.53



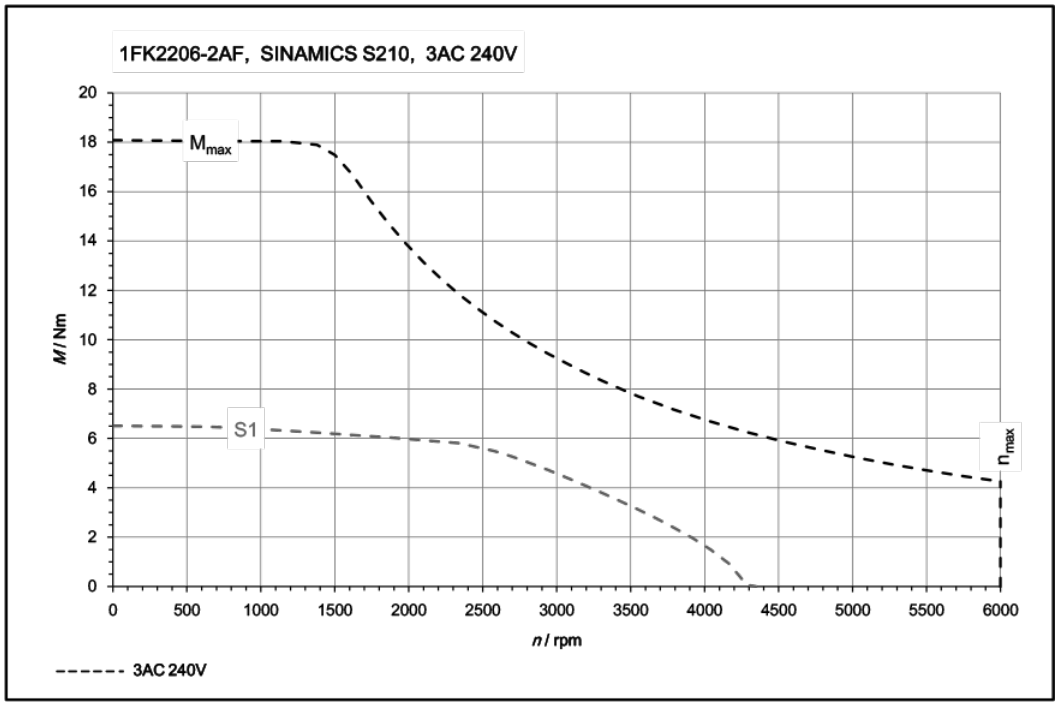
11.1.14.18 1FK2205-4AF connected to 3 AC 240 V

1FK2205-4AF	For 240 V 3 AC		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	6
Stall current	I_0	A	4.7
Maximum permissible speed	n_{max}	rpm	6000
Maximum torque	M_{max}	Nm	18
Maximum current	I_{max}	A	15.1
Thermal time constant	T_{th}	min	31
Rotor moment of inertia	J_{mot}	$kgcm^2$	5.1
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	6
Weight	m_{mot}	kg	5.2
Weight (with brake)	$m_{mot\ br}$	kg	6.2
Rated data for S210 connected to 3 AC 240 V			
Rated speed	n_{rated}	rpm	1500
Rated torque	M_{rated}	Nm	5.5
Rated current	I_{rated}	A	4.35
Rated power	P_{rated}	kW	0.86



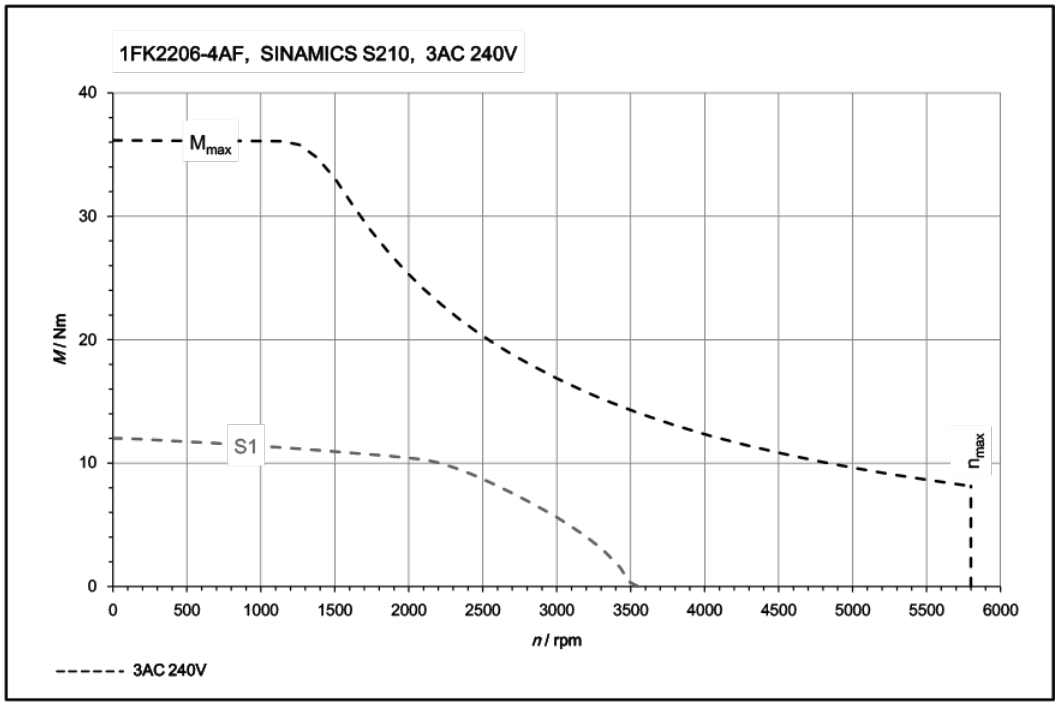
11.1.14.19 1FK2206-2AF connected to 240 V 3 AC

1FK2206-2AF	For 240 V 3 AC		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	6.5
Stall current	I_0	A	5
Maximum permissible speed	n_{max}	rpm	6000
Maximum torque	M_{max}	Nm	18
Maximum current	I_{max}	A	17.8
Thermal time constant	T_{th}	min	22
Rotor moment of inertia	J_{mot}	$kgcm^2$	7.8
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	9.4
Weight	m_{mot}	kg	6.3
Weight (with brake)	$m_{mot\ br}$	kg	7.9
Rated data for S210 connected to 3 AC 240 V			
Rated speed	n_{rated}	rpm	1500
Rated torque	M_{rated}	Nm	6.1
Rated current	I_{rated}	A	4.8
Rated power	P_{rated}	kW	0.97



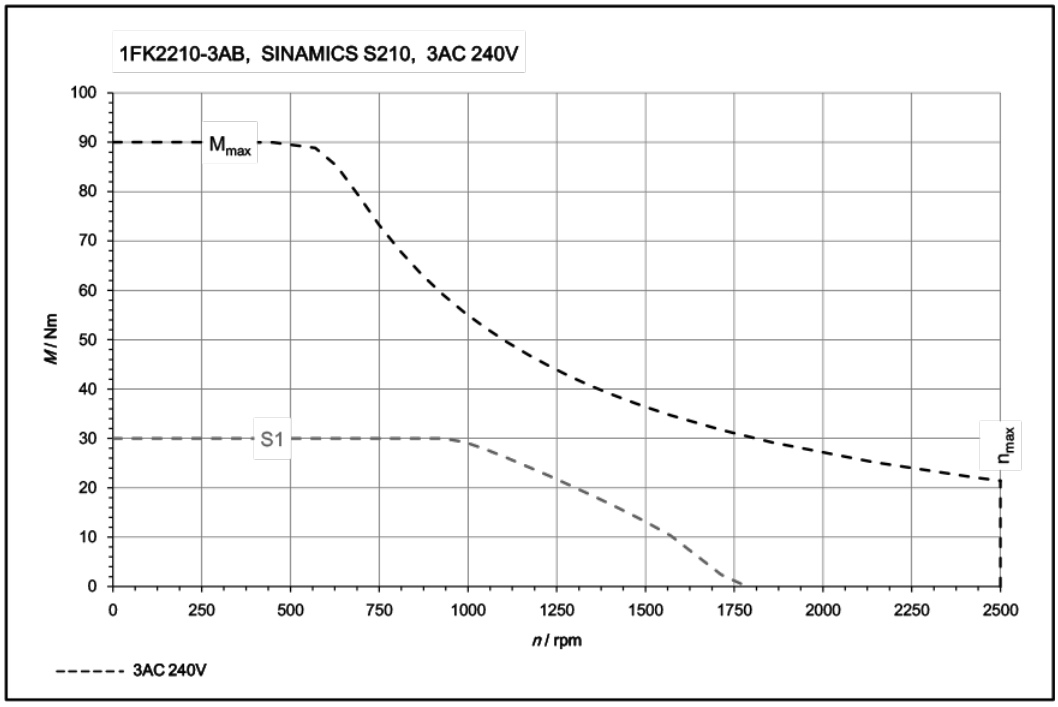
11.1.14.20 1FK2206-4AF connected to 240 V 3 AC

1FK2206-4AF	For 240 V 3 AC		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	12
Stall current	I_0	A	7.9
Maximum permissible speed	n_{max}	rpm	5800
Maximum torque	M_{max}	Nm	36
Maximum current	I_{max}	A	29.5
Thermal time constant	T_{th}	min	24
Rotor moment of inertia	J_{mot}	$kgcm^2$	15.1
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	16.8
Weight	m_{mot}	kg	8.9
Weight (with brake)	$m_{mot\ br}$	kg	10.6
Rated data for S210 connected to 3 AC 240 V			
Rated speed	n_{rated}	rpm	1500
Rated torque	M_{rated}	Nm	10.9
Rated current	I_{rated}	A	7.3
Rated power	P_{rated}	kW	1.72



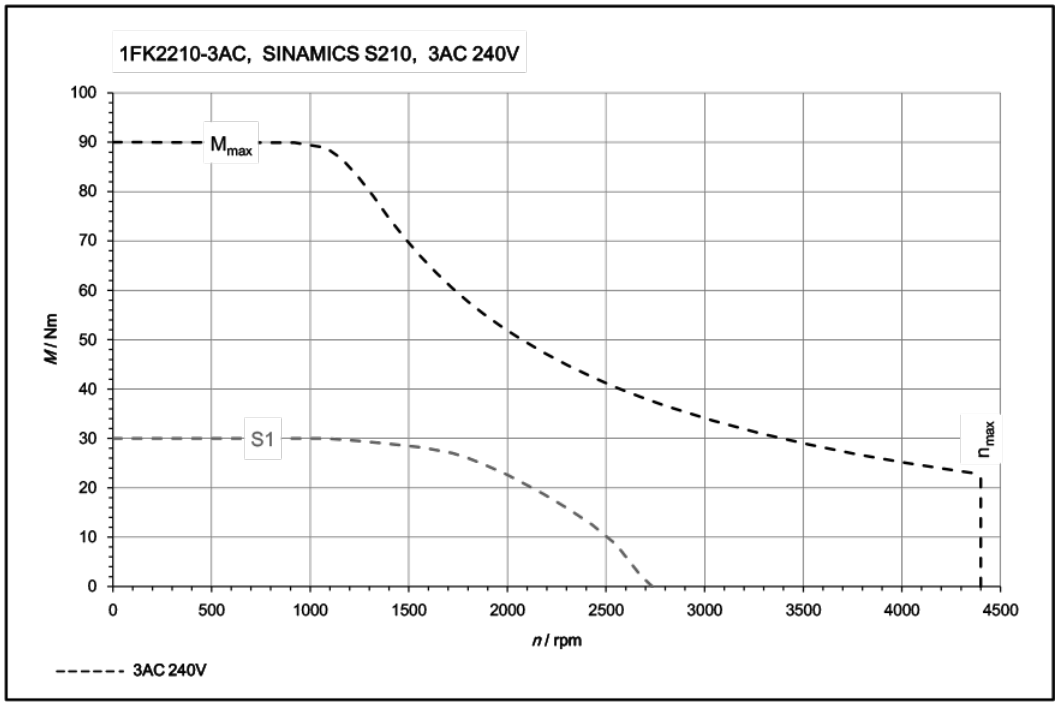
11.1.14.21 1FK2210-3AB connected to 240 V 3 AC

1FK2210-3AB	For 240 V 3 AC		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	30
Stall current	I_0	A	8.5
Maximum permissible speed	n_{max}	rpm	2500
Maximum torque	M_{max}	Nm	90
Maximum current	I_{max}	A	31.5
Thermal time constant	T_{th}	min	33
Rotor moment of inertia	J_{mot}	$kgcm^2$	88.8
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	94.8
Weight	m_{mot}	kg	22
Weight (with brake)	$m_{mot\ br}$	kg	25
Rated data for S210 connected to 3 AC 240 V			
Rated speed	n_{rated}	rpm	750
Rated torque	M_{rated}	Nm	30
Rated current	I_{rated}	A	8.6
Rated power	P_{rated}	kW	2.5



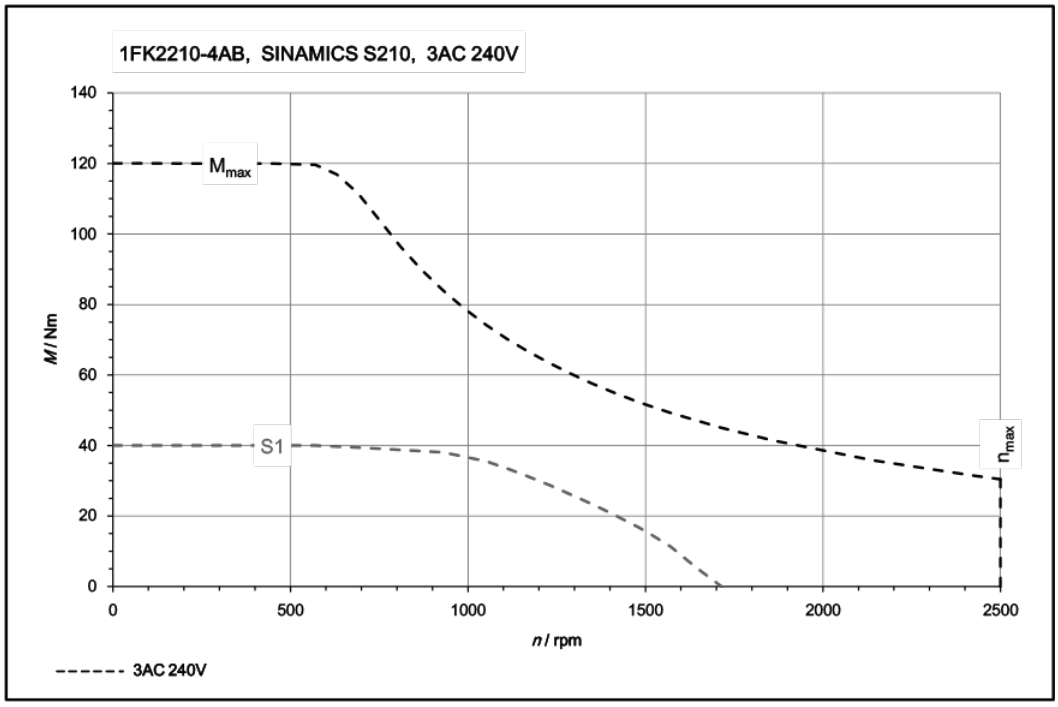
11.1.14.22 1FK2210-3AC connected to 240 V 3 AC

1FK2210-3AC	For 240 V 3 AC		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	30
Stall current	I_0	A	15
Maximum permissible speed	n_{max}	rpm	4400
Maximum torque	M_{max}	Nm	90
Maximum current	I_{max}	A	55
Thermal time constant	T_{th}	min	33
Rotor moment of inertia	J_{mot}	$kgcm^2$	88.8
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	94.8
Weight	m_{mot}	kg	22
Weight (with brake)	$m_{mot\ br}$	kg	25
Rated data for S210 connected to 3 AC 240 V			
Rated speed	n_{rated}	rpm	1000
Rated torque	M_{rated}	Nm	30
Rated current	I_{rated}	A	15.5
Rated power	P_{rated}	kW	3.2



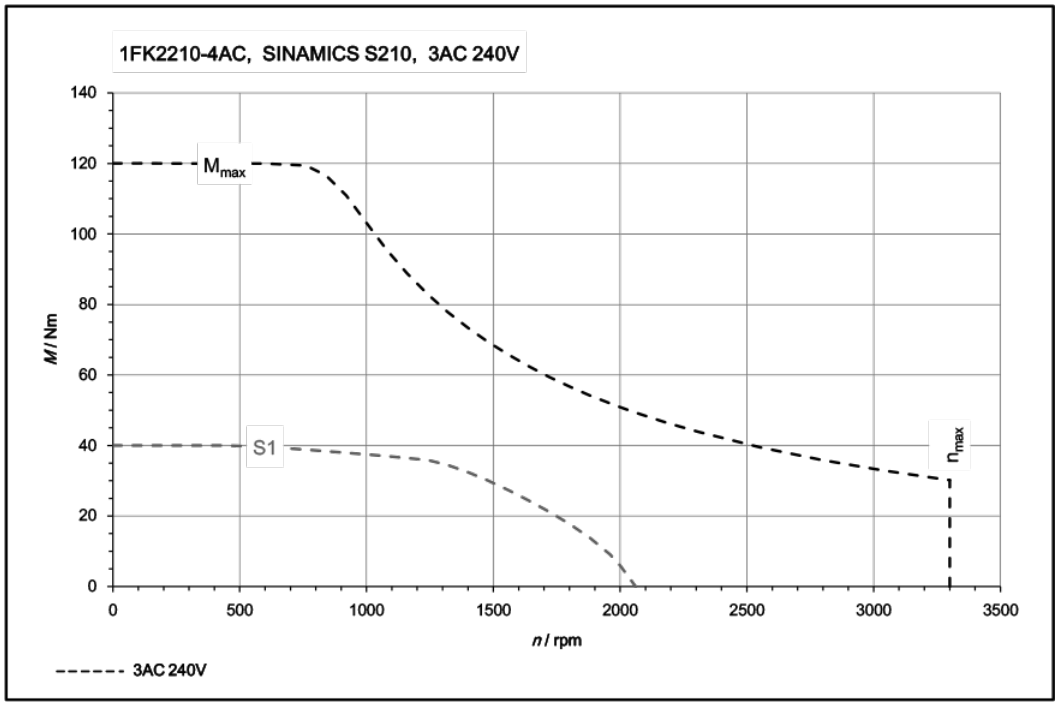
11.1.14.23 1FK2210-4AB connected to 240 V 3 AC

1FK2210-4AB	For 240 V 3 AC		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	40
Stall current	I_0	A	11.8
Maximum permissible speed	n_{max}	rpm	2500
Maximum torque	M_{max}	Nm	120
Maximum current	I_{max}	A	43.5
Thermal time constant	T_{th}	min	35
Rotor moment of inertia	J_{mot}	$kgcm^2$	117
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	133
Weight	m_{mot}	kg	27
Weight (with brake)	$m_{mot\ br}$	kg	31
Rated data for S210 connected to 3 AC 240 V			
Rated speed	n_{rated}	rpm	750
Rated torque	M_{rated}	Nm	39
Rated current	I_{rated}	A	11.6
Rated power	P_{rated}	kW	3.05



11.1.14.24 1FK2210-4AC connected to 240 V 3 AC

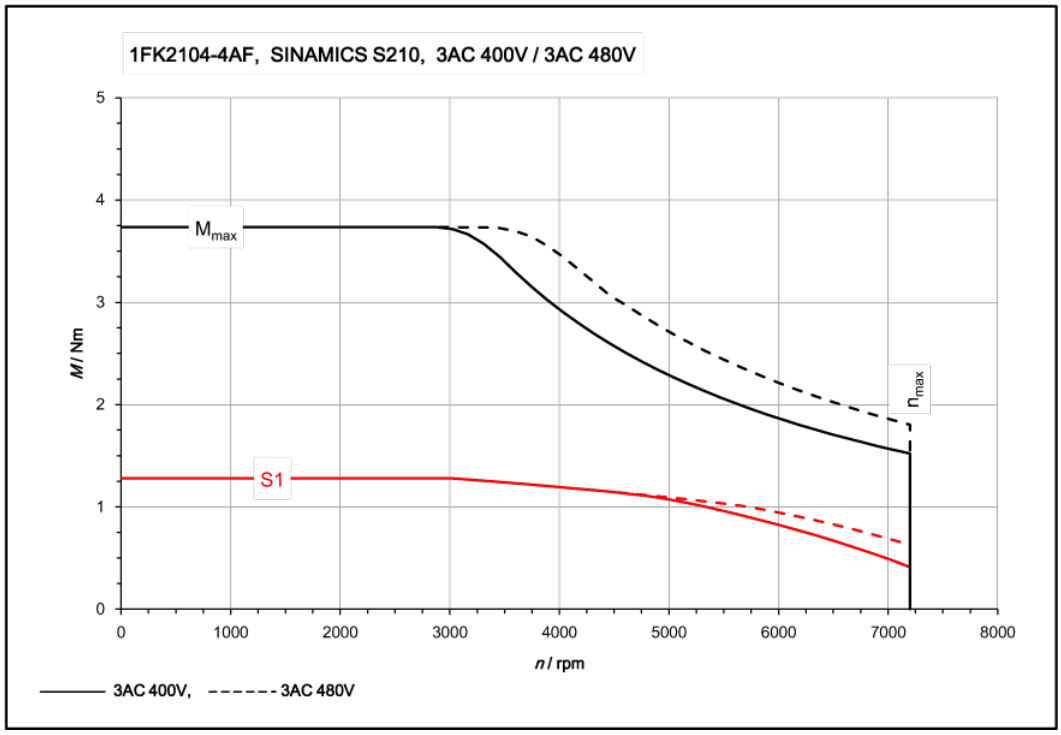
1FK2210-4AC	For 240 V 3 AC,		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	40
Stall current	I_0	A	15
Maximum permissible speed	n_{max}	rpm	3300
Maximum torque	M_{max}	Nm	120
Maximum current	I_{max}	A	55
Thermal time constant	T_{th}	min	35
Rotor moment of inertia	J_{mot}	$kgcm^2$	117
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	133
Weight	m_{mot}	kg	27
Weight (with brake)	$m_{mot\ br}$	kg	31
Rated data for S210 connected to 3 AC 240 V			
Rated speed	n_{rated}	rpm	1000
Rated torque	M_{rated}	Nm	37
Rated current	I_{rated}	A	14.3
Rated power	P_{rated}	kW	3.9



11.1.15 Technical data and characteristics of the 1FK2 connected to 3AC 400 V, 3AC 480 V

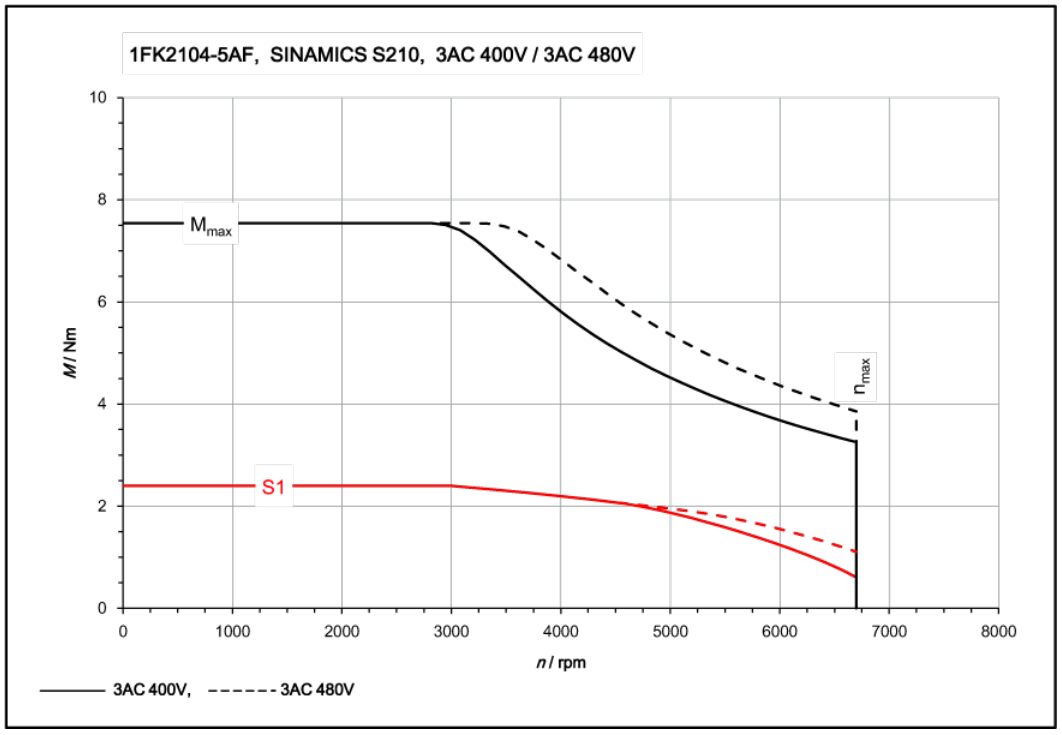
11.1.15.1 1FK2104-4AF connected to 3 AC 400 V / 3 AC 480 V

1FK2104-4AF	For 3 AC 400 V, 3 AC 480 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	1.27
Stall current	I_0	A	1.19
Maximum permissible speed	n_{max}	rpm	7200
Maximum torque	M_{max}	Nm	3.75
Maximum current	I_{max}	A	4.2
Thermal time constant	T_{th}	min	33
Rotor moment of inertia	J_{mot}	$kgcm^2$	0.35
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	0.43
Weight	m_{mot}	kg	2.05
Weight (with brake)	$m_{mot\ br}$	kg	2.9
Rated data for S210 connected to 3 AC 400 V, 3 AC 480 V			
Rated speed	n_{rated}	rpm	3000
Rated torque	M_{rated}	Nm	1.27
Rated current	I_{rated}	A	1.19
Rated power	P_{rated}	kW	0.4


1FK2104-4AF, SINAMICS S210, 3AC 400V / 3AC 480V
M / Nm
n / rpm
M_max
S1
n_max
0
1
2
3
4
5
0
1000
2000
3000
4000
5000
6000
7000
8000
3AC 400V,
3AC 480V

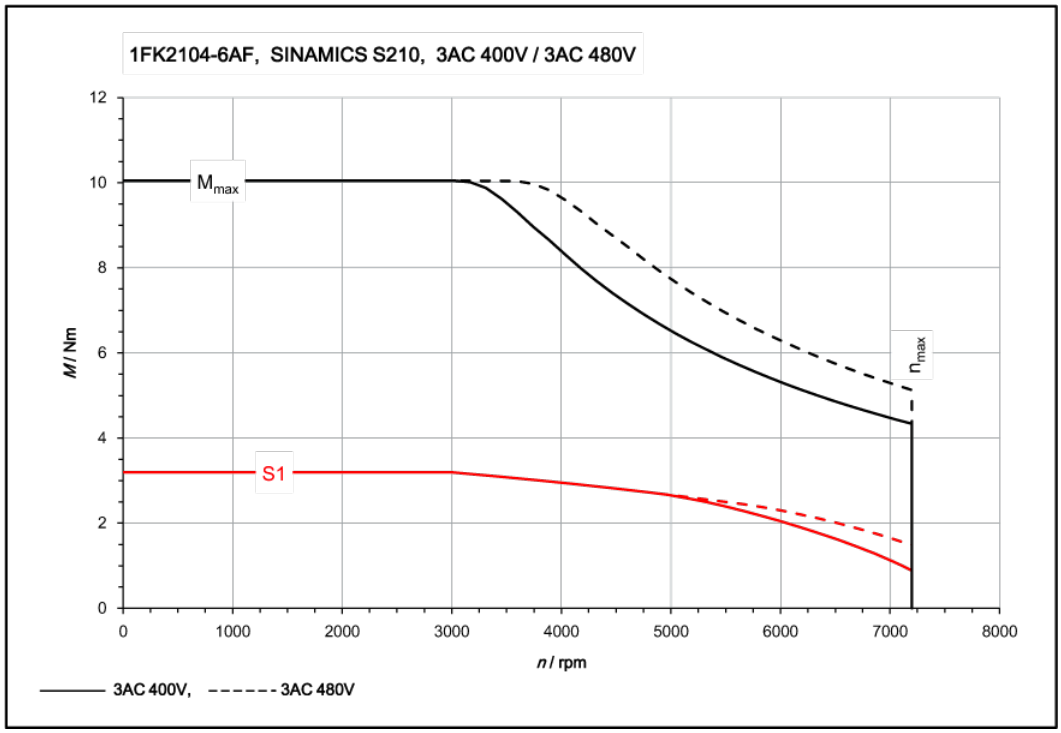
11.1.15.2 1FK2104-5AF connected to 3 AC 400 V / 3 AC 480 V

1FK2104-5AF	For 3 AC 400 V, 3 AC 480 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	2.4
Stall current	I_0	A	2.1
Maximum permissible speed	n_{max}	rpm	6700
Maximum torque	M_{max}	Nm	7.5
Maximum current	I_{max}	A	7.6
Thermal time constant	T_{th}	min	35
Rotor moment of inertia	J_{mot}	$kgcm^2$	0.56
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	0.65
Weight	m_{mot}	kg	2.85
Weight (with brake)	$m_{mot\ br}$	kg	3.7
Rated data for S210 connected to 3 AC 400 V, 3 AC 480 V			
Rated speed	n_{rated}	rpm	3000
Rated torque	M_{rated}	Nm	2.4
Rated current	I_{rated}	A	2.1
Rated power	P_{rated}	kW	0.75



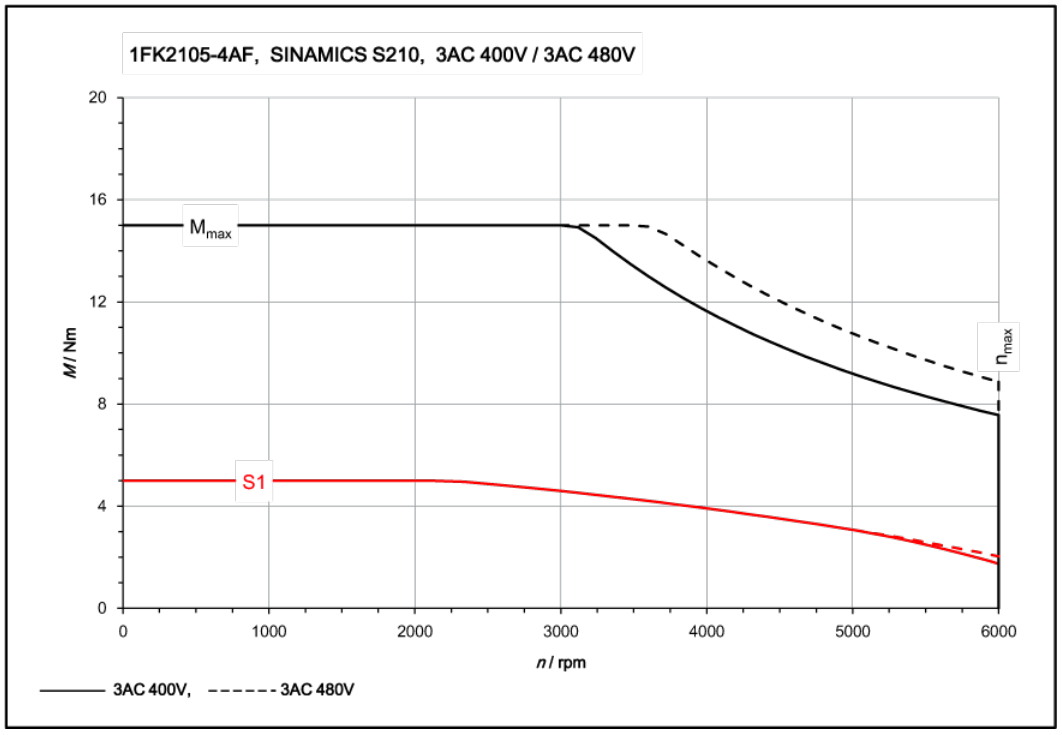
11.1.15.3 1FK2104-6AF connected to 3 AC 400 V / 3 AC 480 V

1FK2104-6AF	For 3 AC 400 V, 3 AC 480 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	3.2
Stall current	I_0	A	3
Maximum permissible speed	n_{max}	rpm	7200
Maximum torque	M_{max}	Nm	10
Maximum current	I_{max}	A	10.9
Thermal time constant	T_{th}	min	38
Rotor moment of inertia	J_{mot}	$kgcm^2$	0.76
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	0.84
Weight	m_{mot}	kg	3.4
Weight (with brake)	$m_{mot\ br}$	kg	4.25
Rated data for S210 connected to 3 AC 400 V, 3 AC 480 V			
Rated speed	n_{rated}	rpm	3000
Rated torque	M_{rated}	Nm	3.2
Rated current	I_{rated}	A	3
Rated power	P_{rated}	kW	1



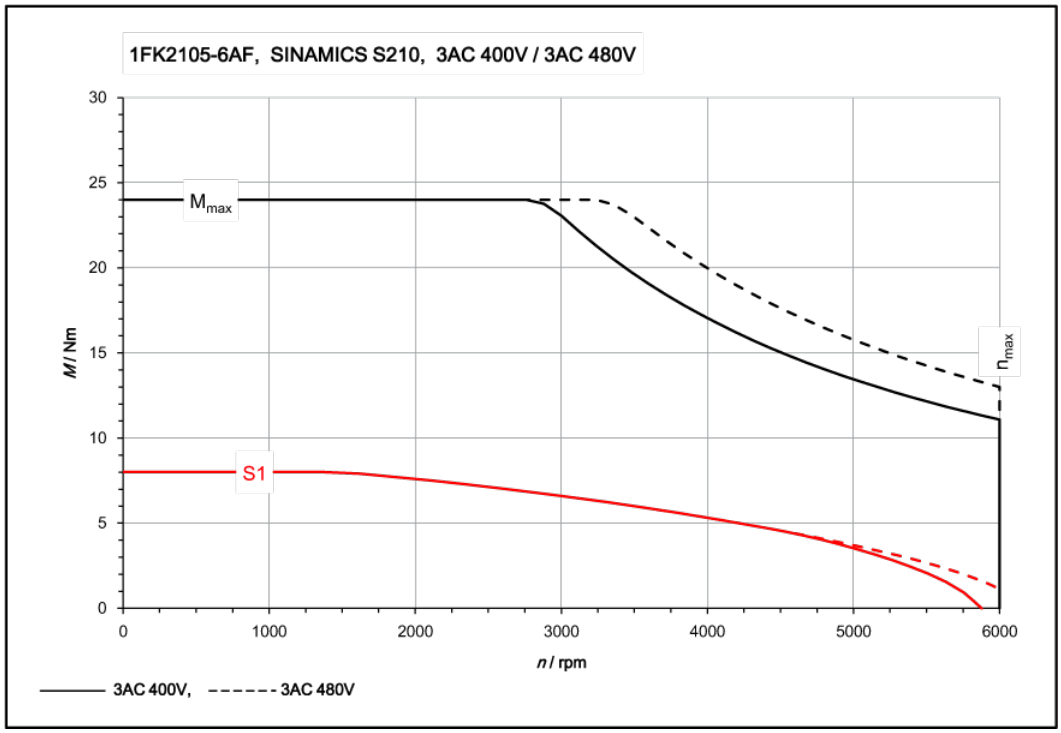
11.1.15.4 1FK2105-4AF connected to 3 AC 400 V / 3 AC 480 V

1FK2105-4AF	For 3 AC 400 V, 3 AC 480 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	5
Stall current	I_0	A	4.65
Maximum permissible speed	n_{max}	rpm	6000
Maximum torque	M_{max}	Nm	15
Maximum current	I_{max}	A	18
Thermal time constant	T_{th}	min	37
Rotor moment of inertia	J_{mot}	$kgcm^2$	1.71
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	2.55
Weight	m_{mot}	kg	5.6
Weight (with brake)	$m_{mot\ br}$	kg	6.6
Rated data for S210 connected to 3 AC 400 V, 3 AC 480 V			
Rated speed	n_{rated}	rpm	3000
Rated torque	M_{rated}	Nm	4.6
Rated current	I_{rated}	A	4.35
Rated power	P_{rated}	kW	1.45



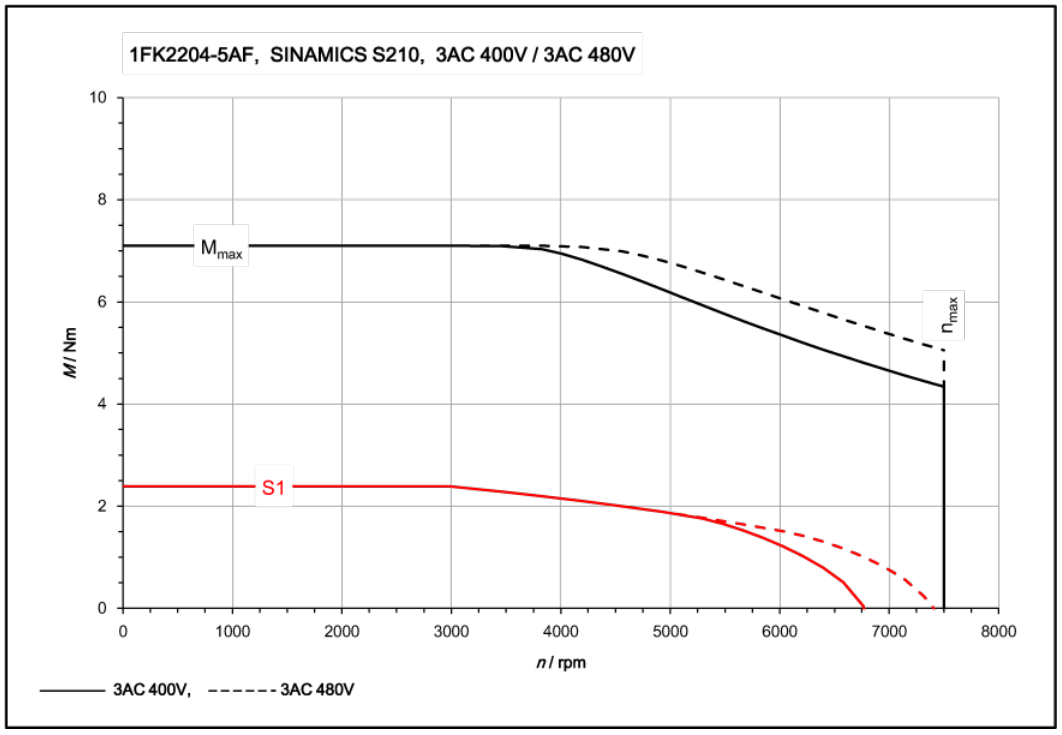
11.1.15.5 1FK2105-6AF connected to 3 AC 400 V / 3 AC 480 V

1FK2105-6AF	For 3 AC 400 V, 3 AC 480 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	8
Stall current	I_0	A	6.7
Maximum permissible speed	n_{max}	rpm	6000
Maximum torque	M_{max}	Nm	24
Maximum current	I_{max}	A	24
Thermal time constant	T_{th}	min	40
Rotor moment of inertia	J_{mot}	$kgcm^2$	2.65
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	3.5
Weight	m_{mot}	kg	7.7
Weight (with brake)	$m_{mot\ br}$	kg	8.7
Rated data for S210 connected to 3 AC 400 V, 3 AC 480 V			
Rated speed	n_{rated}	rpm	3000
Rated torque	M_{rated}	Nm	6.6
Rated current	I_{rated}	A	5.6
Rated power	P_{rated}	kW	2.1



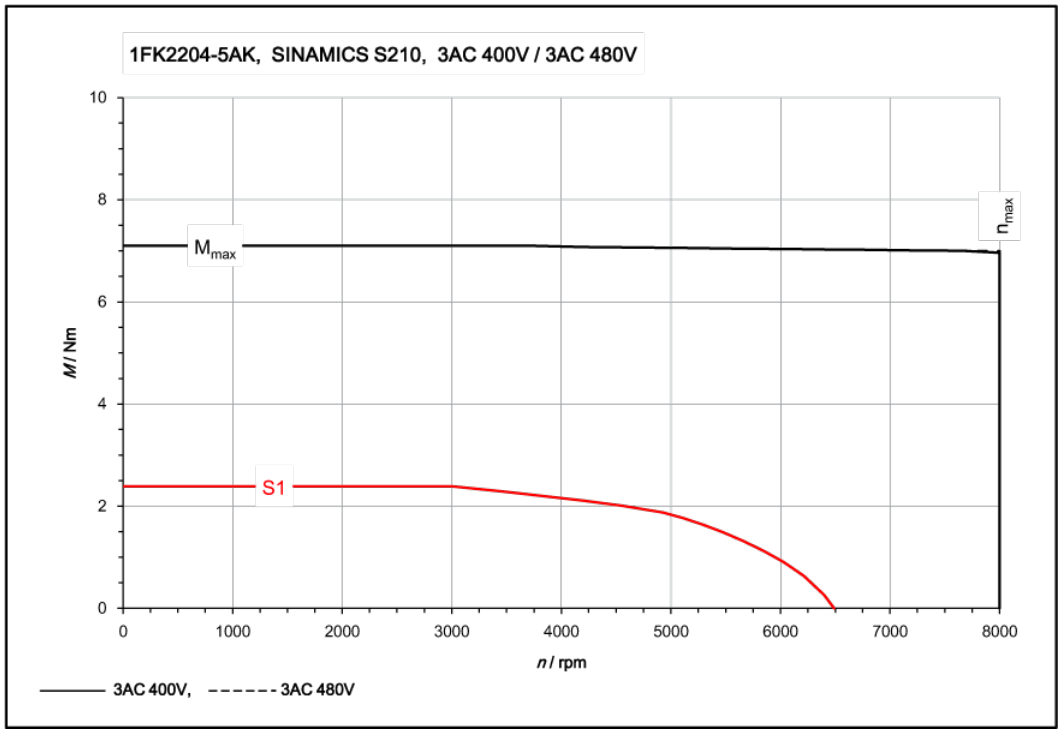
11.1.15.6 1FK2204-5AF connected to 3 AC 400 V / 3 AC 480 V

1FK2204-5AF	For 3 AC 400 V, 3 AC 480 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	2.4
Stall current	I_0	A	2.25
Maximum permissible speed	n_{max}	rpm	7500
Maximum torque	M_{max}	Nm	7.1
Maximum current	I_{max}	A	7.1
Thermal time constant	T_{th}	min	29
Rotor moment of inertia	J_{mot}	$kgcm^2$	1.23
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	1.31
Weight	m_{mot}	kg	2.9
Weight (with brake)	$m_{mot\ br}$	kg	3.75
Rated data for S210 connected to 3 AC 400 V, 3 AC 480 V			
Rated speed	n_{rated}	rpm	3000
Rated torque	M_{rated}	Nm	2.4
Rated current	I_{rated}	A	2.25
Rated power	P_{rated}	kW	0.75



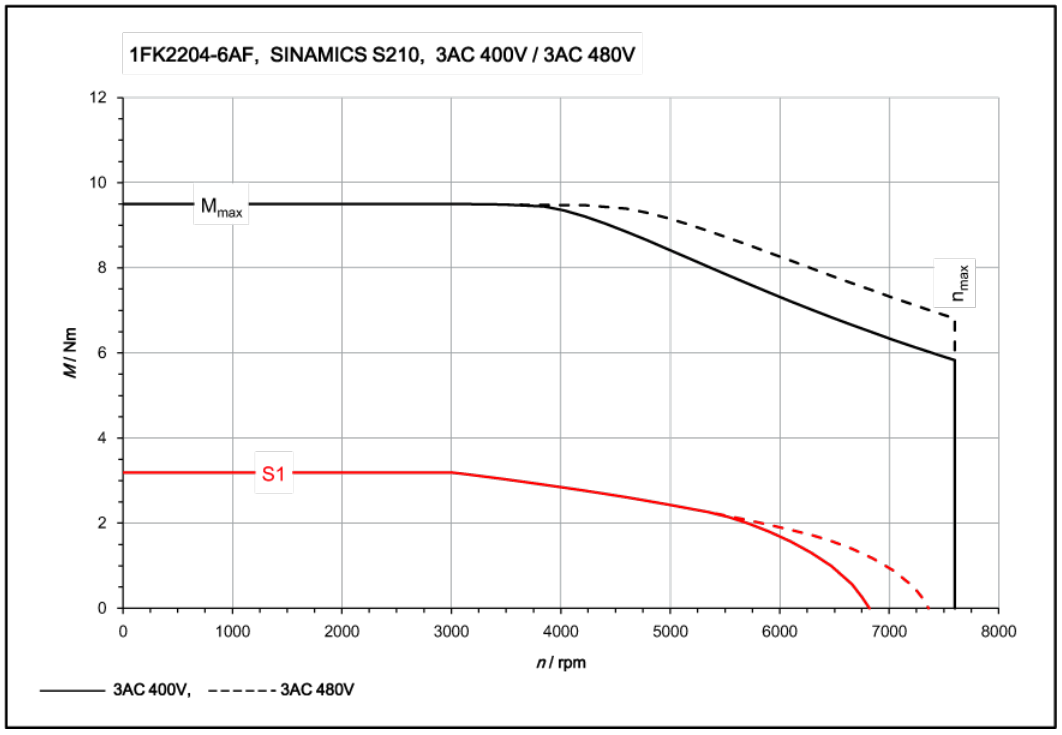
11.1.15.7 1FK2204-5AK connected to 3 AC 400 V / 3 AC 480 V

1FK2204-5AK	For 1 AC 400 V, 3 AC 480 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	2.4
Stall current	I_0	A	4.4
Maximum permissible speed	n_{max}	rpm	8000
Maximum torque	M_{max}	Nm	7.1
Maximum current	I_{max}	A	14.2
Thermal time constant	T_{th}	min	29
Rotor moment of inertia	J_{mot}	$kgcm^2$	1.23
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	1.31
Weight	m_{mot}	kg	2.9
Weight (with brake)	$m_{mot\ br}$	kg	3.75
Rated data for S210 connected to 1 AC 400 V, 3 AC 480 V			
Rated speed	n_{rated}	rpm	6000
Rated torque	M_{rated}	Nm	0.9
Rated current	I_{rated}	A	1.95
Rated power	P_{rated}	kW	0.57



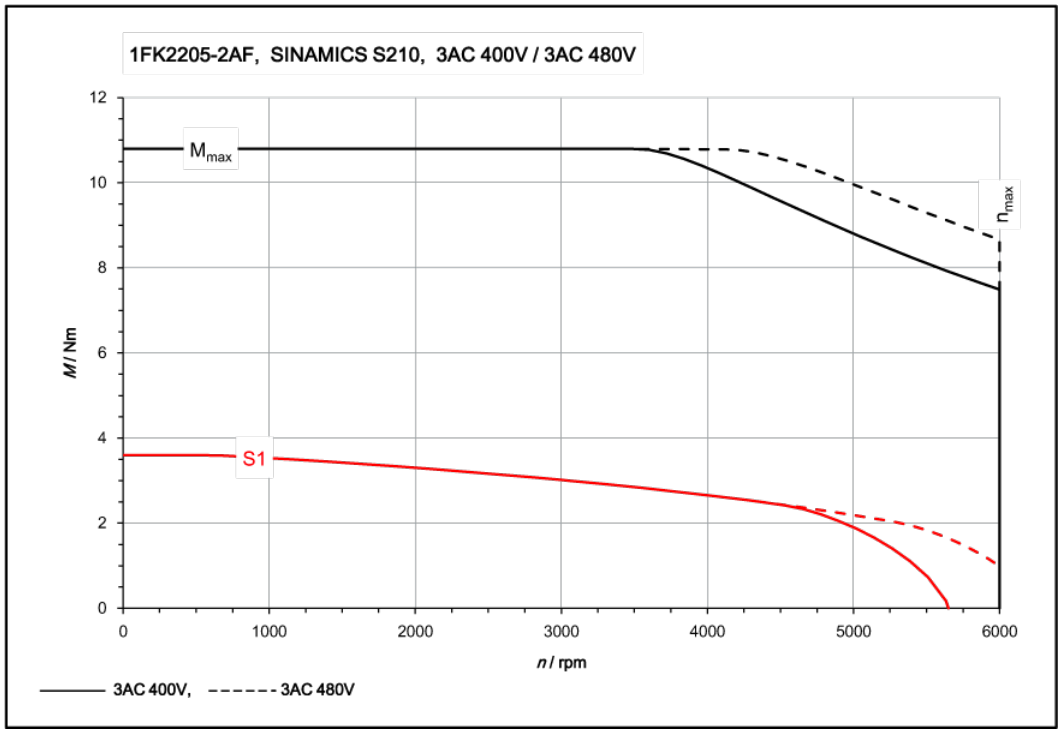
11.1.15.8 1FK2204-6AF connected to 3 AC 400 V / 3 AC 480 V

1FK2204-6AF	For 3 AC 400 V, 3 AC 480 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	3.2
Stall current	I_0	A	3
Maximum permissible speed	n_{max}	rpm	7600
Maximum torque	M_{max}	Nm	9.5
Maximum current	I_{max}	A	9.9
Thermal time constant	T_{th}	min	35
Rotor moment of inertia	J_{mot}	$kgcm^2$	1.61
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	1.69
Weight	m_{mot}	kg	3.5
Weight (with brake)	$m_{mot\ br}$	kg	4.35
Rated data for S210 connected to 3 AC 400 V, 3 AC 480 V			
Rated speed	n_{rated}	rpm	3000
Rated torque	M_{rated}	Nm	3.2
Rated current	I_{rated}	A	3
Rated power	P_{rated}	kW	1



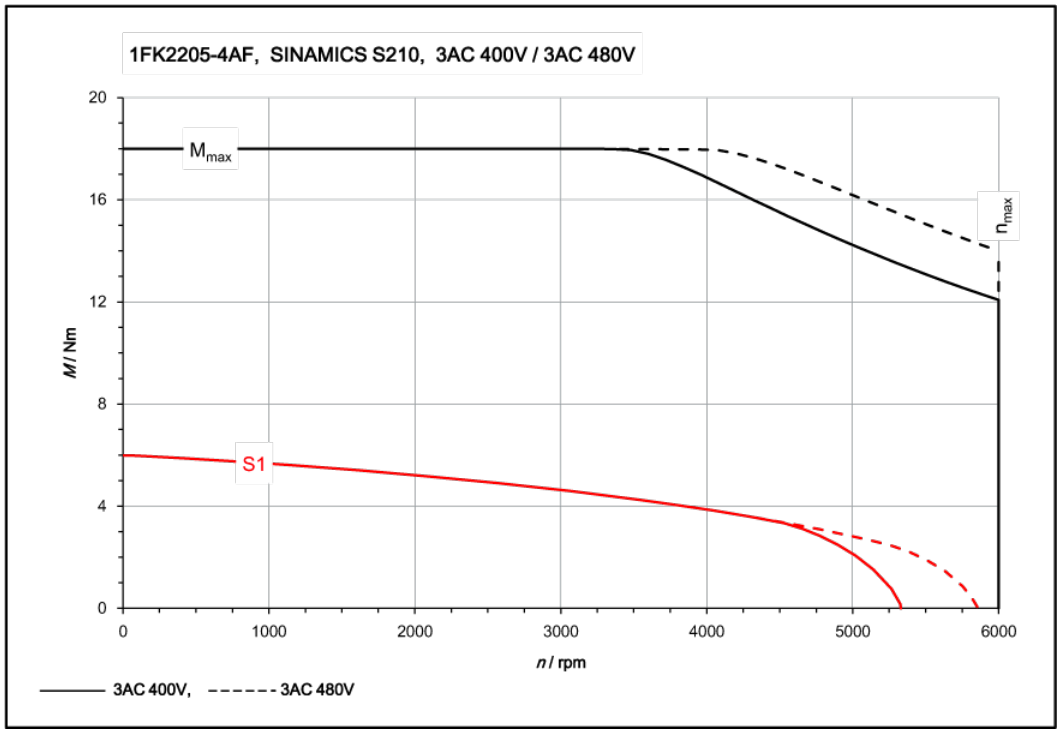
11.1.15.9 1FK2205-2AF connected to 3 AC 400 V / 3 AC 480 V

1FK2205-2AF	For 1 AC 400 V, 3 AC 480 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	3.6
Stall current	I_0	A	2.9
Maximum permissible speed	n_{max}	rpm	6000
Maximum torque	M_{max}	Nm	10.8
Maximum current	I_{max}	A	9.5
Thermal time constant	T_{th}	min	22
Rotor moment of inertia	J_{mot}	$kgcm^2$	3.15
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	4.05
Weight	m_{mot}	kg	3.75
Weight (with brake)	$m_{mot\ br}$	kg	4.75
Rated data for S210 connected to 3 AC 400 V, 3 AC 480 V			
Rated speed	n_{rated}	rpm	3000
Rated torque	M_{rated}	Nm	3
Rated current	I_{rated}	A	2.5
Rated power	P_{rated}	kW	0.94



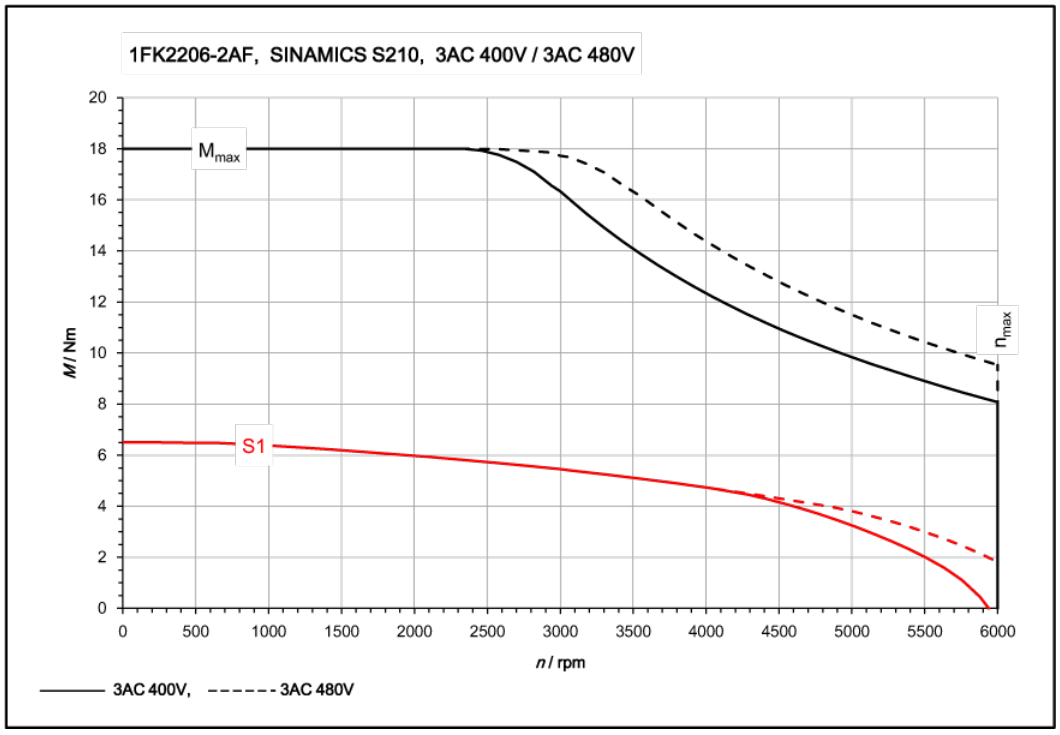
11.1.15.10 1FK2205-4AF connected to 3 AC 400 V / 3 AC 480 V

1FK2205-4AF	For 3 AC 400 V, 3 AC 480 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	6
Stall current	I_0	A	4.7
Maximum permissible speed	n_{max}	rpm	6000
Maximum torque	M_{max}	Nm	18
Maximum current	I_{max}	A	15.1
Thermal time constant	T_{th}	min	31
Rotor moment of inertia	J_{mot}	$kgcm^2$	5.1
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	6
Weight	m_{mot}	kg	5.2
Weight (with brake)	$m_{mot\ br}$	kg	6.2
Rated data for S210 connected to 3 AC 400 V, 3 AC 480 V			
Rated speed	n_{rated}	rpm	3000
Rated torque	M_{rated}	Nm	4.6
Rated current	I_{rated}	A	3.75
Rated power	P_{rated}	kW	1.45



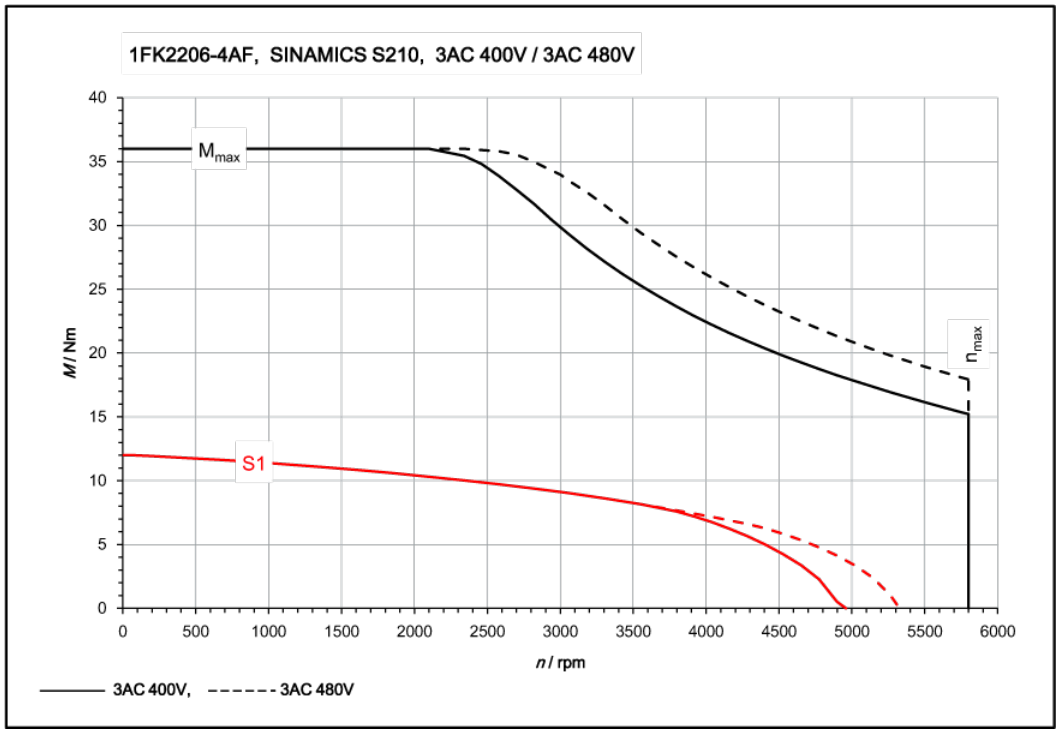
11.1.15.11 1FK2206-2AF connected to 3 AC 400 V / 3 AC 480 V

1FK2206-2AF	For 1 AC 400 V, 3 AC 480 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	6.5
Stall current	I_0	A	5
Maximum permissible speed	n_{max}	rpm	6000
Maximum torque	M_{max}	Nm	18
Maximum current	I_{max}	A	17.8
Thermal time constant	T_{th}	min	22
Rotor moment of inertia	J_{mot}	$kgcm^2$	7.8
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	9.4
Weight	m_{mot}	kg	6.3
Weight (with brake)	$m_{mot\ br}$	kg	7.9
Rated data for S210 connected to 1 AC 400 V, 3 AC 480 V			
Rated speed	n_{rated}	rpm	3000
Rated torque	M_{rated}	Nm	5.4
Rated current	I_{rated}	A	4.35
Rated power	P_{rated}	kW	1.71



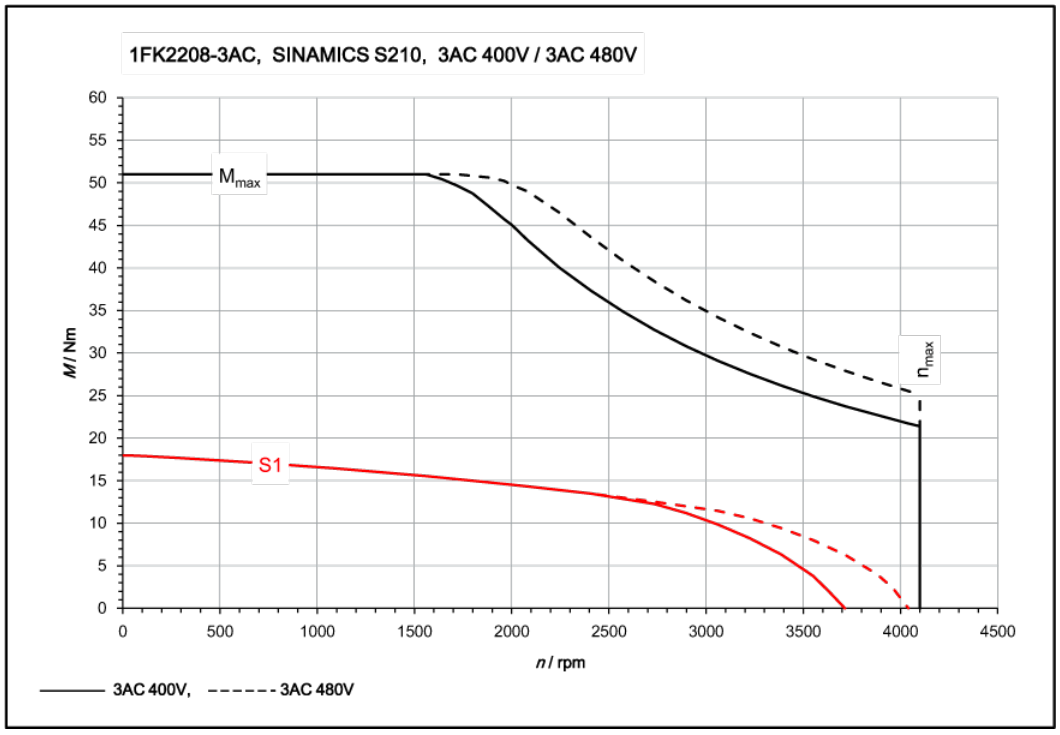
11.1.15.12 1FK2206-4AF connected to 3 AC 400 V / 3 AC 480 V

1FK2206-4AF	For 3 AC 400 V, 3 AC 480 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	12
Stall current	I_0	A	7.9
Maximum permissible speed	n_{max}	rpm	5800
Maximum torque	M_{max}	Nm	36
Maximum current	I_{max}	A	29.5
Thermal time constant	T_{th}	min	24
Rotor moment of inertia	J_{mot}	$kgcm^2$	15.1
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	16.8
Weight	m_{mot}	kg	8.9
Weight (with brake)	$m_{mot\ br}$	kg	10.6
Rated data for S210 connected to 3 AC 400 V, 3 AC 480 V			
Rated speed	n_{rated}	rpm	3000
Rated torque	M_{rated}	Nm	9.1
Rated current	I_{rated}	A	6.2
Rated power	P_{rated}	kW	2.85



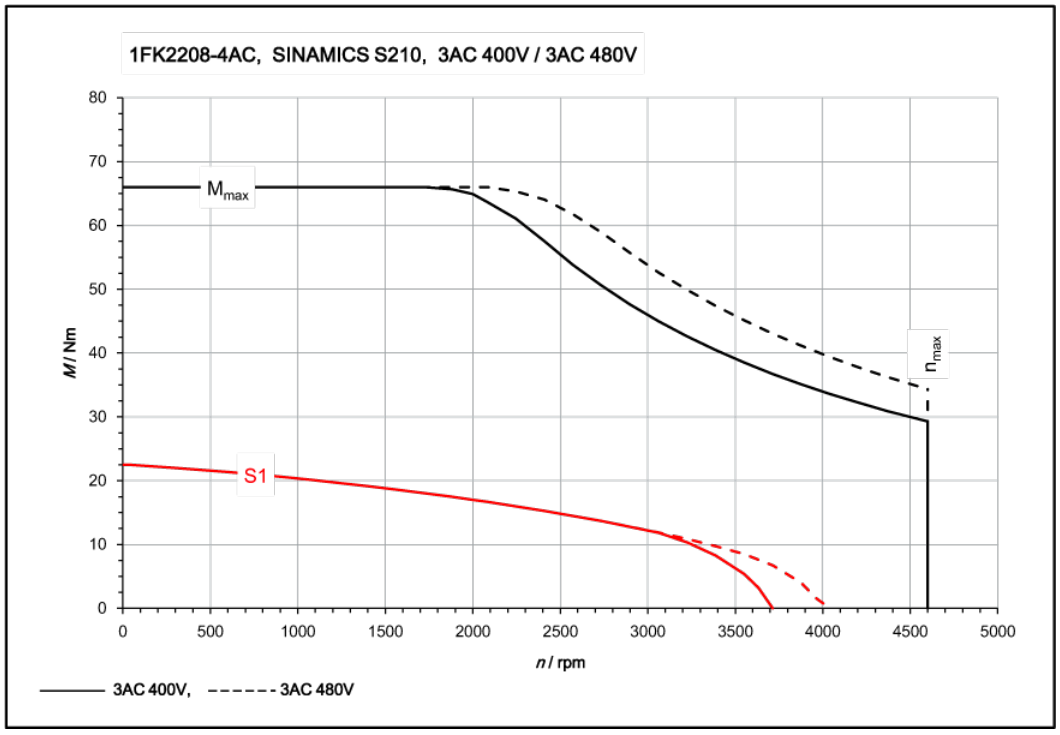
11.1.15.13 1FK2208-3AC connected to 3 AC 400 V / 3 AC 480 V

1FK2208-3AC	For 3 AC 400 V, 3 AC 480 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	18
Stall current	I_0	A	8.4
Maximum permissible speed	n_{max}	rpm	4100
Maximum torque	M_{max}	Nm	51
Maximum current	I_{max}	A	29.5
Thermal time constant	T_{th}	min	26
Rotor moment of inertia	J_{mot}	$kgcm^2$	29.6
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	33
Weight	m_{mot}	kg	12.6
Weight (with brake)	$m_{mot\ br}$	kg	14.6
Rated data for S210 connected to 3 AC 400 V, 3 AC 480 V			
Rated speed	n_{rated}	rpm	2000
Rated torque	M_{rated}	Nm	14.5
Rated current	I_{rated}	A	7
Rated power	P_{rated}	kW	3.05



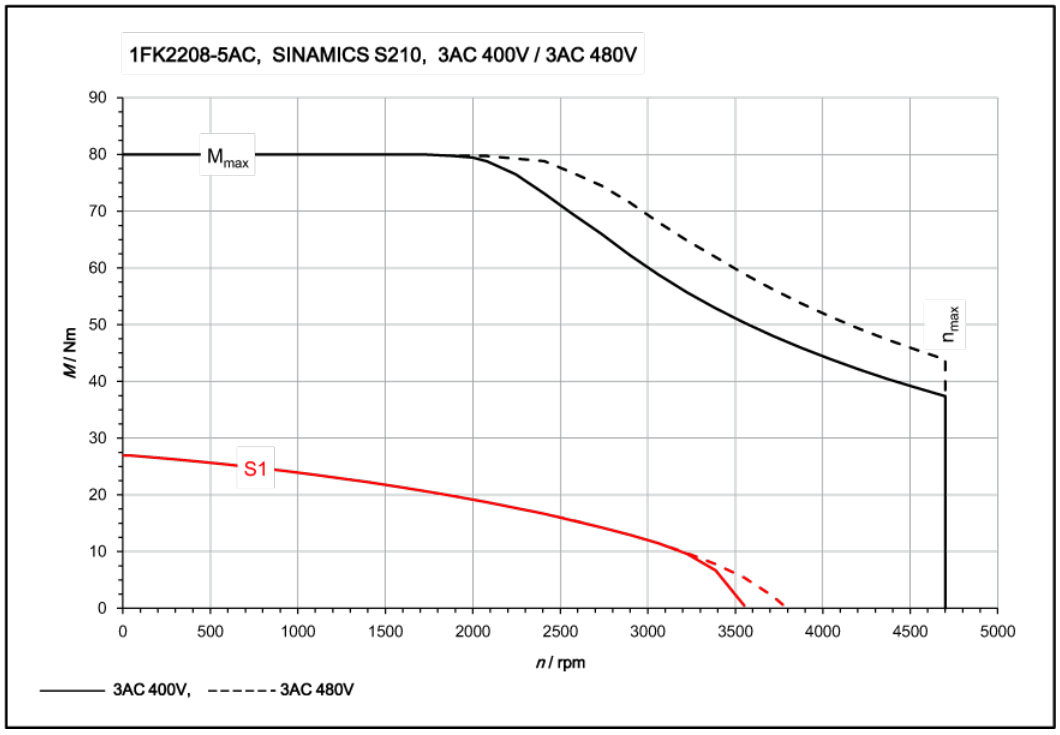
11.1.15.14 1FK2208-4AC connected to 3 AC 400 V / 3 AC 480 V

1FK2208-4AC	For 3 AC 400 V, 3 AC 480 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	22
Stall current	I_0	A	11.7
Maximum permissible speed	n_{max}	rpm	4600
Maximum torque	M_{max}	Nm	66
Maximum current	I_{max}	A	43.5
Thermal time constant	T_{th}	min	28
Rotor moment of inertia	J_{mot}	$kgcm^2$	38.8
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	44.4
Weight	m_{mot}	kg	14.6
Weight (with brake)	$m_{mot\ br}$	kg	17.3
Rated data for S210 connected to 3 AC 400 V, 3 AC 480 V			
Rated speed	n_{rated}	rpm	2000
Rated torque	M_{rated}	Nm	17
Rated current	I_{rated}	A	9.3
Rated power	P_{rated}	kW	3.55



11.1.15.15 1FK2208-5AC connected to 3 AC 400 V / 3 AC 480 V

1FK2208-5AC	For 3 AC 400 V, 3 AC 480 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	27
Stall current	I_0	A	14.6
Maximum permissible speed	n_{max}	rpm	4700
Maximum torque	M_{max}	Nm	80
Maximum current	I_{max}	A	51.5
Thermal time constant	T_{th}	min	30
Rotor moment of inertia	J_{mot}	$kgcm^2$	48.1
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	53.6
Weight	m_{mot}	kg	16.6
Weight (with brake)	$m_{mot\ br}$	kg	19.3
Rated data for S210 connected to 3 AC 400 V, 3 AC 480 V			
Rated speed	n_{rated}	rpm	2000
Rated torque	M_{rated}	Nm	19.1
Rated current	I_{rated}	A	10.8
Rated power	P_{rated}	kW	4



11.1.15.16 1FK2210-3AB connected to 400 V 3 AC / 480 V 3 AC

1FK2210-3AB	For 3 AC 400 V, 3 AC 480 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	30
Stall current	I_0	A	8.5
Maximum permissible speed	n_{max}	rpm	2500
Maximum torque	M_{max}	Nm	90
Maximum current	I_{max}	A	31.5
Thermal time constant	T_{th}	min	33
Rotor moment of inertia	J_{mot}	$kgcm^2$	88.8
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	94.8
Weight	m_{mot}	kg	22
Weight (with brake)	$m_{mot\ br}$	kg	25
Rated data for S210 connected to 3 AC 400 V, 3 AC 480 V			
Rated speed	n_{rated}	rpm	1500
Rated torque	M_{rated}	Nm	28.5
Rated current	I_{rated}	A	8.3
Rated power	P_{rated}	kW	4.5

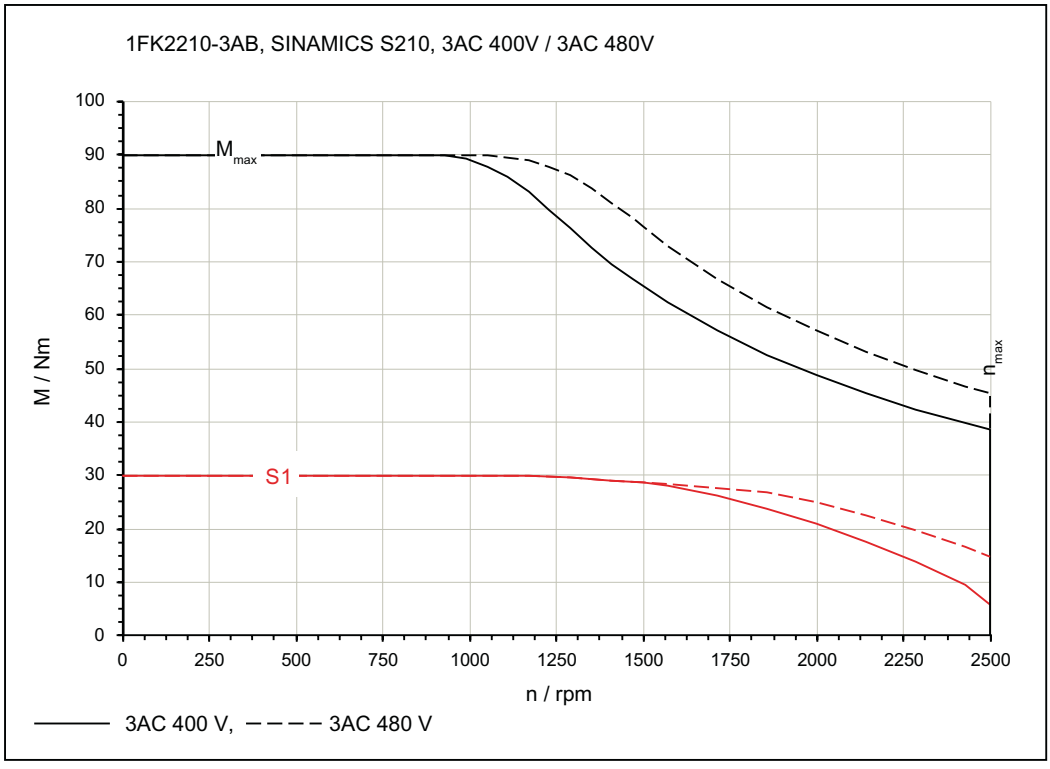
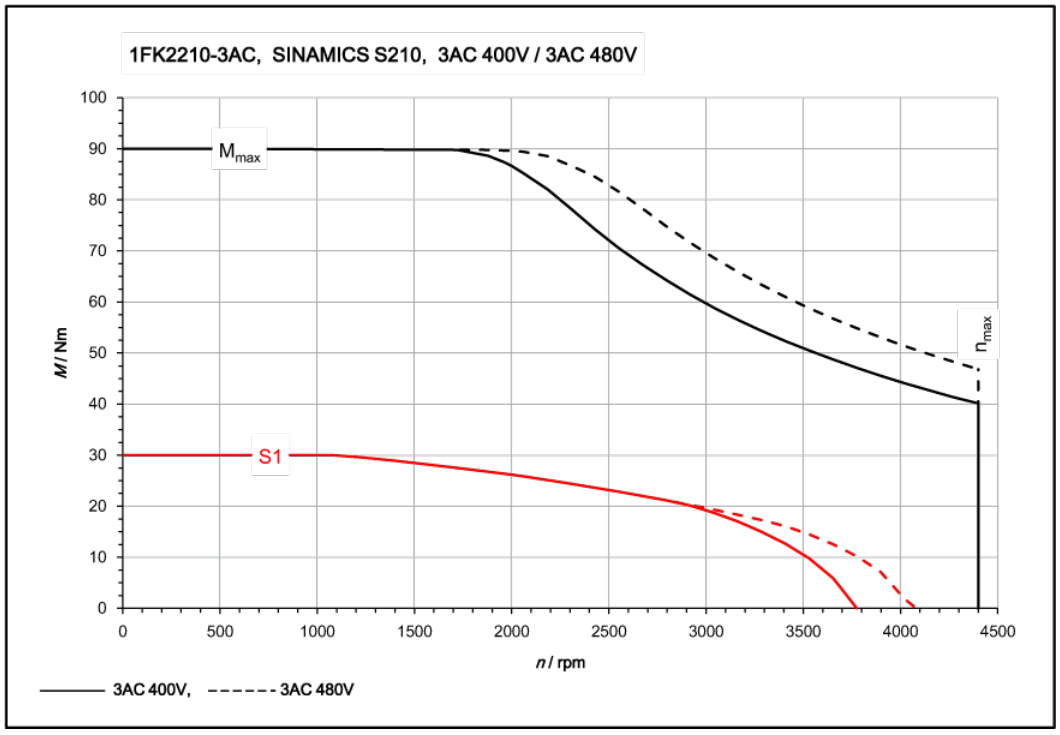


Figure 11-5 1FK2210-3AB_400V

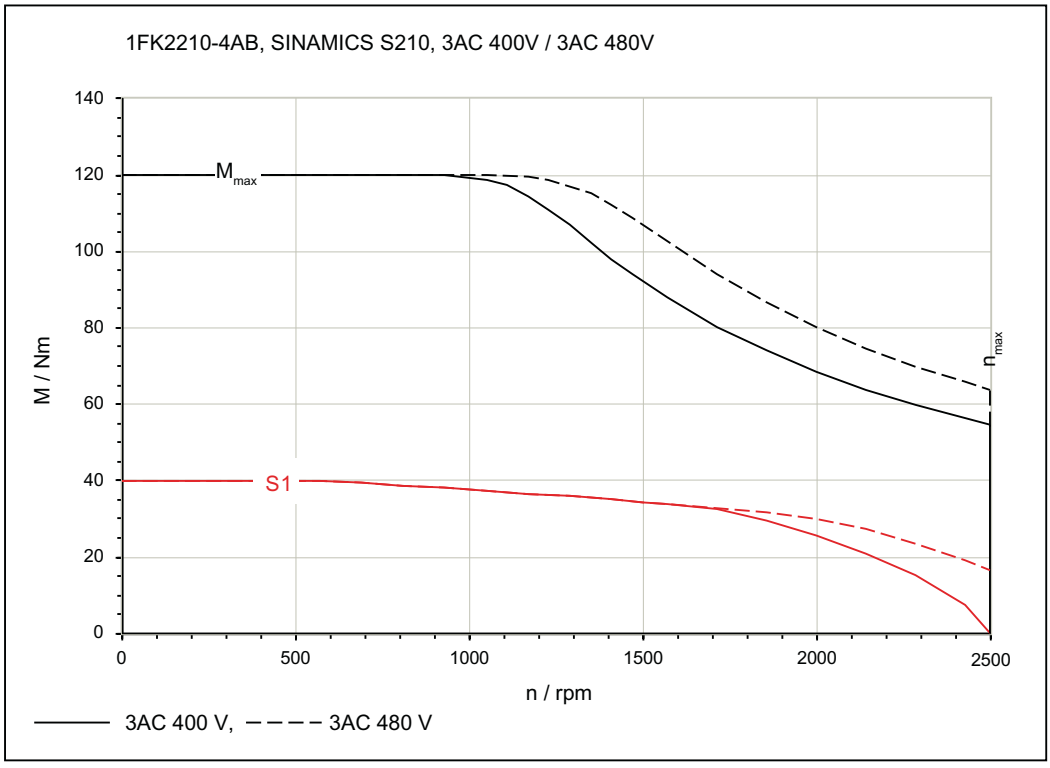
11.1.15.17 1FK2210-3AC connected to 3 AC 400 V / 3 AC 480 V

1FK2210-3AC	For 3 AC 400 V, 3 AC 480 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	30
Stall current	I_0	A	15
Maximum permissible speed	n_{max}	rpm	4400
Maximum torque	M_{max}	Nm	90
Maximum current	I_{max}	A	55
Thermal time constant	T_{th}	min	33
Rotor moment of inertia	J_{mot}	$kgcm^2$	88.8
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	94.8
Weight	m_{mot}	kg	22
Weight (with brake)	$m_{mot\ br}$	kg	25
Rated data for S210 connected to 3 AC 400 V, 3 AC 480 V			
Rated speed	n_{rated}	rpm	2000
Rated torque	M_{rated}	Nm	26
Rated current	I_{rated}	A	13.5
Rated power	P_{rated}	kW	5.5



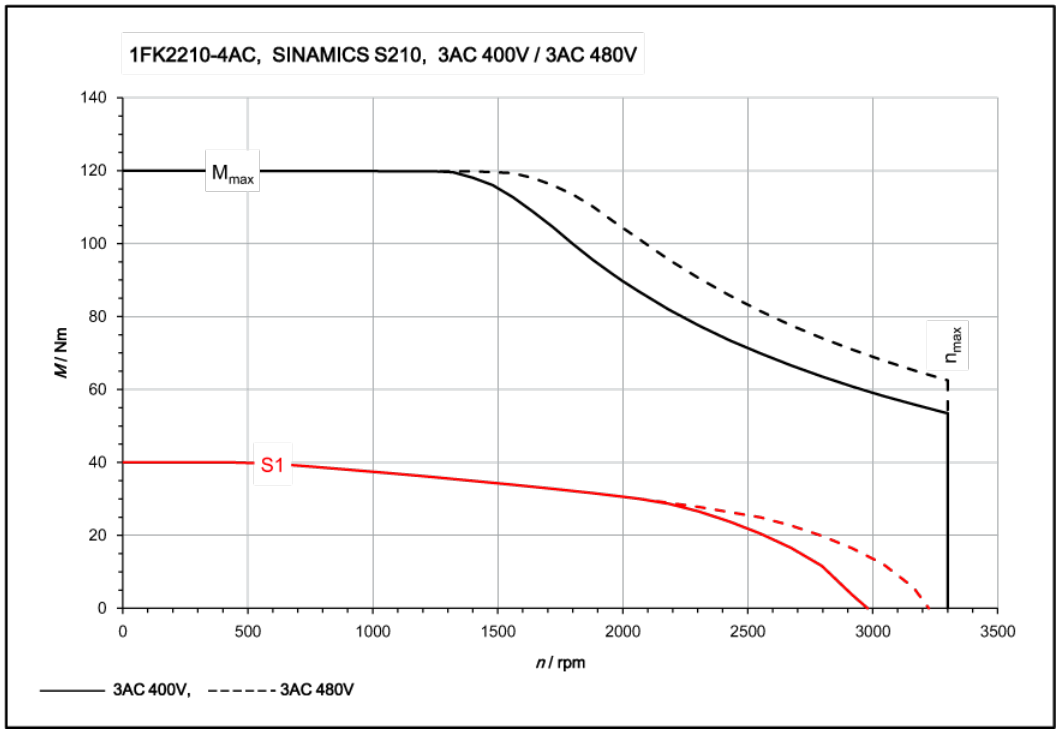
11.1.15.18 1FK2210-4AB connected to 400 V 3 AC / 480 V 3 AC

1FK2210-4AB	For 3 AC 400 V, 3 AC 480 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	40
Stall current	I_0	A	11.8
Maximum permissible speed	n_{max}	rpm	2500
Maximum torque	M_{max}	Nm	120
Maximum current	I_{max}	A	43.5
Thermal time constant	T_{th}	min	35
Rotor moment of inertia	J_{mot}	$kgcm^2$	117
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	133
Weight	m_{mot}	kg	27
Weight (with brake)	$m_{mot\ br}$	kg	31
Rated data for S210 connected to 3 AC 400 V, 3 AC 480 V			
Rated speed	n_{rated}	rpm	1500
Rated torque	M_{rated}	Nm	34.5
Rated current	I_{rated}	A	10.4
Rated power	P_{rated}	kW	5.4



11.1.15.19 1FK2210-4AC connected to 3 AC 400 V / 3 AC 480 V

1FK2210-4AC	For 3 AC 400 V, 3 AC 480 V		
Technical specifications in the SINAMICS S210 system	**Symbol**	**Unit**	**Value**
Static torque	M_0	Nm	40
Stall current	I_0	A	15
Maximum permissible speed	n_{max}	rpm	3300
Maximum torque	M_{max}	Nm	120
Maximum current	I_{max}	A	55
Thermal time constant	T_{th}	min	35
Rotor moment of inertia	J_{mot}	$kgcm^2$	117
Rotor moment of inertia (with brake)	$J_{mot\ br}$	$kgcm^2$	133
Weight	m_{mot}	kg	27
Weight (with brake)	$m_{mot\ br}$	kg	31
Rated data for S210 connected to 3 AC 400 V, 3 AC 480 V			
Rated speed	n_{rated}	rpm	2000
Rated torque	M_{rated}	Nm	30.5
Rated current	I_{rated}	A	11.8
Rated power	P_{rated}	kW	6.4



11.2 Technical specifications of the converter

11.2.1 Overload capability

Overload capability and shutdown behavior of the converter

For a short time, the servomotors are able to withstand maximum current.

The values for the individual motors can be found in the following sections:

- "Technical data and characteristics of the 1FK2 connected to 1AC 230 V, 3AC 240 V (Page 358)"
- "Technical data and characteristics of the 1FK2 connected to 3AC 400 V, 3AC 480 V (Page 383)"

The converter has integrated overload protection for the connected motor.

When delivered, the tripping threshold is 115 % of the parameterized motor current. Brief overloads of up to 300% of the motor current are possible.

When the load exceeds the rated current, the thermal protection of the converter starts and switches the motor off in accordance with the overload characteristics shown below.

When you operate the S210 converter in combination with motors with DQ interface, such as the 1FK2 motor, parameterization takes place automatically.

The following diagrams show the general characteristic for several motor/converter combinations. The maximum current of each converter is given in the technical data. It must not be exceeded irrespective of the overload characteristics.

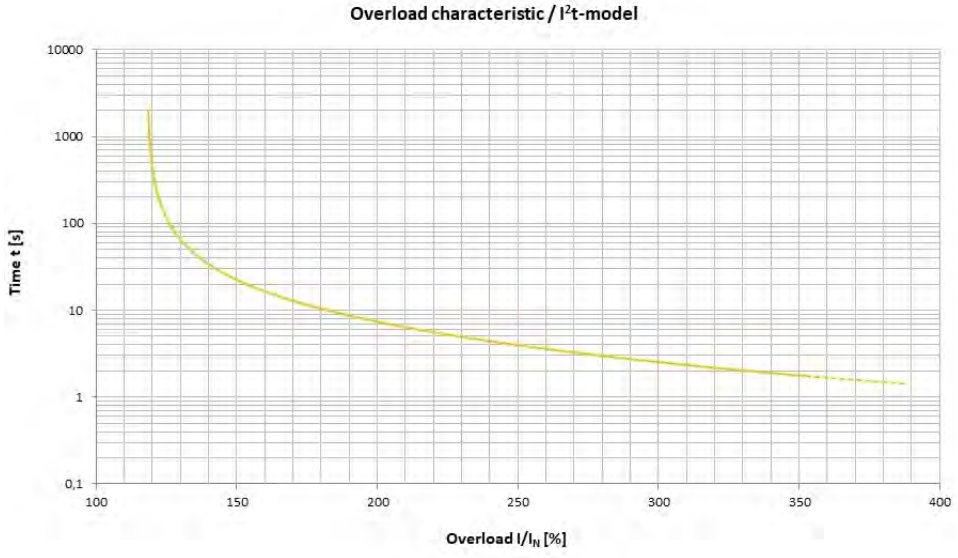


Figure 11-6 Overload characteristic for shutting down the motor for converters with 1 AC line connection

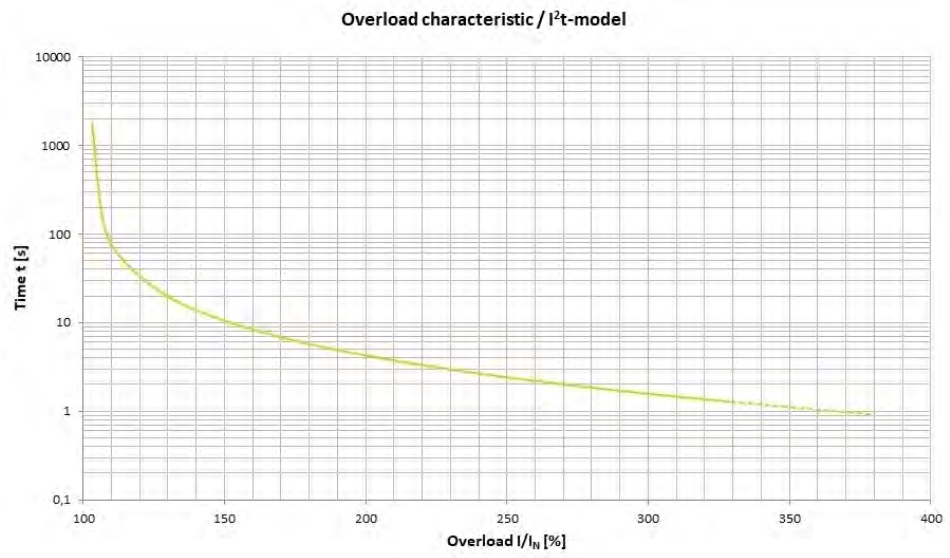


Figure 11-7 Overload characteristic for shutting down the motor for converters with 3 AC line connection

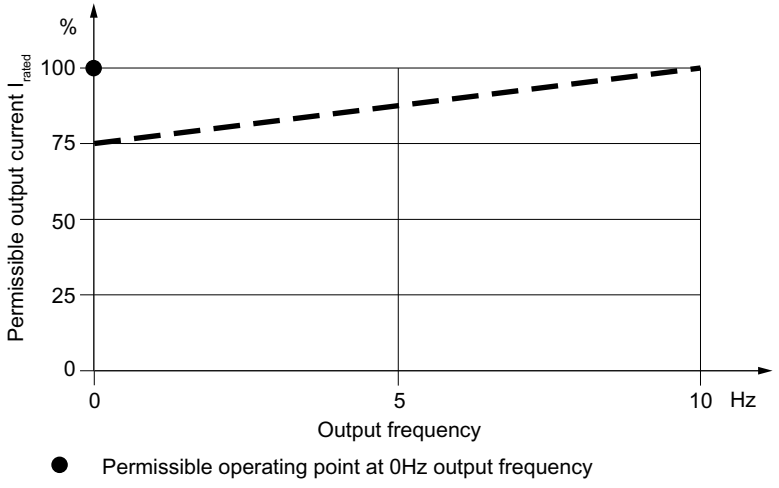


Figure 11-8 Permitted output current at low frequencies

Note

Using the TIA Selection Tool (TST)

Because of the range of possibilities (smaller motor on larger converter and vice verse), the behavior cannot be covered solely by the diagram. The TST is then required.

TIA selection tool (TST)

Use the TIA Selection Tool (TST) to configure a converter-motor combination, adapted to your specific machine. This enables more precise checking of the load profile for a chosen drive configuration - even with more complex profiles.

- "TIA selection tool (https://mall.industry.siemens.com/spice/TSTWeb/#/Start/) "

11.2.2 Electromagnetic compatibility according to IEC 61800-3

Converters are equipment used on a professional basis, deployed in certain areas of business and industry – and are not operated in the general public domain.

For an EMC-compliant installation, observe the information provided in the Configuration Manual: EMC installation guideline (http://support.automation.siemens.com/WW/view/en/60612658).

The devices described there are intended for operation in the second environment. In this environment, they meet all requirements relating to interference immunity. Qualified personnel must check that harmonic currents comply with IEC 61000-3-2 and IEC 61000-3-12.

The drive system must be installed by appropriately qualified personnel in compliance with EMC regulations - and the installation notes provided in the manual.

Maximum permissible cable lengths for the respective EMC categories

Table 11-4 Converters with 1 AC line connection

	Converters with internal line filter	**Converters with additional external filter**
EMC category C2	10 m	25 m
EMC category C3	25 m	50 m

Table 11-5 Converters with 3 AC line connection

	Converters with internal line filter	**Converters with additional external filter**[1)]
	without line/DC link coupling	
EMC category C2	---	25 m
EMC category C3	25 m	50 m
	with line or DC link coupling ≤ 6 converters[2)]	
EMC category C2	---	100 m
EMC category C3	100 m	250 m

1) The filters are scheduled for supply in the 3rd quarter of 2020.

2) The data is applicable for the complete cable length of the motors whose converters are coupled with one another through an AC coupling or the DC link.
The maximum cable length per motor is 25 m when using the internal filters or an external filter to achieve EMC category C2. If an external filter is used to achieve EMC category C3, the maximum cable length per motor is 50 m.

Note

To note for C2 devices

In a residential environment this product may cause radio-frequency interference, which may make interference suppression measures necessary.

- Have qualified personnel carry out the installation and commissioning with suitable interference suppression measures.

Note

To note for C3 devices

In a residential environment this product may cause radio-frequency interference.

- Do not use this device in the first environment (residential area).

Note

Behavior regarding flicker

The flicker behavior can only be evaluated in a combination of the drive with an application (see IEC 61800-3, Section 6.2.4.2). The drive behaves passively in this regard, i.e. load fluctuations of the application will be visible without changes on the line side.

11.2.3 Protection from electromagnetic fields

Overview

Protection of workers from electromagnetic fields is specified in the European EMF Directive 2013/35/EU. This directive is implemented in national law in the European Economic Area (EEA). Employers are obligated to design workplaces in such a way that workers are protected from impermissibly strong electromagnetic fields.

To this end, assessments and/or measurements must be performed for workplaces.

General conditions

The following general conditions apply for the evaluations and measurements:

1. The laws for protection from electromagnetic fields in force in individual EU member states can go beyond the minimum requirements of the EMF Directive 2013/35/EU and always take precedence.
2. The ICNIRP 2010 limits for the workplace are the basis for the assessment.
3. The 26th BImSchV (German Federal Emission Protection Regulation) defines 100 µT (RMS) for the assessment of active implants.
   According to Directive 2013/35/EU, 500 µT (RMS) at 50 Hz is applicable here.
4. The routing of power cables has a significant impact on the electromagnetic fields that occur. Install and operate the components inside metallic cabinets in compliance with the documentation and use shielded motor cables (see "EMC Installation Guideline (https://support.industry.siemens.com/cs/ww/de/view/60612658)").

Evaluation of the converter

The converters are normally used in machines. The assessment and testing is based on DIN EN 12198.

Compliance with the limit values was assessed for the following frequencies:

- Line frequency 47 ... 63 Hz
- 8 kHz pulse frequency

The indicated minimum distances apply to the head and complete torso of the human body. Shorter distances are possible for extremities.

Table 11-6 Minimum distances to the converter

Individuals without active implants		**Individuals with active implants**	
Control cabinet closed	**Control cabinet open**	**Control cabinet closed**	**Control cabinet open**
0 cm	Forearm length (approx. 35 cm)	Must be separately assessed depending on the active implant.	

11.2.4 Permissible environmental conditions for the converter

Property	Version
Ambient conditions for transport in the transport packaging	
Climatic ambient conditions	-40 °C ... +70 °C, according to Class 2K4 to IEC 60721-3-2:1997 maximum humidity 95 % at 40 °C
Mechanical ambient conditions	Shocks and vibrations permissible according to 2M3 to IEC 60721-3-2:1997
Protection against chemical substances	Protected according to Class 2C2 to IEC 60721-3-2:1997
Biological environmental conditions	Suitable according to Class 2B2 to IEC 60721-3-2:1997
Ambient conditions for long-term storage in the product packaging	
Climatic ambient conditions	-25 °C ... +55 °C, according to Class 1K4 to IEC 60721-3-1:1997
Protection against chemical substances	Protected according to Class 1C2 to IEC 60721-3-1:1997
Biological environmental conditions	Suitable according to Class 1B2 to IEC 60721-3-1:1997
Ambient conditions in operation	
Installation altitude	• Up to 1000 m above sea level without restrictions • Up to 4000 m, restrictions, see the following table
Climatic ambient conditions	• Temperature range: 0 °C ... +50 °C • Relative humidity: 5 ... 95%, condensation not permitted • Oil mist, salt mist, ice formation, condensation, dripping water, spraying water, splashing water and water jets are not permitted Increased ruggedness regarding temperature range and relative humidity; therefore better than 3K3 according to IEC 60721-3-3:2002
Mechanical ambient conditions	• Vibration levels permissible according to Class 3M2 to IEC 60721-3-3:2002 Vibration test in operation according to IEC 60068-2-6 Test Fc (sinusoidal) – 9 Hz ... 18 Hz: 1.5 mm deflection amplitude – 18 Hz ... 200 Hz: 2 g acceleration amplitude – 10 frequency cycles per axis • Shocks permissible according to Class 3M2 to IEC 60721-3-3:2002 Shock test in operation according to IEC 60068-2-27 Test Ea (half sinusoidal) – 5 g peak acceleration – 30 ms duration – 3 shocks in all three axes in both directions
Protection against chemical substances	Protected according to 3C2 to IEC 60721-3-3:2002
Biological environmental conditions	Suitable according to 3B2 to IEC 60721-3-3: 2002
Pollution	Suitable for environments with degree of pollution 2 according to EN 61800-5-1

Table 11-7 Maximum permissible output current depending on the installation altitude and ambient temperature

Installation altitude [m] up to	Ambient temperature [°C]		
	50	**45**	**40**
	Output current [%]		
1000	100		
2000	90	100	
3000	80	90	100
4000	70	80	90

A maximum of 2000 m is permissible for CSA compliance.

Conditions for operation at installation altitudes from 2000 m

For 230 V 1 AC devices:

- An isolating transformer is required for operation.

For 3 AC 400 V devices:

- A supply network with grounded neutral point is required for operation.

11.2.5 General data

Property	Version
Line voltage	200 V 1 AC ... 240 V 1 AC, ±10 % Line supply type: Grounded TN/TT systems and non-grounded IT systems
	200 V ... 240 V 3 AC, ±10 % (external, intrinsically safe braking resistor required) 380 V ... 480 V 3 AC, ±10 % Line supply type: TN or TT systems with grounded neutral point An isolating transformer is required for ungrounded IT networks and for networks with a grounded line conductor.
Mains buffering concept	The converter is dimensioned so that there is no functional restriction at rated power (3 ms power dip or interruption according to IEC 61800-3 (2017)[1]). The specified times can be several times longer depending on the drive constellation and the operating conditions. In particular in 3 AC devices in groupings with DC link coupling in which some converters operate in motor mode while others run in generator mode, the time can be substantially longer. Based on these influencing factors, no generally valid statements can be made about the S210 system, however, so that each drive constellation must be assessed individually.
Output voltage	3 AC 0 V ... 0.95 x input voltage
Input frequency	50 Hz ... 60 Hz, ±10%
Output frequency	0 ... 550 Hz
Overvoltage category to IEC/EN 61800-5-1	The converter insulation is designed for surge voltages of overvoltage category III.
Pulse frequency	8 kHz
Short-circuit current rating (SCCR) and branch protection	≤ 65 kA rms Branch protection and short-circuit strength according to UL and IEC Protective devices (https://support.industry.siemens.com/cs/ww/en/view/109748999)
Minimum prospective short-circuit current	To prevent fire in the event of a fault, a minimum value must be ensured for the prospective short-circuit current so that the upstream protective device trips quickly enough. A typical dimensioning value is 20 to 25 times that of the rated current of the protective device being used.
Degree of protection according to EN 60529	IP20 Must be installed in a control cabinet

Property	Version			
Electronics power supply	24 V DC, -15% ... +20%, (PELV or SELV) For PELV systems, grounding must be carried out via the external power supply.			
	Current requirements from electronic power supply at 24 V DC (motor without brake)			
		Frame size	Current requirements [A]	
	230 V	FSA - FSC	0.8	
	400 V	FSA	0.9	
		FSB	1.0	
		FSC	1.2	
	Additional current requirements for 1FK2 servo motor with brake (at 24 V DC)			
	Motor type	Break-induced current typical[2] (to open the brake)	Duration for the break-induced current After expiration of t_{oex}, the holding current takes effect	Holding current (with open brake)
		I_o / A	t_{oex} / ms	I_h / A
	1FK2102	0.6	50	0.1
	1FK2□03	0.8	60	0.15
	1FK2□04	1.2	80	0.2
	1FK2□05	1.1	120	0.3
	1FK2□06	1.1	120	0.35
	1FK2208-3	1.2	120	0.4
	1FK2208-4	1.4	180	0.5
	1FK2208-5	1.4	180	0.5
	1FK2210-3	1.4	180	0.5
	1FK2210-4	1.5	200	0.5
	The brake output voltage is controlled internally. Therefore, with a deviating input voltage at X124, the brake currents must be converted accordingly (constant power). It is not necessary to adjust the input voltage to the cable length. For additional information on the motor brake, refer to the technical specifications in the section "Brake data (Page 356)".			
Control mode	Servo control			
Switch-on frequency minimum precharging cycle	120 s[3]			
Protection functions	Ground fault protection, output short-circuit protection, overvoltage/undervoltage protection, I^2t detection, IGBT overtemperature protection			

[1] During operation of the 3 AC devices on a voltage of 200 V ... 240 V 3 AC, the 3 ms may possibly not be reached depending on the operating conditions.

[2] Typical value for 20 °C ambient temperature. At -15 °C, the break-induced currents can increase by up to 30%.

[3] Shorter precharging cycles may result in a shorter service life.

Table 11-8 Technical data of the digital inputs

Type	**High-speed digital inputs for probe or reference marks**	**Failsafe Digital Input (F-DI)**	**Digital input for monitoring the temperature of an external braking resistor**
Number	**2 (DI 0, DI 1)**	**1 (DI 2 and DI 3)**	**1 (DI 4)**
• Low level	-30 V ... +5 V and ≤ 2 mA	-30 V ... +5 V and ≤ 2 mA	-30 V ... +5 V and ≤ 2 mA
• High level	15 V ... 30 V	15 V ... 30 V	15 V ... 30 V
• Current consumption	6 mA	5 mA	6 mA
• Delay time, typ. L → H	5 µs	50 µs	5 µs
• Delay time, typ. H → L	50 µs	100 µs	50 µs
• Electrical isolation	No	Yes	No
Conductor cross section, max.	1.5 mm²	1.5 mm²	1.5 mm²

The inputs correspond to Type 1 according to EN 61131-2.

11.2.6 Specific data of the converter with 1 AC line connection

Table 11-9 FSA, 1 AC

Article number	**6SL3210-5HB10-1UF0**	**6SL3210-5HB10-2UF0**
Rated output current	0.8 A	1.4 A
Maximum output current	3.1 A	4.8 A
Rated power	100 W	200 W
Rated input current	1.4 A	2.7 A
Inrush current	8 A	8 A
Power loss	15.7 W	23.2 W
Fuse according to IEC Fuse according to UL, Class J	3NA3 801 (6 A) 6 A	3NA3 801 (6 A) 6 A
Cooling	Convection cooling without fan	Convection cooling without fan
Weight	1.1 kg	1.1 kg

Table 11-10 FSB, 1 AC

Article number	**6SL3210-5HB10-4UF0**
Rated output current	2.4 A
Maximum output current	8.7 A
Rated power	400 W
Rated input current	5 A
Inrush current	8 A
Power loss	38.5 W
Fuse according to IEC Fuse according to UL, Class J	3NA3 803 (10 A) 10 A
Cooling	Convection cooling without fan
Weight	1.2 kg

Table 11-11 FSC, 1 AC

Article number	**6SL3210-5HB10-8UF0**
Rated output current	4.4 A
Maximum output current	16 A
Rated power	750 W
Rated input current	9.3 A
Inrush current	8 A
Power loss	71.1 W
Fuse according to IEC Fuse according to UL, Class J	3NA3 805 (16 A) 20 A
Cooling	Convection cooling without fan
Weight	1.9 kg

11.2.7 Specific data of the converter with 3 AC line connection

Table 11-12 FSA, 3 AC

Article number	**6SL3210-5HE10-4UF0**	**6SL3210-5HE10-8UF0**
Rated output current	1.2 A	2.3 A
Maximum output current	4.2 A	7.6 A
Rated power	0.4 kW	0.75 kW
Rated input current	1.6 A	2.8 A
Inrush current	4.3 A	4.3 A
Power loss	69 W	81 W
Fuse according to IEC Fuse according to UL, Class J	3NA3 805 (16 A) 15 A	3NA3 805 (16 A) 15 A
Cooling	Integrated fan	Integrated fan
Weight	2.1 kg	2.1 kg

Table 11-13 FSA, 3 AC

Article number	**6SL3210-5HE11-0UF0**
Rated output current	3 A
Maximum output current	10.9 A
Rated power	1 kW
Rated input current	3.8 A
Inrush current	4.3 A
Power loss	94 W
Fuse according to IEC Fuse according to UL, Class J	3NA3 805 (16 A) 15 A
Cooling	Integrated fan
Weight	2.1 kg

Table 11-14 FSB, 3 AC

Article number	**6SL3210-5HE11-5UF0**	**6SL3210-5HE12-0UF0**
Rated output current	5 A	7 A
Maximum output current	19 A	24 A
Rated power	1.5 kW	2 kW
Rated input current	6.0 A	7.5 A
Inrush current	8.6 A	8.6 A
Power loss	114 W	131 W
Fuse according to IEC Fuse according to UL, Class J	3NA3 812 (32 A) 30 A	3NA3 812 (32 A) 30 A
Cooling	Integrated fan	Integrated fan
Weight	3.3 kg	3.3 kg

Table 11-15 FSC, 3 AC

Article number	**6SL3210-5HE13-5UF0**	**6SL3210-5HE15-0UF0**
Rated output current	9 A	12 A
Maximum output current	33 A	44 A
Rated power	3.5 kW	5 kW
Rated input current	12.5 A	15.0 A
Inrush current	27.8 A	27.8 A
Power loss	167 W	191 W
Fuse according to IEC Fuse according to UL, Class J	3NA3 822 (63 A) 70 A	3NA3 822 (63 A) 70 A
Cooling	Integrated fan	Integrated fan
Weight	5 kg	5 kg

Table 11-16 FSC, 3 AC

Article number	**6SL3210-5HE17-0UF0**
Rated output current	15 A
Maximum output current	55 A
Rated power	7 kW
Rated input current	17.9 A
Inrush current	27.8 A
Power loss	204 W
Fuse according to IEC Fuse according to UL, Class J	3NA3 822 (63 A) 70 A
Cooling	Integrated fan
Weight	5 kg

11.3 Technical data and properties of the connection system

MOTION-CONNECT connection cables between the motor and the converter

The following technical data applies to the MOTION-CONNECT OCC cables.

Table 11-17 MOTION-CONNECT OCC cable with SPEED-CONNECT connector

	Designation and use	Connector size	Outer diameter	Minimum bending radius, static	For connection to motor	Article number[1]
			D_{max} / mm	R / mm		
	Motor connection cable MC500 OCC for predominantly fixed installation	M12	9.7	23.5	1FK2□02 1FK2□03	6FX5002-8QN04-□□□□
		M17	10.5	25.5	1FK2□04 1FK2□05	6FX5002-8QN08-□□□□
		M23	12.7	31	1FK2□06 1FK2□08 1FK2□10	6FX5002-8QN11-□□□□
	Motor connection cable MC800 OCC for use in a cable carrier	M12	9.7	28.2	1FK2□02 1FK2□03	6FX8002-8QN04-□□□□
		M17	10.5	30.6	1FK2□04 1FK2□05	6FX8002-8QN08-□□□□
		M23	12.7	37.2	1FK2□06 1FK2□08 1FK2□10	6FX8002-8QN11-□□□□
	Extension cable MC500 OCC for predominantly fixed installation	M12	9.7	23.5	1FK2□02 1FK2□03	6FX5002-8QE04-□□□□
		M17	10.5	25.5	1FK2□04 1FK2□05	6FX5002-8QE08-□□□□
		M23	12.7	31	1FK2□06 1FK2□08 1FK2□10	6FX5002-8QE11-□□□□
	Extension cable MC800 OCC for use in a cable carrier	M12	9.7	28.2	1FK2□02 1FK2□03	6FX8002-8QE04-□□□□
		M17	10.5	30.6	1FK2□04 1FK2□05	6FX8002-8QE08-□□□□
		M23	12.7	37.2	1FK2□06 1FK2□08 1FK2□10	6FX8002-8QE11-□□□□

[1] The last 4 positions (□□□□) define the cable length corresponding to the length code.

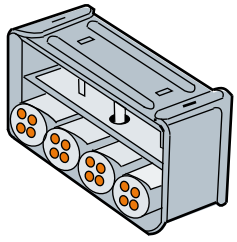
The length code can be found in the section "Ordering data of the connection system (Page 462)".

Technical data and notes for cable carrier use with MC800 PLUS

Note

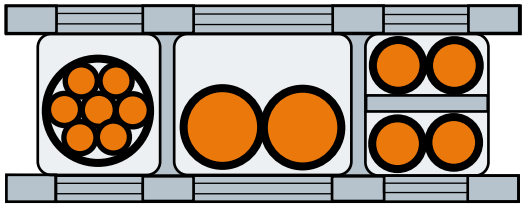
You require an MC800 PLUS cable to connect the motor using a cable carrier.

- When inserting prefabricated cables in the cable carrier, do not pull the connector, as this may damage the strain relief or cable clamping.



Strain relief in a cable carrier

- Lay the cables loosely in the carrier. They must be free to move. The cables must be free to move in particular in the bending radii of the carrier. Observe the specified minimal bending radii.



Cable routed in a cable carrier

- The cable fixings must be attached at both ends at an appropriate distance away from the end points of the moving parts in a dead zone.

When laying cables, comply with the instructions given by the cable carrier manufacturer.

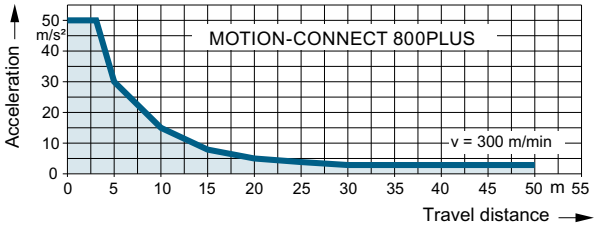


Figure 11-9 Permissible acceleration levels for MOTION-CONNECT 800 PLUS cables

Note

Additional fixing of the cable

If between the cable strain relief on the cable carrier and the terminal at the motor, part of the cable is hanging loose or is not routed, we recommend that the cable is additionally fixed for vibration load and with horizontal or vertical cable entries.

- Also fix the cable where the motor is fixed so that machine vibrations are not transferred to the connector.

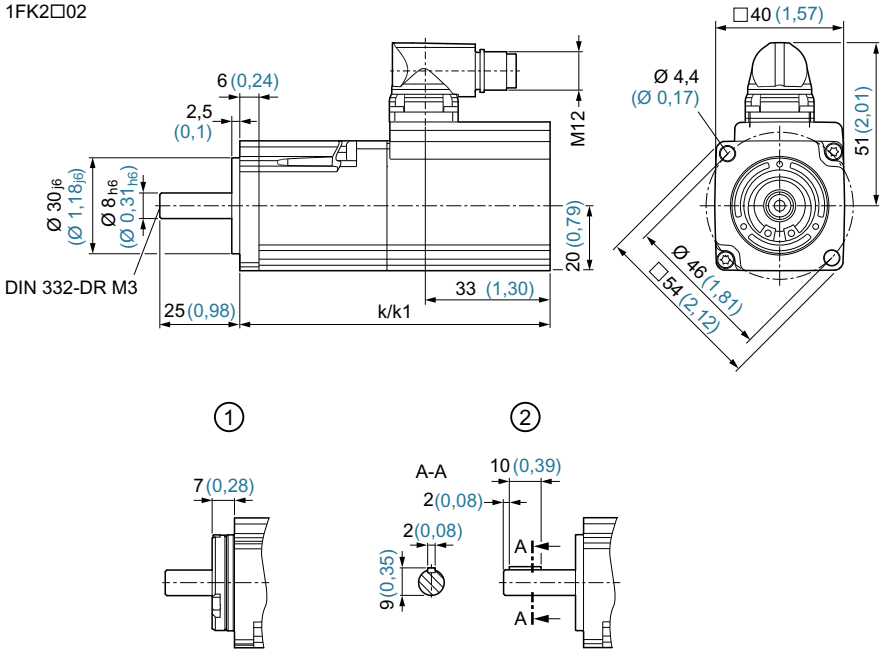
Dimension drawings

12

12.1 Dimension drawings, motor

12.1.1 Dimension drawings 1FK2, shaft height 20

All dimensions in mm (inches).



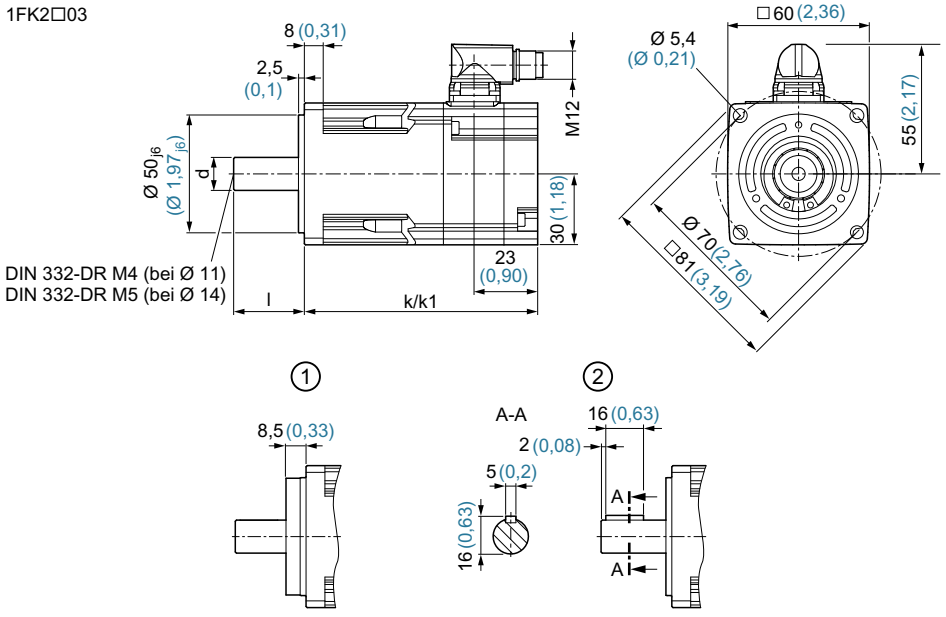
① With shaft sealing ring (IP65) ② With feather key

Figure 12-1 Dimension drawing 1FK2102

SIMOTICS S-1FK2 Shaft height 20		Dimensions	
		Without brake	With brake
	DIN	k	k1
	IEC	LB	LB1
1FK2102-0A☐ (50 W)		90 (3.54)	121 (4.76)
1FK2102-1A☐ (100 W)		106 (4.17)	137 (5.39)

12.1.2 Dimension drawings 1FK2, shaft height 30

All dimensions in mm (inches).



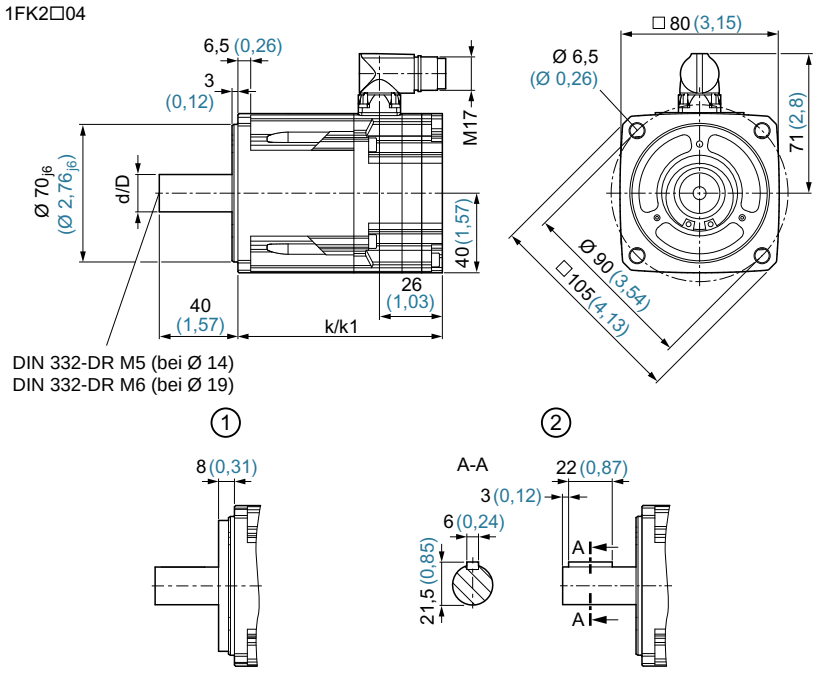
① With shaft sealing ring (IP65) ② With feather key

Figure 12-2 Dimension drawing 1FK2□03

SIMOTICS S-1FK2 Shaft height 30		Dimensions					
		Without brake	With brake	Shaft 14 x 30 mm		Shaft 11 x 23 mm	
	DIN	k	k1	d	l	d	l
	IEC	LB	LB1	D	L	D	L
1FK2□03-2A□□□-0□□□ (200 W), plain shaft		99 (3.9)	131 (5.16)	14_{h6} (0.55_{h6})	30 (1.18)		
1FK2□03-2A□□□-1□□□ (200 W), shaft with feather key							
1FK2□03-2A□□□-2□□□ (200 W), plain shaft						11_{k6} (0.43_{k6})	23 (0.91)
1FK2□03-4A□□□-0□□□ (400 W), plain shaft		123 (4.84)	155 (6.10)	14_{h6} (0.55_{h6})	30 (1.18)		
1FK2□03-4A□□□-1□□□ (400 W), shaft with feather key							
1FK2□03-4A□□□-2□□□ (400 W), plain shaft						11_{k6} (0.43_{k6})	23 (0.91)

12.1.3 Dimension drawings 1FK2, shaft height 40

All dimensions in mm (inches)



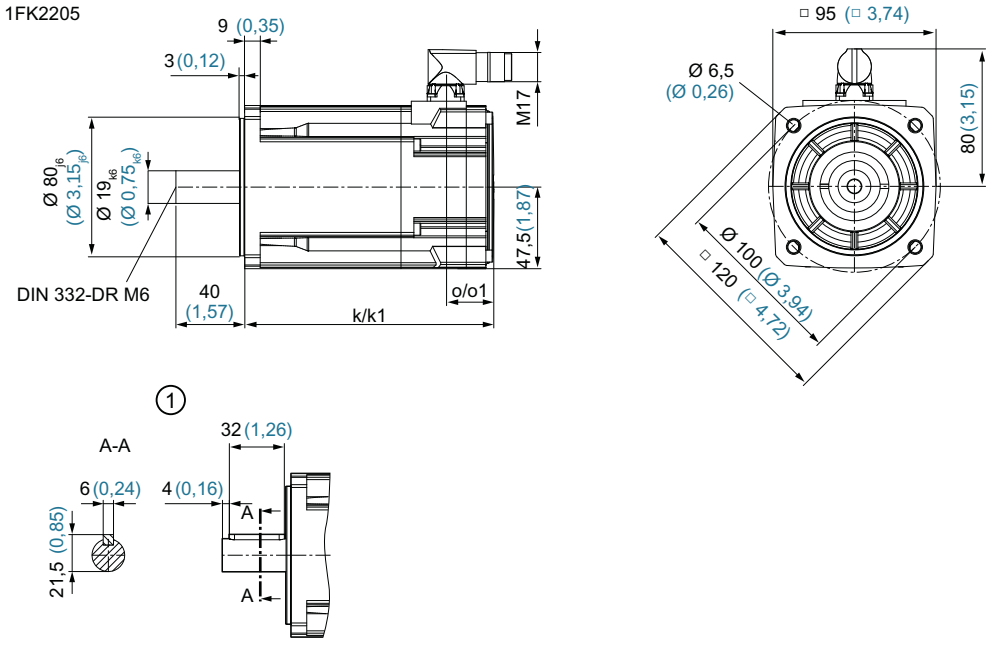
① With shaft sealing ring (IP65) ② With feather key

Figure 12-3 Dimension drawing_1FK2104

SIMOTICS S-1FK2 Shaft height 40		Dimensions					
		Without brake	With brake	Shaft diam. 19 x 40		Shaft diam. 14 x 30 (only IP64, only plain shaft) (option N05)	
	DIN	k	k1	d	l	d	l
	IEC	LB	LB1	D	L	D	L
1FK2□04-4A□ (400 W)		98 (3.86)	142 (5.59)	Diam. 19 $_{k6}$ (diam. 0.75 $_{k6}$)	40 (1.57)	Diam. 14 $_{k6}$ (diam. 0.55 $_{k6}$)	30 (1.18)
1FK2□04-5A□ (750 W)		126 (4.96)	170 (6.69)				
1FK2□04-6A□ (1000 W)		144 (5.57)	188 (7.40)				

12.1.4 Dimension drawings, 1FK2, shaft height 48

All dimensions in mm (inches).



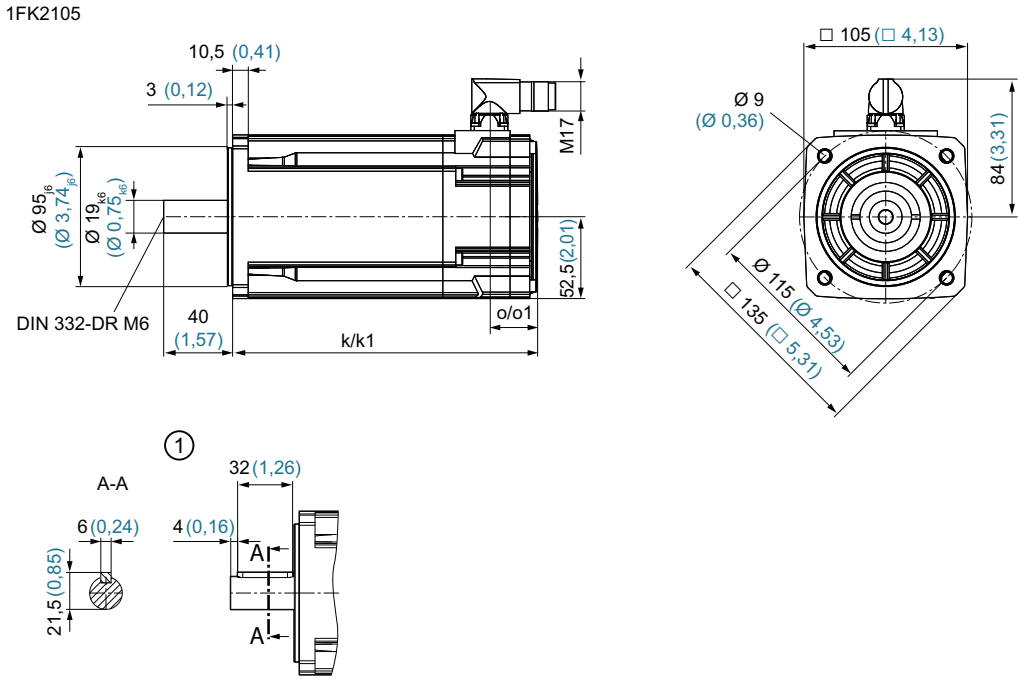
① With feather key

Figure 12-4 Dimension drawing, 1FK2205

SIMOTICS S-1FK2 Shaft height 48		Dimensions			
		Without brake		With brake	
	DIN	k	o	k1	o1
	IEC	LB	-	LB1	-
1FK2205-2A□		145 (5.71)		188 (7.4)	
1FK2205-4A□		177 (6.97)	28 (1.1)	220 (8.66)	34 (1.34)

12.1.5 Dimensional drawings, 1FK2, shaft height 52

All dimensions in mm (inches).



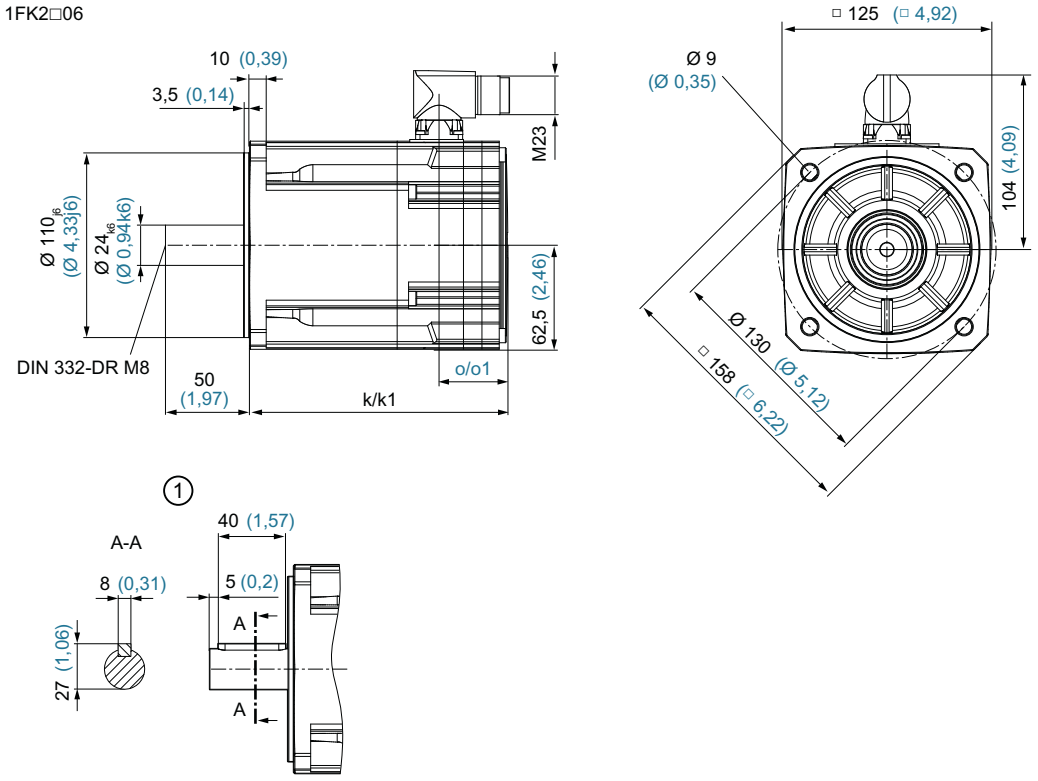
① With feather key

Figure 12-5 Dimension drawing, 1FK2105

SIMOTICS S-1FK2 Shaft height 52		Dimensions			
		Without brake		With brake	
	DIN	k	o	k1	o1
	IEC	LB	-	LB1	-
1FK2105-4A□		159 (6.26)		202 (7.95)	
1FK2105-6A□		201 (7.91)	20 (0.79)	244 (9.61)	36 (1.42)

12.1.6 Dimensional drawings, 1FK2, shaft height 63

All dimensions in mm (inches).



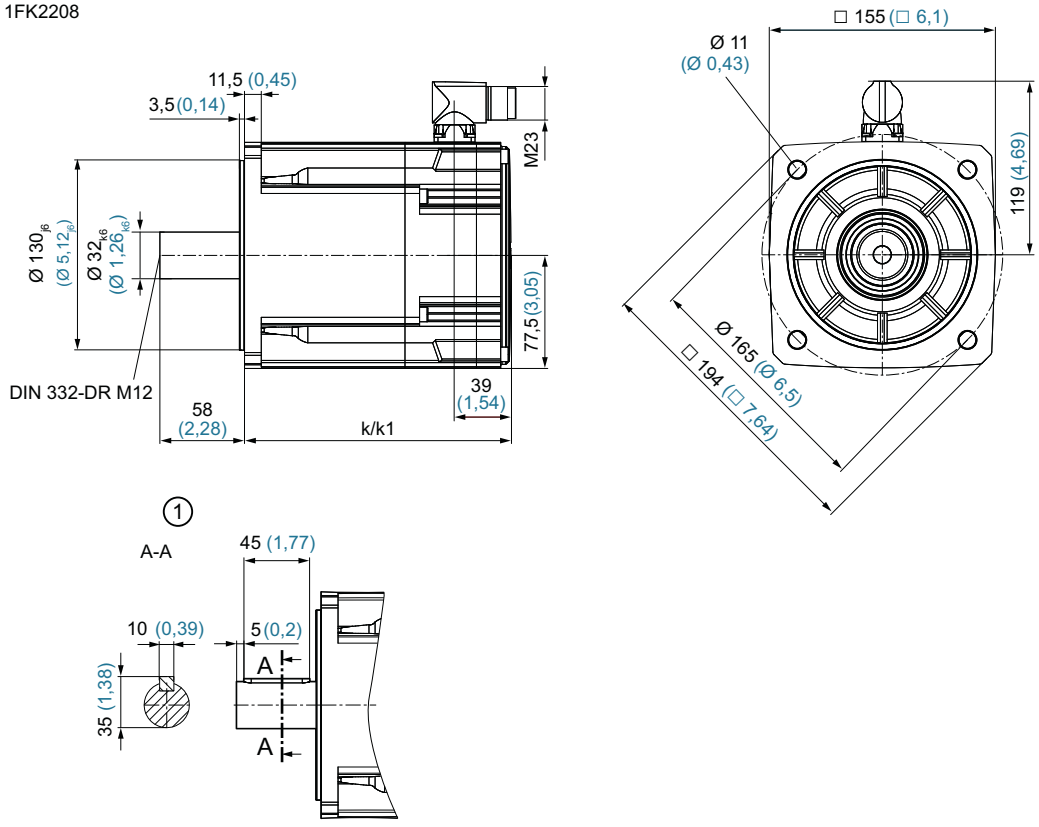
① With feather key

Figure 12-6 Dimension drawing, 1FK2□06

SIMOTICS S-1FK2 Shaft height 63		Dimensions			
		Without brake		With brake	
	DIN	k	o	k1	o1
	IEC	LB	-	LB1	-
1FK2206-2A□		154 (6.06)	41 (1.61)	205 (8.07)	53 (2.09)
1FK2106-3A□		174 (6.85)		225 (8.86)	
1FK2□06-4A□		193 (7.60)		244 (9.61)	
1FK2106-6A□		232 (9.13)		283 (11.14)	

12.1.7 Dimension drawings 1FK2, shaft height 80

All dimensions in mm (inches).



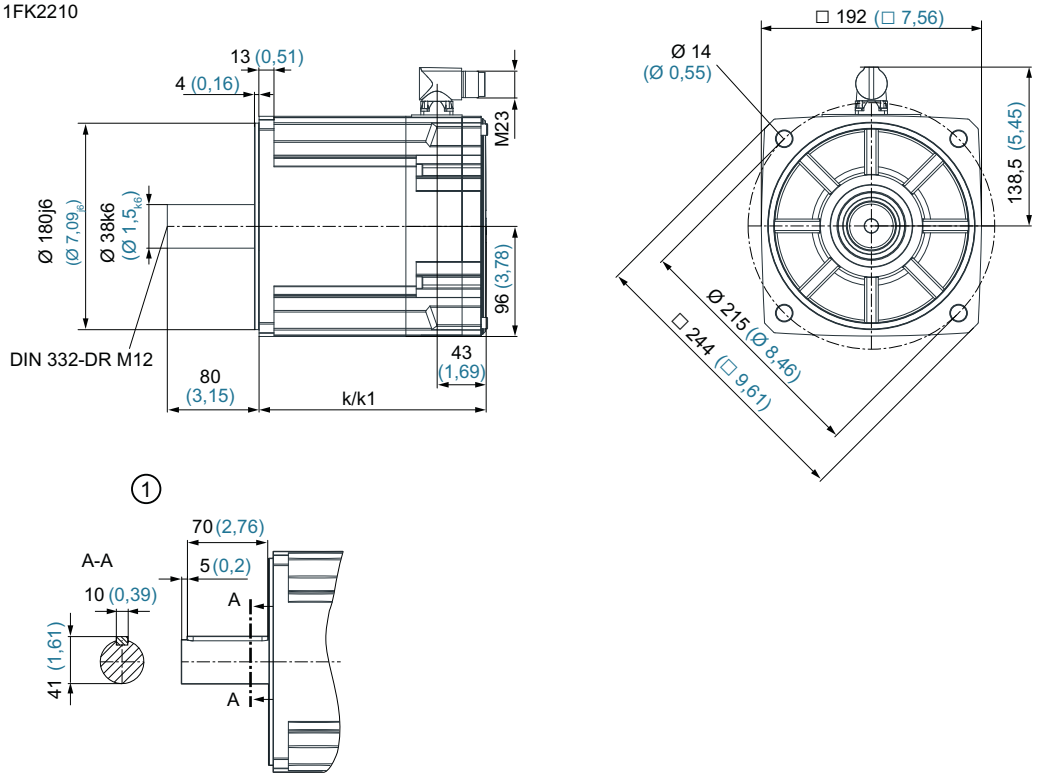
① With feather key

Figure 12-7 Dimension drawing, 1FK2208

SIMOTICS S-1FK2 Shaft height 80		Dimensions	
		Without brake	With brake
	DIN	k	k1
	IEC	LB	LB1
1FK2208-3A□		183 (7.20)	236 (9.29)
1FK2208-4A□		203 (7.99)	256 (10.08)
1FK2208-5A□		223 (8.78)	276 (10.87)

12.1.8 Dimensional drawings, 1FK2, shaft height 100

All dimensions in mm (inches).



① With feather key

Figure 12-8 Dimension drawing, 1FK2210

SIMOTICS S-1FK2 Shaft height 100		Dimensions	
		Without brake	With brake
	DIN	k	k1
	IEC	LB	LB1
1FK2210-3A☐		198 (7.80)	257 (10.12)
1FK2210-4A☐		223 (8.78)	282 (11.10)
1FK2210-5A☐		148 (9.76)	307 (12.09)

12.2 Dimension drawings, converter

12.2.1 FSA with 1 AC line connection

6SL3210-5HB10-1UF0 (100 W)

6SL3210-5HB10-2UF0 (200 W)

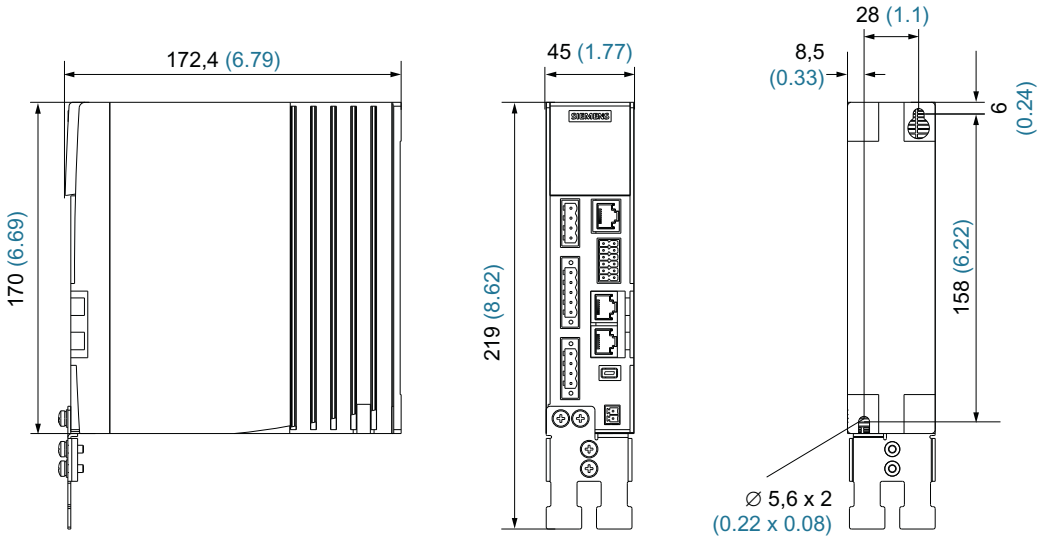


Figure 12-9 Dimension drawing SINAMICS S210 FSA, 1 AC, dimensions in mm (inch)

12.2.2 FSB with 1 AC line connection

6SL3210-5HB10-4UF0 (400 W)

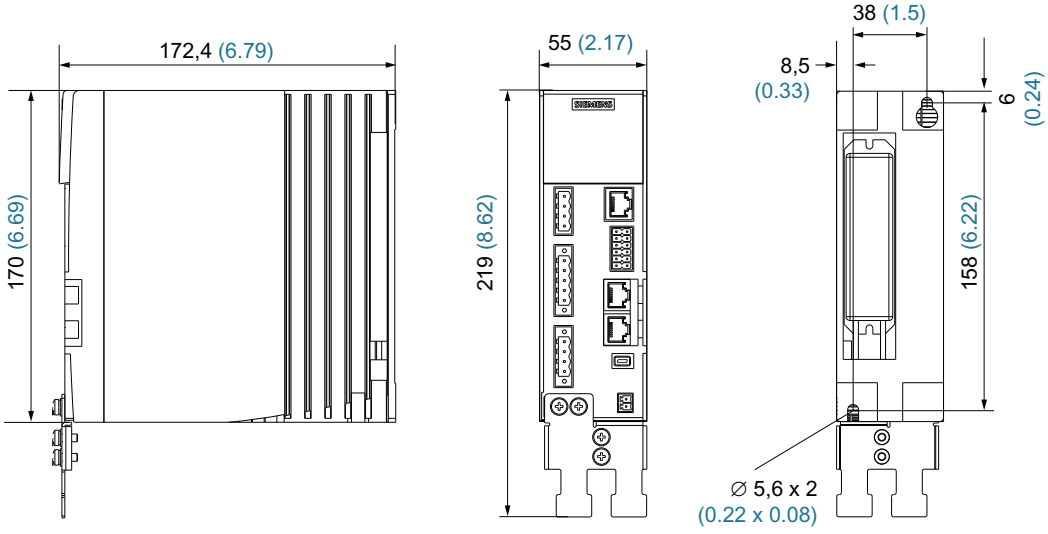


Figure 12-10 Dimension drawing SINAMICS S210 FSB, 1 AC, dimensions in mm (inch)

12.2.3 FSC with 1 AC line connection

6SL3210-5HB10-8UF0 (750 W)

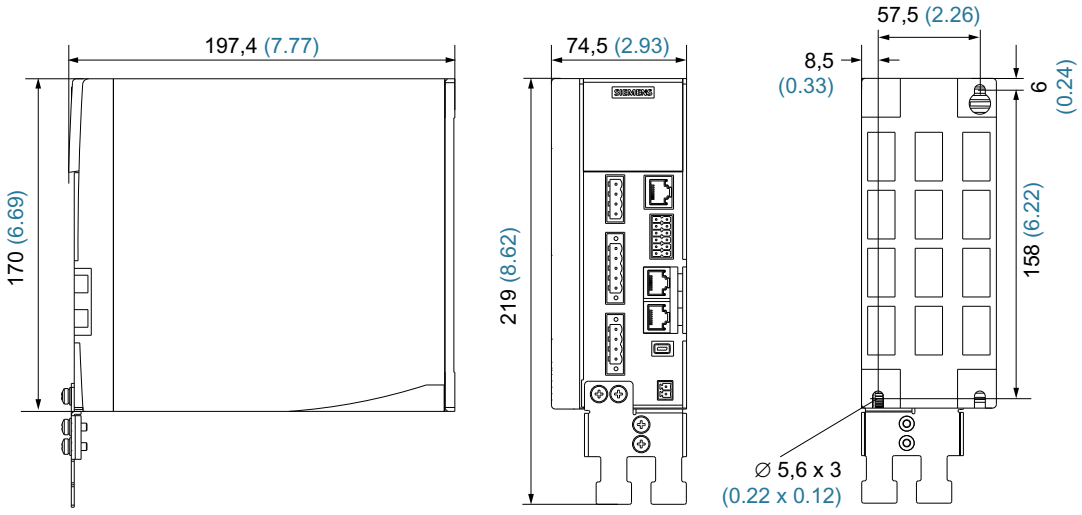


Figure 12-11 Dimension drawing SINAMICS S210 FSC, 1 AC, dimensions in mm (inch)

12.2.4 FSA with 3 AC line connection

6SL3210-5HE10-4UF0 (400 W)

6SL3210-5HE10-8UF0 (750 W)

6SL3210-5HE11-0UF0 (1.0 kW)

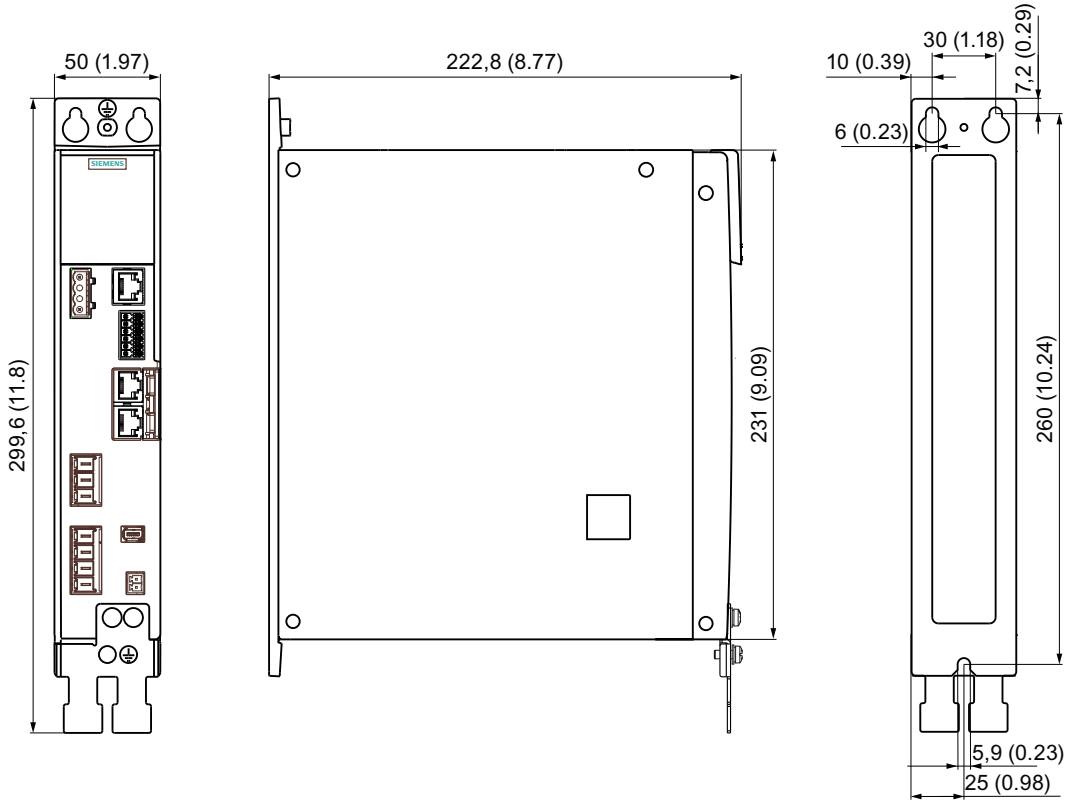


Figure 12-12 Dimension drawing SINAMICS S210 FSA, 3 AC, dimensions in mm (inch)

12.2.5 FSB with 3 AC line connection

6SL3210-5HE11-5UF0 (1.5 kW)

6SL3210-5HE12-0UF0 (2.0 kW)

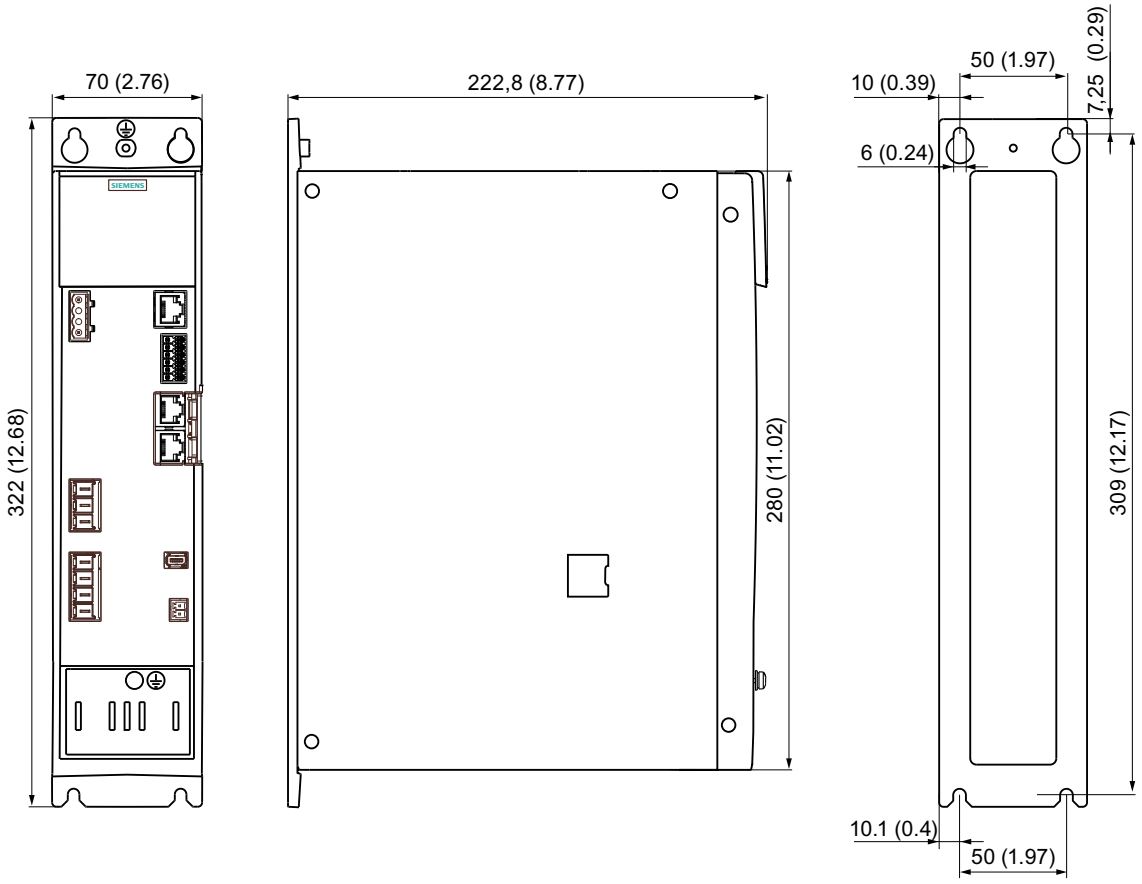


Figure 12-13 Dimension drawing SINAMICS S210 FSB, 3 AC, dimensions in mm (inch)

12.2.6 FSC with 3 AC line connection

6SL3210-5HE13-5UF0 (3.5 kW)

6SL3210-5HE15-0UF0 (5.0 kW)

6SL3210-5HE17-0UF0 (7.0 kW)

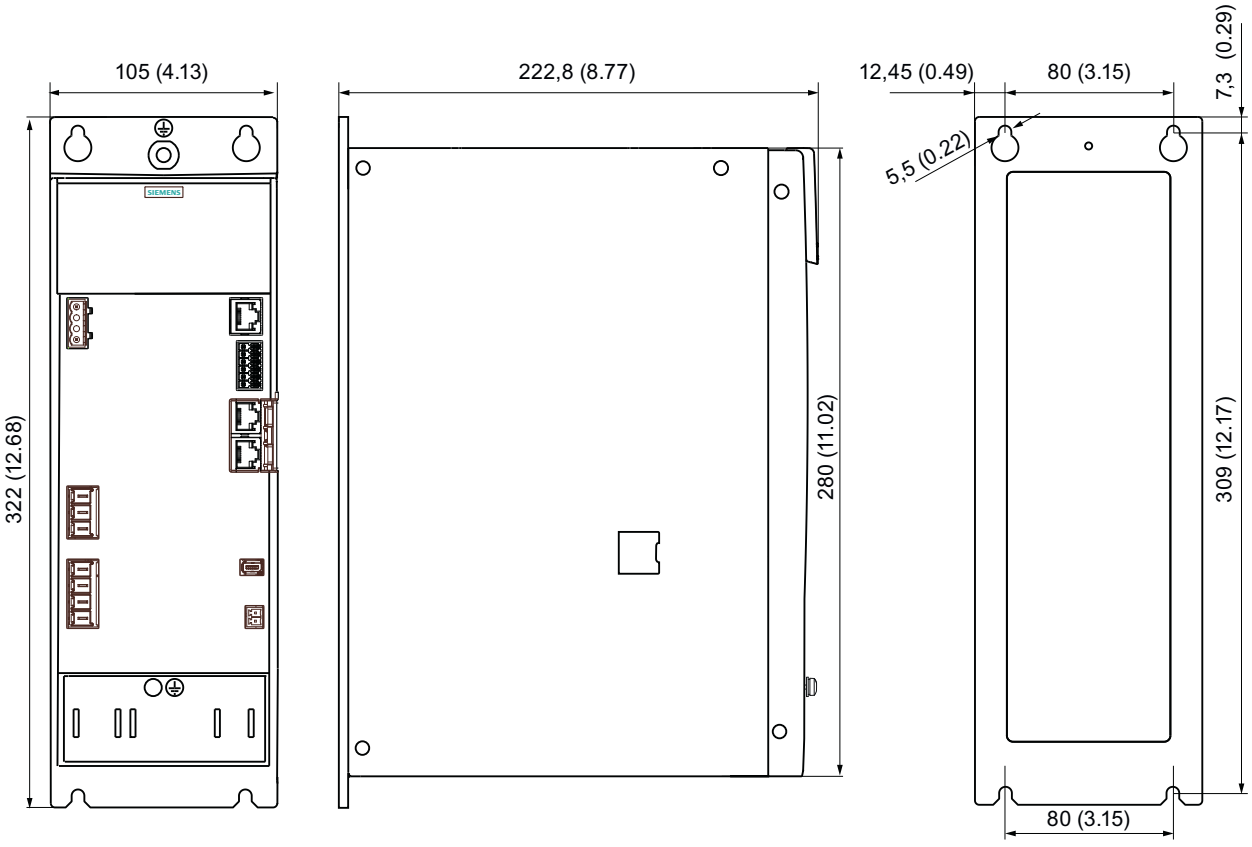


Figure 12-14 Dimension drawing SINAMICS S210 FSC, 3 AC, dimensions in mm (inch)

Decommissioning and disposal

13

⚠ WARNING

Risk of injury through falling motors or machine components

Motors and machine components can fall when being dismantled from the machine. They can cause serious injury or property damage.

- Secure the machine components being dismantled to prevent them falling.

NOTICE

Damage caused by data misuse

If the memory card or converter is disposed of in a non-secure manner, misuse of data may occur resulting in damage or malfunctions in the systems.

- Therefore, delete the configuration of the converter with a "Reset to factory settings" and delete/format the memory card. There are programs that support you in securely deleting/formatting the memory card.
- Make sure you securely remove all custom certificates.

You can find more information in the "Industrial Security (https://support.industry.siemens.com/cs/ww/en/view/108862708)" configuration manual.

Removing the device from the machine

1. Check that all parts of the device are in a no voltage condition.
2. Let the device cool down enough so that you are not burnt.
3. Disconnect all electrical connections.
4. Remove the fixing elements.
5. Transport the device to a suitable location for disposal.

Recycling and disposal

For environmentally-friendly recycling and disposal of your old device, please contact a company certified for the disposal of waste electrical and electronic equipment, and dispose of the old device as prescribed in the respective country of use.

Accessories and spare parts

14

14.1 Accessories

14.1.1 Memory cards

The converter can also be operated without a memory card. The memory card is only required for data backup, series commissioning and for functions that require a license.

Memory card for data backup and series commissioning

Use the following memory cards to back up data, for licensing and for series commissioning. If you are using functions that require a license, a memory card is absolutely necessary for converter operation (and must be permanently inserted). Converters with 3 AC line connection require firmware version 5.2 or higher.

Card type	Article number
Empty SD card	6SL3054-4AG00-2AA0
SD card with firmware V5.1	6SL3054-4FB00-2BA0
SD card with firmware V5.1 SP1	6SL3054-4FB10-2BA0
SD card with firmware V5.1 SP1 and license for Extended Safety Functions	6SL3054-4FB10-2BA0-Z F01
SD card with firmware V5.2	6SL3054-4FC00-2BA0
SD card with firmware V5.2 and license for Extended Safety Functions	6SL3054-4FC00-2BA0-Z F01
SD card with firmware V5.2 SP3	6SL3054-4FC30-2BA0
SD card with firmware V5.2 SP3 and license for Extended Safety Functions	6SL3054-4FC30-2BA0-Z F01
as of firmware version 5.1 SP1: License for Extended Safety Functions "Certificate of License" without SD card, to subsequently license an existing SD card	6SL3074-0AA10-0AA0

Note

Permissible memory cards

The integrated card reader supports SD cards up to a memory capacity of 2 GB.

SDHC or SDXC cards are not supported.

14.1.2 Connectors and cables for the AC and DC link coupling

The following packages are available for the connectors:

Article number	Spare part
6SL3260-2DC00-0AA0	Connector kit for the AC and DC link coupling
6SL3260-2DC10-0AA0	Connector kit for the AC coupling

Contents	6SL3260-2DC00-0AA0	6SL3260-2DC10-0AA0
Connectors for the AC coupling	1	1
Connector for the DC link coupling	1	-
End caps	2	1
Description/data sheet	1	1

The connectors are designed so that they cannot be accidentally interchanged.

The cables required for the AC and DC link coupling are standard cables and therefore not included in the scope of delivery. Permissible connecting cables are listed in section "Establishing the AC and DC link coupling (Page 176)".

X1: Connectors for the AC coupling

Pin	Pin assignment	Explanation
L1	Phase L1 line system	The terminals are Torx screw terminals. Permissible conductor cross-sections: • 16 mm² • AWG: 6 Tightening torque: 3 Nm
L2	Phase L2 line system	
L3	Phase L3 line system	

X3: Connector for the DC link coupling

Pin	Pin assignment	Explanation
DCP	DC link, positive	The terminals are Torx screw terminals. Permissible conductor cross-sections: • 16 mm² • AWG: 6 Tightening torque: 3 Nm
--	not assigned	
DCN	DC link, negative	

End cap for the AC and DC link coupling

14.1.3 PROFINET patch cable

Use the following patch cable to network converters located adjacent one another via PROFINET:

Cable type	Length	Article number
Industrial Ethernet TP cord, CAT 6A, TP cable 4 x 2 conductors, prefabricated with 2 RJ45 connectors	0.3 m	6XV1870-3QE30
	0.5 m	6XV1870-3QE50

14.1.4 External line filters

Line filters limit the electromagnetic interference emissions from the SINAMICS S210 to the permissible limit values according to EN61800-3 or the requirements of Class A of standard EN 55011.

The SINAMICS S210 line filters are passive components used to expand the EMC properties of the S210 system. With them, the EMC categories C2 or C3 with longer cable lengths are possible (see section "Electromagnetic compatibility according to EN 61800-3 (Page 406)").

Figure 14-1 3 AC line filter and converter

In a 3 AC drive line-up, the associated line filter must always be mounted to the left of the converters.

14.1.4.1 Safety instructions

⚠ WARNING

Electric shock caused by PEN conductor overload

In TN-C supply networks, the protective function of the PEN conductor can be adversely affected by exposure to harmonic currents.

- Consider the harmonic currents when dimensioning the PEN conductor.

⚠ WARNING

Fire caused by neutral conductor (N) overload

The neutral conductor can heat up due to the load from harmonic currents and cause a fire.

- Consider the harmonic currents when dimensioning the neutral conductor.

NOTICE

Line filter damage by connecting to impermissible line supply

The line filters are only suitable for direct connection to line supplies with grounded neutral point. Connecting the line filter to another network will damage the line filter.

- Only connect the line filter to a line supply with grounded neutral point.

NOTICE

Destruction or damage of components by incorrectly connecting the line filter

When incorrectly connecting the line filter, components can be destroyed or damaged.

- Connect the line filter in accordance with the instructions in the technical documentation.
- Do not connect any additional loads downstream of the line filter.

NOTICE

Line filter damage due to interchanged connections

The line filter might be damaged if the input and output connections are interchanged.

- Connect the incoming line supply cable to "Line" or X5.
- Connect the outgoing cable to "Load" or X6.

NOTICE

Damage to the system caused by a line filter that is not permissible

A line filter that is not permissible can cause system damage.

- Only use the line filter with the components that are compatible with it.

NOTICE

Damage caused by using third party filters

According to product standard IEC 61800-3, RFI suppression commensurate with the relevant rated conditions must be provided and is a legal requirement in the EU (EMC Directive). Line filters and line reactors are required in order to comply with this standard. The use of filters of other makes can lead to limit value violations, resonances, overvoltage, and irreparable damage to motors and other equipment.

- The machine manufacturer must provide verification that the machine equipped with the drive products and the installed suppression elements, e.g. line filters, is EMC-compliant before the machines are placed in the market.

NOTICE

Destruction of the line filter when used with an unsuitable protective element

Use of an incorrectly dimensioned protective element can result in thermal overload or destruction of the line filter.

- Consider the SCCR and the rated current of the line filter when selecting the protective element.

Note

Disconnect the line filter for a high-voltage test

If a high-voltage test is conducted with alternating voltage in the system, the existing line filters must be disconnected in order to obtain accurate measurements.

14.1.4.2 Interfaces

Line filters for 1 AC converters

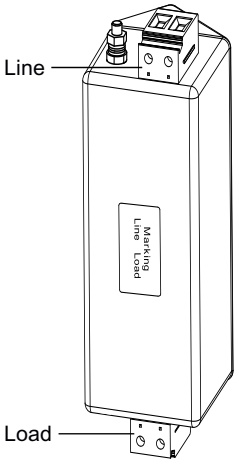


Figure 14-2 Interfaces of the line filter for 1 AC converters

Terminals for line filters for 1 AC converters:

- Line: Line connection
- Load: Load connection

Line filters for 3 AC converters

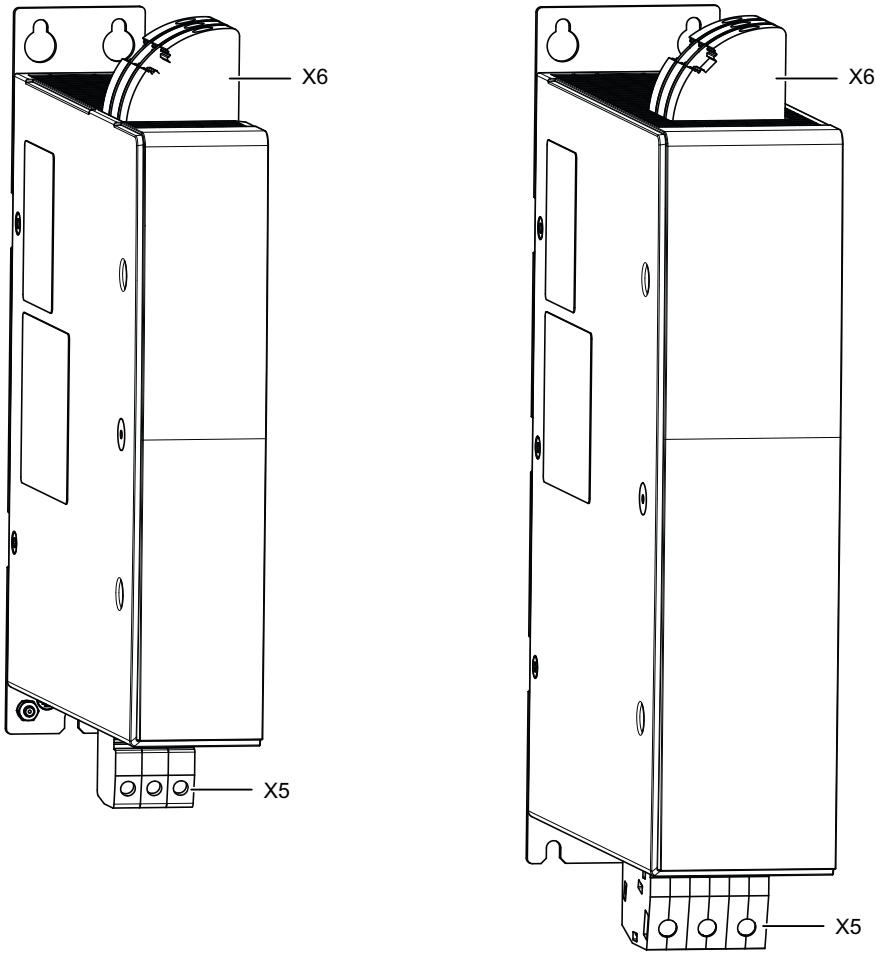
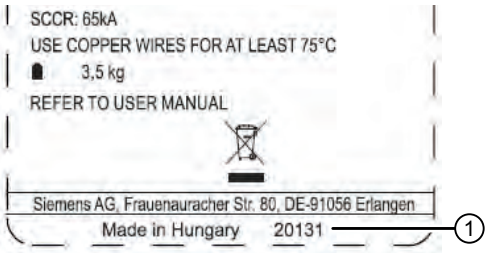


Figure 14-3 Interfaces of the line filters for 3 AC converters, 35 A and 65 A

Terminals for line filters for 3 AC converters:

- X5: Line connection
- X6: Load connection

Date of manufacture



The date of manufacturer of the filter ① is stated on the nameplate in the following form:

- CY: Calendar year (two digit)
- CW: Calendar week (01 ... 53)
- D: Day (Mon ... Sun)

In the example provided here, "20131" means:
2020, CW 13, Monday = March 23, 2020

14.1.4.3 Dimension drawings

Line filters for 1 AC converters

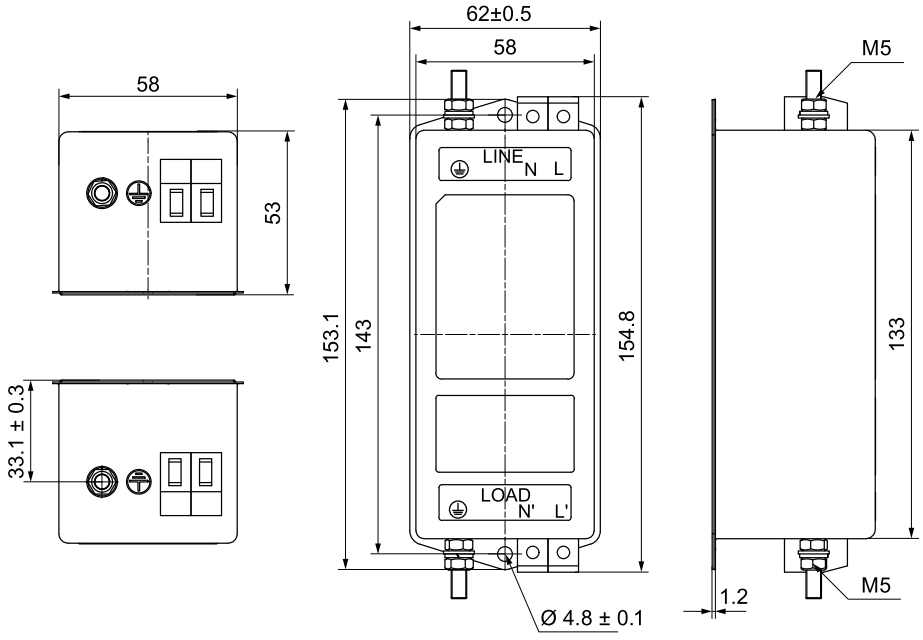
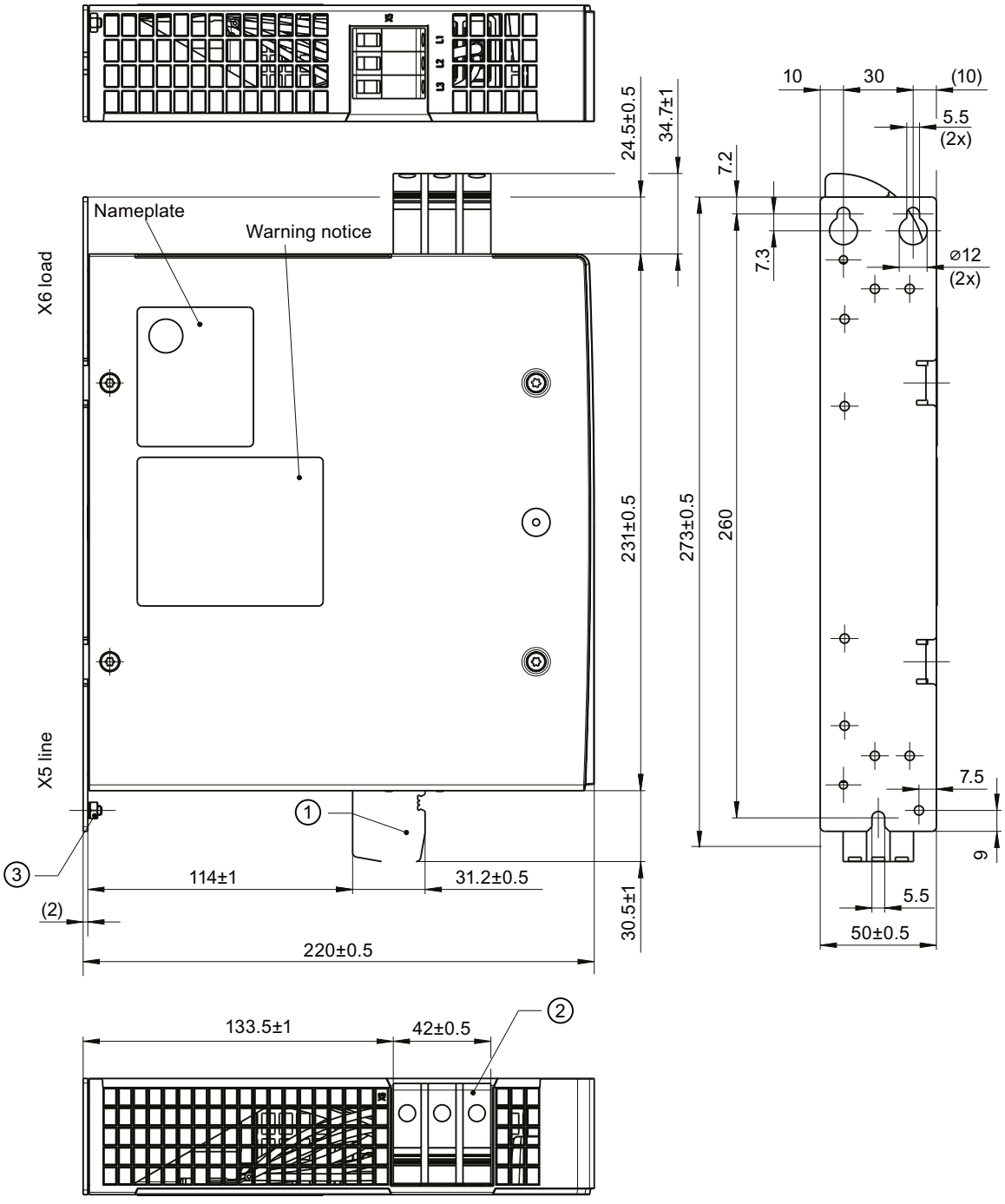


Figure 14-4 Dimension drawing for the line filter for 1 AC converters

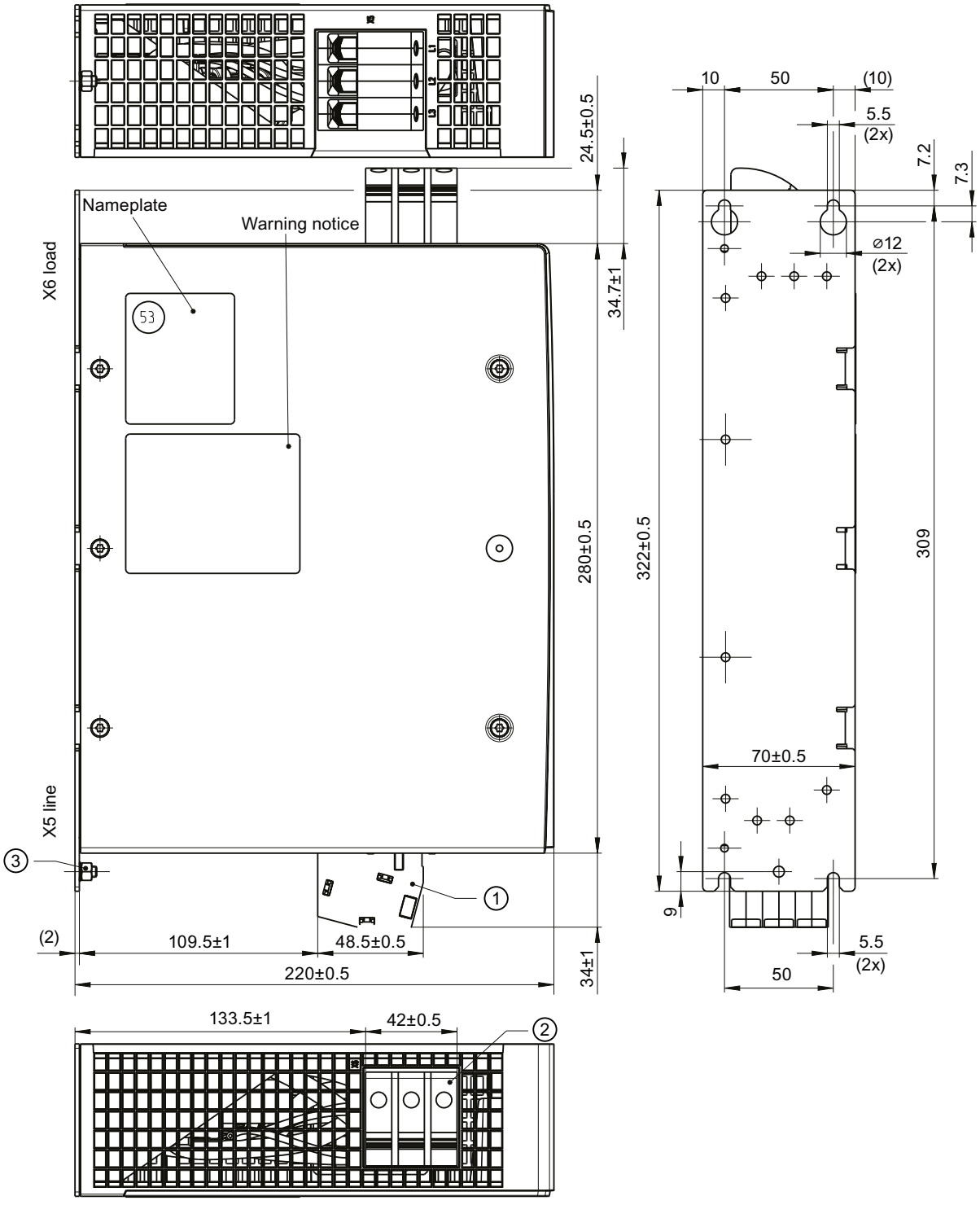
- Tightening torque for the mounting screws (M4): 1.2 ... 1.8 Nm
- Tightening torque for the protective conductor fastening bolt (M5): 2.0 ... 2.2 Nm
- Tightening torque of the line-side and load-side screw connection: 0.7 ... 0.8 Nm

Line filters for 3 AC converters



① Terminal 10 mm², tightening torque 1.5 ... 1.8 Nm
② Terminal 16 mm², tightening torque 2.5 ... 3 Nm
③ Protective conductor M4x6, tightening torque 1.8 Nm

Figure 14-5 Dimension drawing for the line filter for 3 AC converters, 35 A



① Terminal 25 mm², tightening torque 4 ... 4.5 Nm
② Terminal 16 mm², tightening torque 2.5 ... 3 Nm
③ Protective conductor M5x8, tightening torque 3 Nm

Figure 14-6 Dimension drawing for the line filter for 3 AC converters, 65 A

14.1.4.4 Mounting

Note

When you mount external line filters, consider the specifications for the "Cable routing inside the cabinet (Page 48)".

1 AC filter

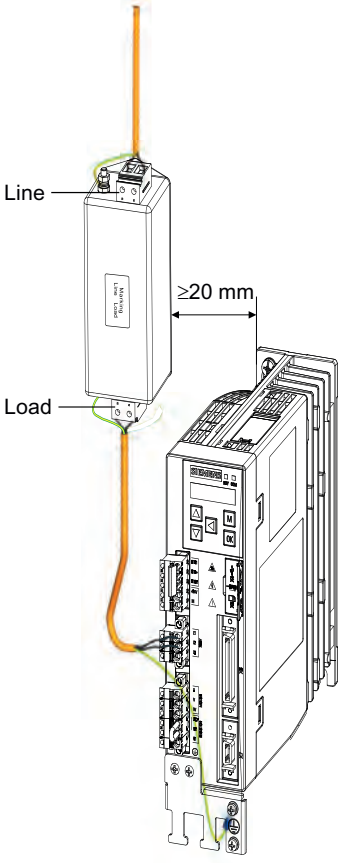


Figure 14-7 1 AC filter mounting

Note

When you mount a 1 AC filter, maintain a minimum clearance of 20 mm (0.79 inches) from the converter.

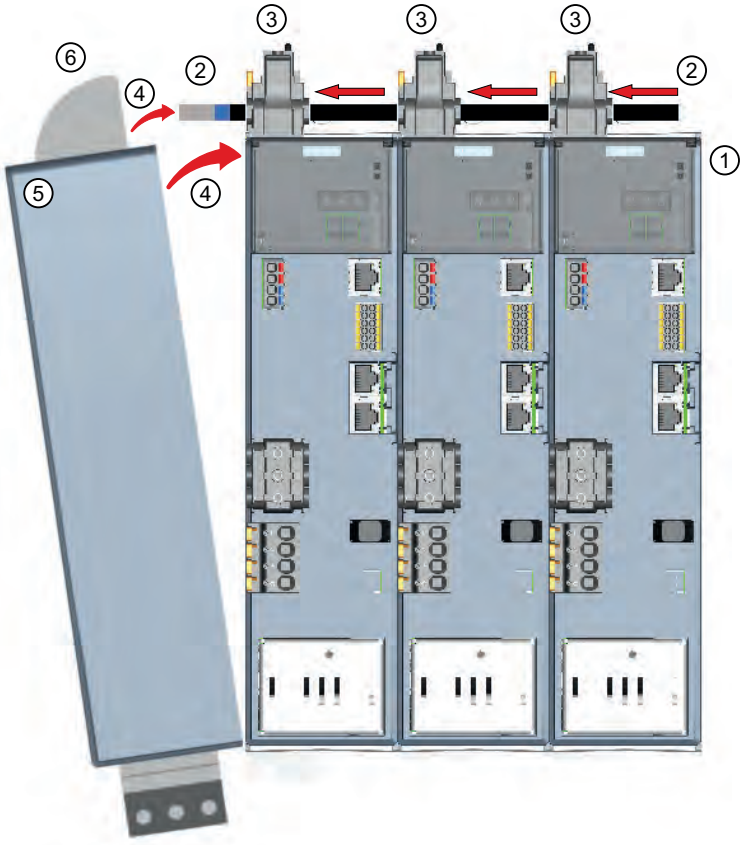
3 AC filter

There are 2 ways of mounting and connecting 3 AC filters:

Variant 1: The converter group is mounted and wired

The converter group is already mounted and the AC coupling is wired and prepared for the filter, i.e. insulation stripped and provided with end sleeves.

The filter then only has to be "threaded" from the left and screwed on. This simpler variant requires sufficient mounting space to the left of the converters.



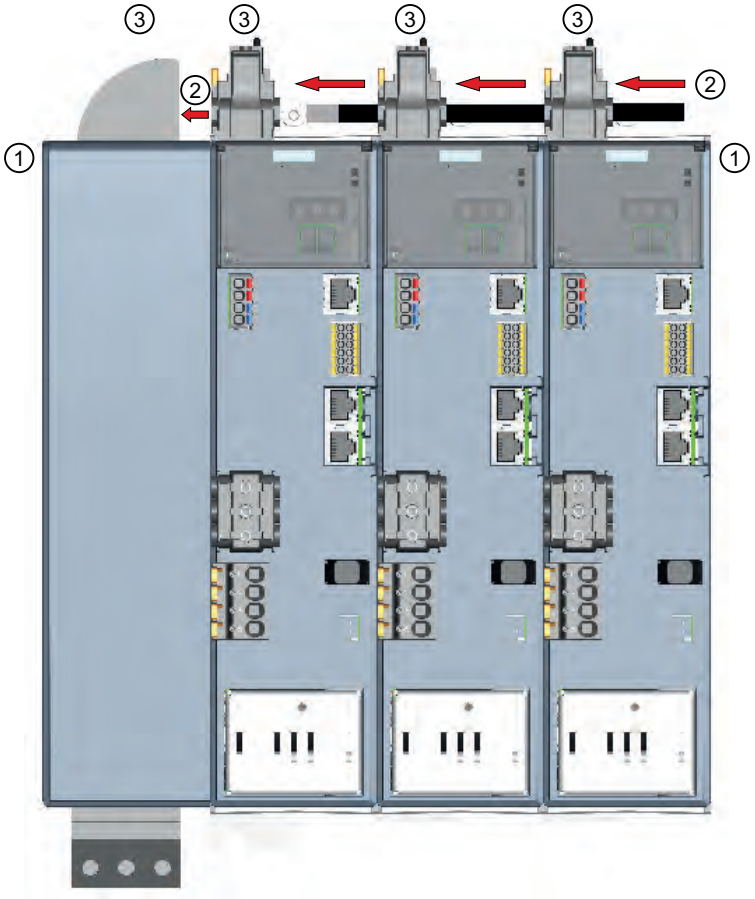
① Screw the converters tight in the cabinet.
② Push the cable for the AC coupling through the AC connector and provide it with end sleeves (with or without plastic protection).
③ Screw the cable into the AC connectors.
④ Swing the filter with the filter connection from the side over the cable/end sleeves.
⑤ Screw the filter tight in the cabinet.
⑥ Screw the cable in the filter connection.

Figure 14-8 3 AC filter mounting - variant 1

Variant 2: The converter group and 3 AC filter are mounted, but not wired

For wiring, each conductor must be pulled individually through the bus connector as far as the filter terminal and screwed in the control cabinet.

You can only insert end sleeves without a plastic collar because otherwise the conductor no longer fits through the bus connector.



① Screw the devices tight on the cabinet wall or on the mounting plate.

② Equip the cables for the AC coupling with end sleeves without plastic protection and push them through the AC connectors into the filter connection.

③ Screw the cables in the AC connectors and in the filter connection.

Figure 14-9 3 AC filter mounting - variant 2

14.1.4.5 Technical data

The following external line filters are available for the converter:

Line filters for 1 AC converters

Table 14-1 Technical data

Article number		**6SL3203-0BB21-8VA1**
Line voltage		200 ... 240 V 1 AC
Rated current	A	18
Power loss	W	< 1.2
Type of connection		Screw terminals
Conductor cross-section for single-conductor connection for flexible cables	 mm^2 mm^2	 0.25 ... 6 (AWG 24 ... 10) 0.25 ... 4 (AWG 24 ... 12)
Insulation stripping length	mm	8 ... 9
Protective conductor connection		M5 studs
Degree of protection		IP20
Dimensions (W x H x D)	mm	62 x 155 x 53
Weight	kg	0.7

Line filters for 3 AC converters

Table 14-2 Technical data

Article number		**6SL3203-0BE23-5HA0**	**6SL3203-0BE26-5HA0**
Line voltage		200 ... 480 V 3 AC	
Rated current	A	35	65
Power loss	W	12	18
Type of connection		Screw terminals	
Conductor cross-section Line-side connection Load-side connection	 mm^2 mm^2	 0.5 ... 10 (AWG 24 ... 6) 16 (AWG 6)	 4 ... 25 (AWG 10 ... 3) 16 (AWG 6)
Insulation stripping length Line side Load side	 mm mm	 10 16	 18 16
Protective conductor connection		M4 studs	M5 studs
Degree of protection		IP20	
Dimensions (W x H x D)	mm	50 x 296 x 220	70 x 349 x 220
Weight	kg	2.3	3.5

14.1.5 External braking resistors for 200 ... 240 V 3 AC

For operation of a converter with a supply voltage of 3 AC 200 V to 240 V, an external, intrinsically safe braking resistor is always required for each device. Use of braking resistors integrated in the device is not permissible with this supply voltage.

We recommend the following resistors as a substitute for the internal braking resistors. If these are not sufficient, you can use the resistors stated in the table "Examples of suitable braking resistors from a third-party supplier (Page 75)" (3 AC 200 ... 240 V).

- For FSA and FSB devices: GXK:BWG250047TS-190, 100 W, 47 ohm
- For FSC devices: GXK:BWG600014TS-190, 240 W, 14 ohm[1)]

Figure 14-10 External braking resistor BWG250

The resistors have approvals for the North American market (cURus and CSA).

The temperature sensor of the resistor can by connected at input DI4 on the converter for temperature monitoring. This switches the converter off when the braking resistor is overloaded.

[1)] For UL, the resistor has only a 240 W braking power. According to CE, 400 W braking power is also possible.

See also

Requirements placed on the external braking resistor (Page 73)

14.1.6 Cabinet bushing via mounting flange

Mounting accessories for connection system

Accessories	Diagram	For connector size	For motor	Article number
Mounting flange as cabinet bushing (with installation instructions) Packing unit: 1 item		M12	1FK2□02 1FK2□03	6FX2003-7JX00
		M17	1FK2□04 1FK2□05	6FX2003-7HX00
		M23	1FK2□06 1FK2□08 1FK2□10	6FX2003-7BX00

The mounting flange is installed on the external wall of the control cabinet. It ensures the degree of protection of the control cabinet.

- Install the mounting flange as specified in the enclosed installation instructions.

14.1.7 Degree of protection kit IP65 for the motor

Shaft sealing ring - IP65 degree of protection kit for the motor

The shaft sealing ring can be used as spare part or for retrofitting.

Note

You can order a motor with shaft sealing ring (degree of protection IP65) directly.

Additional information about ordering degree of protection IP65 can be found in the section "Ordering data of the motor (Page 459)".

The motor satisfies degree of protection IP65 when the shaft sealing ring is installed.

Motor article number	Figure of the shaft sealing ring	Article number of the degree of protection kit
1FK2□02		1FK2902-0GC00
1FK2□03		1FK2903-0GC00
1FK2□04		1FK2904-0GC00

14.2 Spare parts

Spare parts for the converter

The following components are available as spare parts for the converter:

- Connector set for converters with 1 AC line connection 6SL3260-2DB00-0AA0
- Connector set for converters with 3 AC line connection 6SL3260-2DB10-0AA0
- Siemens IX connector for the encoder connection for converters with 1 AC / 3 AC line connection 6FX2003-0DE01
- Fan for converters with 3 AC line connection, FSA 6SL3260-0AA00-0AA0
- Fan for converters with 3 AC line connection, FSB 6SL3260-0AB00-0AA0
- Fan for converters with 3 AC line connection, FSC 6SL3260-0AC00-0AA0

14.2.1 Connector set for converters with 1 AC line connection - 6SL3260-2DB00-0AA0

Under this article number, you will receive a spare parts package for the frame sizes FSA, FSB and FSC with the following content:

- Connectors
  - X1: Connector for the line connection and the external braking resistor (jumper for internal braking resistor is included)
  - X2: Connector for the motor connection
  - X107: Connector for the motor holding brake
  - X124: Connector for the external 24 V DC power supply
  - X130: Connector for the digital inputs
- Shield plate for FSA, FSB and FSC

X1: Connector for the line connection and the external braking resistor

	Pin	Pin assignment	Explanation
	L1	Phase L1 line system	
	N	Neutral conductor	
	DCP	Braking resistor, external Braking resistor, internal	If you are using the internal braking resistor, DCP and R2 must be jumpered.
	R2	Internal braking resistor	If you are using the external braking resistor, remove the jumper between DCP and R2. Connect the external braking resistor via the DCP and R1 terminals.
	R1	External braking resistor	
Weidmüller: BLF 5.08HC/05/180F SN BK BX, article number 1012670000 As daisy chain: BLDF 5.08/05/180F SN BK BX, article number 1000970000			

The terminals are spring-type terminals.

Permissible conductor cross-sections for single-conductor connection or for connecting flexible cables with end sleeves:

- 0.2 mm² ... 2.5 mm²
- AWG: 26 ... 12
- Insulation stripping length: 10 mm

X2: Connector for the motor connection

	Pin	Pin assignment	Color coding for Siemens OCC cables
	U	Motor phase U	Brown
	V	Motor phase V	Black
	W	Motor phase W	Gray
	PE	Protective ground	Green-yellow
Weidmüller: BLF 5.08HC/04/180F SN BK BX, article number 1012660000			

The terminals are spring-type terminals.

Permissible conductor cross-sections for single-conductor connection or for connecting flexible cables with end sleeves:

- 0.2 mm² ... 2.5 mm²
- AWG: 26 ... 12
- Insulation stripping length: 10 mm

X107: Connector for the motor holding brake

	Pin	Pin assignment	Explanation
	BR-	B-	Voltage for motor holding brake, 0 V (white-turquoise)
	BR+	B+	Voltage for motor holding brake, 24 V (black-turquoise)
Phoenix 1745894 FMC 1.5 / 2-ST-3.81, article number 1745894			

The terminals are spring-type terminals.

Permissible conductor cross-sections:

- For single-conductor cables or for flexible cable conductors with end sleeves without plastic protection or long end sleeves with plastic protection:
  - 0.25 mm² ... 1.5 mm²
  - AWG: 24 ... 16
- For flexible cables with end sleeves with plastic protection:
  - 0.25 mm² ... 0.75 mm²
  - AWG: 24 ... 19
- Insulation stripping length: 10 mm

Also connect the conductors for the motor holding brake to the connector at X107, even when you are using a motor without holding brake.

X124: Connector for the external 24 V DC control voltage

	Pin	Pin assignment	Explanation
	0V	0 V	Power supply for the converter electronics
	0V	0 V	
	24 V	+24 V	
	24 V	+24 V	
Dinkle article number 2ESS-6621-04P			

The terminals are spring-type terminals.

Permissible conductor cross-sections for single-conductor connection or for connecting flexible cables with or without end sleeves:

- 0.2 mm^2 ... 2.5 mm^2
- AWG: 26 ... 12
- Insulation stripping length: 10 mm

X130: Connector for the digital inputs

	Pin	Pin assignment		Pin assignment	Pin
	+	+24 V output		Failsafe digital input	DI2+
	DI0	High-speed DI, measuring input			DI2-
	M	Ground			DI3+
	+	+24 V output			DI3-
	DI1	High-speed DI, measuring input		+24 V output	+
	M	Ground		Digital input	DI4
Phoenix 1790140 DFMC 1.5 / 6-ST-3.5, article number 1790140					

The terminals are spring-type terminals.

The three "+" terminals are provided as power supply for external sensors. They are short-circuit proof and provide a max. of 50 mA per sensor. A sensor short-circuit interrupts the power supply for all three sensors.

Permissible conductor cross-sections:

- For single-conductor connection:
  - 0.2 mm^2 ... 1.5 mm^2
  - AWG: 24 ... 16
- For flexible cables with end sleeves:
  - 0.25 mm^2 ... 1.5 mm^2
  - AWG: 24 ... 16
- For flexible cables with end sleeves with plastic protection:
  - 0.25 mm^2 ... 0.75 mm^2
  - AWG: 24 ... 19
- Insulation stripping length: 10 mm

14.2.2 Connector set for converters with 3 AC line connection - 6SL3260-2DB10-0AA0

Under this article number, you will receive a spare parts package for the frame sizes FSA, FSB and FSC with the following content:

- Connectors
  - X1: Standard connector for the line connection
  - X2: Connector for the motor connection
  - X4: Connector for the external braking resistor
    Cable jumper - is required if you do not connect a braking resistor
  - X107: Connector for the motor holding brake
  - X124: Connector for the external 24 V DC power supply
  - X130: Connector for the digital inputs
- Shield plate with two fixing screws M4 x 10 for FSA

X1: Connector for the line connection

Standard connector

	Pin	Pin assignment	Explanation
	L1	Phase L1 line system	
	L2	Phase L2 line system	
	L3	Phase L3 line system	
Phoenix, article number 1060224			

The terminals are spring-type terminals.

Permissible conductor cross-sections for single-conductor connection or for connecting flexible cables with or without end sleeves:

- 0.75 mm^2 ... 6 mm^2
- AWG: 18 ... 8
- Insulation stripping length: 18 mm

X2: Connector for the motor connection

	Pin	Pin assignment	Color coding for Siemens OCC cables
	U	Motor phase U	Brown
	V	Motor phase V	Black
	W	Motor phase W	Gray
	PE	Protective ground	Green-yellow
Phoenix, article number 1060242			

The terminals are spring-type terminals.

Permissible conductor cross-sections for single-conductor connection or for connecting flexible cables with or without end sleeves:

- 0.75 mm^2 ... 6 mm^2
- AWG: 18 ... 8
- Insulation stripping length: 18 mm

X4: Connector for the external braking resistor

	Pin	Pin assignment	Explanation
	DCP	External braking resistor Internal braking resistor	If you are using the internal braking resistor, DCP and R2 must be jumpered. If you are using the external braking resistor, remove the jumper between DCP and R2. Connect the external braking resistor via the DCP and R1 terminals.
	R1	Internal braking resistor	
	R2	External braking resistor	
Phoenix, article number 1060241			

The terminals are spring-type terminals.

Permissible conductor cross-sections for single-conductor connection or for connecting flexible cables with or without end sleeves:

- 0.75 mm^2 ... 6 mm^2
- AWG: 18 ... 8
- Insulation stripping length: 18 mm

X107: Connector for the motor holding brake

	Pin	Pin assignment	Explanation
	BR-	B-	Voltage for motor holding brake, 0 V (white-turquoise)
	BR+	B+	Voltage for motor holding brake, 24 V (black-turquoise)
Phoenix 1745894 FMC 1.5 / 2-ST-3.81, article number 1745894			

The terminals are spring-type terminals.

Permissible conductor cross-sections:

- For single-conductor cables or for flexible cable conductors with end sleeves without plastic protection or long end sleeves with plastic protection:
  - 0.25 mm^2 ... 1.5 mm^2
  - AWG: 24 ... 16
- For flexible cables with end sleeves with plastic protection:
  - 0.25 mm^2 ... 0.75 mm^2
  - AWG: 24 ... 19
- Insulation stripping length: 10 mm

Also connect the conductors for the motor holding brake to the connector at X107, even when you are using a motor without holding brake.

X124: Connector for the external 24 V DC control voltage

	Pin	Pin assignment	Explanation
	24 V	+24 V	Power supply for the converter electronics
	24 V	+24 V	
	0V	0 V	
	0V	0 V	
Dinkle article number 2ESS-6621-04P			

The terminals are spring-type terminals.

Permissible conductor cross-sections for single-conductor connection or for connecting flexible cables with or without end sleeves:

- 0.2 mm^2 ... 2.5 mm^2
- AWG: 26 ... 12
- Insulation stripping length: 10 mm

X130: Connector for the digital inputs

	Pin	Pin assignment		Pin assignment	Pin
	+	+24 V output		Failsafe digital input	DI2+
	DI0	High-speed DI, measuring input			DI2-
	M	Ground			DI3+
	+	+24 V output			DI3-
	DI1	High-speed DI, measuring input		+24 V output	+
	M	Ground		Digital input	DI4
Phoenix 1790140 DFMC 1.5 / 6-ST-3.5, article number 1790140					

The terminals are spring-type terminals.

The three "+" terminals are provided as power supply for external sensors. They are short-circuit proof and provide a max. of 50 mA per sensor. A sensor short-circuit interrupts the power supply for all three sensors.

Permissible conductor cross-sections:

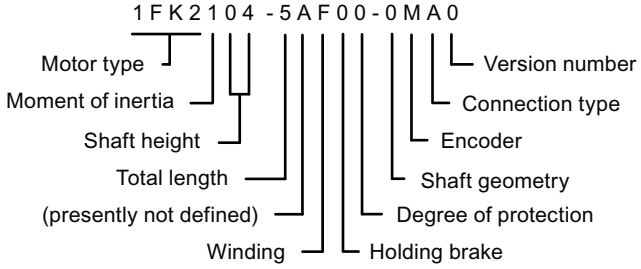
- For single-conductor connection:
  - 0.2 mm^2 ... 1.5 mm^2
  - AWG: 24 ... 16
- For flexible cables with end sleeves:
  - 0.25 mm^2 ... 1.5 mm^2
  - AWG: 24 ... 16
- For flexible cables with end sleeves with plastic protection:
  - 0.25 mm^2 ... 0.75 mm^2
  - AWG: 24 ... 19
- Insulation stripping length: 10 mm

Ordering data

15

15.1 Ordering data of the motor

The article number comprises a combination of digits and letters. It is divided into three hyphenated blocks.



Note that not every theoretical combination is possible in practice.

Permissible combinations can be obtained in section "Motor-converter combinations for 3 AC 380 ... 480 V (Page 39)" or in the catalog "D 32 SINAMICS S210 and SIMOTICS S-1FK2".

Description		Position of the article number																
		1	2	3	4	5	6	7	-	8	9	10	11	12	-	13	14	15	16
SIMOTICS S-1FK2 synchronous servomotors		**1**	**F**	**K**	2														
Moment of inertia	High Dynamic					1													
	Compact					2													
	High Inertia					3													
Shaft height	SH 20						0	2											
	SH 30						0	3											
	SH 40						0	4											
	AH 48 (Compact) AH 52 (High Dynamic)						0	5											
	SH 63						0	6											
	SH 80						0	8											
	SH 100						1	0											
Total length	0 ... 8									0									
(presently not defined)											A								
Winding, rated speed	**max. 1 AC 240 V**																		
	3000 rpm @ 230 V											G							
	max. 3 AC 480 V																		
	1500 rpm @ 400 V											B							
	2000 rpm @ 400 V	1000 rpm @ 230 V										C							
	3000 rpm @ 400 V	1500 rpm @ 230 V										F							
	6000 rpm @ 400 V	3000 rpm @ 230 V										K							
Holding brake	Without												0						
	With												1						
Degree of protection	IP64													0					
	IP65 with radial shaft sealing ring													1					
Shaft geometry	Plain shaft															0			
	Shaft with feather key															1			
	Plain shaft, alternative shaft geometry (11 mm x 23 mm), only SH 30						0	3						0		2			
	Plain shaft, alternative shaft geometry (14 mm x 30 mm), only SH 40						0	4						0		2			
Encoder	Absolute encoder, singleturn, 22 bit (encoder AS22DQC)																S		
	Absolute encoder multiturn 22 bit + 12 bit (encoder AM22DQC)																M		
Connection type	OCC (one cable connection) for S210																	A	
Version number	Start																		0

15.2 Ordering data of the converter

An overview of the available converters is provided below.

Converters with 1 AC line connection

Article number	Frame size	Rated power
6SL3210-5HB10-1UF0	FSA	100 W
6SL3210-5HB10-2UF0	FSA	200 W
6SL3210-5HB10-4UF0	FSB	400 W
6SL3210-5HB10-8UF0	FSC	750 W

Converters with 3 AC line connection

Article number	Frame size	Rated power
6SL3210-5HE10-4UF0	FSA	0.4 kW
6SL3210-5HE10-8UF0	FSA	0.75 kW
6SL3210-5HE11-0UF0	FSA	1 kW
6SL3210-5HE11-5UF0	FSB	1.5 kW
6SL3210-5HE12-0UF0	FSB	2 kW
6SL3210-5HE13-5UF0	FSC	3.5 kW
6SL3210-5HE15-0UF0	FSC	5 kW
6SL3210-5HE17-0UF0	FSC	7 kW

You can find additional details regarding motors and converters in the section "Technical specifications (Page 339)".

15.3 Ordering data of the connection system

OCC MOTION-CONNECT cables can only be ordered as prefabricated cables.

Note

A maximum of three separating points are allowed without reducing the total permitted length.

OCC MOTION-CONNECT cable with SPEED-CONNECT connector

	Designation and use	For connection to motor	Connector size	Article number[1)]
	Motor connection cable OCC MC 500 for predominantly fixed installation	1FK2□02 1FK2□03	M12	6FX5002-8QN04-□□□□
		1FK2□03 1FK2□04 1FK2□05	M17	6FX5002-8QN08-□□□□
		1FK2□06 1FK2□08 1FK2□10	M23	1.5 mm²: 6FX5002-8QN11-□□□□ 2.5 mm²: 6FX5002-8QN21-□□□□
	Motor connection cable OCC MC 800PLUS for use in cable carriers	1FK2□02 1FK2□03	M12	6FX8002-8QN04-□□□□
		1FK2□03 1FK2□04 1FK2□05	M17	6FX8002-8QN08-□□□□
		1FK2□06 1FK2□08 1FK2□10	M23	1.5 mm²: 6FX8002-8QN11-□□□□ 2.5 mm²: 6FX8002-8QN21-□□□□

	Designation and use	For connection to motor	Connector size	Article number[1)]
	Extension for motor connection cable OCC MC 500 for predominantly fixed installation	1FK2□02 1FK2□03	M12	6FX5002-8QE04-□□□□
		1FK2□03 1FK2□04 1FK2□05	M17	6FX5002-8QE08-□□□□
		1FK2□06 1FK2□08 1FK2□10	M23	1.5 mm²: 6FX5002-8QE11-□□□□ 2.5 mm²: 6FX5002-8QE21-□□□□
	Extension for motor connection cable OCC MC 800PLUS for use in cable carriers	1FK2□02 1FK2□03	M12	6FX8002-8QE04-□□□□
		1FK2□03 1FK2□04 1FK2□05	M17	6FX8002-8QE08-□□□□
		1FK2□06 1FK2□08 1FK2□10	M23	1.5 mm²: 6FX8002-8QE11-□□□□ 2.5 mm²: 6FX8002-8QE21-□□□□

[1)] The last 4 digits (□□□□) define the cable length corresponding to the length code

Determining the article number of a prefabricated OCC MOTION-CONNECT cable

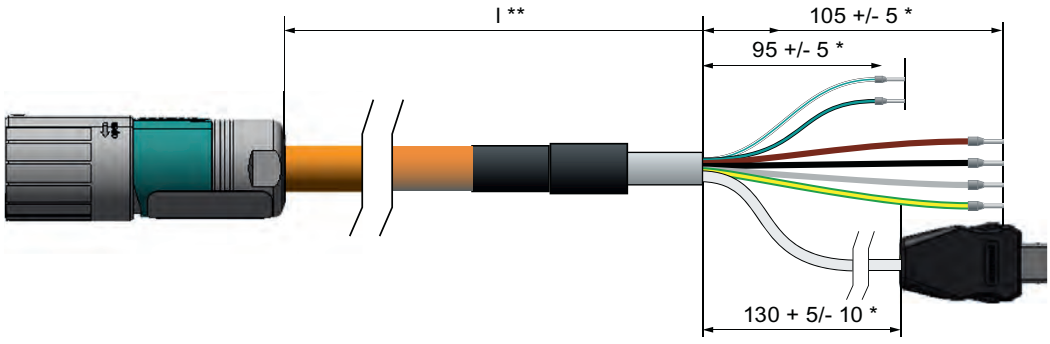


Figure 15-1 Lengths of an OCC MOTION-CONNECT cable

Procedure

1. Determine the required cable length l **. Consider having cable in reserve for strain-free routing.
2. Determine the length code for the required length l ** corresponding to the following overview. The stretched lengths (*) are added automatically for the prefabricated cables.

3. Also select the cable type, the desired cable version, and the required connectors for the article number.

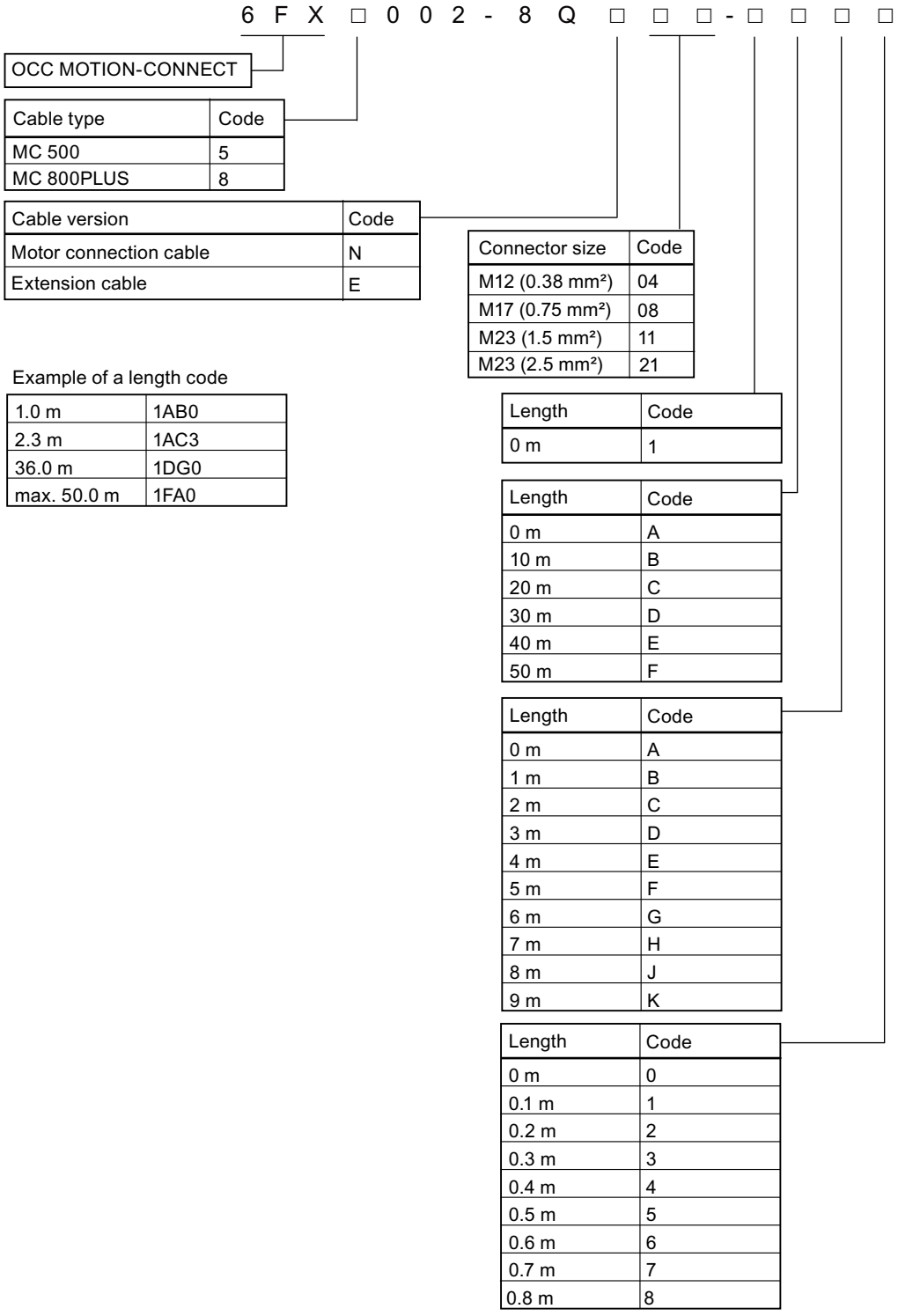


Figure 15-2 Structure of the article number with length code for an OCC MOTION-CONNECT cable

4. Order the required cable with the article number thus determined.

Parameters 16

16.1 Parameter overview

Structure of the parameter descriptions

Some variables and settings of the converter are displayed via parameters. There are adjustable parameters and display parameters.

Different representations of adjustable parameters and display parameters - as well as the components of the parameter description - are subsequently explained.

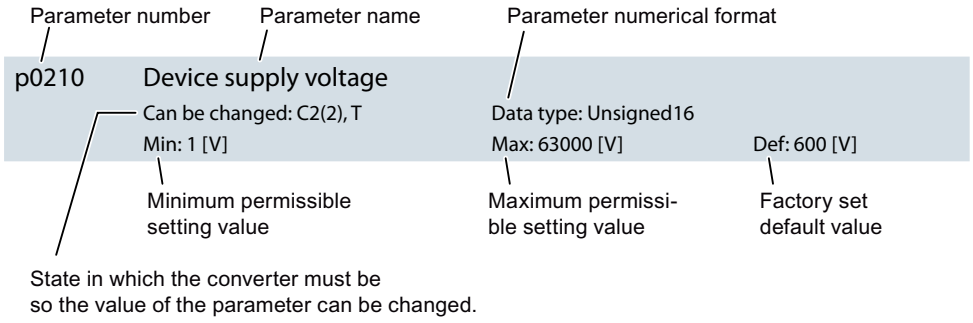


Figure 16-1 Adjustable parameters

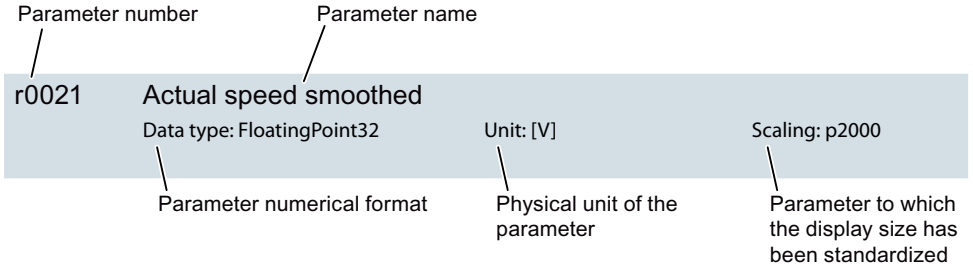


Figure 16-2 Display parameters

For parameters that apply to both rotary as well as linear motion, the unit is displayed for both motion types.

Parameter number

The parameter number is made up of a "p" or "r", followed by the parameter number and optionally the index or bit array.

Examples of how parameters are shown in the parameter list:

- **p...** Adjustable parameters (read and write)
- **r...** Display parameters (read-only)
- **p0977** Adjustable parameter 977

- **p0489[0...2]** Adjustable parameter 489 indices 0 to 2
- **r0944** Display parameter 944
- **p9515.0 ... 16** Adjustable parameter 9515 with array bit 0 to 16

Further examples of the notation in the documentation:

- **p9531[1]** Adjustable parameter 9531 index 1
- **p0940.1** Adjustable parameter 940, bit 1

Can be changed

The "-" sign indicates that the parameter can be changed in any object state and that the change will be effective immediately.

The information "C1(x), C2(x), T, U" ((x): optional) means that the parameter can only be changed in this converter state and that the change will not take effect until the state has been exited. One or more states are possible.

The following states are possible:

- C1(x) Device commissioning C1: **C**ommissioning **1**
  The device is being commissioned (p0009 > 0). The pulses cannot be enabled.
  The parameter can only be changed in the following device commissioning settings (p0009 > 0):
  - C1: Can be changed for all settings p0009 > 0.
  - C1(x): Can only be changed for settings p0009 = x.

  A changed parameter value does not take effect until the device commissioning is exited with p0009 = 0.
- C2(x) Drive object commissioning C2: **C**ommissioning **2**
  The drive is commissioned (p0009 = 0 and p0010 > 0). The pulses cannot be enabled.
  The parameter can only be changed in the following drive commissioning settings (p0010 > 0):
  - C2: Can be changed for all settings p0010 > 0.
  - C2(x): Can only be changed for settings p0010 = x.

  A changed parameter value does not take effect until the drive commissioning mode is exited with p0010 = 0.
- U Operation U: R**u**n
  The pulses have been enabled.
- T ready for operation T: Ready **t**o run
  The pulses have not been enabled and the state "C1(x)" or "C2(x)" is not active.

Data type of the parameters

Every parameter corresponds to one of the following data types. The relevant data type is indicated in the parameter header.

• Integer8	I8	8-bit integer
• Integer16	I16	16-bit integer
• Integer32	I32	32-bit integer
• Unsigned8	U8	8-bit without sign
• Unsigned16	U16	16-bit without sign
• Unsigned32	U32	32-bit without sign
• FloatingPoint32	Float	32-bit floating-point number

Scaling

Specification of the reference variable with which a signal value is automatically converted with a BICO interconnection.

The following reference variables are available:

- p2000 ... p2003: Reference speed, reference voltage, etc.
- PERCENT: 1.0 = 100%
- 4000H: 4000 hex = 100 % (word) or 4000 0000 hex = 100 % (double word)

Parameter values

- **Min**
  Minimum value of the parameter [unit]
- **Max**
  Maximum value of the parameter [unit]
- **Def**
  Value when delivered [unit]
  Some parameters are assigned on startup depending on the connected motor.

16.2 List of parameters

Product: SINAMICS S210, Version: 5206900

r0002 Operating display

Data type: Integer16 **Unit:** -

Description: Operating display for the drive.

Value:

0:	Operation - everything enabled
10:	Operation - set "enable setpoint" = "1"
11:	Operation - set "Enable speed controller" = "1"
12:	Operation - RFG frozen, set "RFG start" = "1"
13:	Operation - set "enable RFG" = "1"
14:	Operation - speed setpoint not enabled
15:	Operation - open brake (p1215)
16:	Operation - withdraw braking with OFF1 using "ON/OFF1" = "1"
17:	Operation - braking with OFF3 can only be interrupted with OFF2
18:	Operation - brake on fault, remove fault, acknowledge
21:	Ready for operation - set "Enable operation" = "1"
31:	Ready for switching on - set "ON/OFF1" = "0/1"
41:	Switching on inhibited - set "ON/OFF1" = "0"
42:	Switching on inhibited - set "OC/OFF2" = "1"
43:	Switching on inhibited - set "OC/OFF3" = "1"
44:	Switching on inhibited - supply STO terminal w/ 24 V (hardware)
45:	Switching on inhibited - rectify fault, acknowledge fault, STO
46:	Switching on inhibited - exit commissioning mode (p0009, p0010)
60:	Drive deactivated/not operational
70:	Initialization
200:	Wait for booting/partial booting
250:	Device signals a topology error

Dependency: See also: r0046

NOTICE

For a display not equal to 0, the drive is either powering up or an enable signal is missing. The control sends these enable signals.
For several missing enable signals, the corresponding value with the highest number is displayed.

Note

The drive only controls the motor speed in the "Operation" state (r0002 = 0).
OC: Operating condition
EP: Enable Pulses (pulse enable)
RFG: Ramp-function generator
COMM: Commissioning
MotID: Motor data identification
SS2: Safe Stop 2
STO: Safe Torque Off

p0009 Drive commissioning parameter filter 1

Can be changed: C1, T **Data type:** Integer16

Min: 0 **Max:** 30 **Def:** 1

Description: Setting parameter filter 1 to commission the drive.

Value:
0: Ready
1: Device configuration
30: Parameter reset

Note
The drive can only be switched on when in the "Ready" state (p0009 = 0).

p0010 Drive commissioning parameter filter 2

Can be changed: C2(1), T **Data type:** Integer16
Min: 0 **Max:** 95 **Def:** 1

Description: Setting parameter filter 2 for commissioning the drive.

Value:
0: Ready
1: Only Siemens internal
3: Motor commissioning
95: Safety Integrated commissioning

NOTICE
For p0010 = 95:
The safety commissioning Wizard must be carried out in the web server after changing safety parameters. These changes become effective after carry out all of the commissioning steps of the wizards.

Note
The drive can only be switched on when in the "Ready" state (p0010 = 0).

r0020 Speed setpoint smoothed

Data type: FloatingPoint32 **Unit:** [rpm] **Scaling:** p2000

Description: Displays the smoothed speed setpoint at the speed controller input.

r0021 Actual speed smoothed

Data type: FloatingPoint32 **Unit:** [rpm] **Scaling:** p2000

Description: Displays the smoothed actual value of the motor speed.

Dependency: See also: r0063

r0026 DC link voltage smoothed

Data type: FloatingPoint32 **Unit:** [V] **Scaling:** p2001

Description: Displays the smoothed actual value of the DC link voltage.

Dependency: See also: r0070

r0027 Absolute actual current smoothed

Data type: FloatingPoint32 **Unit:** [Arms] **Scaling:** p2002

Description: Displays the smoothed absolute current actual value.

Dependency: See also: r0068

r0031 Actual torque smoothed

Data type: FloatingPoint32 **Unit:** [Nm] **Scaling:** p2003

Description: Displays the smoothed torque actual value.

Dependency: See also: r0080

r0032 Active power actual value smoothed

Data type: FloatingPoint32 **Unit:** [kW] **Scaling:** r2004

Description: Display for the smoothed actual value of the active power.
Dependency: See also: r0082

r0034 Motor utilization thermal

Data type: FloatingPoint32 **Unit:** [%] **Scaling:** PERCENT

Description: Displays the thermal motor utilization taking into account the ambient temperature set in p0613.
Dependency: See also: p0613
See also: F07011, A07012

NOTICE
After the drive is switched on, the system starts to determine the motor temperature with an assumed model value. This means that the value for the motor utilization is only valid after a stabilization time.

r0037[0...20] Drive temperatures

Data type: FloatingPoint32 **Unit:** [°C] **Scaling:** p2006

Description: Displays the temperatures of the drive components.
Index: [0] = Inverter maximum value
[1] = Depletion layer maximum value
[2] = Reserved
[3] = Reserved
[4] = Interior of power unit
[5] = Inverter 1
[6...12] = Reserved
[13] = Depletion layer 1
[14...20] = Reserved

Note
The value of -200 indicates that there is no measuring signal.
For index [0]:
Maximum value of the inverter temperatures (r0037[5...10]).
For index [1]:
Maximum value of the depletion layer temperatures (r0037[13...18]).
The maximum value is the temperature of the hottest inverter or depletion layer.
In the case of a fault, the particular shutdown threshold depends on the power unit, and cannot be read out.

r0039[0...2] Energy display

Data type: FloatingPoint32 **Unit:** [kWh]

Description: Display for the energy values at the drive output terminals.
Index: [0] = Energy balance (sum)
[1] = Energy drawn
[2] = Energy fed back

Note
For index [0]:
Difference between the energy drawn and energy that is fed back.

r0044 Thermal converter utilization

Data type: FloatingPoint32 **Unit:** [%] **Scaling:** PERCENT

Description: Displays the thermal converter utilization as a percentage.
With this value, various thermal monitoring functions are taken into account.
Dependency: See also: r0034

Note
The thermal motor utilization is displayed in parameter r0034.

r0046.0...30 Missing enable signal

Data type: Unsigned32 **Unit:** -

Description: Displays the missing enable signals.
All enable signals are required to operate the drive. The enable signals are set by the control.

Bit field:

Bit	Signal name	1 signal	0 signal
00	OFF1 enable missing	Yes	No
01	OFF2 enable missing	Yes	No
02	OFF3 enable missing	Yes	No
03	Operation enable missing	Yes	No
05	STOP2 enable missing	Yes	No
08	Safety enable missing	Yes	No
10	Ramp-function generator enable missing	Yes	No
11	Ramp-function generator start missing	Yes	No
12	Setpoint enable missing	Yes	No
16	OFF1 enable internal missing	Yes	No
17	OFF2 enable internal missing	Yes	No
18	OFF3 enable internal missing	Yes	No
19	Pulse enable internal missing	Yes	No
21	STOP2 enable internal missing	Yes	No
26	Drive inactive or not operational	Yes	No
28	Brake open missing	Yes	No
30	Speed controller inhibited	Yes	No

Dependency: See also: r0002

Note

The value r0046 = 0 indicates that all enable signals for this drive are present.
Bit 00 = 1 (enable signal missing), if:
- the signal source in p0840 is a 0 signal.
- there is a "switching on inhibited".
Bit 01 = 1 (enable signal missing), if:
- the signal source in p0844 or p0845 is a 0 signal.
Bit 02 = 1 (enable signal missing), if:
- the signal source in p0848 or p0849 is a 0 signal.
Bit 03 = 1 (enable signal missing), if:
- the signal source in p0852 is a 0 signal.
Bit 04 =1 (armature short-circuit active), if:
- the signal source in p1230 has a 1 signal
Bit 05, Bit 06: Being prepared
Bit 08 = 1 (enable signal missing), if:
- safety functions have been enabled and STO is active.
- a safety-relevant message with STO as response is active.
STO enabled via terminals:
- pulse enable via the STO terminals has a 0 signal.
STO enabled via PROFIsafe:
- STO is selected via PROFIsafe.
Bit 09 = 1 (enable signal missing), if:
- the signal source in p0864 is a 0 signal.
Bit 10 = 1 (enable signal missing), if:
- the signal source in p1140 is a 0 signal.
Bit 11 = 1 (enable signal missing) if the speed setpoint is frozen, because:
- the signal source in p1141 is a 0 signal.
- the speed setpoint is entered from jogging and the two signal sources for jogging, bit 0 (p1055) and bit 1 (p1056) have a 1 signal.
Bit 12 = 1 (enable signal missing), if:
- the signal source in p1142 is a 0 signal.
Bit 16 = 1 (enable signal missing), if:
- there is an OFF1 fault response. The system is only enabled if the fault is removed and was acknowledged and the "switching on inhibited" withdrawn with OFF1 = 0.
Bit 17 = 1 (enable signal missing), if:
- commissioning mode is selected (p0009 > 0 or p0010 > 0).
- there is an OFF2 fault response.
- the drive is inactive (p0105 = 0) or is not operational (r7850[DO-Index]=0).
Bit 18 = 1 (enable signal missing), if:
- OFF3 has still not been completed or an OFF3 fault response is present.
Bit 19 = 1 (internal pulse enable missing), if:
- synchronization is running between the basic clock cycle, DRIVE-CLiQ clock cycle and application clock cycle.
Bit 20 =1 (internal armature short-circuit active), if:
- The drive is not in state "S4: operation" or "S5x".
- the internal pulse enable is missing (r0046.19 = 0).
Bit 21 = 1 (enable signal missing), if:
The pulses have been enabled and the speed setpoint has still not been enabled, because:
- the holding brake opening time (p1216) has still not expired.
- the motor has still not been magnetized (induction motor).
- the encoder has not been calibrated (U/f vector and synchronous motor)
Bit 22: Being prepared
Bit 26 = 1 (enable signal missing), if:
- the drive is inactive (p0105 = 0) or is not operational (r7850[DO-Index]=0).
- the drive device is in the "PROFIenergy energy-saving mode" (r5600, CU-specific).
Bit 27 = 1 (enable signal missing), if:
- de-magnetizing has still not been completed (only for vector).
Bit 28 = 1 (enable signal missing), if:

- the holding brake is closed or has still not been opened.
Bit 29: being prepared
Bit 30 = 1 (speed controller inhibited), if one of the following reasons is present:
- a 0 signal is available via binector input p0856.
- the function generator with current input is active.
- the measuring function "current controller reference frequency characteristic" is active.
- the pole position identification is active.
- motor data identification is active (only certain steps).
Bit 31 = 1 (enable signal missing), if:
- the speed setpoint from jog 1 or 2 is entered.

r0061[0...1] Actual speed unsmoothed

Data type: FloatingPoint32 **Unit:** [rpm] **Scaling:** p2000

Description: Displays the unsmoothed speed actual value sensed by the encoder.

Index: [0] = Encoder 1
[1] = Reserved

r0062 Speed setpoint after the filter

Data type: FloatingPoint32 **Unit:** [rpm] **Scaling:** p2000

Description: Display for the speed setpoint after the setpoint filters.

r0063 Actual speed smoothed

Data type: FloatingPoint32 **Unit:** [rpm] **Scaling:** p2000

Description: Display for the speed actual value.

Dependency: See also: r0021, r0061, p1441

r0068 Absolute current actual value

Data type: FloatingPoint32 **Unit:** [Arms] **Scaling:** p2002

Description: Displays actual absolute current.

Dependency: See also: r0027

NOTICE
The value is updated with a sampling time of 1 ms.

Note
Absolute current value = sqrt(Iq^2 + Id^2)
The absolute current actual value is available smoothed (r0027) and unsmoothed (r0068).

r0070 Actual DC link voltage

Data type: FloatingPoint32 **Unit:** [V] **Scaling:** p2001

Description: Display for the measured actual value of the DC link voltage.

Dependency: See also: r0026

Note
The DC link voltage is available smoothed (r0026) and unsmoothed (r0070).

r0076 Current actual value field-generating

Data type: FloatingPoint32 **Unit:** [Arms] **Scaling:** p2002

Description: Display for the actual value of the field-generating current Id.

r0077 Current setpoint torque-generating

Data type: FloatingPoint32 **Unit:** [Arms] **Scaling:** p2002

Description: Displays the torque/force-generating current setpoint.

r0078[0...1] Current actual value torque-generating

Data type: FloatingPoint32 **Unit:** [Arms] **Scaling:** p2002

Description: Display for the actual value of the torque-generating current Iq.

Index: [0] = Unsmoothed
[1] = Smoothed

r0079[0...1] Torque setpoint total

Data type: FloatingPoint32 **Unit:** [Nm] **Scaling:** p2003

Description: Display for the torque setpoint at the output of the speed controller.

Index: [0] = Unsmoothed
[1] = Smoothed

r0080 Torque actual value

Data type: FloatingPoint32 **Unit:** [Nm] **Scaling:** p2003

Description: Display for the actual torque.

Dependency: See also: r0031

Note
The value is available smoothed (r0031) and unsmoothed (r0080).

r0082[0...3] Active power actual value

Data type: FloatingPoint32 **Unit:** [kW] **Scaling:** r2004

Description: Displays the actual active power.

Index: [0] = Unsmoothed
[1] = Smoothed
[2] = Power drawn
[3] = Power drawn smoothed

Dependency: See also: r0032

Note
The mechanical active power is available smoothed (r0032 with 100 ms, r0082[1] with p0045) and unsmoothed (r0082[0]).
For index [3]:
Smoothing time constant = 4 ms

r0196[0...255] Topology component status

Data type: Unsigned32 **Unit:** -

Description: Displays the status of the components.
r0196[0]: group status of all components
r0196[1]: Status of component with component number 1
...
r0196[255]: Status of component with component number 255

Bit field:

Bit	Signal name	1 signal	0 signal
04	Component state	Active	Inactive/parking
06	Topology problem active	Yes	No
07	Part of the target topology	Yes	No only act topo
08	Alarm present	Yes	No
10	Fault present	Yes	No
13	Maintenance required	Yes	No

14	Maintenance urgently required	Yes	No
15	Fault gone/can be acknowledged	Yes	No

Note

For bits 12 ... 11:

These status bits are used for the classification of internal alarm classes and are intended for diagnostic purposes only on certain automation systems with integrated SINAMICS functionality.

p0210 Drive unit line supply voltage

Can be changed: T **Data type:** Unsigned16

Min: 1 [V] **Max:** 63000 [V] **Def:** 600 [V]

Description: Sets the drive unit supply voltage.

The voltage between two phases should be entered as the device supply voltage.

This setting is important for operating with voltages that are less than the voltage range intended for the drive.

NOTICE

If, in the switched-off state (pulse inhibit), the supply voltage is higher than the entered value, the Vdc controller may be automatically deactivated in some cases to prevent the motor from accelerating the next time the system is switched on. In this case, an appropriate alarm A07401 is output.

Note

Setting ranges for p0210 as a function of the rated power unit voltage:

U_rated = 400 V:

- p0210 = 380 ... 480 V (AC/AC), 510 ... 720 V (DC/AC)

U_rated = 500 V:

- p0210 = 500 ... 600 V (AC/AC), 675 ... 900 V (DC/AC)

U_rated = 660 ... 690 V:

- p0210 = 660 ... 690 V (AC/AC), 890 ... 1035 V (DC/AC)

U_rated = 500 ... 690 V:

- p0210 = 500 ... 690 V (AC/AC), 675 ... 1035 V (DC/AC)

The precharging switch-in threshold for the DC link voltage (Vdc) is calculated from p0210:

Vdc_pre = p0210 * 0.82 * 1.35 (AC/AC)

Vdc_pre = p0210 * 0.82 (DC/AC)

The undervoltage thresholds for the DC link voltage (Vdc) are calculated from p0210 as a function of the rated power unit voltage:

U_rated = 400 V:

- U_min = p0210 * 0.78 (AC/AC) > 330 V, p0210 * 0.60 (DC/AC) > 380 V

U_rated = 500 V:

- U_min = p0210 * 0.76 (AC/AC) > 410 V

U_rated = 660 ... 690 V:

- U_min = p0210 * 0.82 (AC/AC) > 565 V, p0210 * 0.63 (DC/AC) > 650 V

U_rated = 500 ... 690 V:

- U_min = p0210 * 0.82 (AC/AC) > 420 V, p0210 * 0.63 (DC/AC) > 480 V

p0251[0] Power unit heat sink fan operating hours counter

Can be changed: T **Data type:** Unsigned32

Min: 0 [h] **Max:** 4294967295 [h] **Def:** 0 [h]

Description: Displays the operating hours of the heat sink fan in the power unit.

The number of hours operated can only be reset to 0 in this parameter (e.g. after a fan has been replaced).

Dependency: See also: A30042

r0302[0] motor code DRIVE-CLiQ

Data type: Unsigned16 **Unit:** -

Description: Displays the number of the motor with DRIVE-CLiQ
When the drive powers up, the motor code is read out the motor.
For r0302 = 0, the motor was not identified.

r0304[0] Rated motor voltage

Data type: FloatingPoint32 **Unit:** [Vrms]

Description: Displays the rated motor voltage.

r0305[0] Rated motor current

Data type: FloatingPoint32 **Unit:** [Arms]

Description: Displays the rated motor current.

r0307[0] Rated motor power

Data type: FloatingPoint32 **Unit:** [kW]

Description: Displays the rated motor power.

r0311[0] Rated motor speed

Data type: FloatingPoint32 **Unit:** [rpm]

Description: Displays the rated motor speed.

r0312[0] Rated motor torque

Data type: FloatingPoint32 **Unit:** [Nm]

Description: Displays the rated motor torque.

r0316[0] Motor torque constant

Data type: FloatingPoint32 **Unit:** [Nm/A]

Description: Sets the torque constant of the synchronous motor.
p0316 = 0:
The torque constant is calculated from the motor data.
p0316 > 0:
The selected value is used as torque constant.

NOTICE

When selecting a catalog motor (p0301), this parameter is automatically pre-assigned and is write protected.
Information in p0300 should be carefully observed when removing write protection.

Note

This parameter is not used for induction motors (p0300 = 1xx).

r0318[0] Motor stall current

Data type: FloatingPoint32 **Unit:** [Arms]

Description: Displays the rated motor stall current.

r0319[0] Motor stall torque

Data type: FloatingPoint32 **Unit:** [Nm]

Description: Displays the motor standstill/stall torque.

r0322[0] Maximum motor speed

Data type: FloatingPoint32 **Unit:** [rpm]

Description: Displays the maximum motor speed.

Dependency: See also: p1082

r0323[0] Maximum motor current

Data type: FloatingPoint32 **Unit:** [Arms]

Description: Displays the maximum permissible motor current.

r0338[0] Motor limit current

Data type: FloatingPoint32 **Unit:** [Arms]

Description: Sets the motor limit current for synchronous motors (for a 600 V DC link voltage).
Using this current, the maximum torque is achieved at the rated speed (voltage limit characteristic).

Dependency: If p0338 is changed during quick commissioning (p0010 = 1), then the maximum current p0640 is appropriately pre-assigned. This is not the case when commissioning the motor (p0010 = 3).

NOTICE

When selecting a catalog motor (p0301), this parameter is automatically pre-assigned and is write protected. Information in p0300 should be carefully observed when removing write protection.

r0341[0] Motor moment of inertia

Data type: FloatingPoint32 **Unit:** [kgm²]

Description: Displays the motor moment of inertia (without load).

r0479[0...2] Diagnostics encoder position actual value Gn_XIST1

Data type: Integer32 **Unit:** -

Description: Display for the encoder actual position value Gn_XIST1 according to PROFIdrive for diagnostics.
The value of r0479 is updated in each DRIVE-CLiQ basic clock cycle and displayed with sign.

Index: [0] = Encoder 1
[1] = Reserved
[2] = Reserved

p0488[0...2] Activate measuring probe 1

Can be changed: T, U **Data type:** Integer16

Min: 0 **Max:** 210 **Def:** 210

Description: Setting to activate/deactivate measuring probe 1.
The inversion of probe 1 is set in p0490.0.

Value: 0: No measuring probe
210: DI 0 (X130 / 1.2)

Index: [0] = Encoder 1
[1] = Reserved
[2] = Reserved

Dependency: See also: p0489, p0490

⚠ CAUTION

In order to prevent incorrect measurement values, these parameters may not be written during an active measurement.

Note

DI: Digital Input
Refer to the encoder interface for PROFIdrive.

p0489[0...2] Activate measuring probe 2

Can be changed: T, U **Data type:** Integer16

Min: 0 **Max:** 211 **Def:** 211

Description: Setting to activate/deactivate measuring probe 2.
The inversion of probe 2 is set in p0490.1.

Value:
0: No measuring probe
211: DI 1 (X130 / 1.5)

Index:
[0] = Encoder 1
[1] = Reserved
[2] = Reserved

Dependency: See also: p0488, p0490

⚠ CAUTION
In order to prevent incorrect measurement values, these parameters may not be written during an active measurement.

Note
DI: Digital Input
Refer to the encoder interface for PROFIdrive.

p0490 Invert measuring probe

Can be changed: T, U **Data type:** Unsigned32
Min: - **Max:** - **Def:** 0000 bin

Description: Setting to invert digital input 0 or 1 (probe 1, 2).

Bit field:

Bit	Signal name	1 signal	0 signal
00	DI 0 (X130 / 1.2)	Inverted	Not inverted
01	DI 1 (X130 / 1.5)	Inverted	Not inverted

Dependency: See also: p0488, p0489

Note
DI: Digital Input
The inversion has no effect on the status display of the digital inputs (r0722).

p0494[0] Equivalent zero mark input terminal

Can be changed: T, U **Data type:** Integer16
Min: 0 **Max:** 211 **Def:** 0

Description: Selects the input terminal for connecting an equivalent zero mark (external encoder zero mark).

Value:
0: No equivalent zero mark (evaluation of the encoder zero mark)
210: DI 0 (X130 / 1.2)
211: DI 1 (X130 / 1.5)

Dependency: See also: p0490

⚠ CAUTION
In order to prevent incorrect measurement values, these parameters may not be written during an active measurement.

Note
Refer to the encoder interface for PROFIdrive.

r0550[0] Brake status

Data type: Integer16 **Unit:** -

Description: Displays the status of the brake.
The value of r0550 is read when the drive powers up.

Value:
0: No data
1: Holding brake
2: High performance holding brake

Dependency: See also: p1215, r1216, r1217

Note
For p0550 = 1:
The default value for opening time/closing time applies.
For p0550 = 2:
A shorter opening time/closing time is realized if the drive satisfies the preconditions.

p0613[0] Motor temperature model ambient temperature

Can be changed: T, U **Data type:** FloatingPoint32
Min: -40 [°C] **Max:** 100 [°C] **Def:** 40 [°C]

Description: Sets the motor ambient temperature.
Based on this value, the motor temperature model calculates the thermal motor utilization (r0034).

Dependency: See also: r0034
See also: F07011, A07012

r0722.0...4 Digital inputs status

Data type: Unsigned32 **Unit:** -

Description: Displays the status of the digital inputs.

Bit field:

Bit	Signal name	1 signal	0 signal
00	DI 0 (X130 / 1.2)	High	Low
01	DI 1 (X130 / 1.5)	High	Low
02	DI 2 (X130 / 2.1-2)	High	Low
03	DI 3 (X130 / 2.3-4)	High	Low
04	DI 4 (X130 / 2.6)	High	Low

Dependency: See also: p0488, p0489

Note
DI: Digital Input
For bit 00, 01:
DI 0 and DI 1 are fast digital inputs and can be used to connect a measuring probe (p0488, p0489).
For bits 02, 03:
DI 2 and DI 3 form a failsafe digital input.
For bit 04:
DI 4 is intended to monitor the temperature of the external brake resistor.

r0898.0...14 Control word sequence control

Data type: Unsigned16 **Unit:** -

Description: Display for the control word of the sequence control.
The higher-level control cyclically sends the control word to the drive.

Bit field:

Bit	Signal name	1 signal	0 signal
00	ON/OFF1	Yes	No
01	OC / OFF2	Yes	No
02	OC / OFF3	Yes	No
03	Enable operation	Yes	No
04	Enable ramp-function generator	Yes	No
05	Continue ramp-function generator	Yes	No
06	Enable speed setpoint	Yes	No
07	Command open brake	Yes	No
08	Jog 1	Yes	No
09	Jog 2	Yes	No
10	Master control by PLC	Yes	No
12	Speed controller enable	Yes	No

	14	Command close brake	Yes	No

r0899.0...15 Status word sequence control

Data type: Unsigned16 **Unit:** -

Description: Display for the status word of the sequence control.
The status word is cyclically sent from the drive to the higher-level control.

Bit field:

Bit	Signal name	1 signal	0 signal
00	Ready for switching on	Yes	No
01	Ready	Yes	No
02	Operation enabled	Yes	No
03	Jog active	Yes	No
04	No coasting active	OFF2 inactive	OFF2 active
05	No Quick Stop active	OFF3 inactive	OFF3 active
06	Switching on inhibited active	Yes	No
07	Drive ready	Yes	No
08	Controller enable	Yes	No
09	Control request	Yes	No
11	Pulses enabled	Yes	No
12	Open holding brake	Yes	No
13	Command close holding brake	Yes	No
14	Pulse enable from the brake control	Yes	No
15	Setpoint enable from the brake control	Yes	No

Note
For bits 00, 01, 02, 04, 05, 06, 09:
For PROFIdrive, these signals are used for status word 1.
For bit 13:
When the "Safe Brake Control" (SBC) is activated and selected, the brake is no longer controlled using this signal.
For bit 14, 15:
These signals are only of significance when the "extended brake control" function module is activated (r0108.14 = 1).

r0922 PROFIdrive PZD telegram selection

Data type: Unsigned16 **Unit:** -

Description: Displays the send and receive telegram.
The telegram settings are taken from the higher-level control system.

Value:
3: Standard telegram 3, PZD-5/9
5: Standard telegram 5, PZD-9/9
102: SIEMENS telegram 102, PZD-6/10
105: SIEMENS telegram 105, PZD-10/10

r0924[0...1] ZSW bit pulses enabled

Data type: Unsigned16 **Unit:** -

Description: Displays the position of the "Pulses enabled" status signal in the PROFIdrive telegram.

Index: [0] = Signal number
[1] = Bit position

p0925 PROFIdrive clock synchronous sign-of-life tolerance

Can be changed: T, U **Data type:** Unsigned16
Min: 0 **Max:** 65535 **Def:** 1

Description: Sets the number of tolerated consecutive sign-of-life errors of the isochronous controller.
The sign-of-life signal is normally received in PZD4 (control word 2) from the controller.
Dependency: See also: F01912

Note
The sign-of-life monitoring is disabled for p0925 = 65535.

r0930 PROFIdrive operating mode

Data type: Unsigned16 **Unit:** -
Description: Displays the operating mode.
3: Closed-loop speed controlled operation without ramp-function generator

r0944 Fault buffer counter

Data type: Unsigned16 **Unit:** -
Description: Display for the fault buffer counter
This counter is incremented every time that a fault occurs.
Recommendation: This is used to check whether an additional fault has occurred while reading out the fault buffer.
Dependency: See also: r0945, r0947, r0948, r0949, r2109

r0945[0...63] Fault code

Data type: Unsigned16 **Unit:** -
Description: Displays the numbers of faults that have occurred.
Dependency: See also: r0947, r0948, r0949, r2109, r2130, r2133, r2136

NOTICE
The properties of the fault buffer should be taken from the corresponding product documentation.

Note
The buffer parameters are cyclically updated in the background.
Drive faults are signaled using parameters r0945, r0947, r0948 and r0949.

r0947[0...63] Fault code

Data type: Unsigned16 **Unit:** -
Description: This parameter is identical to r0945.

r0948[0...63] Fault received in milliseconds

Data type: Unsigned32 **Unit:** [ms]
Description: Displays the system runtime in milliseconds referred to the day that the fault occurred.
Dependency: See also: r0945, r0947, r0949, r2109, r2130, r2133, r2136

NOTICE
The time comprises r2130 (complete days) and r0948 (milliseconds, incomplete day).

r0949[0...63] Fault value

Data type: Integer32 **Unit:** -
Description: Displays additional information about the fault that occurred (as integer number).
The fault causes can be found under the fault values of the particular fault number.
Dependency: See also: r0945, r0947, r0948, r2109, r2130, r2133, r2136

Note
The buffer parameters are cyclically updated in the background.
The structure of the fault buffer and the assignment of the indices is shown in r0945.

p0952 Fault cases counter

Can be changed: T, U **Data type:** Unsigned16
Min: 0 **Max:** 65535 **Def:** 0

Description: Number of fault situations since the last reset.

Dependency: The counter is reset with p0952 = 0.
See also: r0945, r0947, r0948, r0949, r2109, r2130, r2133, r2136

r0964[0...6] Device identification

Data type: Unsigned16 **Unit:** -

Description: Displays the device identification.
The drive internally comprises components, device and drive object. Both components require their own identification parameters according to PROFIdrive

Index: [0] = Company (Siemens = 42)
[1] = Device type
[2] = Firmware version
[3] = Firmware date (year)
[4] = Firmware date (day/month)
[5] = Number of drive objects
[6] = Firmware patch/hot fix

Dependency: See also: r0975

Note
Example:
r0964[0] = 42 --> SIEMENS
r0964[1] = 5410 --> SINAMICS S210 PN
r0964[2] = 501 --> first part firmware version V05.01 (second part, refer to index 6)
r0964[3] = 2018 --> year 2018
r0964[4] = 1705 --> 17th of May
r0964[5] = 1 --> 1 drive object
r0964[6] = 100 --> second part firmware version (complete version: V05.01.01.00)

r0965 PROFIdrive profile number profile version

Data type: Unsigned16 **Unit:** -

Description: Displays the PROFIdrive profile number and profile version.
Constant value = 032A hex.
Byte 1: Profile number = 03 hex = PROFIdrive profile
Byte 2: profile version = 2A hex = 42 dec = version 4.2

Note
When the parameter is read via PROFIdrive, the Octet String 2 data type applies.

r0975[0...10] Drive object identification

Data type: Unsigned16 **Unit:** -

Description: Displays the identification of the drive object.
The drive internally comprises components, device and drive object. Both components require their own identification parameters according to PROFIdrive

Index: [0] = Company (Siemens = 42)
[1] = Drive object type
[2] = Firmware version
[3] = Firmware date (year)
[4] = Firmware date (day/month)
[5] = PROFIdrive drive object type class
[6] = PROFIdrive drive object sub-type Class 1
[7] = Drive object number
[8] = Reserved
[9] = Reserved
[10] = Firmware patch/hot fix

Dependency: See also: r0964

Note
Example:
r0975[0] = 42 --> SIEMENS
r0975[1] = 11 --> SERVO drive object type
r0975[2] = 102 --> first part, firmware version V01.02 (second part, refer to index 10)
r0975[3] = 2003 --> year 2003
r0975[4] = 1401 --> 14th of January
r0975[5] = 1 --> PROFIdrive drive object, type class
r0975[6] = 9 --> PROFIdrive drive object sub-type class 1
r0975[7] = 2 --> drive object number = 2
r0975[8] = 0 (reserved)
r0975[9] = 0 (reserved)
r0975[10] = 600 --> second part, firmware version (complete version: V01.02.06.00)

p0976 Reset all parameters

Can be changed: C1(30), C2(30) **Data type:** Unsigned16
Min: 0 **Max:** 1 **Def:** 0

Description: Resets all parameters of the drive system.

Value:
0: Inactive
1: Start reset of all parameters to factory setting

Dependency: See also: p0977

NOTICE
After changing the value, it is not possible to change parameters until the operation has been completed.

Note
After all of the parameters have been reset to their factory setting, the system must be commissioned for the first time again.
Reset is realized in the non-volatile memory.
Procedure:
1. Set p0009 = 30 (parameter reset).
2. Set p0976 = 1 The system is powered up again.
p0976 is automatically set to 0 and p0009 is automatically set to 1 after this has been carried out.

p0977 Save all parameters

Can be changed: T, U **Data type:** Unsigned16
Min: 0 **Max:** 1 **Def:** 0

Description: Saves all parameters of the drive system to the non-volatile memory.
When saving, only the adjustable parameters intended to be saved are taken into account.

Value:
0: Inactive
1: Save in non-volatile memory - loaded at POWER ON

Dependency: See also: p0976

NOTICE
The drive power supply may only be switched off after data has been saved (i.e. after data save has been started, wait until the parameter again has the value 0). Writing to parameters is inhibited while saving.

r0979[0...30] PROFIdrive encoder format

Data type: Unsigned32 **Unit:** -

Description: Displays the actual position encoder used according to PROFIdrive.

Index:
[0] = Header
[1] = Type encoder 1
[2] = Resolution encoder 1
[3] = Shift factor G1_XIST1
[4] = Shift factor G1_XIST2
[5] = Distinguishable revolutions encoder 1
[6...30] = Reserved

Note
Information about the individual indices can be taken from the following literature:
PROFIdrive Profile Drive Technology

p1082[0] Maximum speed

Can be changed: C2(1), T **Data type:** FloatingPoint32
Min: 0.000 [rpm] **Max:** 210000.000 [rpm] **Def:** 1500.000 [rpm]

Description: Sets the maximum motor speed to a value less than or equal to the maximum motor speed (r0322).
The set value is valid for both directions of rotation.

Dependency: See also: r0322

p1083[0] Speed limit positive

Can be changed: T, U **Data type:** FloatingPoint32
Scaling: p2000
Min: 0.000 [rpm] **Max:** 210000.000 [rpm] **Def:** 210000.000 [rpm]

Description: Sets the maximum speed for the positive direction.
The set value must be less than or equal to the maximum speed (p1082).

p1086[0] Speed limit negative

Can be changed: T, U **Data type:** FloatingPoint32
Scaling: p2000
Min: -210000.000 [rpm] **Max:** 0.000 [rpm] **Def:** -210000.000 [rpm]

Description: Sets the maximum speed for the negative direction.
The set value must be less than or equal to the maximum speed (p1082).

p1121[0] OFF1 ramp-down time

Can be changed: C2(1), T, U **Data type:** FloatingPoint32
Min: 0.000 [s] **Max:** 999999.000 [s] **Def:** 1.000 [s]

Description: Sets the ramp-down time after an OFF1 command.
The value is referred to the maximum speed (p1082).
After an OFF1 command, within this time, the speed setpoint is ramped down from the maximum speed (p1082) to standstill.

Dependency: See also: p1082

p1135[0] OFF3 ramp-down time

Can be changed: C2(1), T, U **Data type:** FloatingPoint32
Min: 0.000 [s] **Max:** 600.000 [s] **Def:** 0.000 [s]

Description: Sets the ramp-down time for quick stop.
In this time, after an OFF3, the speed setpoint is reduced from the maximum speed (p1082) down to standstill.

Note
This time can be exceeded if the DC link voltage reaches its maximum value.

r1196 DSC position setpoint

Data type: Integer32 **Unit:** -

Description: Displays the position setpoint of Dynamic Servo Control in fine pulses.

Note
DSC: Dynamic Servo Control

p1215 Motor holding brake configuration

Can be changed: T **Data type:** Integer16
Min: 0 **Max:** 2 **Def:** 0

Description: Sets the configuration for the motor holding brake.
Re value 2:
This setting allows the motor shaft to be rotated for installation purposes.

Value:
0: No motor holding brake available
1: Motor holding brake acc. to sequence control
2: Motor holding brake always open

Dependency: See also: r1216, r1217, 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.
Setting p1215 = 2 is not permissible if the brake is used to hold loads.

r1216 Motor holding brake opening time

Data type: FloatingPoint32 **Unit:** [ms]

Description: Displays the opening time for the motor holding brake.
The speed setpoint is kept at 0 for this time. The speed setpoint is then enabled.

Dependency: See also: p1215, r1217

r1217 Motor holding brake closing time

Data type: FloatingPoint32 **Unit:** [ms]

Description: Displays the time to close the motor holding brake.
If the drive signals that the motor is at a standstill, if the holding brake is activated, after the closing time has expired, the pulses are canceled. This prevents the load from sagging, for example.

Dependency: See also: p1215, r1216

p1226[0] Threshold for zero speed detection

Can be changed: T, U **Data type:** FloatingPoint32
Min: 0.00 [rpm] **Max:** 210000.00 [rpm] **Def:** 20.00 [rpm]

Description: Sets the speed threshold for the standstill identification.
The following applies when the motor holding brake is activated:
The motor is shut down and held by the brake after the closing time for the brake in p1217 has elapsed.
The following applies when the motor holding brake is not activated:
The motor is shut down and it then coasts down.

Dependency: See also: p1215, r1216, r1217, p1227

Note
In order that standstill is identified, the speed threshold in p1226 must be somewhat higher than the speed actual value noise level.

p1227 Zero speed detection monitoring time

Can be changed: T, U **Data type:** FloatingPoint32
Min: 0.000 [s] **Max:** 300.000 [s] **Def:** 4.000 [s]

Description: Sets the monitoring time for the standstill identification.
When the speed setpoint falls below the speed threshold p1226 after OFF1 or OFF3, after the monitoring time that has been set expires, the drive signals that the motor at a standstill.

Dependency: See also: p1215, r1216, r1217, p1226

Note
The monitoring is deactivated with p1227 = maximum value.

p1228 Pulse suppression delay time

Can be changed: T, U **Data type:** FloatingPoint32
Min: 0.000 [s] **Max:** 299.000 [s] **Def:** 0.000 [s]

Description: Sets the delay time for pulse suppression.
When the speed actual value falls below the speed threshold p1226 after OFF1 or OFF3, after the delay time that has been set expires, the drive signals that the motor at a standstill.

Dependency: See also: p1226, p1227

p1416[0] Speed setpoint filter 1 time constant

Can be changed: T, U **Data type:** FloatingPoint32
Min: 0.00 [ms] **Max:** 5000.00 [ms] **Def:** 0.00 [ms]

Description: Sets the time constant for the speed setpoint filter (PT1).

Note
The speed setpoint filter is activated with a time constant greater than zero.

r1438 Speed controller speed setpoint

Data type: FloatingPoint32 **Unit:** [rpm] **Scaling:** p2000

Description: Displays the speed setpoint after setpoint limiting for the P component of the speed controller.

p1441[0] Actual speed smoothing time

Can be changed: T, U **Data type:** FloatingPoint32
Min: 0.00 [ms] **Max:** 50.00 [ms] **Def:** 0.00 [ms]

Description: Sets the smoothing time constant (PT1) for the speed actual value.

Dependency: See also: r0063

p1460[0] Speed controller P gain

Can be changed: T, U **Data type:** FloatingPoint32
Min: 0.0000 [Nms/rad] **Max:** 500000000.0000 [Nms/rad] **Def:** 0.3000 [Nms/rad]

Description: Sets the P gain of the speed controller.
The drive determines the P gain for One Button Tuning and writes the value to p1460.
The value can be changed.

Dependency: See also: p1462

Note
The higher the set P gain, the faster and more unstable the control.

p1462[0] Speed controller integral time

Can be changed: T, U **Data type:** FloatingPoint32
Min: 0.00 [ms] **Max:** 100000.00 [ms] **Def:** 10.00 [ms]

Description: Sets the integral time for the speed controller
The drive determines the integral time for One Button Tuning - and writes the value to p1462.

Dependency: See also: p1460

Note
The shorter the integral time, the faster and more unstable the control.

p1498[0] Load moment of inertia

Can be changed: T, U **Data type:** FloatingPoint32
Min: - [kgm²] **Max:** - [kgm²] **Def:** - [kgm²]

Description: Sets the load moment of inertia.
The setting is made during commissioning while the One Button Tuning is being performed.

p1520[0] Torque limit upper

Can be changed: T, U **Data type:** FloatingPoint32
Scaling: p2003
Min: -1000000.00 [Nm] **Max:** 20000000.00 [Nm] **Def:** 0.00 [Nm]

Description: Setting the upper torque limit.
This setting is made as part of the basic commissioning.

Dependency: See also: p1521, p1532, r1538, r1539

p1521[0] Torque limit lower

Can be changed: T, U **Data type:** FloatingPoint32
Scaling: p2003
Min: -20000000.00 [Nm] **Max:** 1000000.00 [Nm] **Def:** 0.00 [Nm]

Description: Sets the lower torque limit
This setting is made as part of the basic commissioning.

Dependency: See also: p1520, p1532, r1538, r1539

p1532[0] Torque limit offset

Can be changed: T, U **Data type:** FloatingPoint32
Scaling: p2003
Min: -100000.00 [Nm] **Max:** 100000.00 [Nm] **Def:** 0.00 [Nm]

Description: Sets the offset for the torque limit.
The setting allows electronic weight equalization to be used for vertical axes.
Parameters p1520 and p1521 are offset by the set value in the same direction.

Dependency: See also: p1520, p1521

⚠ DANGER

If the offset is set higher/lower than the lower/upper torque limit, then the unloaded drive can accelerate up to the maximum speed.

r1538 Upper effective torque limit

Data type: FloatingPoint32 **Unit:** [Nm] **Scaling:** p2003

Description: Displays the currently effective upper torque limit.

Note

The value in r1538 may not exceed the value in p1520.

r1539 Lower effective torque limit

Data type: FloatingPoint32 **Unit:** [Nm] **Scaling:** p2003

Description: Displays the currently active lower torque limit.

Note

The value in r1539 may not exceed the value in p1521.

p1558 Measure/precontrol hanging/suspended axis force due to weight

Can be changed: T, U **Data type:** Integer16

Min: -1 **Max:** 1 **Def:** 0

Description: Setting to start/reset the measurement of the force due to weight for a hanging/suspended axis.

The measurement can be started when the pulses are inhibited or the pulses are enabled (p1558 = 1). If it was started when the pulses were inhibited, then it is only executed after the pulses have been enabled. In both cases, alarm A07991 is output after starting.

For the measurement, the torque to hold the axis is determined and entered into p1532.

Further, this value is used internally for the precontrol.

Value:

-1: Reset values

0: Inactive

1: Start measurement and activate precontrol

Dependency: The pulse enable is withdrawn at the end of the measurement.

See also: p1532

Note

For master control with speed setpoint input from the commissioning tool, the torque precontrol channels are deactivated, so that the weight equalization entered here is not active.

p1703[0] Isq current controller precontrol scaling

Can be changed: T, U **Data type:** FloatingPoint32

Min: 0.0 [%] **Max:** 200.0 [%] **Def:** 0.0 [%]

Description: Sets the scaling of the dynamic current controller precontrol for the torque-generating current component Isq.

p1821[0] Direction of rotation

Can be changed: C2(3) **Data type:** Integer16

Min: 0 **Max:** 1 **Def:** 0

Description: Setting to change the direction of rotation.

If the parameter is changed, it reverses the direction of rotation of the motor and the encoder actual value without changing the setpoint.

Value:

0: Clockwise

1: Counter-clockwise

Dependency: See also: F07434

NOTICE
After changing parameter p1821, the direction of rotation is not automatically adapted in the safety area. The following parameters can be used to set the direction of rotation for safety monitoring: - p9516.1 "Position actual value sign change" (only for operation with encoder)

p2000 Reference speed

Can be changed: T **Data type:** FloatingPoint32

Min: 6.00 [rpm] **Max:** 210000.00 [rpm] **Def:** 3000.00 [rpm]

Description: Sets the reference quantity for the speed values.
All speeds specified as relative values refer to this reference quantity.
The reference quantity corresponds to 100% or 4000 hex (word) or 4000 0000 hex (double word).

Dependency: See also: p2003

p2003 Reference torque

Can be changed: T **Data type:** FloatingPoint32

Min: 0.01 [Nm] **Max:** 20000000.00 [Nm] **Def:** 1.00 [Nm]

Description: Sets the reference quantity for the torque values.
All torques specified as relative value are referred to this reference quantity.
The reference quantity corresponds to 100% or 4000 hex (word) or 4000 0000 hex (double word).

r2050[0...21] Diagnostics PZD receive word

Data type: Integer16 **Unit:** - **Scaling:** 4000H

Description: Displays the received process data (setpoints) in the word format.

Index:
[0] = PZD 1
[1] = PZD 2
[2] = PZD 3
[3] = PZD 4
[4] = PZD 5
[5] = PZD 6
[6] = PZD 7
[7] = PZD 8
[8] = PZD 9
[9] = PZD 10
[10] = PZD 11
[11] = PZD 12
[12] = PZD 13
[13] = PZD 14
[14] = PZD 15
[15] = PZD 16
[16] = PZD 17
[17] = PZD 18
[18] = PZD 19
[19] = PZD 20
[20] = PZD 21
[21] = PZD 22

Dependency: See also: r2060

r2053[0...27] Diagnostics PZD send word

Data type: Unsigned16 **Unit:** -

Description: Displays the send process data (actual values) in the word format.

Index:
[0] = PZD 1
[1] = PZD 2
[2] = PZD 3
[3] = PZD 4
[4] = PZD 5
[5] = PZD 6
[6] = PZD 7
[7] = PZD 8
[8] = PZD 9
[9] = PZD 10
[10] = PZD 11
[11] = PZD 12
[12] = PZD 13
[13] = PZD 14
[14] = PZD 15
[15] = PZD 16
[16] = PZD 17
[17] = PZD 18
[18] = PZD 19
[19] = PZD 20
[20] = PZD 21
[21] = PZD 22
[22] = PZD 23
[23] = PZD 24
[24] = PZD 25
[25] = PZD 26
[26] = PZD 27
[27] = PZD 28

Bit field:

Bit	Signal name	1 signal	0 signal
00	Bit 0	ON	OFF
01	Bit 1	ON	OFF
02	Bit 2	ON	OFF
03	Bit 3	ON	OFF
04	Bit 4	ON	OFF
05	Bit 5	ON	OFF
06	Bit 6	ON	OFF
07	Bit 7	ON	OFF
08	Bit 8	ON	OFF
09	Bit 9	ON	OFF
10	Bit 10	ON	OFF
11	Bit 11	ON	OFF
12	Bit 12	ON	OFF
13	Bit 13	ON	OFF
14	Bit 14	ON	OFF
15	Bit 15	ON	OFF

r2060[0...20] Diagnostics PZD receive double word

Data type: Integer32 **Unit:** - **Scaling:** 4000H

Description: Displays the received process data (setpoints) in the double word format.

Index: [0] = PZD 1 + 2
[1] = PZD 2 + 3
[2] = PZD 3 + 4
[3] = PZD 4 + 5
[4] = PZD 5 + 6
[5] = PZD 6 + 7
[6] = PZD 7 + 8
[7] = PZD 8 + 9
[8] = PZD 9 + 10
[9] = PZD 10 + 11
[10] = PZD 11 + 12
[11] = PZD 12 + 13
[12] = PZD 13 + 14
[13] = PZD 14 + 15
[14] = PZD 15 + 16
[15] = PZD 16 + 17
[16] = PZD 17 + 18
[17] = PZD 18 + 19
[18] = PZD 19 + 20
[19] = PZD 20 + 21
[20] = PZD 21 + 22

Dependency: See also: r2050

r2063[0...26] Diagnostics PZD send double word

Data type: Unsigned32 **Unit:** -

Description: Displays the send process data (actual values) in the double word format.

Index:
[0] = PZD 1 + 2
[1] = PZD 2 + 3
[2] = PZD 3 + 4
[3] = PZD 4 + 5
[4] = PZD 5 + 6
[5] = PZD 6 + 7
[6] = PZD 7 + 8
[7] = PZD 8 + 9
[8] = PZD 9 + 10
[9] = PZD 10 + 11
[10] = PZD 11 + 12
[11] = PZD 12 + 13
[12] = PZD 13 + 14
[13] = PZD 14 + 15
[14] = PZD 15 + 16
[15] = PZD 16 + 17
[16] = PZD 17 + 18
[17] = PZD 18 + 19
[18] = PZD 19 + 20
[19] = PZD 20 + 21
[20] = PZD 21 + 22
[21] = PZD 22 + 23
[22] = PZD 23 + 24
[23] = PZD 24 + 25
[24] = PZD 25 + 26
[25] = PZD 26 + 27
[26] = PZD 27 + 28

Bit field:

Bit	Signal name	1 signal	0 signal
00	Bit 0	ON	OFF
01	Bit 1	ON	OFF
02	Bit 2	ON	OFF
03	Bit 3	ON	OFF
04	Bit 4	ON	OFF
05	Bit 5	ON	OFF
06	Bit 6	ON	OFF
07	Bit 7	ON	OFF
08	Bit 8	ON	OFF
09	Bit 9	ON	OFF
10	Bit 10	ON	OFF
11	Bit 11	ON	OFF
12	Bit 12	ON	OFF
13	Bit 13	ON	OFF
14	Bit 14	ON	OFF
15	Bit 15	ON	OFF
16	Bit 16	ON	OFF
17	Bit 17	ON	OFF
18	Bit 18	ON	OFF
19	Bit 19	ON	OFF
20	Bit 20	ON	OFF
21	Bit 21	ON	OFF
22	Bit 22	ON	OFF

23	Bit 23	ON	OFF
24	Bit 24	ON	OFF
25	Bit 25	ON	OFF
26	Bit 26	ON	OFF
27	Bit 27	ON	OFF
28	Bit 28	ON	OFF
29	Bit 29	ON	OFF
30	Bit 30	ON	OFF
31	Bit 31	ON	OFF

r2109[0...63] Fault removed in milliseconds

Data type: Unsigned32 **Unit:** [ms]

Description: Displays the time in milliseconds referred to the day that the fault was resolved.

Dependency: See also: r0945, r0947, r0948, r0949, r2130, r2133, r2136

NOTICE

The time comprises r2136 (days) and r2109 (milliseconds).

Note

The buffer parameters are cyclically updated in the background.
The structure of the fault buffer and the assignment of the indices is shown in r0945.

p2111 Alarm counter

Can be changed: T, U **Data type:** Unsigned16

Min: 0 **Max:** 65535 **Def:** 0

Description: Number of alarms that have occurred after the last reset.

Dependency: When setting p2111 = 0, all of the alarms that have been removed from the alarm buffer [0...7] are transferred into the alarm history [8...63] - and alarm buffer [0...7] is deleted.
See also: r2122, r2123, r2124, r2125

Note

The parameter is reset to 0 at POWER ON.

r2121 Counter alarm buffer changes

Data type: Unsigned16 **Unit:** -

Description: This counter is incremented every time the alarm buffer changes.

Dependency: See also: r2122, r2123, r2124, r2125

r2122[0...63] Alarm number

Data type: Unsigned16 **Unit:** -

Description: Displays the number of the last 64 alarms.

Dependency: See also: r2123, r2124, r2125, r2134, r2145, r2146

NOTICE

The properties of the alarm buffer should be taken from the corresponding product documentation.

Note
The buffer parameters are cyclically updated in the background.
Alarm buffer structure (general principle):
r2122[0], r2124[0], r2123[0], r2125[0] --> alarm 1 (the oldest)
. . .
r2122[7], r2124[7], r2123[7], r2125[7] --> Alarm 8 (the latest)
When the alarm buffer is full, the alarms that have gone are entered into the alarm history:
r2122[8], r2124[8], r2123[8], r2125[8] --> Alarm 1 (the latest)
. . .
r2122[63], r2124[63], r2123[63], r2125[63] --> alarm 56 (the oldest)

r2123[0...63] Alarm received in milliseconds

Data type: Unsigned32 **Unit:** [ms]

Description: Displays the time in milliseconds referred to the day that the alarm occurred.

Dependency: See also: r2122, r2124, r2125, r2134, r2145, r2146

NOTICE
The time comprises r2145 (days) and r2123 (milliseconds).

Note
The buffer parameters are cyclically updated in the background.
The structure of the alarm buffer and the assignment of the indices is shown in r2122.

r2124[0...63] Alarm value

Data type: Integer32 **Unit:** -

Description: Displays additional information about the active alarm (as integer number).

Dependency: See also: r2122, r2123, r2125, r2134, r2145, r2146

Note
The buffer parameters are cyclically updated in the background.
The structure of the alarm buffer and the assignment of the indices are shown in r2122.

r2125[0...63] Alarm removed in milliseconds

Data type: Unsigned32 **Unit:** [ms]

Description: Displays the time in milliseconds referred to the day that the alarm was resolved.

Dependency: See also: r2122, r2123, r2124, r2134, r2145, r2146

NOTICE
The time comprises r2146 (days) and r2125 (milliseconds).

Note
The buffer parameters are cyclically updated in the background.
The structure of the alarm buffer and the assignment of the indices is shown in r2122.

r2130[0...63] Fault received in days

Data type: Unsigned16 **Unit:** -

Description: Displays the time in days referred to the day that the fault occurred.

Dependency: See also: r0945, r0947, r0948, r0949, r2109, r2133, r2136

NOTICE
The time comprises r2130 (days) and r0948 (milliseconds).

Note
The buffer parameters are cyclically updated in the background.

r2131 **Actual fault number**

Data type: Unsigned16 **Unit:** -

Description: Displays the number of the active fault that occurred last.

Note
0: No fault present.

r2132 **Actual alarm number**

Data type: Unsigned16 **Unit:** -

Description: Displays the number of the alarm that last occurred.

Note
0: No alarm present.

r2133[0...63] **Fault value for float values**

Data type: FloatingPoint32 **Unit:** -

Description: Displays the additional information about the fault that occurred for float values.
Refer to the fault for the interpretation of the fault value.

Dependency: See also: r0945, r0947, r0948, r0949, r2109, r2130, r2136

Note
The buffer parameters are cyclically updated in the background.

r2134[0...63] **Alarm value for float values**

Data type: FloatingPoint32 **Unit:** -

Description: Displays the additional information about the alarm that occurred for float values.
Refer to the alarm for an interpretation of the alarm value.

Dependency: See also: r2122, r2123, r2124, r2125, r2145, r2146

Note
The buffer parameters are cyclically updated in the background.

r2136[0...63] **Fault removed in days**

Data type: Unsigned16 **Unit:** -

Description: Displays the time in days referred to the day when the fault was rectified.

Dependency: See also: r0945, r0947, r0948, r0949, r2109, r2130, r2133

NOTICE
The time comprises r2136 (days) and r2109 (milliseconds).

Note
The buffer parameters are cyclically updated in the background.

r2145[0...63] **Alarm received in days**

Data type: Unsigned16 **Unit:** -

Description: Displays the time in days referred to the day that the alarm occurred.

Dependency: See also: r2122, r2123, r2124, r2125, r2134, r2146

NOTICE
The time comprises r2145 (days) and r2123 (milliseconds).

Note
The buffer parameters are cyclically updated in the background.

r2146[0...63] Alarm removed in days

Data type: Unsigned16 **Unit:** -

Description: Displays the time in days referred to the day when the alarm was cleared.

Dependency: See also: r2122, r2123, r2124, r2125, r2134, r2145

NOTICE
The time comprises r2146 (days) and r2125 (milliseconds).

Note
The buffer parameters are cyclically updated in the background.

p2175[0] Motor blocked speed threshold

Can be changed: T, U **Data type:** FloatingPoint32

Min: 0.00 [rpm] **Max:** 210000.00 [rpm] **Def:** 120.00 [rpm]

Description: Sets the speed threshold for the message "Motor locked".
Monitoring is deactivated with p2175 = 0.

Dependency: See also: F07900

Note
If the motor speed is less than the threshold value set in p2175 - and the motor is operated for longer than 200 ms at the torque limit - then the motor is shut down and a fault is output.

p3103 UTC synchronization process

Can be changed: T, U **Data type:** Integer16

Min: 4 **Max:** 99 **Def:** 4

Description: Setting the synchronization process.

Value:
4: Network Time Protocol
99: No synchronization

Note
If value = 4:
Synchronization of the time in the drive with the time specified by the higher-level control system.

p3106 NTP time zone

Can be changed: T, U **Data type:** Integer16

Min: 0 **Max:** 38 **Def:** 14

Description: Sets the local time zone for NTP (Network Time Protocol).

Value:
0: UTC-12 (AOE)
1: UTC-11 (NURT)
2: UTC-10 (HAST)
3: UTC-9:30 (MART)
4: UTC-9 (AKST)
5: UTC-8 (PST)
6: UTC-7 (MST)
7: UTC-6 (CST)
8: UTC-5 (EST)
9: UTC-4 (VET)
10: UTC-3:30 (NST)
11: UTC-3 (ART)
12: UTC-2 (GST)
13: UTC-1 (CVT)
14: UTC+0 (GMT)

15: UTC+1 (CET)
16: UTC+2 (EEK)
17: UTC+3 (MISK)
18: UTC+3:30 (IRST)
19: UTC+4 (GST)
20: UTC+4:30 (AFT)
21: UTC+5 (UZT)
22: UTC+5:30 (IST)
23: UTC+5:45 (NPT)
24: UTC+6 (BST)
25: UTC+6:30 (MMT)
26: UTC+7 (WIB)
27: UTC+8 (CST)
28: UTC+8:30 (PYT)
29: UTC+8:45 (ACWST)
30: UTC+9 (JST)
31: UTC+9:30 (ACST)
32: UTC+10 (AEST)
33: UTC+10:30 (ACDT)
34: UTC+11 (AEDT)
35: UTC+12 (ANAT)
36: UTC+13 (NZDT)
37: UTC+13:45 (CHADT)
38: UTC+14 (LINT)

Dependency: See also: p3103

p3117 Change safety message type

Can be changed: C1(1) **Data type:** Unsigned32
Min: 0 **Max:** 1 **Def:** 1

Description: Sets the re-parameterization of all safety messages for faults and alarms.
The relevant message type during changeover is selected by the firmware.
0: Safety messages are not reparameterized (safety message buffer)
1: Safety messages are reparameterized (no safety message buffer)

Note
A change only becomes effective after a POWER ON.

p5271[0] One Button Tuning configuration 1

Can be changed: T **Data type:** Unsigned16
Min: - **Max:** - **Def:** 0001 1100 bin

Description: Sets the configuration for One Button Tuning.

Bit field:

Bit	Signal name	1 signal	0 signal
03	Setting the speed precontrol	Yes	No
04	Setting the torque precontrol	Yes	No
07	Setting the voltage precontrol	Yes	No

Dependency: See also: r5274

Note
For bit 03:
Activation of speed feedforward control.
For bit 04:
Activation of speed/torque precontrol in the drive.
For bit 07:
Activation of the voltage precontrol.

r5274 One Button Tuning dynamic response estimated

Data type: FloatingPoint32 **Unit:** [ms]

Description: Displays the estimated dynamic response of the speed control loop as PT1 time constant for One Button Tuning.
The lower the time constant, the higher the dynamic performance.

Dependency: See also: p5271

r5276[0] One Button Tuning Kv factor estimated

Data type: FloatingPoint32 **Unit:** [1000 rpm]

Description: Displays the estimated position controller gain (Kv factor) for One Button Tuning.

Dependency: See also: p5271

Note
The value for the closed-loop position control is required by a higher-level control system.

r5277[0] One Button Tuning precontrol symmetrizing time estimated

Data type: FloatingPoint32 **Unit:** [ms]

Description: Displays the estimated precontrol symmetrizing time for One Button Tuning.
This is required to symmetrize the position controller if the closed-loop position control is in an external control system.

Dependency: See also: p5271

p5291 FFT tuning configuration

Can be changed: T, U **Data type:** Unsigned32

Min: - **Max:** - **Def:** 0000 0000 0000 0000 0000 0000 0011 1001 bin

Description: Sets the configuration for the "FFT tuning" function.
This function is used for One Button Tuning (p5300 = 1).

Bit field:

Bit	Signal name	1 signal	0 signal
00	Noise excitation after pulse enable	Yes	No
01	Set current setpoint filter (HF)	Yes	No
02	Set speed controller gain (HF)	Yes	No
03	Length of FFT window bit 0 (LF, HF)	Yes	No
04	Length of FFT window bit 1 (LF, HF)	Yes	No
05	Windowing the time signals using a Hamming window (LF, HF)	Yes	No
06	Measure current controller	Yes	No
07	Bandwidth bit 0 (LF)	Yes	No
08	Bandwidth bit 1 (LF)	Yes	No
09	Bandwidth bit 2 (LF)	Yes	No
10	Measuring periods bit 0	Yes	No
11	Measuring periods bit 1	Yes	No
12	Inject noise onto speed setpoint	Yes	No
13	Do not reduce Kp for measurement	Yes	No
14	Set the current setpoint filter with loop compensation	Yes	No

16	Torque in front of the current setpoint filter	Yes	No

Dependency: See also: r5293, p5296

Note

HF: high frequency
LF: low frequency
For bit 00:
A PRBS signal (pseudo random binary signal) is superimposed on the current setpoint to be able to better identify the mechanical controlled system.
For bit 01:
The identified mechanical resonance points are suppressed using current setpoint filters.
For bit 02:
The maximum speed controller gain is determined from the identified mechanical controlled system.
For bits 03, 04:
The measured value buffer length is set using these bits:
Bit 04 = 0 and bit 03 = 0 -> buffer length = 256
Bit 04 = 0 and bit 03 = 1 -> buffer length = 512
Bit 04 = 1 and bit 03 = 0 -> buffer length = 1024
Bit 04 = 1 and bit 03 = 1 -> buffer length = 2048
For bit 05:
A Hamming window is used to filter the measured time signals.
For bit 06:
The measurement checks the current controller frequency response and this is taken into account in the speed controller loop. For high amplitudes in p5298, it is possible that the measurement is unsuccessful, as the converter reaches its voltage limit.
For bits 07, 08, 09:
The measurement bandwidth is set using these bits:
Bit 09 = 0, bit 08 = 0, bit 07 = 0 -> bandwidth = 50 Hz
Bit 09 = 0, bit 08 = 0, bit 07 = 1 -> bandwidth = 100 Hz
Bit 09 = 0, bit 08 = 1, bit 07 = 0 -> bandwidth = 200 Hz
Bit 09 = 0, bit 08 = 1, bit 07 = 1 -> bandwidth = 400 Hz
Bit 09 = 1, bit 08 = 0, bit 07 = 0 -> bandwidth = 800 Hz
Bit 09 = 1, bit 08 = 0, bit 07 = 1 -> bandwidth = 1600 Hz
For bits 10, 11:
Number of measuring periods.
Bit 11 = 0 and bit 10 = 0 -> number of measurements = 1
Bit 11 = 0 and bit 10 = 1 -> number of measurements = 2
Bit 11 = 1 and bit 10 = 0 -> number of measurements = 4
Bit 11 = 1 and bit 10 = 1 -> number of measurements = 8
For bit 12:
The PRBS signal is switched to the speed setpoint (in front of the filter).
For bit 13:
The input signal for the torque actual value is taken from in front of the current setpoints filters.
For bit 14:
When the bit is set, a current setpoint filter is used to partially compensate the mechanical system.
This is recommended for the following machine attributes:
- the load moment of inertia is significantly higher than the motor moment of inertia (e.g. > 6x).
- the coupling between the machine elements has almost no backlash (no play).
- the stiffness of the mechanical transmission elements does not change significantly in the traversing range.

p5292 Controller optimization dynamic factor

Can be changed: T, U **Data type:** FloatingPoint32

Min: 25.0 [%] **Max:** 125.0 [%] **Def:** 80.0 [%]

Description: Sets the dynamic factor for optimizing the speed controller when One Button Tuning is activated (p5300 = 1).

Dependency: The higher the value in p5292, the lower the value in r5274.
See also: p5291

Note
The higher the dynamic factor, the faster and more unstable the control.

r5293 FFT tuning speed controller P gain identified

Data type: FloatingPoint32 **Unit:** [Nms/rad]

Description: Displays the determined proportional gain Kp of the speed controller before FFT tuning.
This function is used for One Button Tuning (p5300 = 1).

Dependency: See also: p5291

p5296[0...2] Controller optimization noise amplitude

Can be changed: T, U **Data type:** FloatingPoint32

Min: 1.0 [%] **Max:** 300.0 [%] **Def:** [0] 10.0 [%] , [1] 30.0 [%] , [2] 5.0 [%]

Description: The drive determines the noise amplitude for One Button Tuning and writes the value to p5296.

Dependency: See also: p5291

p5300[0] One Button Tuning selection

Can be changed: T **Data type:** Integer16

Min: -1 **Max:** 1 **Def:** 0

Description: Setting to activate/deactivate the One Button Tuning function.
If p5300 = 1:
The One Button Tuning function is configured using p5271 and p5301.

Value:
-1: Reset controller parameters
0: Inactive
1: One Button Tuning

Dependency: The motor must have already been commissioned so that One Button Tuning functions perfectly.
The One Button Tuning function is configured using p5271 and p5301.
The required dynamic performance of the control loop is set in p5292.
The traversing path for the test signal is parameterized in p5308.
Additional relevant parameters
p5309, p5296, p5297, r5274
See also: p5271, r5274, p5292, r5293, p5296, p5301, p5308, p5309

NOTICE
When executing One Button Tuning, the motor can be accelerated with its rated torque if the torque limit (p1520, p1521) does not limit this to lower values. If the mechanical system is sensitive, then it is recommended that the torque limits are appropriately reduced before executing One Button Tuning.

Note
If p5300 = -1:
One Button Tuning is deactivated and p5300 is automatically set = 0. Further, the presetting values for the speed controller are restored.
If p5300 = 0:
To permanently save the values for the speed controller that have been determined, the parameters must be saved in a non-volatile memory.
If p5300 = 1:
One Button Tuning is active.
The moment of inertia is determined once using a test signal. The controller parameters and current setpoint filters are additionally determined once using a noise signal as excitation source. The steps to be executed can be configured using p5301.

p5301[0] One Button Tuning configuration 2

Can be changed: T, U **Data type:** Unsigned32

Min: - **Max:** - **Def:** 0000 0000 0000 0111 bin

Description: Sets the functions for One Button Tuning (p5300 = 1).

A test signal is required for some functions. To do this, observe parameters p5308 and p5309.

Bit field:

Bit	Signal name	1 signal	0 signal
00	Setting the proportional gain Kp	Yes	No
01	Setting current setpoint filter	Yes	No
02	Estimate moment of inertia	Yes	No
07	Activating synchronized axes	Yes	No
08	Moment of inertia determination from frequency response	Yes	No

Dependency: It is only possible to change the configuration if One Button Tuning is not active (p5300 = 0).

See also: p5292, r5293, p5296, p5300, p5308, p5309

Note

For bit 00:
The speed controller gain is determined and set using a noise signal.
For bit 01:
Possibly required current setpoint filters are determined and set using a noise signal.
As a consequence, a higher dynamic performance can be achieved in the speed control loop.
For bit 02:
Using this bit, the moment of inertia is determined using a test signal. If this bit is not set, then the load moment of inertia must be manually set using parameter p1498. The test signal must have been previously set using parameters p5308 and p5309.
For bit 07:
With this function, these axes are adapted to the dynamic response set in p5275. This is necessary for interpolating axes. The time in p5275 should be set according to the axis with the lowest dynamic response.
For bit 08:
Using this bit, the moment of inertia is determined from the frequency characteristic using a test signal, and is transferred to p1498. The traversing path must first be set using parameter p5308.

r5306[0] One Button Tuning status

Data type: Unsigned16 **Unit:** -

Description: Displays the status of the functions performed using One Button Tuning.

Bit field:

Bit	Signal name	1 signal	0 signal
00	Proportional gain Kp set	Yes	No
01	Current setpoint filter set	Yes	No
02	Moment of inertia estimation carried out	Yes	No
13	One Button Tuning successfully completed	Yes	No
14	Controller parameters reset due to fault	Yes	No

Dependency: See also: p5300, p5301

Note

For bit 00 = 1: The speed controller gain was set using One Button Tuning.
For bit 01 = 1: The current setpoint filter was set using One Button Tuning
For bit 02 = 1: The moment of inertia was determined.

p5308[0] One Button Tuning distance limiting

Can be changed: T **Data type:** Integer32

Min: -30000 [°] **Max:** 30000 [°] **Def:** 0 [°]

Description: Setting the distance limiting (permissible traversing range des motor).

The traversing range is limited in the positive and negative directions.

Note
A value of 360 degrees corresponds to one motor revolution.
The position before the pulse enable is used as zero point.

p5309[0] One Button Tuning duration

Can be changed: T **Data type:** Unsigned32
Min: 0 [ms] **Max:** 5000 [ms] **Def:** 2000 [ms]

Description: Sets the duration for One Button Tuning (several acceleration operations)
This function is used for One Button Tuning (p5300 = 1) to identify the total moment of inertia of the drive train.

Dependency: See also: F07093

Note
If, within this time, no setting values can be determined, then the drive is shut down with the corresponding fault.

r5600 Pe energy-saving mode ID

Data type: Integer16 **Unit:** -

Description: Displays the PROFIenergy mode ID of the effective energy-saving mode.

Value:
0: POWER OFF
2: Energy-saving mode
240: Operation
255: Ready

Note
Pe: PROFIenergy profiles
For value = 0: This value is displayed in the "First commissioning" state.

p5611 Pe energy-saving properties general

Can be changed: T **Data type:** Unsigned32
Min: - **Max:** - **Def:** 0000 bin

Description: Sets the general properties for energy-saving.

Bit field:

Bit	Signal name	1 signal	0 signal
00	Inhibit PROFIenergy control commands	Yes	No

Note
Pe: PROFIenergy profiles

r8936[0...1] Cyclic connection status

Data type: Integer16 **Unit:** -

Description: Displays the status of cyclic connections.

Value:
0: Interrupted
1: Not connected
2: Connection starts to be established
3: Module information expected
4: Module information received
5: Module address expected
6: Module address received
7: Parameterization data expected
8: Parameterization data received
9: Evaluate parameterization data
10: Connection being established completion expected
11: Configured controller RUN expected

12: Configured controller STOP
13: Configured controller RUN

Index: [0] = Controller 1
[1] = Controller 2

Note
The parameter is active when the "PROFINET Device" and "EtherNet/IP" protocols are selected (p2030 = 7, 10).
For PROFINET, the following applies:
For two connections (Shared Device or system redundancy) the display in the index depends on the sequence in which the connections are established.
The IP addresses of controllers 1 and 2 are displayed in r8961 and r8962.
The following states are displayed for system redundancy:
Primary controller: r8936[x] = 13
Backup controller: r8936[x] = 11
If value = 10:
If the connection remains in this state, then when using PROFINET IRT the following can apply:
- topology error (incorrect port assignment).
- synchronization missing.
For EtherNet/IP, the following applies:
Only a cyclic connection is possible for EtherNet/IP. Index 0 indicates the status of the cyclic connection.

r8937[0...5] Cyclic connection diagnostics

Data type: Unsigned32 **Unit:** -

Description: Display for the cyclic connection diagnostics.

Index: [0] = Number of cyclic connections
[1] = Number of send subslots of all connections
[2] = Number of send net data (bytes) of all connections
[3] = Number of receive subslots of all connections
[4] = Number of receive net data (bytes) of all connections
[5] = Connection type (RT, IRT)

Note
The parameter is active when the "PROFINET Device" and "EtherNet/IP" protocols are selected (p2030 = 7, 10).
For PROFINET, the following applies:
For index [5]:
Bit 0 = 1: there is at least one RT connection.
Bit 1 = 1: there is an IRT connection.
For EtherNet/IP, the following applies:
For index [1, 3, 5]:
These indices are not relevant.

p8979 Activate SNMP

Can be changed: T **Data type:** Integer16
Min: 0 **Max:** 1 **Def:** 1

Description: The setting to activate/deactivate SNMP for the Industrial Ethernet interface (X127) and the onboard PROFINET interface (X150).
Facilitates SNMP access for network diagnostic tools (e.g. PRONETA).

Value: 0: No
1: Yes

NOTICE
When SNMP is activated, carefully note the impact relating to Industrial Security.

Note
SNMP: Simple Network Management Protocol
A change only becomes effective after a POWER ON or reset.

p8984[0...1] Web server interface enable

Can be changed: T | **Data type:** Unsigned32 / Binary
Min: - | **Max:** - | **Def:** [0] 1 , [1] 0

Description: Setting to enable the interface for access via the web server.

Index:
[0] = Reserved
[1] = PROFINET X150

Note
p8984[1] = 65536:
PROFINET interface X150 is enabled for access to the web server.
p8984[1] = 0:
PROFINET interface X150 is blocked for access to the web server.

p9370 SI Motion acceptance test mode

Can be changed: T, U | **Data type:** Integer16
Min: 0000 hex | **Max:** 00AC hex | **Def:** 0000 hex

Description: Setting to select and deselect the acceptance test mode.

Value:
0: [00 hex] Deselect the acceptance test mode
172: [AC hex] Select the acceptance test mode

Dependency: See also: A01799

Note
The acceptance test mode can only be selected if the motion monitoring functions integrated in the drive are enabled (p9601.2).

r9371 SI Motion acceptance test status

Data type: Integer16 | **Unit:** -

Description: Displays the status of the acceptance test mode.

Value:
0: [00 hex] Acc_mode inactive
12: [0C hex] Acc_mode not possible due to POWER ON fault
13: [0D hex] Acc_mode not possible due to incorrect ID in p9370
15: [0F hex] Acc_mode not possible due to expired Acc_timer
172: [AC hex] Acc_mode active

Dependency: See also: p9370
See also: A01799

p9501 SI Motion enable safety functions

Can be changed: C2(95) | **Data type:** Unsigned32
Min: - | **Max:** - | **Def:** 0000 0000 0000 0000 0000 0000 0000 0000 bin

Description: Sets the enable signals for the safe motion monitoring.

Bit field:

Bit	Signal name	1 signal	0 signal
00	Enable SOS/SLS	Enable	Inhibit
16	Enable SSM	Enable	Inhibit
17	Enable SDI	Enable	Inhibit
18	Enable SS2E	Enable	Inhibit
20	Enable SLA	Enable	Inhibit

	24 Enable transfer SLS limit value via PROFIsafe	Enable	Inhibit

Dependency: See also: F01682, F01683

Note
A change only becomes effective after a POWER ON.
SDI: Safe Direction (safe motion direction)
SLA: Safely-Limited Acceleration
SLS: Safely-Limited Speed
SOS: Safe Operating Stop
SS2E: Safe Stop 2 External (Safe Stop 2 with external stop)
SSM: Safe Speed Monitor (safety-relevant feedback signal from the speed monitoring)

p9502 SI Motion axis type

Can be changed: C2(95) **Data type:** Integer16

Min: 0 **Max:** 1 **Def:** 0

Description: Sets the axis type (linear axis or rotary axis/spindle).

Value:
0: Linear axis
1: Rotary axis/spindle

Note
For the commissioning tool, after changing over the axis type, the units dependent on the axis type are only updated after a project upload.
A change only becomes effective after a POWER ON.

p9505 SI Motion SP modulo value

Can be changed: C2(95) **Data type:** FloatingPoint32

Min: 0 [°] **Max:** 737280 [°] **Def:** 0 [°]

Description: Sets the modulo value in degrees for rotary axes.
This setting is only used to correctly display the diagnostics information in r9708.
The value should be set so that it is precisely at 2^n revolutions, so that when the range that can be represented (+/-2048) overflows, this does not cause the position actual value to jump.
The modulo function is deactivated for a value = 0.

Dependency: See also: p9501
See also: F01681

Note
SP: Safe Position

p9506 SI Motion function specification

Can be changed: C2(95) **Data type:** Integer16

Min: 0 **Max:** 2 **Def:** 0

Description: Sets the function specification for the safe motion monitoring.

Value:
0: Safety with encoder and acceleration monitoring (SAM)
2: Safety with encoder with brake ramp (SBR)

Dependency: See also: A01711

Note
A change only becomes effective after a POWER ON.
SAM: Safe Acceleration Monitor (safe acceleration monitoring)
SBR: Safe Brake Ramp (safe brake ramp monitoring)
SI: Safety Integrated

p9507 SI Motion function configuration

Can be changed: C2(95) **Data type:** Unsigned32

Min: - **Max:** - **Def:** 0100 0001 bin

Description: Sets the function configuration for the safe motion monitoring functions.

Bit field:

Bit	Signal name	1 signal	0 signal
00	Extended message acknowledgment	Yes	No
01	Setpoint speed limiting for A01711	No	Yes
03	SS1 with OFF3 (brake response)	SS1E external stop	SS1 with OFF3

Dependency: See also: A01711

Note

For bit 00:
When the function is activated, a safety-relevant acknowledgment (internal event acknowledge) can be performed by selecting/deselecting STO.
For bit 01:
When the function is activated, the active setpoint velocity limiting (r9733) for active A01711 is set to zero.
For bit 03:
When the bit is activated, for a fault response with SS1 or when SS1 is selected, an SS1E is initiated. As a consequence, brake monitoring (SBR, SAM) is deactivated.
SS1: Safe Stop 1
SS1E: Safe Stop 1 external (Safe Stop 1 with external stop)
STO: Safe Torque Off

p9515 SI Motion encoder coarse position value configuration

Can be changed: C2(95) **Data type:** Unsigned32

Min: - **Max:** - **Def:** 0000 0000 0000 0000 0000 0000 0000 0000 bin

Description: Sets the encoder configuration for the redundant coarse position value.
The encoder that is used for the safe motion monitoring function must be parameterized in this parameter.

Bit field:

Bit	Signal name	1 signal	0 signal
00	Incrementer	Yes	No
01	Encoder CRC least significant byte first	Yes	No
02	Redundant coarse position val. most significant bit left-aligned	Yes	No
04	Binary comparison not possible	Yes	No
05	Single-channel encoder	Yes	No
16	DRIVE-CLiQ encoder	Yes	No

Note

- after starting the copy function (p9700 = 57 hex), p9515.0...5 are set according to the encoder.
For safety functions that are not enabled (p9501 = 0), the following applies:
- p9515.16 is automatically set when the system powers up.
For safety functions that are enabled (p9501 > 0), the following applies:
- p9515.16 is checked to see that it matches the encoder.

p9516 SI Motion encoder configuration safety functions

Can be changed: C2(95) **Data type:** Unsigned16

Min: - **Max:** - **Def:** 0000 0000 bin

Description: Sets the configuration for the motor encoder and position actual value.
The encoder that is used for the safe motion monitoring function must be parameterized in this parameter.

Bit field:

Bit	Signal name	1 signal	0 signal
01	Position actual value sign change	Yes	No
04	No STO after encoder fault	Yes	No

Dependency: See also: F01671

p9518 **SI Motion encoder pulses per revolution**

Can be changed: C2(95) **Data type:** Unsigned32

Min: 0 **Max:** 16777215 **Def:** 2048

Description: Sets the number of encoder pulses per revolution.

The encoder that is used for the safe motion monitoring function must be parameterized in this parameter.

Dependency: See also: F01671

Note

For safety functions that are not enabled (p9501 = 0), the following applies:
- p9518 is automatically set when the system powers up.

For safety functions that are enabled (p9501 > 0), the following applies:
- p9518 is checked to see that it matches the encoder.

p9519 **SI Motion fine resolution G1_XIST1**

Can be changed: C2(95) **Data type:** Unsigned32

Min: 2 **Max:** 18 **Def:** 11

Description: Sets the fine resolution for G1_XIST1 in bits.

The encoder that is used for the safe motion monitoring function must be parameterized in this parameter.

Dependency: See also: F01671

Note

G1_XIST1: encoder 1 position actual value 1 (PROFIdrive)

For safety functions that are not enabled (p9501 = 0), the following applies:
- p9519 is automatically set when the system powers up.

For safety functions that are enabled (p9501 > 0), the following applies:
- p9519 is checked to see that it matches the encoder.

p9520 **SI Motion spindle pitch**

Can be changed: C2(95) **Data type:** FloatingPoint32

Min: 0.1000 [mm] **Max:** 8388.0000 [mm] **Def:** 10.0000 [mm]

Description: Sets the gear ratio between the encoder and load in mm/revolution for a linear axis with rotary encoder.

NOTICE

The fourth decimal point can be rounded-off depending on the size of the entered number (from 3 places before the decimal point).

p9521[0...7] **SI Motion gearbox encoder (motor)/load denominator**

Can be changed: C2(95) **Data type:** Unsigned32

Min: 1 **Max:** 2147000000 **Def:** 1

Description: Sets the denominator for the gearbox between the encoder and load.

Index: [0] = Gearbox 1

[1...7] = Reserved

Dependency: See also: p9522

p9522[0...7] **SI Motion gearbox encoder (motor)/load numerator**

Can be changed: C2(95) **Data type:** Unsigned32

Min: 1 **Max:** 2147000000 **Def:** 1

Description: Sets the numerator for the gearbox between the encoder and load.

Index: [0] = Gearbox 1

[1...7] = Reserved

Dependency: See also: p9521

p9530 SI Motion standstill tolerance

Can be changed: C2(95) **Data type:** FloatingPoint32

Min: 0.000 [mm] **Max:** 100.000 [mm] **Def:** 1.000 [mm]

Min: 0.000 [°] **Max:** 100.000 [°] **Def:** 1.000 [°]

Description: Sets the tolerance for the "SOS" function.

Dependency: See also: A01707

Note
SOS: Safe Operating Stop

p9531[0...3] SI Motion SLS limit values

Can be changed: C2(95) **Data type:** FloatingPoint32

Min: 0.00 [mm/min] **Max:** 1000000.00 [mm/min] **Def:** 2000.00 [mm/min]

Min: 0.00 [rpm] **Max:** 1000000.00 [rpm] **Def:** 2000.00 [rpm]

Description: Sets the limit values for the "SLS" function.

Index: [0] = Limit value SLS1
[1] = Limit value SLS2
[2] = Limit value SLS3
[3] = Limit value SLS4

Dependency: See also: p9563
See also: A01714

Note
SLS: Safely-Limited Speed

p9533 SI Motion SLS setpoint speed limiting

Can be changed: T, U **Data type:** FloatingPoint32

Min: 0.000 [%] **Max:** 100.000 [%] **Def:** 80.000 [%]

Description: This is an evaluation factor to define the setpoint limit from the selected actual speed limit.
The active SLS limit value is evaluated with this factor and is made available as setpoint limit in r9733.

Dependency: This parameter only has to be parameterized for the motion monitoring functions integrated in the drive (p9601.2 = 1)
r9733[0] = p9531[x] x p9533 (converted from the load side to the motor side)
r9733[1] = - p9531[x] x p9533 (converted from the load side to the motor side)
[x] = Selected SLS stage
Conversion factor from the motor side to the load side:
- motor type = rotary and axis type = linear: p9522 / (p9521 x p9520)
- otherwise: p9522 / p9521
See also: p9501, p9531, p9601

Note
The active actual speed limit is selected via safety-relevant inputs.
When SOS is selected or an STO, SS1, SS2, SS2E, a setpoint of 0 is entered in r9733.
SLS: Safely-Limited Speed

p9539[0...7] SI Motion gearbox direction of rotation reversal

Can be changed: C2(95) **Data type:** Integer16

Min: 0 **Max:** 1 **Def:** 0

Description: Sets the direction of rotation reversal for the gearbox.
0: No direction of rotation reversal
1: Direction of rotation reversal

Index: [0] = Gearbox 1
[1...7] = Reserved
Dependency: See also: p9521

p9542 SI Motion actual value comparison tolerance (cross-check)

Can be changed: C2(95) **Data type:** FloatingPoint32
Min: 0.0010 [mm] **Max:** 360.0000 [mm] **Def:** 0.1000 [mm]
Min: 0.0010 [°] **Max:** 360.0000 [°] **Def:** 0.1000 [°]

Description: Sets the tolerance for the data cross-check of the actual position between the two monitoring channels.
Dependency: See also: A01711

Note
For a "linear axis with rotating motor" configuration and factory setting of p9520, p9521 and p9522, the factory setting of p9542 corresponds to a position tolerance of 36 ° on the motor side.

p9545 SI Motion SSM filter time

Can be changed: C2(95) **Data type:** FloatingPoint32
Min: 0.00 [ms] **Max:** 500.00 [ms] **Def:** 0.00 [ms]

Description: Sets the filter time for the SSM feedback signal to detect standstill.

Note
The filter time is effective only if the function is enabled (p9501.16 = 1).
The parameter is included in the data cross-check of the two monitoring channels.
The set time is rounded internally to an integer multiple of the monitoring clock cycle.
SSM: Safe Speed Monitor (safety-relevant feedback signal from the speed monitoring)

p9546 SI Motion SSM velocity limit

Can be changed: C2(95) **Data type:** FloatingPoint32
Min: 0.00 [mm/min] **Max:** 1000000.00 [mm/min] **Def:** 20.00 [mm/min]
Min: 0.00 [rpm] **Max:** 1000000.00 [rpm] **Def:** 20.00 [rpm]

Description: Sets the velocity limit for the SSM feedback signal to detect standstill.
When this limit value is undershot, the signal "SSM feedback signal active" is set.
For p9568 = 0, the value in p9546 is also applicable for SAM/SBR.

Note
SAM: Safe Acceleration Monitor (safe acceleration monitoring)
SBR: Safe Brake Ramp (safe brake ramp monitoring)
SSM: Safe Speed Monitor (safety-relevant feedback signal from the speed monitoring)

p9547 SI Motion SSM velocity hysteresis

Can be changed: C2(95) **Data type:** FloatingPoint32
Min: 0.0010 [mm/min] **Max:** 500.0000 [mm/min] **Def:** 10.0000 [mm/min]
Min: 0.0010 [rpm] **Max:** 500.0000 [rpm] **Def:** 10.0000 [rpm]

Description: Sets the velocity hysteresis for the SSM feedback signal to detect standstill.
Dependency: See also: A01711

Note
The velocity hysteresis is effective only if the function is enabled (p9501.16 = 1).
The parameter is included in the data cross-check of the two monitoring channels.
SSM: Safe Speed Monitor (safety-relevant feedback signal from the speed monitoring)

p9548 **SI Motion SAM actual speed tolerance**

Can be changed: C2(95) **Data type:** FloatingPoint32

Min: 0.00 [mm/min] **Max:** 120000.00 [mm/min] **Def:** 300.00 [mm/min]

Min: 0.00 [rpm] **Max:** 120000.00 [rpm] **Def:** 300.00 [rpm]

Description: Sets the velocity tolerance for the "SAM" function.

Dependency: See also: A01706

Note
SAM: Safe Acceleration Monitor (safe acceleration monitoring)

p9551 **SI Motion SLS switchover/SOS delay time**

Can be changed: C2(95) **Data type:** FloatingPoint32

Min: 0.00 [ms] **Max:** 600000.00 [ms] **Def:** 100.00 [ms]

Description: Sets the delay time for the SLS changeover and for the activation of SOS for the "SLS" and "SOS" functions.
When transitioning from a higher to a lower Safely-Limited Speed level, and when activating SOS, within this delay time, the "old" speed level remains active.
This delay is also applicable when activating SLS from the state "SOS and SLS inactive" and activating SOS from the state "SOS inactive".

Note
The set time is rounded internally to an integer multiple of the monitoring clock cycle.
SLS: Safely-Limited Speed
SOS: Safe Operating Stop

p9552 **SI Motion transition time SS2 to SOS**

Can be changed: C2(95) **Data type:** FloatingPoint32

Min: 0.00 [ms] **Max:** 600000.00 [ms] **Def:** 100.00 [ms]

Description: Sets the transition time from SS2 to SOS.

Note
The set time is rounded internally to an integer multiple of the monitoring clock cycle.
SOS: Safe Operating Stop
SS2: Safe Stop 2

p9553 **SI Motion transition time SS2E to SOS**

Can be changed: C2(95) **Data type:** FloatingPoint32

Min: 0.00 [ms] **Max:** 600000.00 [ms] **Def:** 100.00 [ms]

Description: Sets the transition time from SS2E to SOS.

Note
The set time is rounded internally to an integer multiple of the monitoring clock cycle.
SI: Safety Integrated
SOS: Safe Operating Stop
SS2E: Safe Stop 2 External (Safe Stop 2 with external stop)

p9555 **SI Motion transition time A01711 to SS1**

Can be changed: C2(95) **Data type:** FloatingPoint32

Min: 0.00 [ms] **Max:** 600000.00 [ms] **Def:** 0.00 [ms]

Description: Sets the transition time from A01711 to SS1.

Dependency: See also: A01711

Note
The set time is rounded internally to an integer multiple of the monitoring clock cycle.

p9556 **SI Motion SS1 to STO delay time**

Can be changed: C2(95) **Data type:** FloatingPoint32

Min: 0.00 [ms] **Max:** 3600000.00 [ms] **Def:** 100.00 [ms]

Description: Sets the delay time for STO after an SS1.

Dependency: See also: p9560
See also: F01701

Note
The set time is rounded internally to an integer multiple of the monitoring clock cycle.

p9557 **SI Motion STO test time**

Can be changed: C2(95) **Data type:** FloatingPoint32

Min: 0.00 [ms] **Max:** 10000.00 [ms] **Def:** 100.00 [ms]

Description: Sets the time after which STO must be active when initiating the test stop.

Dependency: See also: A01798

Note
The set time is rounded internally to an integer multiple of the monitoring clock cycle.
STO: Safe Torque Off

p9558 **SI Motion acceptance test mode, time limit**

Can be changed: C2(95) **Data type:** FloatingPoint32

Min: 5000.00 [ms] **Max:** 100000.00 [ms] **Def:** 40000.00 [ms]

Description: Sets the maximum time for the acceptance test mode.
If the acceptance test mode takes longer than the selected time limit, then the mode is automatically terminated.

Dependency: See also: A01799

Note
The set time is rounded internally to an integer multiple of the monitoring clock cycle.

p9559 **SI Motion forced checking procedure timer**

Can be changed: C2(95) **Data type:** FloatingPoint32

Min: 0.00 [h] **Max:** 9000.00 [h] **Def:** 8600.00 [h]

Description: Sets the time interval for carrying out the forced checking procedure and testing the safety motion monitoring functions integrated in the drives.
Within the parameterized time, the safety functions must have been tested at least once (including deselection of the "STO" function).
This monitoring time is reset each time the test is carried out.
The signal source to initiate the forced checking procedure is set in p9705.

Dependency: See also: A01697, A01798

Note
STO: Safe Torque Off

p9560 **SI Motion STO shutdown speed**

Can be changed: C2(95) **Data type:** FloatingPoint32

Min: 0.00 [mm/min] **Max:** 6000.00 [mm/min] **Def:** 0.00 [mm/min]

Min: 0.00 [rpm] **Max:** 6000.00 [rpm] **Def:** 0.00 [rpm]

Description: Sets the shutdown velocity for activating STO.
Below this velocity, "standstill" is assumed, and for an SS1, STO is selected.

Dependency: See also: p9556

Note
The shutdown velocity has no effect for a value = 0.
SS1: Safe Stop 1
STO: Safe Torque Off

p9563[0...3] SI Motion SLS-specific stop response

Can be changed: C2(95) **Data type:** Integer16
Min: 0 **Max:** 3 **Def:** 1

Description: Sets the SLS-specific stop response for the SLS function.
These settings apply to the individual limit values for SLS.
An input value of less than 5 signifies personnel protection, from 10 and upwards, machine protection.

Value:
0: STO
1: SS1
2: SS2
3: SS2E

Index:
[0] = Limit value SLS1
[1] = Limit value SLS2
[2] = Limit value SLS3
[3] = Limit value SLS4

Dependency: See also: p9531

Note
In an extended sense, bus failure is interpreted here as a communication error in the control signals of the safety functions (e.g. via PROFIsafe).
SI: Safety Integrated
SLS: Safely-Limited Speed
SS1: Safe Stop 1
SS2: Safe Stop 2
SS2E: Safe Stop 2 External (Safe Stop 2 with external stop)
STO: Safe Torque Off

p9564 SI Motion SDI tolerance

Can be changed: C2(95) **Data type:** FloatingPoint32
Min: 0.001 [mm] **Max:** 360.000 [mm] **Def:** 12.000 [mm]
Min: 0.001 [°] **Max:** 360.000 [°] **Def:** 12.000 [°]

Description: Sets the tolerance for the "SDI" function.
This motion in the monitored direction is still permissible before message A01716 is initiated.

Dependency: See also: p9565, p9566
See also: A01716

Note
SDI: Safe Direction (safe motion direction)

p9565 SI Motion SDI delay time

Can be changed: C2(95) **Data type:** FloatingPoint32
Min: 0.00 [ms] **Max:** 600000.00 [ms] **Def:** 100.00 [ms]

Description: Sets the delay time for the "SDI" function.
After selecting the SDI function, then for a maximum of this time, motion in the monitored direction is permissible. This time can therefore be used for braking any motion.

Dependency: See also: p9564, p9566
See also: A01716

Note
The set time is rounded internally to an integer multiple of the monitoring clock cycle.
SDI: Safe Direction (safe motion direction)

p9566 SI Motion SDI stop response

Can be changed: C2(95) **Data type:** Integer16
Min: 0 **Max:** 3 **Def:** 1

Description: Sets the stop response for the SDI function.
This setting applies to both directions of motion.

Value:
0: STO
1: SS1
2: SS2
3: SS2E

Dependency: See also: p9564, p9565
See also: A01716

Note
In an extended sense, bus failure is interpreted here as a communication fault in the control signals of the safety functions (e.g. via PROFIsafe).
SDI: Safe Direction (safe motion direction)

p9568 SI Motion SAM/SBR speed limit

Can be changed: C2(95) **Data type:** FloatingPoint32
Min: 0.00 [mm/min] **Max:** 1000.00 [mm/min] **Def:** 0.00 [mm/min]
Min: 0.00 [rpm] **Max:** 1000.00 [rpm] **Def:** 0.00 [rpm]

Description: Sets the velocity limit for the "SAM" and "SBR" functions.
If the drive accelerates during the down ramp by the tolerance in p9548, then SAM identifies this and STO is initiated.
The monitoring operates as follows:
- SAM monitoring is activated for SS1 and SS2.
- the SAM limit value is frozen after the velocity limit in p9568 is undershot.
- SAM monitoring is still executed until the transition time to SOS/STO has expired.

Note
For p9568 = 0, the following applies:
The value in p9546 (SSM) is applied as the velocity limit for SAM/SBR.
SAM: Safe Acceleration Monitor (safe acceleration monitoring)
SBR: Safe Brake Ramp (safe brake ramp monitoring)
SSM: Safe Speed Monitor (safety-relevant feedback signal from the speed monitoring)

p9570 SI Motion acceptance test mode

Can be changed: T, U **Data type:** Integer16
Min: 0000 hex **Max:** 00AC hex **Def:** 0000 hex

Description: Setting to select and deselect the acceptance test mode.

Value:
0: [00 hex] Deselect the acceptance test mode
172: [AC hex] Select the acceptance test mode

Dependency: See also: p9558, r9571, p9601
See also: A01799

Note
Acceptance test mode can only be selected if the safe motion monitoring functions are enabled.

r9571 SI Motion acceptance test status

Data type: Integer16 **Unit:** -

Description: Displays the status of the acceptance test mode.

Value:
- 0: [00 hex] Acc_mode inactive
- 12: [0C hex] Acc_mode not possible due to POWER ON fault
- 13: [0D hex] Acc_mode not possible due to incorrect ID in p9570
- 15: [0F hex] Acc_mode not possible due to expired Acc_timer
- 172: [AC hex] Acc_mode active

Dependency: See also: p9558, p9570
See also: A01799

p9576 SI Motion SLA filter time

Can be changed: C2(95) **Data type:** FloatingPoint32
Min: 0.00 [ms] **Max:** 500.00 [ms] **Def:** 0.00 [ms]

Description: Sets the filter time for the acceleration monitoring with a fine resolution of the acceleration.

Note
The filter time is only effective if the function is enabled (p9501.20 = 1).
The set time is rounded internally to an integer multiple of the monitoring clock cycle.
The parameter is included in the data cross-check of the two monitoring channels.
SLA: Safely-Limited Acceleration

p9578 SI Motion SLA acceleration limit

Can be changed: C2(95) **Data type:** FloatingPoint32
Min: 0.00 [m/s²] **Max:** 1000.00 [m/s²] **Def:** 1.00 [m/s²]
Min: 0.00 [rev/s²] **Max:** 1000.00 [rev/s²] **Def:** 1.00 [rev/s²]

Description: Sets the acceleration limit for the "Safely-Limited Acceleration" function (SLA).

Dependency: See also: p9579

Note
The set time is rounded internally to an integer multiple of the monitoring clock cycle.
SLA: Safely-Limited Acceleration

p9579 SI Motion SLA stop response

Can be changed: C2(95) **Data type:** Integer16
Min: 0 **Max:** 3 **Def:** 1

Description: Sets the stop response for the "Safely-Limited Acceleration" function (SLA).

Value:
- 0: STO
- 1: SS1
- 2: SS2
- 3: SS2E

Dependency: See also: p9578

Note
The set time is rounded internally to an integer multiple of the monitoring clock cycle.
SLA: Safely-Limited Acceleration

p9581 SI Motion brake ramp reference value

Can be changed: C2(95) **Data type:** FloatingPoint32
Min: 600.0000 [mm/min] **Max:** 1000000.0000 [mm/min] **Def:** 1500.0000 [mm/min]
Min: 600.0000 [rpm] **Max:** 1000000.0000 [rpm] **Def:** 1500.0000 [rpm]

Description: Sets the reference value to define the brake ramp.
The rate of rise of the brake ramp depends upon p9581 (reference value) and p9583 (monitoring time).
Dependency: See also: p9582, p9583

p9582 SI Motion brake ramp delay time

Can be changed: C2(95) **Data type:** FloatingPoint32
Min: 10.00 [ms] **Max:** 99000.00 [ms] **Def:** 250.00 [ms]

Description: Sets the delay time for monitoring the brake ramp.
Monitoring of the brake ramp starts once the delay time has elapsed.
Dependency: See also: p9581, p9583

Note
The set time is rounded internally to an integer multiple of the monitoring clock cycle.
The set time is internally limited (lower limit) to 2 safety monitoring clock cycles.

p9583 SI Motion brake ramp monitoring time

Can be changed: C2(95) **Data type:** FloatingPoint32
Min: 0.50 [s] **Max:** 3600.00 [s] **Def:** 10.00 [s]

Description: Sets the monitoring time to define the brake ramp.
The rate of rise of the brake ramp depends upon p9581 (reference value) and p9583 (monitoring time).
Dependency: See also: p9581, p9582

Note
The set time is rounded internally to an integer multiple of the monitoring clock cycle.

r9590[0...3] SI Motion version, safe motion monitoring functions

Data type: Unsigned16 **Unit:** -

Description: Displays the Safety Integrated version for the safe monitoring functions.
Index: [0] = Safety Version (major release)
[1] = Safety Version (minor release)
[2] = Safety Version (baselevel or patch)
[3] = Safety Version (hotfix)
Dependency: See also: r9770

Note
Example:
r9590[0] = 5, r9590[1] = 10, r9590[2] = 1, r9590[3] = 0 --> SI Motion version V05.10.01.00

p9601 SI enable, functions integrated in the drive

Can be changed: C2(95) **Data type:** Unsigned32
Min: - **Max:** - **Def:** 0000 bin

Description: Sets the enable signals for the safety functions integrated in the drive and the type of selection.
Only a selection of the subsequently listed settings is permissible:
0000 hex:
Safety functions integrated in the drive inhibited (no safety function).
0001 hex:
Basis functions are enabled via the onboard terminals.
0008 hex:
Basis functions are enabled via PROFIsafe.
0009 hex:
Basis functions are enabled via PROFIsafe and onboard terminals.
000C hex:
Extended functions via PROFIsafe are enabled.
000D hex:
Extended functions via PROFIsafe and basic functions via onboard terminals are enabled.

Bit field:

Bit	Signal name	1 signal	0 signal
00	STO enabled via terminals:	Enable	Inhibit
02	Enable motion monitoring functions integrated in drive	Enable	Inhibit
03	Enable PROFIsafe	Enable	Inhibit

Note
A change only becomes effective only after a POWER ON.
Exception:
A change to p9601.0 takes effect immediately.
STO: Safe Torque Off
SS1: Safe Stop 1
SI: Safety Integrated

p9602 SI enable safe brake control

Can be changed: C2(95) **Data type:** Integer16
Min: 0 **Max:** 1 **Def:** 0

Description: Sets the enable for the "SBC" function.

Value:
0: Inhibit SBC
1: Enable SBC

Note
The "SBC" function is not activated until at least one safety monitoring function has been enabled (i.e. p9501 not equal to 0 and/or p9601 not equal to 0).
The parameterization "No motor holding brake available" and "Safe Brake Control" enabled (p1215 = 0, p9602 = 1) does not make sense if a motor holding brake is not being used.
SBC: Safe Brake Control
SI: Safety Integrated

p9610 SI PROFIsafe address

Can be changed: C2(95) **Data type:** Unsigned16
Min: 0 **Max:** 65534 **Def:** 0

Description: Sets the PROFIsafe address.

Note
A change only becomes effective after a POWER ON.
The PROFIsafe address in the drive must be identical with the address in the control.

p9611 SI PROFIsafe telegram selection

Can be changed: C2(95) **Data type:** Unsigned16

Min: 0 **Max:** 901 **Def:** 0

Description: Sets the PROFIsafe telegram number.

Value:
0: No PROFIsafe telegram selected
30: PROFIsafe standard telegram 30, PZD-1/1
901: PROFIsafe SIEMENS telegram 901, PZD-3/5

Dependency: See also: r60022

Note
A change only becomes effective after a POWER ON.
To select the PROFIdrive telegram, PROFIsafe must have been enabled (p9601.3 = 1).

p9612 SI PROFIsafe failure response

Can be changed: C2(95) **Data type:** Integer16

Min: 0 **Max:** 1 **Def:** 0

Description: Sets the stop response when PROFIsafe communication fails.

Value:
0: STO
1: SS1

Note
For p9612 = 0 (STO):
The drive safely switches off the motor, the motor coasts down.
For p9612 = 1 (SS1):
The drive brakes the motor with OFF3 ramp-down time until standstill is detected. A switchover is then made to STO.
The following must be observed:
- the transition time F01611 to STO (p9658) must be set higher or equal to the delay time (p9652).

p9650 SI F-DI discrepancy time

Can be changed: C2(95) **Data type:** FloatingPoint32

Min: 0.00 [ms] **Max:** 2000.00 [ms] **Def:** 500.00 [ms]

Description: Sets the time during which the drive tolerates different signal states of the failsafe digital input.

Note
F-DI: Failsafe Digital Input

p9651 SI STO/SBC/SS1 t_debounce time

Can be changed: C2(95) **Data type:** FloatingPoint32

Min: 0.00 [ms] **Max:** 100.00 [ms] **Def:** 0.00 [ms]

Description: Sets the debounce time for the failsafe digital input used to control STO/SBC/SS1.
The debounce time specifies the duration of a fault (noise) pulse at a failsafe digital input that does not change the drive state.

Note
The debounce time is rounded to whole milliseconds.
Example:
Debounce time = 1 ms: Fault pulses of 1 ms are tolerated; only pulses longer than 2 ms result in a response.
Debounce time = 3 ms: Fault pulses of 3 ms are tolerated; only pulses longer than 4 ms result in a response.
The set debounce time impacts the response time of the safety function.

p9652 SI SS1 delay time

Can be changed: C2(95) **Data type:** FloatingPoint32

Min: 0.00 [s] **Max:** 300.00 [s] **Def:** 0.00 [s]

Description: Sets the delay time of the pulse suppression for the "Safe Stop 1" (SS1) function to brake along the OFF3 down ramp (p1135).

Recommendation: In order that the drive can completely ramp-down along the OFF3 ramp and a motor holding brake that is possibly available can close, then the delay time should be set as follows:
Motor holding brake parameterized: delay time >= p1135 + p1228 + p1217
Motor holding brake not parameterized: delay time >= p1135 + p1228

Dependency: See also: p1135

Note
For a stop response SS1 set for PROFIsafe failure (p9612 = 1), pulse cancellation after failure of PROFIsafe communication is delayed by this time.
SS1: Safe Stop 1

p9653 SI SS1 drive-based braking response

Can be changed: C2(95) **Data type:** Integer16
Min: 0 **Max:** 1 **Def:** 0

Description: Sets the drive-based braking response for the "SS1" function.
In the factory setting, SS1 uses the OFF3 ramp.

Value:
0: SS1 with OFF3
1: SS1E external stop

Note
For p9653 = 1, a switchover is made from SS1 to SS1E - and the SS1 response is transferred to the control system.
SS1E requires the externally initiated stop in order to be in conformance with stop Category 1 according to EN60204.
SS1: Safe Stop 1
SS1E: Safe Stop 1 external (Safe Stop 1 with external stop)

p9658 SI transition time F01611 to STO

Can be changed: C2(95) **Data type:** FloatingPoint32
Min: 0.00 [ms] **Max:** 30000.00 [ms] **Def:** 0.00 [ms]

Description: Sets the transition time from F01611 to STO.

Dependency: See also: r9795
See also: F01611

Note
The set time is rounded internally to an integer multiple of the monitoring clock cycle.
STO: Safe Torque Off

p9659 SI forced checking procedure timer

Can be changed: C2(95) **Data type:** FloatingPoint32
Min: 0.00 [h] **Max:** 9000.00 [h] **Def:** 8760.00 [h]

Description: Setting the time interval in order to test Safe Torque Off (STO).
During the test, within the parameterized time, an STO is selected and then again deselected, e.g. by activating and deactivating Emergency Stop.
The monitoring time in r9660 is reset each time that STO is deselected.

Dependency: See also: A01699

Note
STO: Safe Torque Off

r9660 SI forced checking procedure remaining time

Data type: FloatingPoint32 **Unit:** [h]

Description: Displays the remaining time until the next forced checking procedure of the safety functions.

Dependency: See also: A01699

p9670 SI module identification drive

Can be changed: T **Data type:** Unsigned32

Min: 0 **Max:** 4294967295 **Def:** 0

Description: Safety Integrated module identifier for the drive.

Replacement of the drive is identified when the safety functions are activated.

Dependency: See also: F01641

Note

After replacement, when the drive powers up a fault is output.

p9673 SI module identifier motor encoder evaluation

Can be changed: T **Data type:** Unsigned32

Min: 0 **Max:** 4294967295 **Def:** 0

Description: Safety Integrated module identifier for the encoder in the motor.

Replacement of the motor is identified when the safety functions are activated.

Dependency: See also: F01641

Note

After replacement, when the drive powers up a fault is output.

p9675 SI module identifier motor encoder

Can be changed: T **Data type:** Unsigned32

Min: 0 **Max:** 4294967295 **Def:** 0

Description: Safety Integrated module identifier for the encoder in the motor.

Replacement of the motor is identified when the safety functions are activated.

Dependency: See also: F01641

Note

After replacement, when the drive powers up a fault is output.

p9702 SI Acknowledge component replacement

Can be changed: T, U **Data type:** Integer16

Min: 0 **Max:** 29 **Def:** 0

Description: Setting to acknowledge that a component has been replaced.

By writing 29 to this parameter, the unique identifier of a safety-relevant component is transferred into the drive parameterization.

Value:

0: [00 hex] hardware replacement acknowledge ready

29: [1D hex] hardware replacement acknowledgment

NOTICE

It is not permissible that the safety commissioning mode is set in order to write to this parameter.

Note

After successful execution, this parameter is automatically reset to zero.

Parameters must be saved.

The parameter cannot be written to using a project download, and cannot be set in an offline project.

r9708[0...5] SI Motion diagnostics safe position

Data type: FloatingPoint32 **Unit:** [mm]

Unit: [°]

Description: Displays the actual load-side actual values of both monitoring channels and their difference.

Index: [0] = Load-side actual value on the CU
[1] = Load-side actual value on the second channel
[2] = Load-side actual value difference CU - second channel
[3] = Load-side max. actual value difference CU - second channel
[4] = Reserved
[5] = Reserved

Dependency: See also: r9713

Note
For index [0]:
The display of the load-side position actual value on the first channel is updated in the monitoring clock cycle.
For index [1]:
The display of the load-side position actual value on the second channel is updated in the KDV clock cycle (r9724) and delayed by one KDV clock cycle.
For index [2]:
The difference between the load-side position actual value in the first channel and load-side position actual value in the second channel is updated in the KDV clock cycle (r9724) and delayed by one KDV clock cycle.
For index [3]:
The maximum difference between the load-side position actual value in the first channel and the load-side position actual value in the second channel.
KDV: Data cross-check

r9710[0...1] SI Motion diagnostics result list 1

Data type: Unsigned32 **Unit:** -

Description: Displays result list 1 that, for the data cross-check between the monitoring channels, led to the fault.

Index: [0] = Result list channel 2
[1] = Result list channel 1

Bit field:

Bit	Signal name	1 signal	0 signal
00	Actual value > upper limit SOS	Yes	No
01	Actual value > lower limit SOS	Yes	No
06	Actual value > upper limit SLS1	Yes	No
07	Actual value > lower limit SLS1	Yes	No
08	Actual value > upper limit SLS2	Yes	No
09	Actual value > lower limit SLS2	Yes	No
10	Actual value > upper limit SLS3	Yes	No
11	Actual value > lower limit SLS3	Yes	No
12	Actual value > upper limit SLS4	Yes	No
13	Actual value > lower limit SLS4	Yes	No
14	Actual value > upper limit test stop	Yes	No
15	Actual value > lower limit test stop	Yes	No
16	Actual value > upper limit SAM/SBR	Yes	No
17	Actual value > lower limit SAM/SBR	Yes	No
18	Actual value > upper limit SDI positive	Yes	No
19	Actual value > lower limit SDI positive	Yes	No
20	Actual value > upper limit SDI negative	Yes	No
21	Actual value > lower limit SDI negative	Yes	No
22	Actual value > upper limit SLA1	Yes	No
23	Actual value > lower limit SLA1	Yes	No
24	Actual value > fine upper limit SLA1	Yes	No
25	Actual value > fine lower limit SLA1	Yes	No

Dependency: See also: A01711

Note
SBR: Safe Brake Ramp (safe brake ramp monitoring)
SDI: Safe Direction (safe motion direction)
SLA: Safely-Limited Acceleration
SLS: Safely-Limited Speed
SOS: Safe Operating Stop

r9711[0...1] SI Motion diagnostics result list 2

Data type: Unsigned32 **Unit:** -

Description: Displays result list 2 that, for the data cross-check between the monitoring channels, led to the fault.

Index: [0] = Result list channel 2
[1] = Result list channel 1

Bit field:

Bit	Signal name	1 signal	0 signal
16	Actual value > upper limit SSM+	Yes	No
17	Actual value > lower limit SSM+	Yes	No
18	Actual value > upper limit SSM-	Yes	No
19	Actual value > lower limit SSM-	Yes	No
20	Actual value > upper limit modulo	Yes	No
21	Actual value > lower limit modulo	Yes	No

Dependency: See also: A01711

Note
SSM: Safe Speed Monitor (safety-relevant feedback signal from the speed monitoring)

r9712 SI Motion diagnostics position actual value motor side

Data type: Unsigned32 **Unit:** -

Description: Displays the position actual value on the motor side for motion monitoring functions.

Note
The display is updated in the safety monitoring clock cycle.

r9713[0...5] SI Motion diagnostics position actual value load side

Data type: Integer32 **Unit:** -

Description: Displays the actual load-side actual values of both monitoring channels and their difference.

Index: [0] = Load-side actual value on the CU
[1] = Load-side actual value on the second channel
[2] = Load-side actual value difference CU - second channel
[3] = Load-side max. actual value difference CU - second channel
[4] = Reserved
[5] = Reserved

Dependency: See also: r9708

Note
Regarding the units, this parameter should be interpreted as follows:
- linear axis: µm
- rotary axis: mdegrees
The value of this parameter is displayed in r9708 with units (mm or degrees).
The display is updated in the safety monitoring clock cycle.
For index [0]:
The display of the load-side position actual value on the first channel is updated in the monitoring clock cycle.
For index [1]:
The display of the load-side position actual value on the second channel is updated in the KDV clock cycle (r9724) and delayed by one KDV clock cycle.
For index [2]:
The difference between the load-side position actual value in the first channel and load-side position actual value in the second channel is updated in the KDV clock cycle (r9724) and delayed by one KDV clock cycle.
For index [3]:
The maximum difference between the load-side position actual value in the first channel and the load-side position actual value in the second channel.
KDV: Data cross-check

r9714[0...3] SI motion diagnostics velocity

Data type: FloatingPoint32 **Unit:** [mm/min]
Unit: [rpm]

Description: Displays the velocity actual values for motion monitoring functions.

Index:
[0] = Load side speed actual value
[1] = Actual SAM/SBR speed limit
[2] = Actual SLS speed limit
[3] = Actual SLA velocity limit

Note
The display is updated in the safety monitoring clock cycle.
For linear axes, the following unit applies: millimeters per minute
For rotary axes, the following unit applies: revolutions per minute

r9720.0...28 SI Motion control signals integrated in the drive

Data type: Unsigned32 **Unit:** -

Description: Control signals for safety-relevant motion monitoring functions integrated in the drive.

Bit field:

Bit	Signal name	1 signal	0 signal
00	Deselect STO	Yes	No
01	Deselect SS1	Yes	No
02	Deselect SS2	Yes	No
03	Deselect SOS	Yes	No
04	Deselect SLS	Yes	No
07	Acknowledgment	Signal edge active	No
08	Deselect SLA	Yes	No
09	Select SLS bit 0	Set	Not set
10	Select SLS bit 1	Set	Not set
12	Deselect SDI positive	Yes	No
13	Deselect SDI negative	Yes	No
28	Deselect SS2E	Yes	No

Note
This parameter is only supplied with actual values in the case of Safety Integrated Extended Functions. For Safety Integrated Basic Functions (SBC, SS1, STO), the value is equal to zero.

r9722.0...28 SI Motion drive-integrated status signals

Data type: Unsigned32 **Unit:** -

Description: Status signal for safety-relevant motion monitoring functions integrated in the drive.

Bit field:

Bit	Signal name	1 signal	0 signal
00	STO or safe pulse suppression active	Yes	No
01	SS1 active	Yes	No
02	SS2 active	Yes	No
03	SOS active	Yes	No
04	SLS active	Yes	No
07	Internal event	No	Yes
08	SLA active	Yes	No
09	Active SLS stage bit 0	Set	Not set
10	Active SLS stage bit 1	Set	Not set
11	SOS selected	Yes	No
12	SDI positive active	Yes	No
13	SDI negative active	Yes	No
15	SSM (speed below limit value)	Yes	No
28	SS2E active	Yes	No

Dependency: See also: p9501

NOTICE

For bit 07:
The signal state behaves in an opposite way to the PROFIsafe Standard.

Note

This parameter is only supplied with actual values in the case of Safety Integrated Extended Functions.
For Safety Integrated Basic Functions (SBC, SS1, STO), the value is equal to zero.
For bit 07:
An internal event is displayed if a fault response STO, SS1, SS2, SS2E, A01711 is active.
For bit 15:
This bit is only supplied for activated SSM hysteresis and filtering (p9501.16 = 1).

r9723.0...16 SI Motion diagnostic signals integrated in the drive

Data type: Unsigned32 **Unit:** -

Description: Displays the diagnostic signals for safety-relevant motion monitoring functions integrated in the drive.

Bit field:

Bit	Signal name	1 signal	0 signal
00	Forced checking procedure required	Yes	No
01	A01711 and then SS1 becomes active	Yes	No
02	Communication failure delay time active	Yes	No
03	Actual value sensing supplies valid value	Yes	No
12	Test stop active	Yes	No
16	SAM/SBR active	Yes	No

Note
For bit 00:
A required dynamization is also displayed via alarm A01679.
For bit 01:
This bit can be used to execute a control-managed response (e.g. emergency retraction).
For bit 02:
This bit is set if communication fails and the delay time of the stop response is running.
For bit 12:
Test stop active, is also displayed using message A01798.
SAM: Safe Acceleration Monitor (safe acceleration monitoring)
SBR: Safe Brake Ramp (safe brake ramp monitoring)

r9725[0...2] SI Motion diagnostics A01711

Data type: Unsigned32 **Unit:** -

Description:
For index [0]:
Displays the message value that resulted in message A01711 at the drive.
Value = 0:
Message A01711 was communicated from the first channel.
Value = 1 ... 999:
Number of the incorrect date in the data cross-check between the monitoring channels.
Value >= 1000:
Additional diagnostic values of the drive.
For index [1]:
Displays the value from the first channel that resulted in message A01711.
For index [2]:
Displays the value from the second channel that resulted in message A01711.

Index:
[0] = Message value for KDV
[1] = Channel 1 KDV actual value
[2] = Channel 2 KDV actual value

Dependency:
See also: A01711

Note
The significance of the individual message values is described in message A01711.
KDV: Data cross-check
For index [1, 2]:
When message A01711 is output with message value >= 1000, then these indices are not supplied with values.

r9733[0...2] SI Motion setpoint speed limit effective

Data type: FloatingPoint32 **Unit:** [rpm] **Scaling:** p2000

Description:
Displays the necessary setpoint speed limit as a result of the selected motion monitoring functions.
Contrary to the parameterization of the SI limit values, this parameter specifies the motor-side limit value and not the load-side limit value.

Index:
[0] = Setpoint limiting positive
[1] = Setpoint limiting negative
[2] = Setpoint limit absolute

Dependency: For SLS: r9733[0] = p9531[x] x p9533 (converted from the load side to the motor side)
For SDI negative: r9733[0] = 0
For SLS: r9733[1] = - p9531[x] x p9533 (converted from the load side to the motor side)
For SDI positive: r9733[1] = 0
[x] = Selected SLS stage
Conversion factor from the motor side to the load side:
- motor type = rotary and axis type = linear: p9522 / (p9521 x p9520)
- otherwise: p9522 / p9521
See also: p9531, p9533

Note
This parameter is not influenced by setting the axis type (p9502).
If the "SLS" or "SDI" function is not selected, r9733[0] shows p1082 and r9733[1] shows -p1082.
The display in r9733 can be delayed by up to one Safety monitoring clock cycle as compared to the display in r9719/r9720 and r9721/r9722.
When SOS is selected or an STO, SS1, SS2, SS2E, a setpoint of 0 is entered in r9733.

r9734.0...15 SI Safety Information Channel status word S_ZSW1B

Data type: Unsigned16 **Unit:** -

Description: Display for the status word of safety functions (S_ZSW1B).

Bit field:

Bit	Signal name	1 signal	0 signal
00	STO active	Yes	No
01	SS1 active	Yes	No
02	SS2 active	Yes	No
03	SOS active	Yes	No
04	SLS active	Yes	No
05	SOS selected	Yes	No
06	SLS selected	Yes	No
07	Internal event	Yes	No
08	SLA selected	Yes	No
09	Select SLS bit0	Yes	No
10	Select SLS bit1	Yes	No
12	SDI positive selected	Yes	No
13	SDI negative selected	Yes	No
15	Safety message present	Yes	No

Note
For bit 07:
An internal event is displayed if a fault response STO, SS1, SS2, SS2E, A01711 is active.

r9743.8...13 SI Safety Information Channel status word S_ZSW2B

Data type: Unsigned16 **Unit:** -

Description: Display for the status word of the safety functions (S_ZSW2B).

Bit field:

Bit	Signal name	1 signal	0 signal
08	SDI positive selected	Yes	No
09	SDI negative selected	Yes	No
12	Test stop active	Yes	No
13	Test stop required	Yes	No

r9753[0...63] SI message value for float values

Data type: FloatingPoint32 **Unit:** -

Description: Displays additional information about the safety message that has occurred for float values.

r9754[0...63] SI message time received in days

Data type: Unsigned16 **Unit:** -

Description: Displays the relative system runtime in days when the safety message occurred.

r9755[0...63] SI message time removed in milliseconds

Data type: Unsigned32 **Unit:** [ms]

Description: Displays the relative system runtime in milliseconds when the safety message was removed.

r9756[0...63] SI message time removed in days

Data type: Unsigned16 **Unit:** -

Description: Displays the relative system runtime in days when the safety message was removed.

r9765 SI Motion forced checking procedure remaining time

Data type: FloatingPoint32 **Unit:** [h]

Description: Displays the time remaining until the next dynamization and testing of the safety motion monitoring functions integrated in the drives.
The signal source to initiate the forced checking procedure is parameterized in p9705.

Dependency: See also: A01798

r9767.0...1 SI Safety password status

Data type: Unsigned32 **Unit:** -

Description: Display and binector output for the status of the safety password.

Bit field:

Bit	Signal name	1 signal	0 signal
00	Assign password	Yes	No
01	Password entered	Yes	No

Note
For bit 00 = 1:
- a valid safety password was assigned.
For bit 01 = 1:
- a valid safety password was assigned (bit 0 = 1).
- safety parameters can be set.

r9768[0...7] Receive SI PROFIsafe control words

Data type: Unsigned16 **Unit:** -

Description: Displays the received PROFIsafe telegram from the control.

Index:
[0] = PZD 1
[1] = PZD 2
[2] = PZD 3
[3] = PZD 4
[4] = PZD 5
[5] = PZD 6
[6] = PZD 7
[7] = PZD 8

Dependency: See also: r9769

Note
The PROFIsafe trailer at the end of the telegram is also displayed (2 words).

r9769[0...7] Send SI PROFIsafe status words

Data type: Unsigned16 **Unit:** -

Description: Displays the PROFIsafe telegram to be sent to the control.

Index:
[0] = PZD 1
[1] = PZD 2
[2] = PZD 3
[3] = PZD 4
[4] = PZD 5
[5] = PZD 6
[6] = PZD 7
[7] = PZD 8

Dependency: See also: r9768

Note
The PROFIsafe trailer at the end of the telegram is also displayed (2 words).

r9770[0...3] SI version safety functions integrated in the drive

Data type: Unsigned16 **Unit:** -

Description: Displays the Safety Integrated version for the drive-integrated safety functions

Index:
[0] = Safety Version (major release)
[1] = Safety Version (minor release)
[2] = Safety Version (baselevel or patch)
[3] = Safety Version (hotfix)

Note
Example:
r9770[0] = 5, r9770[1] = 10, r9770[2] = 1, r9770[3] = 0 --> safety version V05.10.01.00

r9776.0...3 SI diagnostics

Data type: Unsigned32 **Unit:** -

Description: Displays the operating state, referred to the safety functions.

Bit field:

Bit	Signal name	1 signal	0 signal
00	Safety parameter changed POWER ON required	Yes	No
01	Safety functions enabled	Yes	No
02	Safety component replaced and data save required	Yes	No
03	Safety component replaced and acknowledge/save required	Yes	No

Note
For bit 00 = 1:
At least one Safety parameter has been changed that will only take effect after a POWER ON.
For bit 01 = 1:
Safety functions (basic functions or extended functions) have been enabled and are active.
For bit 02 = 1:
A safety-relevant component has been replaced. Saving required (p0977 = 1).
For bit 03 = 1:
A safety-relevant component has been replaced. Acknowledging (p9702 = 29) and saving (p0977 = 1) required.

r9781[0...1] SI checksum to check changes

Data type: Unsigned32 **Unit:** -

Description: Displays the checksum to track changes for safety functions.

Index:
[0] = SI checksum to track functional changes
[1] = SI checksum to track hardware-specific changes

Dependency: See also: p9601
See also: F01690

Note
The checksum changes when configuring safety functions.

r9782[0...1] SI change control time stamp

Data type: FloatingPoint32 **Unit:** [h]

Description: Displays the time stamps for the checksums for tracking changes for safety functions.
Each new checksum is assigned a time stamp (r9781).

Index: [0] = SI time stamp for checksum to track functional changes
[1] = SI time stamp for checksum to track hardware-specific changes

Dependency: See also: p9601
See also: F01690

r9790[0...1] SI Motion SLA acceleration resolution

Data type: FloatingPoint32 **Unit:** [m/s²]
Unit: [rev/s²]

Description: Displays the acceleration resolution (load side) for the "SLA" function.
Setpoints for acceleration limits or parameter changes for acceleration levels below this threshold have no effect.

Index: [0] = Coarse resolution
[1] = Fine resolution

Note
This parameter does not provide any information about the actual accuracy of the acceleration sensing. This depends on the type of actual value sensing, the gearbox ratios as well as the quality of the encoder being used.
Conversion from internal fixed values to m/s² (linear) or 1/s² (rotary).
Dependent on the task type, the following is obtained:
r9790[0] = 0.0625 m/s² (linear) or 0.173611 1/s² (rotary)
r9790[1] = 0.0000625 m/s² (linear) or 0.0001736 1/s² (rotary)
SLA: Safely-Limited Acceleration

r9795 SI diagnostics F01611

Data type: Unsigned32 **Unit:** -

Description: Displays the number of the cross-checked data, which resulted in fault F01611.

Dependency: See also: F01611

Note
A complete list of numbers for cross-checked data items appears in fault F01611.

p10201 SI Motion SBT enable

Can be changed: C2(95) **Data type:** Unsigned32
Min: - **Max:** - **Def:** 0000 bin

Description: Sets the enable for the safe brake test.

Bit field:

Bit	Signal name	1 signal	0 signal
00	Enable safe brake test	Yes	No

Note
SBT: Safe Brake Test

p10202[0...1] SI Motion SBT brake

Can be changed: C2(95) **Data type:** Integer16
Min: 0 **Max:** 1 **Def:** 0

Description: Selecting the brake to be tested.
p10202[0] must be set = 1 to test the brake.
Value: 0: Inhibit
1: Test motor holding brake
Index: [0] = Brake 1
[1] = Reserved
Dependency: See also: A01785

p10208[0...1] SI Motion SBT test torque ramp time

Can be changed: C2(95) **Data type:** FloatingPoint32
Min: 20 [ms] **Max:** 10000 [ms] **Def:** 1000 [ms]

Description: Sets the time, during which the test torque is ramped up against the closed brake.
The test torque is then ramped down after the safe brake test.
Index: [0] = Brake 1
[1] = Reserved

Note
The set time is rounded internally to an integer multiple of the monitoring clock cycle.

p10209[0...1] SI Motion SBT brake holding torque

Can be changed: C2(95) **Data type:** FloatingPoint32
Min: 0.05 [Nm] **Max:** 60000.00 [Nm] **Def:** 10.00 [Nm]

Description: Sets the effective holding torque on the motor side of the brake to be tested.
Index: [0] = Brake 1
[1] = Reserved
Dependency: See also: p10210, p10220

Note
The test torque effective for the brake test can be set for each sequence using a factor (p10210, p10220).

p10210[0...1] SI Motion SBT test torque factor sequence 1

Can be changed: C2(95) **Data type:** FloatingPoint32
Min: 0.30 **Max:** 1.00 **Def:** 1.00

Description: Sets the factor for the test torque of sequence 1 for the safe brake test.
The factor is referred to the holding torque of the brake (p10209).
Index: [0] = Brake 1
[1] = Reserved
Dependency: See also: p10209

p10211[0...1] SI Motion SBT test duration sequence 1

Can be changed: C2(95) **Data type:** FloatingPoint32
Min: 20 [ms] **Max:** 10000 [ms] **Def:** 1000 [ms]

Description: Sets the test duration for sequence 1 for the safe brake test.
The test torque is available for this time at the closed brake.
Index: [0] = Brake 1
[1] = Reserved

Note
The set time is rounded internally to an integer multiple of the monitoring clock cycle.

p10212[0...1] SI Motion SBT position tolerance sequence 1

Can be changed: C2(95) **Data type:** FloatingPoint32
Min: 0.001 [mm] **Max:** 360.000 [mm] **Def:** 1.000 [mm]
Min: 0.001 [°] **Max:** 360.000 [°] **Def:** 1.000 [°]

Description: Sets the tolerated position deviation for sequence 1 for the safe brake test.

Index: [0] = Brake 1
[1] = Reserved

p10220[0...1] SI Motion SBT test torque factor sequence 2

Can be changed: C2(95) **Data type:** FloatingPoint32
Min: 0.30 **Max:** 1.00 **Def:** 1.00

Description: Sets the factor for the test torque of sequence 2 for the safe brake test.
The factor is referred to the holding torque of the brake (p10209).

Index: [0] = Brake 1
[1] = Reserved

Dependency: See also: p10209

p10221[0...1] SI Motion SBT test duration sequence 2

Can be changed: C2(95) **Data type:** FloatingPoint32
Min: 20 [ms] **Max:** 10000 [ms] **Def:** 1000 [ms]

Description: Sets the test duration for sequence 2 for the safe brake test.
The test torque is available for this time at the closed brake.

Index: [0] = Brake 1
[1] = Reserved

Note
The set time is rounded internally to an integer multiple of the monitoring clock cycle.

p10222[0...1] SI Motion SBT position tolerance sequence 2

Can be changed: C2(95) **Data type:** FloatingPoint32
Min: 0.001 [mm] **Max:** 360.000 [mm] **Def:** 1.000 [mm]
Min: 0.001 [°] **Max:** 360.000 [°] **Def:** 1.000 [°]

Description: Sets the tolerated position deviation for sequence 2 for the safe brake test.

Index: [0] = Brake 1
[1] = Reserved

r10231 SI Motion SBT control word diagnostics

Data type: Unsigned32 **Unit:** -

Description: Displays the diagnostic bits for the control word of the safe brake test

Bit field:

Bit	Signal name	1 signal	0 signal
00	Select brake test	Yes	No
01	Start brake test	Yes	No
03	Select test torque sign	Negative	Positive
04	Select test sequence	Test sequence 2	Test sequence 1

r10234.0...15 SI Safety Information Channel status word S_ZSW3B

Data type: Unsigned32 **Unit:** -

Description: Display for the status word of the safety functions (S_ZSW3B).

Bit field:

Bit	Signal name	1 signal	0 signal

00	Brake test selected	Yes	No
01	Setpoint input drive/external	Drive	External
03	Brake test active	Yes	No
04	Brake test result	Successful	Erroneous/not
05	Brake test completed	Yes	No
07	Actual load sign	Negative	Positive
11	SS2E active	Yes	No
15	Acceptance test mode selected	Yes	No

Note
SS2E: Safe Stop 2 External (Safe Stop 2 with external stop)
For bits 05, 04:
For r10234.4 = 0 signal, it is possible to make a distinction as to whether the brake test was executed with error - or has still not been executed - using bit 5.
Bit 5/4 = 0/0: The brake test has still not been executed since the last warm restart or POWER ON.
Bit 5/4 = 1/0: The last brake test that was executed had an error.

r10240 SI Motion SBT test torque diagnostics

Data type: FloatingPoint32 **Unit:** [Nm]

Description: Displays the effective maximum test torque on the motor side for a safe brake test.

Dependency: See also: p10210, p10220

Note
The value remains displayed until the start of the next test sequence.

r10241 SI Motion SBT load torque diagnostics

Data type: FloatingPoint32 **Unit:** [Nm]

Description: Displays the load torque for a safe brake test.
When initializing the brake test, this load torque is available at the drive.

Note
The value remains displayed until the brake test is deselected.

r10242 SI Motion SBT state diagnostics

Data type: Integer16 **Unit:** -

Description: Displays the actual state of the safe brake test.

Value:

0:	Brake test inactive, wait for SBT selection
1:	Setpoint input drive
2:	Determining the load
3:	Brake test is initialized, wait for start of test sequence
4:	Start test sequence
5:	Closing the brake, establishing the test torque
6:	Brake test active, wait for test duration sequence
7:	Reduce test torque
8:	Wait for the brake to open
9:	Brake test successfully completed, wait for start deselection
10:	Change to brake test initialized - fault acknowledgment
11:	Brake test canceled, torque is reduced
12:	Brake test canceled, wait for brake to open
13:	Brake test ended with error, wait for acknowledgment
14:	Brake opening timer elapsed
15:	Error when initializing the brake test, wait for acknowledgment

16: Change to brake test inactive, acknowledgment active

r10251.8...13 SI Safety Control Channel control word S_STW1B diagnostics

Data type: Unsigned32 **Unit:** -

Description: Displays the diagnostics of control word S_STW1 of the Safety Control Channel.

Bit field:

Bit	Signal name	1 signal	0 signal
08	Extended Functions test stop selection	Selected	Not selected
12	Extended Functions, premature SOS after SS2E	Selected	Not selected
13	Close brake from control	Selected	Not selected

Note
SCC: Safety Control Channel
For bit 13:
The following BICO interconnection is required for brake control via SCC:
BI: p0858 = r10251.13

p60000 PROFIdrive reference speed

Can be changed: T **Data type:** FloatingPoint32

Min: 6.00 [rpm] **Max:** 210000.00 [rpm] **Def:** 3000.00 [rpm]

Description: Sets the reference quantity for the speed values.
All speeds specified as relative values refer to this reference quantity.
The reference quantity corresponds to 100% or 4000 hex (word) or 4000 0000 hex (double word).

Dependency: See also: p2000

Note
Parameter p60000 is an image of parameter p2000 in conformance with PROFIdrive.
A change always effects both parameters.

r60022 PROFIsafe telegram selection

Data type: Unsigned16 **Unit:** -

Description: Displays the number of the PROFIsafe send and receive telegrams.
The telegram settings are taken from the higher-level control system.

Value:
0: No PROFIsafe telegram selected
30: PROFIsafe standard telegram 30, PZD-1/1
901: PROFIsafe SIEMENS telegram 901, PZD-3/5

Dependency: See also: p9611

r60044 SI message buffer changes counter

Data type: Unsigned16 **Unit:** -

Description: Displays the changes of the safety message buffer.
This counter is incremented every time that the safety message buffer changes.

Recommendation: This is used to check whether the safety message buffer has been read out consistently.

r60045[0...63] SI message code

Data type: Unsigned16 **Unit:** -

Description: Displays the numbers of safety messages that have occurred.

Note
The messages type "safety message" (Cxxxxx) are entered in the message fault buffer.
Message buffer structure (principle):
r60047[0], r60048[0], r60049[0], r9753[0], r9754[0], r9755[0], r9756[0] --> actual message case, safety message 1
...
r60047[7], r60048[7], r60049[7], r9753[7], r9754[7], r9755[7], r9756[7] --> actual message case, safety message 8
r60047[8], r60048[8], r60049[8], r9753[8], r9754[8], r9755[8], r9756[8] --> 1st acknowledged message case, safety message 1
...
r60047[15], r60048[15], r60049[15], r9753[15], r9754[15], r9755[15], r9756[15] --> 1st acknowledged message case, safety message 8
...
r60047[56], r60048[56], r60049[56], r9753[56], r9754[56], r9755[56], r9756[56] --> 7th acknowledged message case, safety message 1
...
r60047[63], r60048[63], r60049[63], r9753[63], r9754[63], r9755[63], r9756[63] --> 7th acknowledged message case, safety message 8
Parameter r60047[0...63] has the same content as r60045[0...63].

r60047[0...63] SI message number

Data type: Unsigned16 **Unit:** -

Description: Displays the numbers of safety messages that have occurred.

Note
The messages type "safety message" (Cxxxxx) are entered in the message fault buffer.
Message buffer structure (principle):
r60047[0], r60048[0], r60049[0], r9753[0], r9754[0], r9755[0], r9756[0] --> actual message case, safety message 1
...
r60047[7], r60048[7], r60049[7], r9753[7], r9754[7], r9755[7], r9756[7] --> actual message case, safety message 8
r60047[8], r60048[8], r60049[8], r9753[8], r9754[8], r9755[8], r9756[8] --> 1st acknowledged message case, safety message 1
...
r60047[15], r60048[15], r60049[15], r9753[15], r9754[15], r9755[15], r9756[15] --> 1st acknowledged message case, safety message 8
...
r60047[56], r60048[56], r60049[56], r9753[56], r9754[56], r9755[56], r9756[56] --> 7th acknowledged message case, safety message 1
...
r60047[63], r60048[63], r60049[63], r9753[63], r9754[63], r9755[63], r9756[63] --> 7th acknowledged message case, safety message 8
Parameter r60047[0...63] has the same content as r60045[0...63].

r60048[0...63] SI message time received in milliseconds

Data type: Unsigned32 **Unit:** [ms]

Description: Displays the relative system runtime in milliseconds when the safety message occurred.

r60049[0...63] SI message value

Data type: Integer32 **Unit:** -

Description: Displays the additional information about the safety message that occurred (as integer number).

p60052 SI message cases counter

Can be changed: T, U **Data type:** Unsigned16

Min: 0 **Max:** 65535 **Def:** 0

Description: Number of safety messages that have occurred since the last reset.

Dependency: The safety message buffer is cleared by resetting the parameter to 0.

Note
The parameter is reset to 0 at POWER ON.

r60100[0...4] PROFIdrive telegram display total

Data type: Unsigned16 **Unit:** -

Description: Displays the send and receive telegrams.

Index: [0] = Subslot 1: MAP
[1] = Subslot 2: PROFIsafe
[2] = Subslot 3: standard/SIEMENS
[3] = Subslot 4: supplementary telegram
[4] = Subslot 5: supplementary telegram

Dependency: See also: r0922, r60022, r60122

Note
Value = 65564: no telegram active
Value = 65565: MAP "Module Access Point"

r60122 PROFIdrive SIC/SCC telegram selection

Data type: Unsigned16 **Unit:** -

Description: Displays the telegram for the Safety Information Channel (SIC) / Safety Control Channel (SCC).
The telegram settings are taken from the higher-level control system.

Value:
700: Suppl. telegram 700, PZD-0/3
701: Supplementary telegram 701, PZD-2/5
999: No telegram

r61000[0...239] PROFINET Name of Station

Data type: Unsigned8 **Unit:** -

Description: Displays PROFINET Name of Station.

r61001[0...3] PROFINET IP of Station

Data type: Unsigned8 **Unit:** -

Description: Displays PROFINET IP of Station.

Faults and alarms

17

17.1 Overview of faults and alarms

Explanations for the list of faults and alarms

A message comprises a letter followed by the relevant number.

The letters have the following meaning:

- A means "Alarm"
- F means "Fault"
- N means "No message" or "Internal message"
- C means "Safety message"
  In the delivery condition (p3117 = 1), the Safety Integrated messages are included in the following list as messages of type "A" or "F" (e.g. F01711). If you activate the Safety message buffer (p3117 = 0), the message type changes to "C": Therefore search for Safety Integrated messages in this list only by their number without the message type (e.g. 01711).

Detailed examples:

Axxxxx	Alarm xxxxx
Fxxxxx	Fault xxxxx
Nxxxxx	No message
Cxxxxx	Safety message (dedicated message buffer)

Fault responses

The fault responses have the following consequence:

OFF1
- Normal shutdown of the motor
- Factory setting, ramp down time 1 s
- Can be changed via p1121

OFF2
- The motor current is immediately switched off.
- This means that the motor no longer generates a torque.

OFF3
- Quick stop
- The motor is braked down to standstill as quickly as possible.
- Factory setting, ramp down time 0 s
- Can be changed via p1135

Acknowledging faults

For each fault, the list of faults and alarms specifies how the fault is acknowledged after resolving the cause of the fault.

You must first remove the cause before you can resolve a fault. If the cause has still not been resolved then the fault is immediately displayed again after running up.

POWER ON:	Acknowledge by switching off the converter and switching on again.
IMMEDIATELY:	Acknowledge via STW1.7 (0 -> 1) - or by switching off the converter and switching on again
PULSE INHIBIT:	Acknowledgment is only possible in the "Pulse inhibit" state (r0899.11 = 0). Acknowledge via STW1.7 (0 -> 1) - or by switching off the converter and switching on again

Message class

The message class specifies the associated class for each message with the following structure:

Text of the message class (number according to PROFIdrive)

The message classes are transferred at different interfaces to higher-level control systems and their associated display and operating units.

The message classes that are available are shown in the following table. In addition to the text of the message class, its number according to PROFIdrive, and a brief help text regarding the cause and remedy – they also include information about the various diagnostic interfaces:

- PN (hex)
  Specifies the "Channel error type" of the PROFINET channel diagnostics.
  When activating the channel diagnostics, using the GSDML file, the texts listed in the table can be displayed.
- DS1 (dec)
  Specifies the bit number in date set DS1 of the diagnostic alarm for SIMATIC S7.
  When the diagnostic alarms are activated, the texts listed in the table can be displayed.
- DP (dec)
  Specifies the "Error type" of the channel-related diagnostics for PROFIBUS.
  When the channel diagnostics are activated, the texts listed in the standard and the GSD file can be displayed.
- ET 200 (dec)
  Specifies the "Error type" of the channel-related diagnostics for the SIMATIC ET 200pro FC-2 device.
  When the channel diagnostics are activated, the texts listed in the standard and the GSD file of the ET 200pro can be displayed.
- NAMUR (r3113.x)
  Specifies the bit number in parameter r3113.

For interfaces DP, ET 200, NAMUR, in some instances, the message classes are combined.

Table 17-1 Message classes and coding of various diagnostic interfaces

Text of the message class (number according to PROFIdrive) Cause and remedy.	**Diagnostics interface**				
	PN (hex)	**DS1 (dec)**	**DP (dec)**	**ET 200 (dec)**	**NAMUR (r3113.x)**
Hardware/software errors (1) A hardware or software malfunction has been identified. • Perform a POWER ON for the relevant component. • If the malfunction occurs repeatedly, contact the hotline.	9000	0	16	9	0
Line fault (2) A fault has occurred in the power supply (phase failure, voltage level, etc.). Check: • Line power supply / fuses • Supply voltage • Wiring	9001	1	17	24	1
Supply voltage fault (3) A fault was detected in the electronics power supply (48 V, 24 V, 5 V, etc.). Check: • Wiring • Voltage level	9002	2	2 [1)] 3 [2)]	2 [1)] 3 [2)]	15
DC link overvoltage (4) The DC-link voltage has assumed an inadmissibly high value. Check: • The dimensioning of the system (line supply, reactor, voltages) • The infeed settings	9003	3	18	24	2
Power electronics fault (5) An inadmissible operating state of the power electronics has been identified (overcurrent, overtemperature, IGBT failure,...). Check: • Compliance with the permissible load cycles • The ambient temperatures (fan)	9004	4	19	24	3
Overtemperature of the electronic component (6) The temperature in the component has exceeded the highest permissible limit. • The ambient temperature and the cabinet ventilation.	9005	5	20	5	4
Ground fault / interphase short-circuit detected (7) A ground fault / inter-phase short-circuit has been identified in the power cables or in the motor windings. Check: • The power cables (connection) • The motor	9006	6	21	20	5

Motor overload (8) The motor was operated outside the permissible limits (temperature, current, torque...). Check: • The load cycles and set limits • The ambient temperature / motor ventilation	9007	7	22	24	6
Communication to the higher-level controller faulted (9) The communication to the higher-level controller (internal coupling, PROFIBUS, PROFINET...) is faulted or interrupted. Check: • The state of the higher-level control system • The communication connection/wiring • The bus configuration/cycle clock	9008	8	23	19	7
Safety monitoring channel has detected an error (10) A safe operation monitoring function (Safety) has detected an error.	9009	9	24	25	8
Actual position/speed value incorrect or not available (11) An illegal signal state has been detected while evaluating the encoder signals (track signals, zero marks, absolute values...). • Check the encoder or the status of the encoder signals. • Note the permitted maximum frequencies.	900A	10	25	29	9
Internal (DRIVE-CLiQ) communication faulted (12) The internal communication between the SINAMICS components is faulted or interrupted. • Check the DRIVE-CLiQ wiring. • Make sure that the configuration is EMC-compatible. • Note the permitted maximum quantities / cycle clocks.	900B	11	26	31	10
Infeed fault (13) The infeed is faulted or has failed. Check: • The infeed and its environment (line supply, filters, reactors, fuses...) • The closed-loop infeed control	900C	12	27	24	11
Braking controller / Braking Module faulted (14) The internal or external Braking Module is faulted or overloaded (temperature). • Check the connection or the status of the braking module. • Observe the permitted number and duration of the braking processes.	900D	13	28	24	15
Line filter fault (15) The line filter monitoring has identified an excessively high temperature or other inadmissible state. Check: • The temperature / temperature monitoring • The configuration for validity (filter type, infeed, thresholds).	900E	14	17	24	15

External measured value / signal state outside of the permissible range (16) A measured value / signal state read in via the input area (digital/analog/ temperature) has assumed an inadmissible value/state. • Determine the affected signal and check it. • Check the set thresholds.	900F	15	29	26	15
Application / technological function fault (17) The application / technological function has exceeded a (set) limit (position, velocity, torque...). • Determine the respective limit and check it. • Check the setpoint value specification of the primary control.	9010	16	30	9	15
Error in the parameterization/configuration/commissioning procedure (18) An error has been identified in the parameterization or in a commissioning procedure, or the parameterizviation does not match the existing device configuration. • Determine the exact cause of the error with the commissioning tool. • Adapt the parameter assignment or the device configuration.	9011	17	31	16	15
General drive fault (19) Group fault. • Determine the exact cause of the error with the commissioning tool.	9012	18	9	9	15
Auxiliary unit fault (20) The monitoring of an auxiliary unit (incoming transformer, cooling unit...) has identified an illegal state. • Determine the exact cause of the error and check the affected device.	9013	19	29	26	15

[1] Undervoltage condition of the electronics power supply

[2] Overvoltage condition of the electronics power supply

17.2 List of faults and alarms

Product: SINAMICS S210, Version: 5206900, Language: eng
Objects: S210

F01000 Internal software error

Message class: Hardware/software error (1)
Reaction: OFF2
Acknowledge: POWER ON
Cause: An internal software error has occurred.
Fault value (r0949, interpret hexadecimal):
Only for internal Siemens troubleshooting.
Remedy: - evaluate fault buffer (r0945).
- carry out a POWER ON (switch-off/switch-on) for all components.
- if required, check the data on the non-volatile memory (e.g. memory card).
- upgrade firmware to later version.
- contact Technical Support.
- replace the Control Unit.

F01001 FloatingPoint exception

Message class: Hardware/software error (1)
Reaction: OFF2
Acknowledge: POWER ON
Cause: An exception occurred for an operation with the FloatingPoint data type.
The error can be caused by the basic system or a technology function.
Fault value (r0949, interpret hexadecimal):
Only for internal Siemens troubleshooting.
Remedy: - carry out a POWER ON (switch-off/switch-on).
- upgrade firmware to later version.
- contact Technical Support.

F01002 Internal software error

Message class: Hardware/software error (1)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: An internal software error has occurred.
Fault value (r0949, interpret hexadecimal):
Only for internal Siemens troubleshooting.
Remedy: - carry out a POWER ON (switch-off/switch-on) for all components.
- upgrade firmware to later version.
- contact Technical Support.

F01003 Acknowledgment delay when accessing the memory

Message class: Hardware/software error (1)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: A memory area was accessed that does not return a "READY".
Fault value (r0949, interpret hexadecimal):
Only for internal Siemens troubleshooting.

Remedy: - carry out a POWER ON (switch-off/switch-on) for all components.
- contact Technical Support.

N01004 Internal software error

Message class: Hardware/software error (1)
Reaction: NONE
Acknowledge: NONE
Cause: An internal software error has occurred.
Fault value (r0949, hexadecimal):
Only for internal Siemens troubleshooting.
Remedy: - read out diagnostics parameter (r9999).
- contact Technical Support.

F01005 Firmware download for DRIVE-CLiQ component unsuccessful

Message class: Hardware/software error (1)
Reaction: NONE
Acknowledge: IMMEDIATELY
Cause: It was not possible to download the firmware to a DRIVE-CLiQ component.
Fault value (r0949, interpret hexadecimal):
yyxxxx hex: yy = component number, xxxx = fault cause
xxxx = 000B hex = 11 dec:
DRIVE-CLiQ component has detected a checksum error.
xxxx = 000F hex = 15 dec:
The selected DRIVE-CLiQ component did not accept the contents of the firmware file.
xxxx = 0012 hex = 18 dec:
Firmware version is too old and is not accepted by the component.
xxxx = 0013 hex = 19 dec:
Firmware version is not suitable for the hardware release of the component.
xxxx = 0065 hex = 101 dec:
After several communication attempts, no response from the DRIVE-CLiQ component.
xxxx = 008B hex = 139 dec:
Initially, a new boot loader is loaded (must be repeated after POWER ON).
xxxx = 008C hex = 140 dec:
Firmware file for the DRIVE-CLiQ component not available on the memory card.
xxxx = 008D hex = 141 dec:
An inconsistent length of the firmware file was signaled. The firmware download may have been caused by a loss of connection to the firmware file. This can occur during a project download/reset in the case of a SINAMICS Integrated Control Unit, for example.
xxxx = 008F hex = 143 dec:
Component has not changed to the mode for firmware download. It was not possible to delete the existing firmware.
xxxx = 0090 hex = 144 dec:
When checking the firmware that was downloaded (checksum), the component detected a fault. It is possible that the file on the memory card is defective.
xxxx = 0091 hex = 145 dec:
Checking the loaded firmware (checksum) was not completed by the component in the appropriate time.
xxxx = 009C hex = 156 dec:
Component with the specified component number is not available (p7828).
xxxx = Additional values:
Only for internal Siemens troubleshooting.

Remedy: - check the selected component number (p7828).
- check the DRIVE-CLiQ wiring.
- save suitable firmware file for download in the directory "/siemens/sinamics/code/sac/".
- use a component with a suitable hardware version
- after POWER ON has been carried out again for the DRIVE-CLiQ component, download firmware again. Depending on p7826, the firmware will be automatically downloaded.

A01006 Firmware update for DRIVE-CLiQ component required

Message class: General drive fault (19)
Reaction: NONE
Acknowledge: NONE
Cause: The firmware of a DRIVE-CLiQ component must be updated as there is no suitable firmware or firmware version in the component for operation with the Control Unit.
Alarm value (r2124, interpret decimal):
Component number of the DRIVE-CLiQ component.
Remedy: Update the firmware using the commissioning tool:
The firmware version of all of the components on the "Version overview" page can be read in the Project Navigator under "Configuration" of the associated drive unit and an appropriate firmware update can be carried out.
Firmware update via parameter:
- take the component number from the alarm value and enter into p7828.
- start the firmware download with p7829 = 1.

A01007 POWER ON for DRIVE-CLiQ component required

Message class: General drive fault (19)
Reaction: NONE
Acknowledge: NONE
Cause: A DRIVE-CLiQ component must be switched on again (POWER ON) (e.g. due to a firmware update).
Alarm value (r2124, interpret decimal):
Component number of the DRIVE-CLiQ component.
Note:
For a component number = 1, a POWER ON of the Control Unit is required.
Remedy: - Switch off the power supply of the specified DRIVE-CLiQ component and switch it on again.
- For SINUMERIK, auto commissioning is prevented. In this case, a POWER ON is required for all components and the auto commissioning must be restarted.

A01009 CU: Control module overtemperature

Message class: Overtemperature of the electronic components (6)
Reaction: NONE
Acknowledge: NONE
Cause: The temperature (r0037[0]) of the control module (Control Unit) has exceeded the specified limit value.
Remedy: - check the air intake for the Control Unit.
- check the Control Unit fan.
Note:
The alarm is automatically withdrawn once the limit value has been fallen below.

F01011 Download interrupted

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: NONE
Acknowledge: IMMEDIATELY

Cause: The project download was interrupted.
Fault value (r0949, interpret decimal):
1: The user prematurely interrupted the project download.
2: The communication cable was interrupted (e.g. cable breakage, cable withdrawn).
3: The project download was prematurely exited by the commissioning tool.
100: Different versions between the firmware version and project files which were loaded by loading into the file system "Download from memory card".
Note:
The response to an interrupted download is the state "first commissioning".

Remedy: - check the communication cable.
- download the project again.
- boot from previously saved files (switch-off/switch-on or p0976).
- when loading into the file system (download from memory card), use the matching version.

F01012 Project conversion error

Message class: Hardware/software error (1)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: When converting the project of an older firmware version, an error occurred.
Fault value (r0949, interpret decimal):
Parameter number of the parameter causing the error.
For fault value = 600, the following applies:
The temperature evaluation is no longer assigned to the power unit but to the encoder evaluation.
Notice:
Monitoring of the motor temperature is no longer ensured.

Remedy: Check the parameter indicated in the fault value and correctly adjust it accordingly.
For fault value = 600:
Parameter p0600 must be set to the values 1, 2 or 3 in accordance with the assignment of the internal encoder evaluation to the encoder interface.
Value 1 means: The internal encoder evaluation is assigned to the encoder interface 1 via p0187.
Value 2 means: The internal encoder evaluation is assigned to the encoder interface 2 via p0188.
Value 3 means: The internal encoder evaluation is assigned to the encoder interface 3 via p0189.
- if necessary, the internal encoder evaluation must be assigned to an encoder interface via parameters p0187, p0188 or p0189 accordingly.
- if necessary, upgrade the firmware to a later version.

F01015 Internal software error

Message class: Hardware/software error (1)

Reaction: OFF2

Acknowledge: POWER ON

Cause: An internal software error has occurred.
Fault value (r0949, interpret decimal):
Only for internal Siemens troubleshooting.

Remedy: - carry out a POWER ON (switch-off/switch-on) for all components.
- upgrade firmware to later version.
- contact Technical Support.

A01016 Firmware changed

Message class: Hardware/software error (1)

Reaction: NONE

Acknowledge: NONE

Cause: At least one firmware file in the directory was illegally changed on the non-volatile memory (memory card/device memory) with respect to the version when shipped from the factory.
Alarm value (r2124, interpret decimal):
0: Checksum of one file is incorrect.
1: File missing.
2: File too many.
3: Incorrect firmware version.
4: Incorrect checksum of the back-up file.

Remedy: For the non-volatile memory for the firmware (memory card/device memory), restore the delivery condition.
Note:
The file involved can be read out using parameter r9925.
The status of the firmware check is displayed using r9926.

F01018 Booting has been interrupted several times

Message class: Hardware/software error (1)

Reaction: NONE

Acknowledge: POWER ON

Cause: Module booting was interrupted several times. As a consequence, the module boots with the factory setting.
Possible reasons for booting being interrupted:
- power supply interrupted.
- CPU crashed.
- parameterization invalid.

Remedy: - carry out a POWER ON (switch-off/switch-on). After switching on, the module reboots from the valid parameterization (if available).
- restore the valid parameterization.
Examples:
a) Carry out a first commissioning, save, carry out a POWER ON (switch-off/switch-on).
b) Load another valid parameter backup (e.g. from the memory card), save, carry out a POWER ON (switch-off/switch-on).
Note:
If the fault situation is repeated, then this fault is again output after several interrupted boots.

A01019 Writing to the removable data medium unsuccessful

Message class: Hardware/software error (1)

Reaction: NONE

Acknowledge: NONE

Cause: The write access to the removable data medium was unsuccessful.

Remedy: - Check the removable data medium and if required replace.
- Disconnect any existing USB connection.
- Repeat the data backup.

A01020 Writing to RAM disk unsuccessful

Message class: Hardware/software error (1)

Reaction: NONE

Acknowledge: NONE

Cause: A write access to the internal RAM disk was unsuccessful.

Remedy: Adapt the file size for the system logbook to the internal RAM disk (p9930).

F01023 Software timeout (internal)

Message class: Hardware/software error (1)

Reaction: NONE

Acknowledge: IMMEDIATELY

Cause: An internal software timeout has occurred.
Fault value (r0949, interpret decimal):
Only for internal Siemens troubleshooting.

Remedy: - carry out a POWER ON (switch-off/switch-on) for all components.
- upgrade firmware to later version.
- contact Technical Support.

F01030 Sign-of-life failure for master control

Message class: Communication error to the higher-level control system (9)

Reaction: OFF3

Acknowledge: IMMEDIATELY

Cause: For active PC master control, no sign-of-life was received within the monitoring time.
The master control was returned to the active BICO interconnection.

Remedy: Set the monitoring time higher at the PC or, if required, completely disable the monitoring function.
The monitoring time is set as follows using the commissioning tool:
<Drive> -> Commissioning -> Control panel -> Button "Fetch master control" -> A window is displayed to set the monitoring time in milliseconds.
Notice:
The monitoring time should be set as short as possible. A long monitoring time means a late response when the communication fails!

F01031 Sign-of-life failure for OFF in REMOTE

Message class: Communication error to the higher-level control system (9)

Reaction: OFF3

Acknowledge: IMMEDIATELY

Cause: With the "OFF in REMOTE" mode active, no sign-of-life was received within 3 seconds.

Remedy: - check the data cable connection at the serial interface for the Control Unit (CU) and operator panel.
- check the data cable between the Control Unit and operator panel.

F01033 Units changeover: Reference parameter value invalid

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: NONE

Acknowledge: IMMEDIATELY

Cause: When changing over the units to the referred representation type, it is not permissible for any of the required reference parameters to be equal to 0.0
Fault value (r0949, parameter):
Reference parameter whose value is 0.0.

Remedy: Set the value of the reference parameter to a number different than 0.0.
See also: r0304 (Rated motor voltage), r0305 (Rated motor current), p2000 (Reference speed), p2003 (Reference torque)

F01034 Units changeover: Calculation parameter values after reference value change unsuccessful

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: NONE

Acknowledge: IMMEDIATELY

Cause: The change of a reference parameter meant that for an involved parameter the selected value was not able to be re-calculated in the per unit representation. The change was rejected and the original parameter value restored.
Fault value (r0949, parameter):
Parameter whose value was not able to be re-calculated.
See also: r0304 (Rated motor voltage), r0305 (Rated motor current), p2000 (Reference speed), p2003 (Reference torque)

Remedy: - Select the value of the reference parameter such that the parameter involved can be calculated in the per unit representation.
- technology unit selection (p0595) before changing the reference parameter p0596, set p0595 = 1.

A01035 ACX: Parameter back-up file corrupted

Message class: Hardware/software error (1)
Reaction: NONE
Acknowledge: NONE
Cause: When the Control Unit is booted, no complete data set was found from the parameter back-up files. The last time that the parameterization was saved, it was not completely carried out.
It is possible that the backup was interrupted by switching off or withdrawing the memory card.
Alarm value (r2124, interpret hexadecimal):
ddccbbaa hex:
aa = 01 hex:
Power up was realized without data backup. The drive is in the factory setting.
aa = 02 hex:
The last available backup data record was loaded. The parameterization must be checked. It is recommended that the parameterization is downloaded again.
dd, cc, bb:
Only for internal Siemens troubleshooting.
See also: p0977 (Save all parameters)
Remedy: - download the project again using the commissioning tool.
- save all parameters (p0977 = 1 or "copy RAM to ROM").
See also: p0977 (Save all parameters)

F01036 ACX: Parameter back-up file missing

Message class: Hardware/software error (1)
Reaction: NONE
Acknowledge: IMMEDIATELY
Cause: When downloading the device parameterization, a parameter back-up file PSxxxyyy.ACX associated with a drive object cannot be found.
Fault value (r0949, interpret hexadecimal):
Byte 1: yyy in the file name PSxxxyyy.ACX
yyy = 000 --> consistency back-up file
yyy = 001 ... 062 --> drive object number
yyy = 099 --> PROFIBUS parameter back-up file
Byte 2, 3, 4:
Only for internal Siemens troubleshooting.
Remedy: If you have saved your project data using the commissioning tool, carry-out a new download for your project.
Save using the function "Copy RAM to ROM" or with p0977 = 1.
This means that the parameter files are again completely written into the non-volatile memory.
Note:
If the project data have not been backed up, then a new first commissioning is required.

F01039 ACX: Writing to the parameter back-up file was unsuccessful

Message class: Hardware/software error (1)
Reaction: NONE
Acknowledge: IMMEDIATELY

Cause: Writing to at least one parameter back-up file PSxxxyyy.*** in the non-volatile memory was unsuccessful.
- in the directory /USER/SINAMICS/DATA/ at least one parameter back-up file PSxxxyyy.*** has the "read only" file attribute and cannot be overwritten.
- there is not sufficient free memory space available.
- the non-volatile memory is defective and cannot be written to.

Fault value (r0949, interpret hexadecimal):
dcba hex
a = yyy in the file names PSxxxyyy.***
a = 000 --> consistency back-up file
a = 001 ... 062 --> drive object number
a = 070 --> FEPROM.BIN
a = 080 --> DEL4BOOT.TXT
a = 099 --> PROFIBUS parameter back-up file
b = xxx in the file names PSxxxyyy.***
b = 000 --> data save started with p0977 = 1 or p0971 = 1
b = 010 --> data save started with p0977 = 10
b = 011 --> data save started with p0977 = 11
b = 012 --> data save started with p0977 = 12
d, c:
Only for internal Siemens troubleshooting.

Remedy:
- check the file attribute of the files (PSxxxyyy.***, CAxxxyyy.***, CCxxxyyy.***) and, if required, change from "read only" to "writeable".
- check the free memory space in the non-volatile memory. Approx. 80 kbyte of free memory space is required for every drive object in the system.
- replace the memory card or Control Unit.

F01040 Save parameter settings and carry out a POWER ON

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: OFF2
Acknowledge: POWER ON
Cause: A parameter was changed, which means that it is necessary to save the parameters and reboot.
Remedy:
- save parameters (p0977).
- carry out a POWER ON (switch-off/switch-on).

Then:
- upload the data to the converter (commissioning tool).

F01041 Parameter save necessary

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: NONE
Acknowledge: IMMEDIATELY
Cause: Defective or missing files were detected on the memory card when booting.
Fault value (r0949, interpret decimal):
1: Source file cannot be opened.
2: Source file cannot be read.
3: Target directory cannot be set up.
4. Target file cannot be set up/opened.
5. Target file cannot be written to.
Additional values:
Only for internal Siemens troubleshooting.

Remedy: - save the parameters.
- download the project again to the drive unit.
- update the firmware
- if required, replace the Control Unit and/or memory card card.

F01042 Parameter error during project download

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: OFF2
Acknowledge: IMMEDIATELY

Cause: An error was detected when downloading a project using the commissioning software (e.g. incorrect parameter value). It is possible that the parameter limits are dependent on other parameters.
The detailed cause of the fault can be determined using the fault value.
Fault value (r0949, interpret hexadecimal):
ccbbaaaa hex
aaaa = Parameter
bb = Index
cc = fault cause
0: Parameter number illegal.
1: Parameter value cannot be changed.
2: Lower or upper value limit exceeded.
3: Sub-index incorrect.
4: No array, no sub-index.
5: Data type incorrect.
6: Setting not permitted (only resetting).
7: Descriptive element cannot be changed.
9: Descriptive data not available.
11: No master control.
15: No text array available.
17: Task cannot be executed due to operating state.
20: Illegal value.
21: Response too long.
22: Parameter address illegal.
23: Format illegal.
24: Number of values not consistent.
25: Drive object does not exist.
101: Presently deactivated.
104: Illegal value.
107: Write access not permitted when controller enabled.
108: Unit unknown.
109: Write access only in the commissioning state, encoder (p0010 = 4).
110: Write access only in the commissioning state, motor (p0010 = 3).
111: Write access only in the commissioning state, power unit (p0010 = 2).
112: Write access only in the quick commissioning mode (p0010 = 1).
113: Write access only in the ready mode (p0010 = 0).
114: Write access only in the commissioning state, parameter reset (p0010 = 30).
115: Write access only in the Safety Integrated commissioning state (p0010 = 95).
116: Write access only in the commissioning state, technological application/units (p0010 = 5).
117: Write access only in the commissioning state (p0010 not equal to 0).
118: Write access only in the commissioning state, download (p0010 = 29).
119: Parameter may not be written in download.
120: Write access only in the commissioning state, drive basic configuration (device: p0009 = 3).
121: Write access only in the commissioning state, define drive type (device: p0009 = 2).
122: Write access only in the commissioning state, data set basic configuration (device: p0009 = 4).
123: Write access only in the commissioning state, device configuration (device: p0009 = 1).
124: Write access only in the commissioning state, device download (device: p0009 = 29).
125: Write access only in the commissioning state, device parameter reset (device: p0009 = 30).
126: Write access only in the commissioning state, device ready (device: p0009 = 0).
127: Write access only in the commissioning state, device (device: p0009 not equal to 0).
129: Parameter may not be written in download.
130: Transfer of the master control is inhibited via binector input p0806.
131: Required BICO interconnection not possible because BICO output does not supply floating value

132: Free BICO interconnection inhibited via p0922.
133: Access method not defined.
200: Below the valid values.
201: Above the valid values.
202: Cannot be accessed from the Basic Operator Panel (BOP).
203: Cannot be read from the Basic Operator Panel (BOP).
204: Write access not permitted.

Remedy: - correct the parameterization in the commissioning tool and download the project again.
- enter the correct value in the specified parameter.
- identify the parameter that restricts the limits of the specified parameter.

F01043 Fatal error at project download

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: NONE

Acknowledge: IMMEDIATELY

Cause: A fatal error was detected when downloading a project using the commissioning tool.
Fault value (r0949, interpret decimal):
1: Device status cannot be changed to Device Download (drive object ON?).
2: Incorrect drive object number.
3: A drive object that has already been deleted is deleted again.
4: Deleting a drive object that has already been registered for generation.
5: Deleting a drive object that does not exist.
6: Generating an undeleted drive object that already existed.
7: Regenerating a drive object already registered for generation.
8: Maximum number of drive objects that can be generated exceeded.
9: Error while generating a device drive object.
10: Error while generating target topology parameters (p9902 and p9903).
11: Error when generating a drive object (global component).
12: Error when generating a drive object (drive component).
13: Unknown drive object type.
14: Drive status cannot be changed to "ready for operation" (r0947 and r0949).
15: Drive status cannot be changed to drive download.
16: Device status cannot be changed to "ready for operation".
17: It is not possible to download the topology. The component wiring should be checked, taking into account the various messages/signals.
18: A new download is only possible if the factory settings are restored for the drive unit.
20: The configuration is inconsistent.
21: Error when accepting the download parameters.
22: Software-internal download error.
23: download not possible when know-how protection is activated.
24: download not possible during a partial power up after inserting a component.
25: The configuration is inconsistent. Know-how protection is either not activated or only partially.
Additional values:
Only for internal Siemens troubleshooting.

Remedy: - use the current version of the commissioning tool.
- modify the offline project and carry out a new download (e.g. compare the number of drive objects, motor, encoder, power unit in the offline project and at the drive).
- change the drive state (is a drive rotating or is there a message/signal?).
- Observe additional active messages/signals and remove their cause (e.g. correct any incorrectly set parameters).
- automatically calculate the control parameters (p0340). Then set p0010 = 0.
- boot from previously saved files (switch-off/switch-on or p0976).
- before a new download, restore the factory setting if the know-how protection was not activated on all drive objects.

F01044 CU: Descriptive data error

Message class: Hardware/software error (1)
Reaction: OFF2
Acknowledge: POWER ON
Cause: An error was detected when loading the descriptive data saved in the non-volatile memory.
Remedy: Replace the memory card or Control Unit.

A01045 CU: Configuring data invalid

Message class: Hardware/software error (1)
Reaction: NONE
Acknowledge: NONE
Cause: An error was detected when evaluating the parameter files PSxxxyyy.ACX, PTxxxyyy.ACX, CAxxxyyy.ACX, or CCxxxyyy.ACX saved in the non-volatile memory. Because of this, under certain circumstances, several of the saved parameter values were not able to be accepted.
Alarm value (r2124, interpret hexadecimal):
Only for internal Siemens troubleshooting.
Remedy: - Restore the factory setting (p0976 = 1) and reload the project into the converter.
Then save the parameterization using the "Copy RAM to ROM" or with p0977 = 1. This overwrites the incorrect parameter files in the non-volatile memory – and this alarm is withdrawn.

A01049 CU: It is not possible to write to file

Message class: Hardware/software error (1)
Reaction: NONE
Acknowledge: NONE
Cause: It is not possible to write into a write-protected file (PSxxxxxx.acx). The write request was interrupted.
Alarm value (r2124, interpret decimal):
Drive object number.
Remedy: Check whether the "write protected" attribute has been set for the files in the non-volatile memory under .../USER/SINAMICS/DATA/...
When required, remove write protection and repeat the save operation (e.g. set p0977 = 1).

F01050 Memory card and device incompatible

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: The memory card and the device type do not match (e.g. a memory card for SINAMICS S is inserted in SINAMICS G).
Remedy: - insert the matching memory card.
- use the matching Control Unit or power unit.

A01064 CU: Internal error (CRC)

Message class: Hardware/software error (1)
Reaction: NONE
Acknowledge: NONE
Cause: A checksum error (CRC error) has occurred in the Control Unit program memory
Remedy: - carry out a POWER ON (switch-off/switch-on) for all components.
- upgrade firmware to later version.
- contact Technical Support.

A01069 Parameter backup and device incompatible

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: NONE
Acknowledge: NONE
Cause: The parameter backup on the memory card and the drive unit do not match.
The module boots with the factory settings.
Example:
Devices A and B. are not compatible and a memory card with the parameter backup for device A is inserted in device B.
Remedy: - insert a memory card with compatible parameter backup and carry out a POWER ON.
- insert a memory card without parameter backup and carry out a POWER ON.
- save the parameters (p0977 = 1).

F01072 Memory card restored from the backup copy

Message class: General drive fault (19)
Reaction: NONE
Acknowledge: IMMEDIATELY
Cause: The Control Unit was switched-off while writing to the memory card. This is why the visible partition became defective.
After switching on, the data from the non-visible partition (backup copy) were written to the visible partition.
Remedy: Check that the firmware and parameterization is up-to-date.

A01073 POWER ON required for backup copy on memory card

Message class: General drive fault (19)
Reaction: NONE
Acknowledge: NONE
Cause: The parameter assignment on the visible partition of the memory card has changed.
In order that the backup copy on the memory card is updated on the non-visible partition, it is necessary to carry out a POWER ON or hardware reset (p0972) of the Control Unit.
Note:
It is possible that a new POWER ON is requested via this alarm (e.g. after saving with p0971 = 1).
Remedy: - carry out a POWER ON (switch-off/switch-on) for the Control Unit.
- carry out a hardware reset (RESET button, p0972).

F01082 Parameter error when powering up from data backup

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: OFF2
Acknowledge: IMMEDIATELY

Cause: Parameterizing errors have been detected (e.g. incorrect parameter value). It is possible that the parameter limits are dependent on other parameters.
The detailed cause of the fault can be determined using the fault value.
Fault value (r0949, interpret hexadecimal):
ccbbaaaa hex
aaaa = Parameter
bb = Index
cc = fault cause
0: Parameter number illegal.
1: Parameter value cannot be changed.
2: Lower or upper value limit exceeded.
3: Sub-index incorrect.
4: No array, no sub-index.
5: Data type incorrect.
6: Setting not permitted (only resetting).
7: Descriptive element cannot be changed.
9: Descriptive data not available.
11: No master control.
15: No text array available.
17: Task cannot be executed due to operating state.
20: Illegal value.
21: Response too long.
22: Parameter address illegal.
23: Format illegal.
24: Number of values not consistent.
25: Drive object does not exist.
101: Presently deactivated.
104: Illegal value.
107: Write access not permitted when controller enabled.
108: Unit unknown.
109: Write access only in the commissioning state, encoder (p0010 = 4).
110: Write access only in the commissioning state, motor (p0010 = 3).
111: Write access only in the commissioning state, power unit (p0010 = 2).
112: Write access only in the quick commissioning mode (p0010 = 1).
113: Write access only in the ready mode (p0010 = 0).
114: Write access only in the commissioning state, parameter reset (p0010 = 30).
115: Write access only in the Safety Integrated commissioning state (p0010 = 95).
116: Write access only in the commissioning state, technological application/units (p0010 = 5).
117: Write access only in the commissioning state (p0010 not equal to 0).
118: Write access only in the commissioning state, download (p0010 = 29).
119: Parameter may not be written in download.
120: Write access only in the commissioning state, drive basic configuration (device: p0009 = 3).
121: Write access only in the commissioning state, define drive type (device: p0009 = 2).
122: Write access only in the commissioning state, data set basic configuration (device: p0009 = 4).
123: Write access only in the commissioning state, device configuration (device: p0009 = 1).
124: Write access only in the commissioning state, device download (device: p0009 = 29).
125: Write access only in the commissioning state, device parameter reset (device: p0009 = 30).
126: Write access only in the commissioning state, device ready (device: p0009 = 0).
127: Write access only in the commissioning state, device (device: p0009 not equal to 0).
129: Parameter may not be written in download.
130: Transfer of the master control is inhibited via binector input p0806.
131: Required BICO interconnection not possible because BICO output does not supply floating value

132: Free BICO interconnection inhibited via p0922.
133: Access method not defined.
200: Below the valid values.
201: Above the valid values.
202: Cannot be accessed from the Basic Operator Panel (BOP).
203: Cannot be read from the Basic Operator Panel (BOP).
204: Write access not permitted.

Remedy: - correct the parameterization in the commissioning tool and download the project again.
- enter the correct value in the specified parameter.
- identify the parameter that restricts the limits of the specified parameter.

A01099 UTC synchronization tolerance violated

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: NONE

Acknowledge: NONE

Cause: The tolerance (p3109) set for UTC synchronization was violated.
Note:
UTC: Universal Time Coordinates

Remedy: Select the synchronization intervals shorter so that the deviation between the time of day master and drive system lies within the tolerance.
Note:
The deviation when synchronizing is shown in r3107.

F01120 Terminal initialization has failed

Message class: Hardware/software error (1)

Reaction: OFF1

Acknowledge: IMMEDIATELY

Cause: An internal software error occurred while the terminal functions were being initialized.
Fault value (r0949, interpret hexadecimal):
Only for internal Siemens troubleshooting.

Remedy: - carry out a POWER ON (switch-off/switch-on) for all components.
- upgrade firmware to later version.
- contact Technical Support.
- replace the Control Unit.

F01122 Frequency at the measuring probe input too high

Message class: Application/technological function faulted (17)

Reaction: OFF1

Acknowledge: IMMEDIATELY

Cause: The frequency of the pulses at the measuring probe input is too high.
Fault value (r0949, interpret decimal):
1: DI/DO 9 (X122.8)
2: DI/DO 10 (X122.10)
4: DI/DO 11 (X122.11)
8: DI/DO 13 (X132.8)
16: DI/DO 14 (X132.10)
32: DI/DO 15 (X132.11)
64: DI/DO 8 (X122.7)
128: DI/DO 12 (X132.7)

Remedy: Reduce the frequency of the pulses at the measuring probe input.

F01250 **CU: CU-EEPROM incorrect read-only data**

Message class: Hardware/software error (1)
Reaction: NONE
Acknowledge: POWER ON
Cause: Error when reading the read-only data of the EEPROM in the Control Unit.
Fault value (r0949, interpret decimal):
Only for internal Siemens troubleshooting.
Remedy: - carry out a POWER ON (switch-off/switch-on).
- replace the Control Unit.

A01251 **CU: CU-EEPROM incorrect read-write data**

Message class: Hardware/software error (1)
Reaction: NONE
Acknowledge: NONE
Cause: Error when reading the read-write data of the EEPROM in the Control Unit.
Alarm value (r2124, interpret decimal):
Only for internal Siemens troubleshooting.
Remedy: For alarm value r2124 < 256, the following applies:
- carry out a POWER ON (switch-off/switch-on).
- replace the Control Unit.
For alarm value r2124 >= 256, the following applies:
- for the drive object with this alarm, clear the fault memory (p0952 = 0).
- as an alternative, clear the fault memory of all drive objects (p2147 = 1).
- replace the Control Unit.

A01304 **Firmware version of DRIVE-CLiQ component is not up-to-date**

Message class: General drive fault (19)
Reaction: NONE
Acknowledge: NONE
Cause: The non-volatile memory has a more recent firmware version than the one in the connected DRIVE-CLiQ component.
Alarm value (r2124, interpret decimal):
Component number of the DRIVE-CLiQ component involved.
Remedy: Update the firmware (p7828, p7829 - or commissioning tool).

A01306 **Firmware of the DRIVE-CLiQ component being updated**

Message class: General drive fault (19)
Reaction: NONE
Acknowledge: NONE
Cause: Firmware update is active for at least one DRIVE-CLiQ component.
Alarm value (r2124, interpret decimal):
Component number of the DRIVE-CLiQ component.
Remedy: Not necessary.
This alarm is automatically withdrawn after the firmware update has been completed.

A01330 **Topology: Commissioning not possible**

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: NONE
Acknowledge: NONE
Cause: Unable to carry out commissioning. The actual topology does not fulfill the requirements.

Remedy: - check the OCC cable between the converter and motor.
- carry out a POWER ON (switch-off/switch-on).
- Check that the connected hardware is supported.
Note:
OCC: One Cable Connection (one cable system)

F01357 Topology: Two Control Units identified on the DRIVE-CLiQ line

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: NONE

Acknowledge: IMMEDIATELY

Cause: In the actual topology, 2 Control Units are connected with one another through DRIVE-CLiQ.
As standard, this is not permitted.
This is only permitted if the Technology Extension OALINK has already been installed on the two Control Units and has been commissioned online.
Fault value (r0949, interpret hexadecimal):
yyxx hex:
yy = connection number of the Control Unit at which the second Control Unit is connected
xx = component number of the Control Unit at which the second Control Unit is connected
Note:
Pulse enable is withdrawn and prevented.

Remedy: In general:
- remove the connection to the second Control Unit and restart.
- for the S120M component DRIVE-CLiQ extension, interchange the hybrid cable (IN/OUT).
When using OALINK:
- remove the DRIVE-CLiQ connection and restart the systems.
- install OALINK on both Control Units and activate.
- Check the configuration of the DRIVE-CLiQ sockets in OALINK.

A01489 Topology: motor with DRIVE-CLiQ not connected

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: NONE

Acknowledge: NONE

Cause: The topology comparison has detected a motor with DRIVE-CLiQ missing in the actual topology with respect to the target topology.
Alarm value (r2124, interpret hexadecimal):
ddccbbaa hex:
dd = connection number (%4)
cc = component number (%3)
bb = component class (% 2)
aa = component number of the component that has not been inserted (% 1)
Note:
The component is described in dd, cc and bb, where the component has not been inserted.
Component class and connection number are described in F01375.

Remedy: Adapting topologies:
- insert the components involved at the right connection (correct the actual topology).
- adapt the project/parameterizing in the commissioning tool (correct the target topology).

Check the hardware:
- check the 24 V supply voltage.
- check DRIVE-CLiQ cables for interruption and contact problems.
- check that the component is working properly.

Note:
Under "Topology --> Topology view" the commissioning tool where relevant offers improved diagnostics capability (e.g. setpoint/actual value comparison).

A01590 Drive: Motor maintenance interval expired

Message class: General drive fault (19)
Reaction: NONE
Acknowledge: NONE
Cause: The selected service/maintenance interval for this motor was reached.
Alarm value (r2124, interpret decimal):
Motor data set number.
Remedy: carry out service/maintenance and reset the service/maintenance interval (p0651).

F01600 SI P1: STO initiated

Message class: Safety monitoring channel has identified an error (10)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: The "Safety Integrated" function integrated in the drive has identified a fault in monitoring channel 1, and has initiated STO.
- forced checking procedure (test stop) of the safety switch-off signal path of monitoring channel 1 unsuccessful.
- subsequent response to fault F01611 (defect in a monitoring channel).

Fault value (r0949, interpret decimal):
0: Stop request from another monitoring channel.
1005: STO active, although no STO is selected and no stop response with STO is active.
1010: STO inactive, although STO is selected or a stop response with STO is active.
9999: Subsequent response to fault F01611.

Remedy:
- select Safe Torque Off and deselect again.
- replace drive.

For fault value = 9999:
- carry out diagnostics for fault F01611.

Note:
SI: Safety Integrated
STO: Safe Torque Off

F01611 SI P1: Defect in a monitoring channel

Message class: Safety monitoring channel has identified an error (10)
Reaction: NONE
Acknowledge: IMMEDIATELY

Cause: The "Safety Integrated" function integrated in the drive has identified a fault in monitoring channel 1. As a result of this fault, after the parameterized transition time has elapsed (p9658), fault F01600 is output.

Fault value (r0949, interpret decimal):

0: Stop request from another monitoring channel.

1 ... 999:

Number of the cross-compared data that resulted in this fault. This number is also displayed in r9795.

2: SI enable safety functions (p9601). Crosswise data comparison is only carried out for the supported bits.

3: SI SGE changeover discrepancy time (p9650).

4: SI transition time from F01611 to STO (p9658).

5: SI enable Safe Brake Control (p9602).

6: SI Motion enable safety functions (p9501).

7: SI delay time of STO for Safe Stop 1 (p9652).

8: SI PROFIsafe address (p9610).

9: SI debounce time for STO/SBC/SS1 (p9651).

14: SI PROFIsafe telegram selection (p9611).

15: SI PROFIsafe bus failure response (p9612).

1000: Watchdog timer has expired.

Within the time of approx. 5 x p9650, alternatively, the following was defined:

- the signal at F-DI for STO/SS1 continually changes with time intervals less than or equal to the discrepancy time (p9650).

- via PROFIsafe, STO (also as subsequent response) was continually selected and deselected with time intervals less than or equal to the discrepancy time (p9650).

1001, 1002: Initialization error, change timer / check timer.

1900: CRC error in the SAFETY sector.

1901: CRC error in the ITCM sector.

1902: Overloading in the ITCM sector has occurred in operation.

1903: Internal parameterizing error for CRC calculation.

2000: Status of the STO selection for both monitoring channels different.

2001: Feedback signal of STO shutdown for both monitoring channels different. This value can also subsequently occur as a result of other faults.

2002: Status of the delay timer SS1 on both monitoring channels are different (status of the timer in p9650).

2003: Status of the STO terminal for both monitoring channels different.

6000 ... 6999:

Error in the PROFIsafe control.

For these fault values, the failsafe control signals (Failsafe Values) are transferred to the safety functions. For p9612 = 1, the transfer of Failsafe Values is delayed.

6000: A fatal PROFIsafe communication error has occurred.

6064 ... 6071: error when evaluating the F parameter. The values of the transferred F parameters do not match the expected values in the PROFIsafe driver.

6064: Destination address and PROFIsafe address are different (F_Dest_Add).

6065: Destination address not valid (F_Dest_Add).

6066: Source address not valid (F_Source_Add).

6067: Watchdog time not valid (F_WD_Time).

6068: Incorrect SIL level (F_SIL).

6069: Incorrect F-CRC length (F_CRC_Length).

6070: Incorrect F parameter version (F_Par_Version).

6071: CRC error for the F parameters (CRC1). The transferred CRC value of the F parameters does not match the value calculated in the PROFIsafe driver.

6072: F parameterization is inconsistent.

6165: A communications error was identified when receiving the PROFIsafe telegram. The fault can also occur if an inconsistent or out-of-date PROFIsafe telegram has been received after switching the drive off and on or after plugging in the PROFINET cable.

6166: A time monitoring error (timeout) was identified when receiving the PROFIsafe telegram.

Remedy:

For fault value = 1 ... 5 and 7 ... 999:
- check the data that caused the fault.
- carry out a POWER ON (switch-off/switch-on) for all components.
- upgrade the drive software.

For fault value = 6:
- carry out a POWER ON (switch-off/switch-on) for all components.
- upgrade the drive software.

For fault value = 1000:
Check the wiring of the F-DI for STO/SS1 (contact problems).
- PROFIsafe: Resolve contact problems/faults at the PROFINET controller.
- check the discrepancy time, and if required, increase the value (p9650).

For fault value = 1001, 1002:
- carry out a POWER ON (switch-off/switch-on) for all components.
- upgrade the drive software.

For fault value = 1900, 1901, 1902:
- carry out a POWER ON (switch-off/switch-on) for all components.
- replace drive.
- upgrade the drive software.

For fault value = 2000, 2001, 2002, 2003:
- check the discrepancy time, and if required, increase the value (p9650, p9652).
- check the wiring of the safety-relevant inputs (SGE) (contact problems).
- replace drive.
- diagnose the other active faults and resolve the causes.

Note:
This fault can be acknowledged after removing the cause of the error and after correct selection/deselection of STO.

For fault value = 6000:
- carry out a POWER ON (switch-off/switch-on) for all components.
- check whether there is a DRIVE-CLiQ communication error between the two monitoring channels and, if required, carry out a diagnostics routine for the faults identified.
- upgrade firmware to later version.
- contact Technical Support.
- replace drive.

For fault value = 6064:
- check the setting of the value in the F parameter F_Dest_Add at the PROFIsafe slave.
- check the setting of the PROFIsafe address (p9610). Using the commissioning tool, copy the safety parameters and confirm the data change.

For fault value = 6065:
- check the setting of the value in the F parameter F_Dest_Add at the PROFIsafe slave. It is not permissible for the destination address to be either 0 or FFFF!

For fault value = 6066:
- check the setting of the value in the F parameter F_Source_Add at the PROFIsafe slave. It is not permissible for the source address to be either 0 or FFFF!

For fault value = 6067:
- check the setting of the value in the F parameter F_WD_Time at the PROFIsafe slave. It is not permissible for the watch time to be 0!

For fault value = 6068:
- check the setting of the value in the F parameter F_SIL at the PROFIsafe slave. The SIL level must correspond to SIL2!

For fault value = 6069:
- check the setting of the value in the F parameter F_CRC_Length at the PROFIsafe slave. The setting of the CRC2 length is 2-byte CRC in the V1 mode and 3-byte CRC in the V2 mode!

For fault value = 6070:
- check the setting of the value in the F parameter F_Par_Version at the PROFIsafe slave. The value for the F parameter version is 0 in the V1 mode and 1 in the V2 mode!

For fault value = 6071:
- check the settings of the values of the F parameters and the F parameter CRC (CRC1) calculated from these at the PROFIsafe slave and, if required, update.

For fault value = 6072:
- check the settings of the values for the F parameters and, if required, correct.

The following combinations are permissible for F parameters F_CRC_Length and F_Par_Version:
F_CRC_Length = 2-byte CRC and F_Par_Version = 0
F_CRC_Length = 3-byte CRC and F_Par_Version = 1

For fault value = 6165:
- if the fault occurs after powering up or after inserting the PROFINET cable, acknowledge the fault.
- check the configuration and communication at the PROFIsafe slave.
- check the setting of the value for F parameter F_WD_Time on the PROFIsafe slave and increase if necessary.
- check whether there is a DRIVE-CLiQ communication error between the two monitoring channels and, if required, carry out a diagnostics routine for the faults identified.
- check whether all F parameters of the drive match the F parameters of the F host.

For fault value = 6166:
- check the configuration and communication at the PROFIsafe slave.
- check the setting of the value for F parameter F_WD_Time on the PROFIsafe slave and increase if necessary.
- evaluate diagnostic information in the F host.
- check PROFIsafe connection.
- check whether all F parameters of the drive match the F parameters of the F host.

Note:
F-DI: Failsafe Digital Input
SGE: Safety-relevant input
SI: Safety Integrated
SS1: Safe Stop 1
STO: Safe Torque Off

N01620 SI P1: Safe Torque Off active

Message class: Safety monitoring channel has identified an error (10)

Reaction: NONE

Acknowledge: NONE

Cause: The "Safe Torque Off" (STO) function of the basic functions has been selected in monitoring channel 1 using the input terminal and is active.

Note:
- this message does not result in a safety stop response.
- this message is not output when STO is selected using the Extended Functions.

Remedy: Not necessary.

Note:
SI: Safety Integrated
STO: Safe Torque Off

N01621 SI P1: Safe Stop 1 active

Message class: Safety monitoring channel has identified an error (10)

Reaction: NONE

Acknowledge: NONE

Cause: The "Safe Stop 1" function (SS1) was selected in monitoring channel 1 and is active.

Note:
This message does not result in a safety stop response.

Remedy: Not necessary.
Note:
SI: Safety Integrated
SS1: Safe Stop 1

F01625 SI P1: sign-of-life error in the safety data

Message class: Internal (DRIVE-CLiQ) communication error (12)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: The "Safety Integrated" function integrated in the drive has identified an error in the sign-of-life of the safety data in monitoring channel 1, and has initiated STO.
- there is either a DRIVE-CLiQ communication error or communication has failed.
- a time slice overflow of the safety software has occurred.
Fault value (r0949, interpret decimal):
Only for internal Siemens troubleshooting.
Remedy: - select STO and then deselect again.
- carry out a POWER ON (switch-off/switch-on).
- check whether there is a DRIVE-CLiQ communication error between the two monitoring channels and, if required, carry out a diagnostics routine for the faults identified.
- deselect all drive functions that are not absolutely necessary.
- check the electrical cabinet design and cable routing for EMC compliance
Note:
SI: Safety Integrated
STO: Safe Torque Off

F01630 SI P1: Brake control error

Message class: Safety monitoring channel has identified an error (10)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: The "Safety Integrated" function integrated in the drive has identified a brake control fault in monitoring channel 1, and has initiated STO.
- OCC cable shield is not correctly connected.
- defect in the brake control circuit of the drive.
Fault value (r0949, interpret decimal):
10, 11:
Fault in "open brake" operation.
- brake not closed or interrupted cable.
- ground fault in brake cable.
20:
Fault in "brake open" state.
- short-circuit in brake winding.
30, 31:
Fault in "close brake" operation.
- brake not closed or interrupted cable.
- short-circuit in brake winding.
40:
Fault in "brake closed" state.
50:
Fault in the brake control of the drive or a communication error (brake control diagnostics).

Remedy: - select STO and then deselect again.
- check the motor holding brake connection.
- check the function of the motor holding brake.
- carry out a diagnostics routine for the faults involved.
- check for EMC-compliant control cabinet design and cable routing (e.g. shield OCC cable with shield terminal and shield plate, check the connection of the brake conductors).
- replace drive.

Note:
OCC: One Cable Connection (one cable system)
SBC: Safe Brake Control
SI: Safety Integrated
STO: Safe Torque Off
See also: p1215 (Motor holding brake configuration)

A01631 SI P1: motor holding brake/SBC configuration not practical

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: NONE
Acknowledge: NONE
Cause: A configuration of motor holding brake and SBC was detected that is not practical.
The following configurations can result in this message:
- "No motor holding brake available" (p1215 = 0) and "SBC" enabled (p9602 = 1).

Remedy: Check the parameterization of the motor holding brake and SBC and correct.
Note:
SBC: Safe Brake Control
See also: p1215 (Motor holding brake configuration), p9602 (SI enable safe brake control)

A01637 SI: Safety password not assigned

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: NONE
Acknowledge: NONE
Cause: Safety Integrated is parameterized and enabled. However, a valid safety password has still not been entered.
See also: r9767 (SI Safety password status)
Remedy: - assign a valid safety password.
- carry out data save.

A01638 SI: Safety password entered

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: NONE
Acknowledge: NONE
Cause: A valid safety password has been entered. It is possible to change safety parameters in the safety commissioning mode.
See also: r9767 (SI Safety password status)
Remedy: Not necessary.
This alarm is automatically withdrawn with "Delete password" (e.g. after exiting the web server - or after a Power on). The password remains assigned.

F01640 SI P1: component exchange identified and acknowledge/save necessary

Message class: General drive fault (19)
Reaction: NONE
Acknowledge: IMMEDIATELY

Cause: "Safety Integrated" has identified that a component has been replaced.
It is no longer possible to operate the particular drive without fault.
When safety functions are active, after a component has been replaced it is necessary to carry out a partial acceptance test.
Fault value (r0949, interpret binary):
Bit 0 = 1:
It has been identified that the drive has been replaced.
Bit 3 = 1:
It has been identified that the Sensor Module has been replaced.
Bit 5 = 1:
It has been identified that the sensor has been replaced.

Remedy: - acknowledge component replacement (p9702 = 29).
- back up all parameters.
- acknowledge fault.
Note:
In addition to the fault, diagnostics bits r9776.2 and r9776.3 are set.
See also: r9776 (SI diagnostics)

F01641 SI P1: component exchange identified and save necessary

Message class: General drive fault (19)

Reaction: NONE

Acknowledge: IMMEDIATELY

Cause: "Safety Integrated" has identified that a component has been replaced.
No additional fault response is initiated, therefore operation of the particular drive is not restricted.
When safety functions are active, after a component has been replaced it is necessary to carry out a partial acceptance test.
Fault value (r0949, interpret binary):
Bit 0 = 1:
It has been identified that the drive has been replaced.
Bit 3 = 1:
It has been identified that the Sensor Module has been replaced.
Bit 5 = 1:
It has been identified that the sensor has been replaced.

Remedy: - save all parameters
- acknowledge fault.
See also: r9776 (SI diagnostics)

F01649 SI P1: Internal software error

Message class: Hardware/software error (1)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: An internal error in the Safety Integrated software in monitoring channel 1 has occurred.
Note:
This fault results in an STO that cannot be acknowledged.
Fault value (r0949, interpret hexadecimal):
Only for internal Siemens troubleshooting.

Remedy: - carry out a POWER ON (switch-off/switch-on).
- re-commission the "Safety Integrated" function and carry out a POWER ON.
- upgrade the drive firmware to a later version.
- contact Technical Support.
- replace drive.
Note:
SI: Safety Integrated
STO: Safe Torque Off

F01650 SI P1: Acceptance test required

Message class: Safety monitoring channel has identified an error (10)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: The "Safety Integrated" function on monitoring channel 1 requires an acceptance test.
Note:
This fault results in an STO that can be acknowledged.
Fault value (r0949, interpret decimal):
130: Safety parameters for monitoring channel 2 not available.
Note:
This fault value is always output when Safety Integrated is commissioned for the first time.
1000: Reference and actual checksum in monitoring channel 1 are not identical (booting).
- safety parameters set offline and loaded to the drive.
- at least one checksum-checked piece of data is defective.
2000: Reference and actual checksum in monitoring channel 1 are not identical (commissioning mode).
2001: Reference and actual checksum in monitoring channel 2 are not identical (commissioning mode).
2002: Enable of safety-related functions between the two monitoring channels differ.
2003: Acceptance test is required as a safety parameter has been changed.
2004: An acceptance test is required because a project with enabled safety-functions has been downloaded.
2005: The safety logbook has identified that the safety checksums have changed.
2010: Safe brake control enable different between both monitoring channels.
2020: Error when saving the safety parameters for the monitoring channel 2.
3003: Acceptance test is required as a hardware-related safety parameter has been changed.
3005: The Safety logbook has identified that a hardware-related safety checksum has changed.
9999: Subsequent response of another safety-related fault that occurred when booting that requires an acceptance test.

Remedy: For fault value = 130:
- carry out safety commissioning routine.

For fault value = 1000:
- again carry out safety commissioning routine.
- replace the memory card or drive.

For fault value = 2000:
- confirm the data change using the commissioning tool.

For fault value = 2001:
- confirm the data change using the commissioning tool.

For fault value = 2002:
- using the commissioning tool, copy the safety parameters and confirm the data change.

For fault value = 2003, 2004, 2005:
- carry out an acceptance test and generate an acceptance report.

Note:
The fault with fault value 2005 can only be acknowledged when the "STO" function is deselected.

For fault value = 2010:
- check that safe brake control is enabled.
- using the commissioning tool, copy the safety parameters and confirm the data change.

For fault value = 2020:
- again carry out safety commissioning routine.
- replace the memory card or drive.

For fault value = 3003:
- carry out the function checks for the modified hardware and generate an acceptance report.

For fault value = 3005:
- carry out the function checks for the modified hardware and generate an acceptance report.

Note:
The fault with fault value 3005 can only be acknowledged when the "STO" function is deselected.

For fault value = 9999:
- carry out diagnostics for the other safety-related fault that is present.

Note:
SI: Safety Integrated
STO: Safe Torque Off

F01651 SI P1: Synchronization safety time slices unsuccessful

Message class: Hardware/software error (1)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: The "Safety Integrated" function requires a synchronization of the safety time slices between the two monitoring channels and between the drive and the higher-level control. This synchronization routine was unsuccessful.

Note:
This fault results in an STO that cannot be acknowledged.

Remedy:
- carry out a POWER ON (switch-off/switch-on).
- upgrade the drive software.
- upgrade the software of the higher-level control.

Note:
SI: Safety Integrated
STO: Safe Torque Off

F01653 SI P1: PROFINET configuration error

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: NONE

Acknowledge: IMMEDIATELY

Cause: There is a PROFINET configuration error for using Safety Integrated monitoring functions with a higher-level control (F-PLC).
Note:
When the safety functions are enabled, this fault results in an STO that cannot be acknowledged.
Fault value (r0949, interpret decimal):
200: A safety slot for receive data from the control has not been configured.
210, 220: The configured safety slot for the receive data from the control has an unknown format.
230: The configured safety slot for the receive data from the F-PLC has the incorrect length.
231: The configured safety slot for the receive data from the F-PLC has the incorrect length.
250: A PROFIsafe slot is configured in the higher-level F control, however PROFIsafe is not enabled in the drive.
300: A safety slot for the send data to the control has not been configured.
310, 320: The configured safety slot for the send data to the control has an unknown format.
330: The configured safety slot for the send data to the F-PLC has the incorrect length.
331: The configured safety slot for the send data to the F-PLC has the incorrect length.
400: The telegram number in the F-PLC does not match the parameterization in the drive.

Remedy: The following generally applies:
- check and, if necessary, correct the PROFINET configuration of the safety slot on the master side.
- upgrade the drive software.
For fault value = 250:
- remove the PROFIsafe configuring in the higher-level F control or enable PROFIsafe in the drive.
For fault value = 231, 331:
- in the drive, parameterize the appropriate PROFIsafe telegram (p9611) to be set on the F-PLC.
- configure the PROFIsafe telegram matching the parameterization (p9611) in the F-PLC.
Note:
SI: Safety Integrated
STO: Safe Torque Off

A01654 SI P1: Deviating PROFIsafe configuration

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: NONE

Acknowledge: NONE

Cause: The configuration of a PROFIsafe telegram in the higher-level control (F-PLC) does not match the parameterization in the drive.
Note:
This message does not result in a safety stop response.
Alarm value (r2124, interpret decimal):
1:
A PROFIsafe telegram is configured in the higher-level control, however PROFIsafe is not enabled in the drive (p9601.3).
2:
PROFIsafe is parameterized in the drive; however, a PROFIsafe telegram has not been configured in the higher-level control.

Remedy: The following generally applies:
- check and, if necessary, correct the PROFIsafe configuration in the higher-level control.
For alarm value = 1:
- remove the PROFIsafe configuring in the higher-level F control or enable PROFIsafe in the drive.
For alarm value = 2:
- configure the PROFIsafe telegram to match the parameterization in the higher-level F-control.

F01655 SI P1: Align monitoring functions

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: An error has occurred when aligning the Safety Integrated monitoring functions of both monitoring channels. No common set of supported SI monitoring functions was able to be determined.
- there is either a DRIVE-CLiQ communication error or communication has failed.
- no POWER ON after upgrading the firmware.

Note:
This fault results in an STO that cannot be acknowledged.
Fault value (r0949, interpret hexadecimal):
Only for internal Siemens troubleshooting.

Remedy:
- carry out a POWER ON (switch-off/switch-on) for all components.
- check the electrical cabinet design and cable routing for EMC compliance
- upgrade the drive software.

Note:
SI: Safety Integrated
STO: Safe Torque Off

F01656 SI P1: Parameters monitoring channel 2 error

Message class: Hardware/software error (1)
Reaction: OFF2
Acknowledge: IMMEDIATELY

Cause: When accessing the Safety Integrated parameters for monitoring channel 2 in the non-volatile memory, an error has occurred.
Note:
This fault results in an STO that can be acknowledged.
Fault value (r0949, interpret decimal):
129:
- safety parameters for monitoring channel 2 corrupted.
- drive with enabled safety functions was possibly copied offline using the commissioning tool and the project downloaded.

131: Internal software error on monitoring channel 2.
132: Communication errors when uploading or downloading the safety parameters for monitoring channel 2.
255: Internal software error on monitoring channel 1.

Remedy:
- re-commission the safety functions.
- upgrade the drive software.
- replace the memory card or drive.

For fault value = 129:
- activate the safety commissioning mode (p0010 = 95).
- adapt the PROFIsafe address (p9610).
- using the commissioning tool, copy the safety parameters and confirm the data change.
- exit the safety commissioning mode (p0010 = 0).
- save all parameters (copy RAM to ROM).
- carry out a POWER ON (switch-off/switch-on).

For fault value = 132:
- check the electrical cabinet design and cable routing for EMC compliance

Note:
SI: Safety Integrated
STO: Safe Torque Off

F01657 SI P1: PROFIsafe telegram number not valid

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: OFF2
Acknowledge: POWER ON

Cause: The PROFIsafe telegram number set in p9611 is not valid.
When PROFIsafe is enabled (p9601.3 = 1), then a telegram number greater than zero must be entered in p9611.
Note:
This fault does not result in a safety stop response.
See also: p9611 (SI PROFIsafe telegram selection), r60022 (PROFIsafe telegram selection)
Remedy: Check the telegram number setting (p9611).

F01658 SI P1: PROFIsafe telegram numbers differ

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: The PROFIsafe telegram number is set differently in p9611 and r60022.
The telegram number must be identically set in both parameters.
Note:
This fault does not result in a safety stop response.
See also: p9611 (SI PROFIsafe telegram selection), r60022 (PROFIsafe telegram selection)
Remedy: Align the telegram number in both parameters so that they are the same (p9611, r60022).

F01659 SI P1: Write request for parameter rejected

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: The write request for one or several Safety Integrated parameters from monitoring channel 1 was rejected.
Note:
This fault does not result in a safety stop response.
Fault value (r0949, interpret decimal):
1: The Safety Integrated password is not set.
14: An attempt was made to enable the PROFIsafe communication - although the version of the PROFIsafe driver used on both monitoring channels is different.
20: An attempt was made to enable the motion monitoring functions integrated in the drive and the STO function, both controlled via F-DI.
25: An attempt was made to parameterize a PROFIsafe telegram although this cannot be supported.
27: An attempt was made to activate the Basic Functions by controlling via TM54F although this is not supported.
28: An attempt was made to enable the "STO via terminals at the Power Module" function although this cannot be supported.
9612: An attempt was made to set the stop response SS1 for PROFIsafe failure (p9612 = 1), although PROFIsafe is not enabled.

Remedy: For fault value = 1:
- set the Safety Integrated password.

For fault value = 14, 27:
- check whether there are faults in the safety function alignment between the two monitoring channels (F01655, F30655) and if required, carry out diagnostics for the faults involved.
- upgrade the drive software.

For fault value = 20:
- correct the enable setting (p9601).

For fault value = 25:
- correct the telegram number setting (p9611).

For fault value = 28:
- correct the enable setting (p9601.7 = 0).

For fault value = 9612:
- establish communications with PROFIsafe (p9601).
- parameterize STO as stop response for PROFIsafe failure (p9612 = 0).

Note:
F-DI: Failsafe Digital Input
SBC: Safe Brake Control
SI: Safety Integrated
SS1: Safe Stop 1
STO: Safe Torque Off
See also: p9501 (SI Motion enable safety functions), p9601 (SI enable, functions integrated in the drive), p9612 (SI PROFIsafe failure response)

F01663 SI P1: copying SI parameters rejected

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: The copy function for Safety Integrated parameters is initiated using the commissioning tool.
This is the reason that when booting, an attempt is made to copy Safety Integrated parameters from monitoring channel 1 to monitoring channel 2. However, no safety-relevant function has been selected in monitoring channel 1 (p9501 = 0, p9601 = 0). Copying was rejected for safety reasons.
As a consequence, inconsistent parameterization can occur in both monitoring channels, which in turn results in additional error messages.
Especially for inconsistent enabling of the safety functions on both monitoring channels, fault F30625 is output.
Note:
This fault does not result in a safety stop response.
SI: Safety Integrated

Remedy:
- check p9501 and p9601 and if required, correct.
- perform copy function using the commissioning tool.
- save all parameters or "Copy RAM to ROM".
- carry out a POWER ON (switch-off/switch-on).

F01670 SI Motion: Invalid parameterization of the encoder evaluation

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: The parameterization of the encoder evaluation used for Safety Integrated is not permissible.
Note:
This fault results in an STO that cannot be acknowledged.
Fault value (r0949, interpret decimal):
1: No encoder was parameterized for Safety Integrated.
2: An encoder was parameterized for Safety Integrated that does not have an A/B track (sine/cosine).
3: The encoder data set selected for Safety Integrated is still not valid.
4: A communication error with the encoder has occurred.
5: Number of relevant bits in the encoder coarse position invalid.
6: DRIVE-CLiQ encoder configuration invalid.
8: Parameterized Safety comparison algorithm not supported.

Remedy: For fault value = 1, 2:
- use and parameterize an encoder that Safety Integrated supports (encoder with track A/B sine-wave, p0404.4 = 1).
For fault value = 3:
- check whether the drive or drive commissioning function is active and if required, exit this (p0009 = p00010 = 0), save the parameters (p0971 = 1) and carry out a POWER ON
For fault value = 4:
- check whether there are any active faults in the DRIVE-CLiQ communication between the drive and the encoder evaluation - and when necessary, carry out diagnostics for the faults involved.
For fault value = 5:
- p9525 = 0 (not permissible). Check the encoder parameterization.
For fault value = 6:
- check p9515.0 (for DRIVE-CLiQ encoders, the following applies: p9515.0 = 1). Check the encoder parameterization.
For fault value = 8:
- use and parameterize an encoder that implements an algorithm supported by Safety Integrated.
Note:
SI: Safety Integrated
STO: Safe Torque Off

F01671 SI Motion: Parameterization encoder error

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: The parameterization of the encoder used by Safety Integrated is different to the parameterization of the standard encoder.
Note:
This fault does not result in a safety stop response.
Fault value (r0949, interpret decimal):
Parameter number of the non-corresponding safety parameter.

Remedy: Align the encoder parameterization between the safety encoder and the standard encoder.
Note:
SI: Safety Integrated

F01672 SI P1: drive is incompatible regarding software/hardware

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: The software for monitoring channel 2 does not support safe motion monitoring, is not compatible to the software for monitoring channel 1 - or there is a communications error between the two monitoring channels.
Note:
This fault results in an STO that cannot be acknowledged.
Fault value (r0949, interpret decimal):
Only for internal Siemens troubleshooting.

Remedy: - check whether faults F01655/F30655 are active - and when necessary, carry out diagnostics for the faults involved.
- upgrade the drive software.
Note:
SI: Safety Integrated
STO: Safe Torque Off

F01673 SI Motion: Sensor Module software/hardware incompatible

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: The existing Sensor Module software and/or hardware does not support the safe motion monitoring function with the higher-level control.
Note:
This fault does not result in a safety stop response.
Fault value (r0949, interpret decimal):
Only for internal Siemens troubleshooting.

Remedy: - upgrade the Sensor Module software.
- use a Sensor Module that supports the safe motion monitoring function.
Note:
SI: Safety Integrated

F01674 SI Motion P1: Safety function not supported by PROFIsafe telegram

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: OFF2

Acknowledge: POWER ON

Cause: The monitoring function enabled in p9501 and p9601 is not supported by the currently set PROFIsafe telegram (p9611).
Note:
This fault results in an STO that cannot be acknowledged.
Fault value (r0949, interpret bitwise):
Bit 18 = 1:
SS2E via PROFIsafe is not supported (p9501.18).
Bit 24 = 1:
Transfer SLS (SG) limit value via PROFIsafe not supported (p9501.24).
Bit 25 = 1:
Transfer safe position (SP) via PROFIsafe is not supported (p9501.25).
Bit 26 = 1:
Gearbox stage switchover via PROFIsafe is not supported (p9501.26).
Bit 28 = 1:
SCA via PROFIsafe is not supported (p9501.28).

Remedy: - Deselect the monitoring function involved (p9501, p9601).
- set the matching PROFIsafe telegram (p9611).
Note:
SCA: Safe Cam
SI: Safety Integrated
SLS: Safely-Limited Speed
SP: Safe Position
SS2E: Safe Stop 2 External (Safe Stop 2 with external stop)
STO: Safe Torque Off

F01675 SI Motion P1: settings in the PROFINET controller not permissible

Message class: Safety monitoring channel has identified an error (10)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: For the "Safe synchronous position via PROFIsafe" function, an incorrect configuration setting was identified.
Note:
This fault results in an STO that can be acknowledged as follows.
- select STO and then deselect again.
- internal event acknowledge (if the "Extended message acknowledgment" is active, p9507.0 = 1).
Fault value (r0949, interpret decimal):
1:
"Synchronous safe position via PROFIsafe" is enabled (p9501.29 = 1) and is not set according to the rule Tdp = 2 x n x p9500 (n = 1, 2, 3, ...).
2:
"Synchronous safe position via PROFIsafe" is enabled (p9501.29 = 1) and isochronous operation is not set.
Note:
SI: Safety Integrated
STO: Safe Torque Off
Remedy: For fault value = 1:
- set bus cycle time Tdp and monitoring clock cycle p9500 according to the rule Tdp = 2 x n x p9500 (n = 1, 2, 3, ...).
For fault value = 2:
- set "Isochronous mode" on the PROFINET controller.

F01679 SI P1: Safety parameter settings and topology changed, warm restart/POWER ON required

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: OFF2
Acknowledge: POWER ON
Cause: Safety parameters have been changed; these will only take effect following a warm restart or POWER ON (see alarm A01693).
A partial power up (boot) with modified configuration was then performed.
Remedy: - carry out a warm restart.
- carry out a POWER ON (switch-off/switch-on).

F01680 SI Motion P1: Checksum error safety monitoring functions

Message class: Safety monitoring channel has identified an error (10)
Reaction: OFF2
Acknowledge: IMMEDIATELY

Cause: The calculated actual checksum over the safety-relevant parameters does not match the reference checksum saved at the last machine acceptance.
Safety-relevant parameters have been changed or a fault is present.
Note:
This fault results in an STO that can be acknowledged.
Fault value (r0949, interpret decimal):
0: Checksum error for SI parameters for motion monitoring.
1: Checksum error for SI parameters for actual values.
2: Checksum error for SI parameters for component assignment.

Remedy: - check the safety-relevant parameters and if required, correct.
- execute the function "Copy RAM to ROM".
- if necessary carry out a POWER ON (switch-off/switch-on).
- carry out an acceptance test.
Note:
STO: Safe Torque Off

F01681 SI Motion P1: Incorrect parameter value

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: OFF2
Acknowledge: IMMEDIATELY

Cause: The parameter cannot be parameterized with this value.

Note:

This message does not result in a safety stop response.

Fault value (r0949, interpret decimal):

yyyyxxxx dec: yyyy = supplementary information, xxxx = parameter

yyyy = 0:

No additional information available.

xxxx = 9501:

Enabling function "SSM" (p9501.16) is not permissible in combination with the "Extended functions without selection" function (p9601.5).

xxxx = 9501 and yyyy = 10:

Referencing via SCC (p9501.27 = 1) and epos (r0108.4 = 1) are simultaneously enabled.

xxxx = 9506 and yyyy = 1:

Parameter p9506 differs between the monitoring channels

xxxx = 9522:

The gear stage was set too high.

xxxx = 9547:

The hysteresis tolerance is not permissible.

xxxx = 9578:

SLA is enabled (p9501.20 = 1). Acceleration limit is too low (p9578). The acceleration resolution is no longer sufficient (r9790).

xxxx = 9601 and yyyy = 1:

If motion monitoring functions integrated in the drive (p9601.2 = 1) and extended functions without selection (p9601.5 = 1) are enabled, then PROFIsafe (p9601.3 = 1) or onboard F-DI (p9601.4 = 1) is not possible.

xxxx = 9601 and yyyy = 2:

Extended functions without selection (p9601.5 =1) are enabled without enabling motion monitoring functions integrated in the drive (p9601.2).

xxxx = 9601 and yyyy = 3:

Onboard F-DI are enabled without enabling motion monitoring functions integrated in the drive (p9601.2).

xxxx = 9601 and yyyy = 4:

Onboard F-DI are enabled. Then, it is not permissible to simultaneously set PROFIsafe and F-DI via PROFIsafe (p9501.30).

xxxx = 9601 and yyyy = 5:

Transfer of the SLS limit value via PROFIsafe (p9501.24) has been enabled, without enabling PROFIsafe.

xxxx = 9601 and yyyy = 6:

Transfer of the safe position via PROFIsafe (p9501.25) has been enabled, without enabling PROFIsafe.

xxxx = 9601 and yyyy = 7:

Safe switchover of the gearbox stages (p9501.26) has been enabled without enabling PROFIsafe.

xxxx = 9601 and yyyy = 11:

SS2E (p9501.18 = 1) is enabled without PROFIsafe being enabled.

xxxx = 9601 and yyyy = 12:

SCA (p9501.28 = 1) is enabled without enabling PROFIsafe.

xxxx = 9601 and yyyy = 13:

Extended functions (p9601.2 = 1) have been enabled without enabling PROFIsafe (p9601.3).

Remedy: Correct parameters:
If xxxx = 9501:
- deselect extended functions without selection (p9601.5).
If xxxx = 9501 and yyyy = 10:
Deselect referencing via SCC (p9501.27).
For xxxx = 9501 and yyyy = 11:
Deselect SS2E (p9501.18) - or enable PROFIsafe
For xxxx = 9501 and yyyy = 12:
Deselect SCA (p9501.28).
For xxxx = 9507:
Set synchronous motor.
For xxxx = 9506:
Using the commissioning tool, copy the safety parameters, confirm the data change, backup the parameters and carry out a power on.
For xxxx = 9522:
Correct the corresponding parameter.
For xxxx = 9547:
With hysteresis/filtering enabled (p9501.16 = 1), the following applies:
- set parameters p9546 and p9547 according to the following rule: p9547 <= 0.75 x p9546;
- the following rule must also be adhered to when actual value synchronization (p9501.3 = 1) is enabled: p9547 >= p9549;
For xxxx = 9578:
Increase the acceleration limit (p9578).
- The minimum limit is 10x the acceleration resolution (r9790[1]).
- observe the information in r9790.
If xxxx = 9601:
yyyy = 1:
Only enable motion monitoring functions integrated in the drive (p9601.2 = 1) and PROFIsafe (p9601.3 = 1).
yyyy = 2:
Deselect Extended Functions without selection (p9601.5 = 0)
yyyy = 3:
Deselect F-DI (p9601.4)
yyyy = 4:
Deselect onboard F-DI (p9601.4) and F-DI via PROFIsafe (p9501.30).
yyyy = 5:
To transfer the SLS limit values via PROFIsafe (p9501.24 = 1), also enable PROFIsafe (p9601.3 =1) and motion monitoring functions integrated in the drive (p9601.2 = 1).
yyyy = 6:
Deselect the transfer of the safe position via PROFIsafe (p9501.25 = 0)
yyyy = 7:
Deselect the safe switchover of gearbox stages (p9501.26 = 1)
yyyy = 13:
Also enable PROFIsafe (p9601.3) for the extended functions (p9601.2)
Note:
SSM: Safe Speed Monitor (safety-relevant feedback signal from the speed monitoring)

F01682 SI Motion P1: Monitoring function not supported

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: OFF2
Acknowledge: IMMEDIATELY

Cause: The monitoring function enabled in p9501, p9506, p9507, p9601 is not supported in this firmware version.
Note:
This fault results in an STO that cannot be acknowledged.
Fault value (r0949, interpret decimal):
20: Motion monitoring functions integrated in the drive are only supported in conjunction with PROFIsafe (p9501 and p9601.1 ... 2).
21: Enable a safe motion monitoring function (in p9501), not supported for enabled basic functions via PROFIsafe (p9601.2 = 0, p9601.3 = 1).
59: Safe actual value sensing with SIL3 encoder not supported.
9612: An attempt was made to set the stop response SS1 for PROFIsafe failure (p9612 = 1), although PROFIsafe is not enabled.
Additional fault values:
Monitoring function not supported.
See also: p9612 (SI PROFIsafe failure response)

Remedy: - deselect the monitoring function involved (p9501, p9506, p9507, p9601).
- restore the factory setting and repeat commissioning.
- upgrade the firmware.
For fault value = 59:
- upgrade the firmware of the Motor Module to a later version.
For fault value = 9612:
- establish communications with PROFIsafe (p9601).
- parameterize STO as stop response for PROFIsafe failure (p9612 = 0).
Note:
SI: Safety Integrated
SS1: Safe Stop 1
STO: Safe Torque Off
See also: p9501 (SI Motion enable safety functions), p9601 (SI enable, functions integrated in the drive), p9612 (SI PROFIsafe failure response)

F01683 SI Motion P1: SOS/SLS enable missing

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: The safety-relevant basic function "SOS/SLS" is not enabled in p9501 although other safety-relevant monitoring functions are enabled.
Note:
This fault does not result in a safety stop response.

Remedy: Enable the function "SOS/SLS" (p9501.0) and carry out a POWER ON.
Note:
SI: Safety Integrated
SLS: Safely-Limited Speed
SOS: Safe Operating Stop
See also: p9501 (SI Motion enable safety functions)

F01685 SI Motion P1: Safely-Limited Speed limit value too high

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: The limit value for the function "Safely-Limited Speed" (SLS) is greater than the speed that corresponds to an encoder limit frequency of 500 kHz.
Note:
This fault does not result in a safety stop response.
Fault value (r0949, interpret decimal):
Maximum permissible speed.

Remedy: Correct the limit values for SLS and carry out a POWER ON.
Note:
SI: Safety Integrated
SLS: Safely-Limited Speed
See also: p9531 (SI Motion SLS limit values)

F01689 SI Motion: Axis re-configured

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: OFF2

Acknowledge: POWER ON

Cause: The axis configuration was changed, and internally set to the correct value.
Note:
This fault does not result in a safety stop response.
Fault value (r0949, interpret decimal):
Number of the parameter that initiated the change.

Remedy: The following should be carried out after the changeover:
- exit the safety commissioning mode (p0010).
- save all parameters
- carry out a POWER ON.

Once the drive has been powered up, message F01680 or F30680 indicates that the checksums have changed in the drive. The following must, therefore, be carried out:
- activate safety commissioning mode again.
- complete safety commissioning of the drive.
- exit the safety commissioning mode (p0010).
- save all parameters
- carry out a POWER ON.

Note:
For the commissioning tool, the units are only consistently displayed after a project upload.

F01690 SI Motion: Data save problem for the NVRAM

Message class: Hardware/software error (1)

Reaction: NONE

Acknowledge: POWER ON

Cause: There is not sufficient memory space in the NVRAM on the drive to save parameters r9781 and r9782 (safety logbook).
Note:
This fault does not result in a safety stop response.
Fault value (r0949, interpret decimal):
1: There is no longer any free memory space in the NVRAM.

Remedy: For fault value = 1:
- deselect functions that are not required and that take up memory space in the NVRAM.
- contact Technical Support.

Note:
NVRAM: Non-Volatile Random Access Memory (non-volatile read and write memory)

A01691 SI Motion: Ti and To unsuitable for PN cycle

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: NONE

Acknowledge: NONE

Cause: The configured times for PROFINET communication are not permitted and the PN cycle is used as the actual value acquisition cycle for the safe movement monitoring functions:
Isochronous PROFINET:
The sum of Ti and To is too high for the selected PN cycle. The PN clock cycle should be at least 1 current controller cycle greater than the sum of Ti and To.
No isochronous PROFINET:
The PN clock cycle must be at least 4x the current controller clock cycle.
Notice:
If this alarm is not observed, then message A01711 or A30711 – with the value 1020 ... 1021 – can sporadically occur.

Remedy: Configure Ti and To low so that they are suitable for the PN cycle or increase the PN cycle time.

A01693 SI P1: Safety parameter settings changed, warm restart/POWER ON required

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: NONE

Acknowledge: NONE

Cause: Safety parameters have been changed; these will only take effect following a warm restart or POWER ON.
Alarm value (r2124, interpret decimal):
Parameter number of the safety parameter which has changed, necessitating a warm restart or POWER ON.

Remedy: - carry out a warm restart.
- carry out a POWER ON (switch-off/switch-on).
Note:
A POWER ON is required before carrying out the acceptance test.

F01694 SI Motion P1: Firmware version monitoring channel 2 older than monitoring channel 1

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: The firmware version of monitoring channel 2 is older than monitoring channel 1.
Note:
This message does not result in a safety stop response.
This message can occur, if after an automatic firmware update, a POWER ON was not carried out (Alarm A01007).

Remedy: Carry out a POWER ON at the drive (switch-off/switch-on).
See also: r9590 (SI Motion version, safe motion monitoring functions)

A01695 SI Motion: Sensor Module was replaced

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: NONE

Acknowledge: NONE

Cause: A Sensor Module, which is used for safe motion monitoring functions, was replaced. The hardware replacement must be acknowledged. An acceptance test must be subsequently performed.
Note:
This message does not result in a safety stop response.

Remedy: - acknowledge component replacement (p9702 = 29).
- back up all parameters.
- carry out a POWER ON (switch-off/switch-on) for all components.
- then carry out an acceptance test.

A01696 SI Motion: Test stop for the motion monitoring functions selected when booting

Message class: Safety monitoring channel has identified an error (10)

Reaction: NONE

Acknowledge: NONE

Cause: The forced checking procedure (test stop) for the safe motion monitoring functions is already selected when booting, which is not permissible.
This is the reason that the test is only carried out again after first selecting the forced checking procedure.
Note:
This message does not result in a safety stop response.

Remedy: Deselect the forced checking procedure (test stop) for the safe motion monitoring functions and then select again.
SI: Safety Integrated

A01697 SI Motion: Test stop for motion monitoring functions required

Message class: Safety monitoring channel has identified an error (10)

Reaction: NONE

Acknowledge: NONE

Cause: The time set in p9559 for the forced checking procedure (test stop) for the safe motion monitoring functions has been exceeded. A new forced checking procedure is required.
After the next time the forced checking procedure is selected, the message is withdrawn and the monitoring time is reset.
Note:
- this message does not result in a safety stop response.
- As the switch-off signal paths are not automatically checked during booting, an alarm is always issued once booting is complete.
- the test must be performed within a defined, maximum time interval (p9559, maximum of 9000 hours) in order to comply with the requirements as laid down in the standards for timely fault detection and the conditions to calculate the failure rates of safety functions (PFH value). Operation beyond this maximum time period is permissible if it can be ensured that the forced checking procedure is performed before persons enter the hazardous area and who are depending on the safety functions correctly functioning.
See also: p9559 (SI Motion forced checking procedure timer), r9765 (SI Motion forced checking procedure remaining time)

Remedy: Carry out the forced checking procedure (test stop) for the safe motion monitoring functions.
Note:
SI: Safety Integrated

A01698 SI P1: Commissioning mode active

Message class: General drive fault (19)

Reaction: NONE

Acknowledge: NONE

Cause: The commissioning of the "Safety Integrated" function is selected.
Note:
- this message does not result in a safety stop response.
- in the safety commissioning mode, the "STO" function is internally selected.
See also: p0010 (Drive commissioning parameter filter 2)

Remedy: Not necessary.
This message is automatically withdrawn after the safety functions have been commissioned.
Note:
SI: Safety Integrated
STO: Safe Torque Off

A01699 SI P1: Test stop for STO required

Message class: Safety monitoring channel has identified an error (10)

Reaction: NONE

Acknowledge: NONE

Cause: The time set in p9659 for the forced checking procedure (test stop) for the "STO" function has been exceeded. A new forced checking procedure is required.
After the next time the "STO" function is deselected, the message is withdrawn and the monitoring time is reset.
Note:
- this message does not result in a safety stop response.
- the test must be performed within a defined, maximum time interval (p9659) in order to comply with the requirements as laid down in the standards for timely fault detection and the conditions to calculate the failure rates of safety functions (PFH value). Operation beyond this maximum time period is permissible if it can be ensured that the forced checking procedure is performed before persons enter the hazardous area and who are depending on the safety functions correctly functioning.
See also: p9659 (SI forced checking procedure timer), r9660 (SI forced checking procedure remaining time)

Remedy: Select STO and then deselect again.
Note:
SI: Safety Integrated
STO: Safe Torque Off

F01700 SI Motion P1: STO initiated

Message class: Safety monitoring channel has identified an error (10)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: The drive is stopped using STO.
Possible causes:
- stop request from another monitoring channel.
- STO not active after parameterized time (p9557) after test stop selection.
- subsequent response, following messages: A01706, A01714, F01701, A01716

Remedy: - remove the cause of the fault on the second monitoring channel.
- carry out diagnostics for the active messages (A01706, A01714, F01701, A01716).
- check the value in p9557 (where available), increase the value if necessary, and carry out a POWER ON
- check the switch-off signal path of monitoring channel 1 (check DRIVE-CLiQ communication if it has been implemented)
- replace drive.
Note:
SAM: Safe Acceleration Monitor (safe acceleration monitoring)
SI: Safety Integrated
STO: Safe Torque Off

F01701 SI Motion P1: SS1 initiated

Message class: Safety monitoring channel has identified an error (10)

Reaction: NONE

Acknowledge: IMMEDIATELY

Cause: The drive is stopped using SS1.
As a result of this fault, after the time parameterized in p9556 has expired, or the speed threshold parameterized in p9560 has been fallen below, message F01700 "STO initiated" is output.
Possible causes:
- stop request from another monitoring channel.
- subsequent response, following messages: A01714, A01711, A01707, A01716

Remedy: - remove the cause of the fault on the second monitoring channel.
- carry out diagnostics for the active messages (A01714, A01711, A01707, A01716).
Note:
This message can be acknowledged via PROFIsafe (safe acknowledgment).
SI: Safety Integrated
SS1: Safe Stop 1

A01706 SI Motion P1: SAM/SBR limit exceeded

Message class: Safety monitoring channel has identified an error (10)

Reaction: NONE

Acknowledge: NONE

Cause: Motion monitoring functions with SAM (p9506 = 0):
- after initiating SS1 or SS2, the speed exceeded the set tolerance.

Motion monitoring functions with SBR (p9506 = 2):
- after initiating SS1 or SLS switchover to the lower speed level, the speed exceeded the set tolerance.

The drive is stopped by message F01700.

Remedy: Check the braking behavior and, if necessary, adapt the parameterization of the parameter settings of the "SAM" or the "SBR" function.

Note:
This message can be acknowledged via PROFIsafe (safe acknowledgment).
SAM: Safe Acceleration Monitor (safe acceleration monitoring)
SBR: Safe Brake Ramp (safe ramp monitoring)
SI: Safety Integrated
SS1: Safe Stop 1
SS2: Safe Stop 2
SLS: Safely-Limited Speed
See also: p9548 (SI Motion SAM actual speed tolerance), p9581 (SI Motion brake ramp reference value), p9582 (SI Motion brake ramp delay time), p9583 (SI Motion brake ramp monitoring time)

A01707 SI Motion P1: Tolerance for safe operating stop exceeded

Message class: Safety monitoring channel has identified an error (10)

Reaction: NONE

Acknowledge: NONE

Cause: The actual position has moved further away from the target position than the standstill tolerance.
The drive is stopped by message F01701.

Remedy:
- check whether safety faults are present and if required carry out the appropriate diagnostic routines for the particular faults.
- check whether the standstill tolerance matches the accuracy and control dynamic performance of the axis.
- carry out a POWER ON (switch-off/switch-on).

Note:
SI: Safety Integrated
SOS: Safe Operating Stop
See also: p9530 (SI Motion standstill tolerance)

F01708 SI Motion P1: SS2 initiated

Message class: Safety monitoring channel has identified an error (10)

Reaction: STOP2

Acknowledge: IMMEDIATELY

Cause: The drive is stopped using SS2 (braking along the OFF3 down ramp).
"Safe Operating Stop" (SOS) is activated after the parameterized time has expired.
Possible causes:
Subsequent response, following messages: A01714, A01716
See also: p9552 (SI Motion transition time SS2 to SOS)

Remedy: Carry out diagnostics for the active messages (A01714, A01716).

Note:
SI: Safety Integrated
SOS: Safe Operating Stop
SS2: Safe Stop 2

A01709 **SI Motion P1: SS2E initiated**

Message class: Safety monitoring channel has identified an error (10)
Reaction: NONE
Acknowledge: NONE
Cause: The drive is stopped using SS2E (braking along a path).
"Safe Operating Stop" (SOS) is activated after the parameterized time has expired.
Possible causes:
Subsequent response, following messages: A01714, A01716
See also: p9553 (SI Motion transition time SS2E to SOS)
Remedy: - remove the cause of the fault at the control.
- carry out diagnostics for the active messages (A01714, A01716).
Note:
SI: Safety Integrated
SOS: Safe Operating Stop
SS2E: Safe Stop 2 External (Safe Stop 2 with external stop)

A01711 **SI Motion P1: Defect in a monitoring channel**

Message class: Safety monitoring channel has identified an error (10)
Reaction: NONE
Acknowledge: NONE

Cause: The drive has identified a difference between the input data or results of the monitoring functions and initiated A01711. Safe operation is no longer possible.

At least one monitoring function is active, so that after the parameterized timer has expired, message F01701 is output.

The message value that resulted in this message is shown in r9725.

The following described message values involve the data cross-check between the two monitoring channels (safety functions integrated in the drive).

The message values may also occur in the following cases if the cause that is explicitly mentioned does not apply:

- For message values 3, 44 ... 57, 232 and 1-encoder system, differently set encoder parameters.
- incorrect synchronization.

Message value (r2124, interpret decimal):

0 to 999: Number of the cross-compared data that resulted in this fault.

Message values that are not subsequently listed are only for internal Siemens troubleshooting.

0: Stop request from another monitoring channel.

1: Status image of monitoring functions SOS, SLS, SAM/SBR or SDI (result list 1) (r9710[0], r9710[1]).

2: Status image of monitoring function SSM (result list 2) (r9711[0], r9711[1]).

3: The position actual value differential (r9713[0/1]) between the two monitoring channels is greater than the tolerance in p9542.

4: Error when synchronizing the data cross-check between the two channels.

5: Enable safe functions (p9501).

6: Limit value for SLS1 (p9531[0]).

7: Limit value for SLS2 (p9531[1]).

8: Limit value for SLS3 (p9531[2]).

9: Limit value for SLS4 (p9531[3]).

10: Standstill tolerance (p9530).

31: Position tolerance (p9542).

33: Time, speed switchover (p9551)

35: Delay time STO (p9556).

36: Test time, STO (p9557).

37: Transition time SS2 to SOS (p9552).

38: Transition time SS2E to SOS (p9553).

42: Shutdown speed STO (p9560).

43: Memory test stop response (STO).

44 ... 57: General

Possible cause 1 (during commissioning or parameter modification)

The tolerance value for the monitoring function is not the same on the two monitoring channels.

Possible cause 2 (during active operation)

The limit values are based on the actual value (r9713[0/1]). If the safe actual values on the two monitoring channels do not match, the limit values, which have been set at a defined interval, will also be different (i.e. corresponding to message value 3). This can be ascertained by checking the safe actual positions.

Permissible deviation between the two monitoring channels: p9542.

44: Position actual value (r9713[0/1]) + limit value SLS1 (p9531[0]) * safety monitoring clock cycle.

45: Position actual value (r9713[0/1]) + limit value SLS1 (p9531[0]) * safety monitoring clock cycle.

46: Position actual value (r9713[0/1]) + limit value SLS2 (p9531[1]) * safety monitoring clock cycle.

47: Position actual value (r9713[0/1]) + limit value SLS2 (p9531[1]) * safety monitoring clock cycle.

48: Position actual value (r9713[0/1]) + limit value SLS3 (p9531[2]) * safety monitoring clock cycle.

49: Position actual value (r9713[0/1]) - limit value SLS3 (p9531[2]) * safety monitoring clock cycle.

50: Position actual value (r9713[0/1]) + limit value SLS4 (p9531[3]) * safety monitoring clock cycle.

51: Position actual value (r9713[0/1]) - limit value SLS4 (p9531[3]) * safety monitoring clock cycle.

52: Standstill position + tolerance (p9530).

53: Standstill position - tolerance (p9530).

54: Position actual value (r9713[0/1]) + limit value of SSM (p9546) * safety monitoring clock cycle + tolerance (p9542).

55: Position actual value (r9713[0/1]) + limit value of SSM (p9546) * safety monitoring clock cycle.

56: Position actual value (r9713[0/1]) - limit value of SSM (p9546) * safety monitoring clock cycle.

57: Position actual value (r9713[0/1]) - limit value of SSM (p9546) * safety monitoring clock cycle - tolerance (p9542).
58: Actual stop request.
75: Velocity limit of SSM (p9546).
When function "SSM" is enabled (p9501.16 = 1), then this message value is output - also for a different hysteresis tolerance (p9547).
76: Stop response for SLS1 (p9563[0]).
77: Stop response for SLS2 (p9563[1]).
78: Stop response for SLS3 (p9563[2]).
79: Stop response for SLS4 (p9563[3]).
81: Velocity tolerance for SAM (p9548).
82: SGEs for SLS correction factor.
83: Acceptance test timer (p9558).
84: Transition time A01711 (p9555).
89: Encoder limit frequency.
230: Filter time constant for SSM.
231: Hysteresis tolerance for SSM.
232: Smoothed velocity actual value.
233: Limit value of SSM / safety monitoring clock cycle + hysteresis tolerance.
234: Limit value of SSM / safety monitoring clock cycle.
235: -Limit value of SSM / safety monitoring clock cycle.
236: -Limit value of SSM / safety monitoring clock cycle - hysteresis tolerance.
237: SGA SSM.
238: Speed limit value for SAM (p9568 or p9546).
239: Acceleration for SBR (p9581 and p9583).
240: Inverse value of acceleration for SBR (p9581 and p9583).
241: Deceleration time for SBR (p9582).
242: Function specification (p9506).
243: Function configuration (p9507).
247: SDI tolerance (p9564).
248: SDI positive upper limit (7FFFFFFF hex).
249: Position actual value (r9713[0/1]) - SDI tolerance (p9564).
250: Position actual value (r9713[0/1]) + SDI tolerance (p9564).
251: SDI negative lower limit (80000001 hex).
252: SDI stop response (p9566).
253: SDI delay time (p9565).
256: Status image of monitoring functions SOS, SLS, test stop, SBR, SDI (result list 1 ext) (r9710).
259: PROFIsafe telegram (p9611) is different between the monitoring channels.
261: Scaling factor for acceleration for SBR different.
262: Scaling factor for the inverse value of the acceleration for SBR different.
265: Status image of all change functions (results list 1) (r9710).
270: Screen form for SGE image: all functions, which are not supported/enabled for the actual parameterization (p9501, p9601 and p9506).
273: speed limit value for flattening the ramp for SAM/SBR different.
276: Limit value for SLA1 (p9578/p9378).
277: Stop response for SLA1 (p9579/p9379).
278: Upper limit value for SLA1.
279: Lower limit value for SLA1.
280: Upper limit value for SLA1 (fine resolution).
281: Lower limit value for SLA1 (fine resolution).
282: SLA filter time (p9576/p9376).
283: Acceleration actual value (fine resolution).
1000: Watchdog timer has expired. Too many signal changes have occurred at safety-relevant inputs.
1001: Initialization error of watchdog timer.

1005: STO already active for test stop selection.

1011: Acceptance test status between the monitoring channels differ.

1012: Plausibility violation of the encoder actual value.

1020: Cyc. communication failure between the monit. channels.

1021: Cyclic communication failure between the monitoring channel and encoder evaluation.

1022: Sign-of-life error for DRIVE-CLiQ encoders monitoring channel 1.

1023: Error in the effectiveness test in the DRIVE-CLiQ encoder

1032: Sign-of-life error for DRIVE-CLiQ encoders monitoring channel 2.

1033: Error checking offset between POS1 and POS2 for DRIVE-CLiQ encoder monitoring channel 1.

1034: Error checking offset between POS1 and POS2 for DRIVE-CLiQ encoder monitoring channel 2.

1035: offset between POS1 and POS2 for DRIVE-CLiQ encoder on one of the monitoring channels has changed since the last commissioning.

1039: Overflow when calculating the position.

5000 ... 5140:

PROFIsafe message values.

For these message values, the failsafe control signals (Failsafe Values) are transferred to the safety functions.

5000, 5014, 5023, 5024, 5030 ... 5032, 5042, 5043, 5052, 5053, 5068, 5072, 5073, 5082 ... 5087, 5090, 5091, 5122 ... 5125, 5132 ... 5135, 5140:

An internal software error has occurred (only for internal Siemens troubleshooting).

5012: Error when initializing the PROFIsafe driver.

5013: The result of the initialization is different for the two controllers.

5022: Error when evaluating the F parameters. The values of the transferred F parameters do not match the expected values in the PROFIsafe driver.

5025: The result of the F parameterization is different for the two controllers.

5026: CRC error for the F parameters. The transferred CRC value of the F parameters does not match the value calculated in the PST.

5065: A communications error was identified when receiving the PROFIsafe telegram.

5066: A time monitoring error (timeout) was identified when receiving the PROFIsafe telegram.

6000 ... 6166:

PROFIsafe message values (PROFIsafe driver for PROFIBUS DP V1/V2 and PROFINET).

For these message values, the failsafe control signals (Failsafe Values) are transferred to the safety functions. If "SS1 after failure of PROFIsafe communication" is parameterized (p9612), then transfer of the Failsafe Values is delayed.

The significance of the individual message values is described in safety fault F01611.

7000: Difference of the safe position higher than the parameterized tolerance (p9542).

7002: Cycle counter for transferring the safe position is different in both monitoring channels.

See also: p9555 (SI Motion transition time A01711 to SS1), r9725 (SI Motion diagnostics A01711)

Remedy: For message value = 0:
- no error was identified in this monitoring channel. Observe the error message of the other monitoring channel (A30711).

For message value = 3:
Commissioning phase:
- check encoder parameters, and if required, correct (p9516, p9517, p9518, p9520, p9521, p9522, p9526).

In operation:
- check the mechanical design and the encoder signals.

For message value = 232:
- increase the hysteresis tolerance (p9547). Possibly set the filtering higher (p9545).

For message value = 278, 279, 280, 281: - check whether the same acceleration limit has been set for both channels. A different result depends on whether SLA is enabled and not selected - or enabled and selected. In this case, another message value is possible.

For message value = 1 ... 999:
- if the message value is listed under cause: Check the cross-checked parameters to which the message value refers.
- copy safety parameters and confirm the data change (commissioning tool).
- carry out a POWER ON (switch off/switch on) or a warm restart (p0009 = 30, p0976 = 2, 3).
- upgrade the drive software.
- correction of the encoder evaluation. The actual values differ as a result of mechanical faults (V belts, travel to a mechanical endstop, wear and window setting that is too narrow, encoder fault, ...).

For message value = 1001:
- carry out a POWER ON (switch off/switch on) or a warm restart (p0009 = 30, p0976 = 2, 3).
- upgrade the drive software.

For message value = 1005:
- check the conditions for deselecting STO.

For message value = 1007:
- check the PLC for the correct operating state (run state, basic program).

For message value = 1011:
- for diagnostics, refer to parameter (r9571).

For message value = 1012:
- upgrade the encoder evaluation firmware to a newer version.
- check encoder parameters to ensure that they are the same (p9515, p9519, p9523, p9524, p9525, p9529).
- start the copy function for encoder parameters (commissioning tool).
- the parameterized encoder does not correspond to the connected encoder - replace the encoder.
- check the electrical cabinet design and cable routing for EMC compliance
- carry out a POWER ON (switch off/switch on) or a warm restart (p0009 = 30, p0976 = 2, 3).
- replace the hardware.

For message value = 1020, 1021:
- check the communication link.
- carry out a POWER ON (switch off/switch on) or a warm restart (p0009 = 30, p0976 = 2, 3).
- replace the hardware.

For message value = 1035, if the safety encoder was replaced:
- acknowledge hardware replacement.
- save all parameters
- acknowledge fault.

For message value = 1039:
- check the conversion factors such as spindle pitch or gearbox ratios.

For message value = 5000, 5014, 5023, 5024, 5030, 5031, 5032, 5042, 5043, 5052, 5053, 5068, 5072, 5073, 5082 ... 5087, 5090, 5091, 5122 ... 5125, 5132 ... 5135, 5140:
- carry out a POWER ON (switch off/switch on) or a warm restart (p0009 = 30, p0976 = 2, 3).
- upgrade firmware to later version.
- contact Technical Support.
- replace drive.

For message value = 5012:

- check the setting of the PROFIsafe address of the drive (p9610). It is not permissible for the PROFIsafe address to be 0 or FFFF!
- copy safety parameters and confirm the data change (commissioning tool).
- carry out a POWER ON (switch off/switch on) or a warm restart (p0009 = 30, p0976 = 2, 3).

For message value = 5013, 5025:

- carry out a POWER ON (switch off/switch on) or a warm restart (p0009 = 30, p0976 = 2, 3).
- check the setting of the PROFIsafe address of the drive (p9610).

For message value = 5022:

- check the setting of the values of the F parameters at the PROFIsafe slave (F_SIL, F_CRC_Length, F_Par_Version, F_Source_Add, F_Dest_add, F_WD_Time).

For message value = 5026:

- check the settings of the values of the F parameters and the F parameter CRC (CRC1) calculated from these at the PROFIsafe slave and update.

For message value = 5065:

- check the configuration and communication at the PROFIsafe slave (cons. No. / CRC).
- check the setting of the value for F parameter F_WD_Time on the PROFIsafe slave and increase if necessary.

For message value = 5066:

- check the setting of the value for F parameter F_WD_Time on the PROFIsafe slave and increase if necessary.
- evaluate diagnostic information in the F host.
- check PROFIsafe connection.

For message value = 6000 ... 6999:

See the description of the message values for fault F01611.

Note:

SAM: Safe Acceleration Monitor (safe acceleration monitoring)

SBR: Safe Brake Ramp (safe ramp monitoring)

SDI: Safe Direction (safe motion direction)

SI: Safety Integrated

SLS: Safely-Limited Speed

SOS: Safe Operating Stop

SS1: Safe Stop 1

SS2: Safe Stop 2

SSM: Safe Speed Monitor (safety-relevant feedback signal from the speed monitoring)

A01714 SI Motion P1: Safely-Limited Speed exceeded

Message class: Safety monitoring channel has identified an error (10)

Reaction: NONE

Acknowledge: NONE

Cause: The drive has moved faster than that specified by the velocity limit value (p9531). The drive is stopped by the configured stop response (p9563).

Message value (r2124, interpret decimal):

100: SLS1 exceeded.

200: SLS2 exceeded.

300: SLS3 exceeded.

400: SLS4 exceeded.

1000: Encoder limit frequency exceeded.

Remedy:

- check the traversing/motion program in the control.
- check limits for SLS and if required adapt accordingly (p9531).

Note:

SI: Safety Integrated

SLS: Safely-Limited Speed

See also: p9531 (SI Motion SLS limit values), p9563 (SI Motion SLS-specific stop response)

A01716 SI Motion P1: Tolerance for safe motion direction exceeded

Message class: Safety monitoring channel has identified an error (10)

Reaction: NONE

Acknowledge: NONE

Cause: The tolerance for the "safe motion direction" function was exceeded. The drive is stopped by the configured stop response (p9566).
Message value (r2124, interpret decimal):
0: Tolerance for function "safe motion direction positive" exceeded.
1: Tolerance for function "safe motion direction negative" exceeded.

Remedy: - check the traversing/motion program in the control.
- check the tolerance for "SDI" function and if required, adapt (p9564).
This message can be acknowledged as follows:
Deselect/select SDI and perform safe acknowledgment via PROFIsafe.
Note:
SDI: Safe Direction (safe motion direction)
SI: Safety Integrated
See also: p9564 (SI Motion SDI tolerance), p9565 (SI Motion SDI delay time), p9566 (SI Motion SDI stop response)

A01730 SI Motion P1: Reference block for dynamic Safely-Limited Speed invalid

Message class: Safety monitoring channel has identified an error (10)

Reaction: NONE

Acknowledge: NONE

Cause: The reference block transferred via PROFIsafe is negative.
A reference block is used to generate a referred velocity limit value based on the reference quantity "Velocity limit value SLS1" (p9531[0]).
The drive is stopped by the configured stop response (p9563[0]).
Message value (r2124, interpret decimal):
requested, invalid reference block.

Remedy: In the PROFIsafe telegram, input data S_SLS_LIMIT_IST must be corrected.
Note:
SI: Safety Integrated
SLS: Safely-Limited Speed

A01750 SI Motion P1: Hardware fault safety-relevant encoder

Message class: Hardware/software error (1)

Reaction: NONE

Acknowledge: NONE

Cause: The encoder that is used for the safety-relevant motion monitoring functions signals a hardware fault.
Message value (r2124, interpret decimal):
Encoder status word 1, encoder status word 2 that resulted in the message.

Remedy: - check the encoder connection.
- replace encoder.

A01751 SI Motion P1: Effectivity test fault safety-relevant encoder

Message class: Safety monitoring channel has identified an error (10)

Reaction: NONE

Acknowledge: NONE

Cause: The DRIVE-CLiQ encoder for safe motion monitoring signals an error for the effectivity tests.
Message value (r2124, interpret decimal):
Only for internal Siemens troubleshooting.

Remedy: - check the encoder connection.
- replace encoder.
Note:
This message can be acknowledged via PROFIsafe (safe acknowledgment).

A01780 SBT When selected, the brake is closed

Message class: Safety monitoring channel has identified an error (10)
Reaction: NONE
Acknowledge: NONE
Cause: When selecting the brake test or starting the brake test, the brake was not open.
Alarm value (r2124, interpret binary):
Bit 0 = 1:
The internal brake is closed.
Note:
The alarm is also signaled if no brake is configured in p10202.
SBT: Safe Brake Test
See also: p10202 (SI Motion SBT brake)
Remedy: Open the brake and reselect the brake test.

A01781 SBT brake opening time exceeded

Message class: Safety monitoring channel has identified an error (10)
Reaction: NONE
Acknowledge: NONE
Cause: The maximum time (11 s) to open the brake during the brake test was exceeded.
Possible causes:
- during the brake test the drive went into a fault condition, and therefore the brake was closed by the drive.
Alarm value (r2124, interpret binary):
Bit 0 = 1:
Internal brake was not able to be opened.
Note:
SBT: Safe Brake Test
Remedy: - carry out a safe acknowledgment.
- restart the brake test.

A01782 SBT brake test incorrect control

Message class: Safety monitoring channel has identified an error (10)
Reaction: NONE
Acknowledge: NONE

Cause: The brake test was canceled as a result of incorrect control.
Alarm value (r2124, interpret binary):
Alarm value 0:
The brake test was canceled as a result of a fault (brake opening time or brake closing time exceeded).
Bit 0:
The safe brake test was canceled by resetting the brake test selection.
Bit 1:
The safe brake test was canceled by resetting the brake test start.
Bit 2:
The brake is not configured in configured p10202.
There is a brake test configuration error. In this case, alarm A01785 is also output.
Note:
SBT: Safe Brake Test
See also: p10202 (SI Motion SBT brake)

Remedy: - check parameterization of the brake test (p10202).
- check as to whether alarm A01785 is present, and if so, evaluate.
- carry out a safe acknowledgment.
- if required, restart the brake test.

A01783 SBT brake closing time exceeded

Message class: Safety monitoring channel has identified an error (10)

Reaction: NONE

Acknowledge: NONE

Cause: The maximum time (11 s) to close the brake during the brake test was exceeded.
Alarm value (r2124, interpret binary):
Bit 0 = 1:
The brake was not able to be closed.
Note:
SBT: Safe Brake Test

Remedy: - when using an internal brake with external feedback signal, check whether the feedback signal is correctly interconnected with the extended brake control.
- carry out a safe acknowledgment.
- restart the brake test.

A01784 SBT brake test canceled with fault

Message class: Safety monitoring channel has identified an error (10)

Reaction: NONE

Acknowledge: NONE

Cause: The safe brake test was canceled as a result of a fault.
Alarm value (r2124, interpret binary):
Bit 17 = 1: fault in the brake test sequence (cause, see bits 0 ... 10).
Bit 20 = 1: the brake is not opened (p10202).
Bit 21 = 1: axis position during the brake test not valid due to parking axis.
Bit 22 = 1: internal software error.
Bit 23 = 1: the permissible position range of the axis was violated with the brake closed (p10212/p10222).
Bit 24 = 1: the tested internal brake was opened while the brake test was active.
Bit 26 = 1: during the active brake test, the test torque left its tolerance bandwidth (20 %).
Cause for alarm value bit 17:
Bit 0 = 1: operation when selecting the brake test not enabled (r0899.2 = 0).
Bit 1 = 1: external fault occurred (e.g. the brake test that has already started is canceled by the user).
Bit 2 = 1: when selecting the brake test a brake is closed.
Bit 3 = 1: when determining the load torque a brake is closed.
Bit 4 = 1: A fault has occurred with stop response (e.g. OFF1, OFF2 or OFF3) - or the pulse enable was withdrawn (e.g. STO selected or operation no longer enabled).
Bit 5 = 1: when selecting the brake test the axis speed setpoint is too high.
Bit 6 = 1: the actual speed (r0063) of the axis is too high (e.g. brake does not hold during the brake test).
Bit 8 = 1: closed-loop control not enabled or function generator active.
Bit 9 = 1: control does not switch over to the brake test (e.g. because PI speed control has not been parameterized).
Bit 10 = 1: torque limit reached (r1407.7, r1408.8).
Note:
SBT: Safe Brake Test

Remedy: - remove the fault cause.
- carry out a safe acknowledgment.
- if required, restart the brake test.
For bit 17 = 1 with bit 6 = 1 or bit 23 = 1:
If the brake closing time of the motor holding brake (p1217) has been set too low, then at the start of the brake test, the brake is closed too late. The brake closing time should be adapted (p1217).

A01785 SBT brake test configuration error

Message class: Safety monitoring channel has identified an error (10)

Reaction: NONE

Acknowledge: NONE

Cause: Error when parameterizing the brake test.
In this configuration, the brake test cannot be started or cannot be started without error.
Alarm value (r2124, interpret decimal):
1:
No motion monitoring functions have been enabled.
4:
No brake was configured (p10202).
8:
The brake test is configured for an internal brake, however the safety brake control is not enabled (p9602).
16:
The safe brake test and safety without encoder are simultaneously enabled (p9506). This is not permissible.
Note:
SBT: Safe Brake Test

Remedy: Check parameterization of the brake test.

A01788 SI: Automatic test stop waits for STO deselection via motion monitoring functions

Message class: Safety monitoring channel has identified an error (10)

Reaction: NONE
Acknowledge: NONE
Cause: The automatic test stop (forced checking procedure) was not able to be carried out after powering up.
Possible causes:
- the STO function is selected via safe motion monitoring functions.
- a safety message is present, that resulted in a STO.
Note:
STO: Safe Torque Off
Remedy:
- deselect STO via safe motion monitoring functions.
- remove the cause of the safety messages and acknowledge the messages.
Note:
The automatic test stop is performed after removing the cause.

A01796 SI P1: Wait for communication

Message class: Communication error to the higher-level control system (9)
Reaction: NONE
Acknowledge: NONE
Cause: The drive waits for communication to be established to execute the safety-relevant motion monitoring functions.
Note:
STO is active in this state.
Alarm value (r2124, interpret decimal):
3: Wait for communication to be established to PROFIsafe F-Host.
Remedy: If the message is not automatically withdrawn after a longer period of time, then carry out the following checks:
- check any other PROFIsafe communication messages/signals present and evaluate them.
- check the operating state of the F-Host.
- check the communication connection to the F Host.
Note:
STO: Safe Torque Off
See also: p9601 (SI enable, functions integrated in the drive)

A01798 SI Motion P1: Test stop for motion monitoring functions running

Message class: Safety monitoring channel has identified an error (10)
Reaction: NONE
Acknowledge: NONE
Cause: The forced checking procedure (test stop) for the safe motion monitoring functions is currently in progress.
Remedy: Not necessary.
The message is automatically withdrawn when the test stop has been completed.
Note:
SI: Safety Integrated

A01799 SI Motion P1: Acceptance test mode active

Message class: Safety monitoring channel has identified an error (10)
Reaction: NONE
Acknowledge: NONE
Cause: The acceptance test mode is active.
This means that the setpoint speed limiting is deactivated (r9733).
Remedy: Not necessary.
The message is automatically withdrawn when exiting the acceptance test mode.
Note:
SI: Safety Integrated

F01800 DRIVE-CLiQ: Hardware/configuration error

Message class: Internal (DRIVE-CLiQ) communication error (12)

Reaction: NONE

Acknowledge: IMMEDIATELY

Cause: A DRIVE-CLiQ connection fault has occurred.
Fault value (r0949, interpret decimal):
100 ... 107:
Communication via DRIVE-CLiQ socket X100 ... X107 has not been switched to cyclic operation. The cause may be an incorrect structure or a configuration that results in an impossible bus timing.
10:
Loss of the DRIVE-CLiQ connection. The cause may be, for example, that the DRIVE-CLiQ cable was withdrawn from the Control Unit or as a result of a short-circuit for motors with DRIVE-CLiQ. This fault can only be acknowledged in cyclic communication.
11:
Repeated faults when detecting the connection. This fault can only be acknowledged in cyclic communication.
12:
A connection was detected but the node ID exchange mechanism does not function. The reason is probably that the component is defective. This fault can only be acknowledged in cyclic communication.

Remedy: For fault value = 100 ... 107:
- ensure that the DRIVE-CLiQ components have the same firmware versions.
- avoid longer topologies for short current controller sampling times.

For fault value = 10:
- check the DRIVE-CLiQ cables at the Control Unit.
- remove any short-circuit for motors with DRIVE-CLiQ.
- carry out a POWER ON.

For fault value = 11:
- check the electrical cabinet design and cable routing for EMC compliance

For fault value = 12:
- replace the component involved.

A01839 DRIVE-CLiQ diagnostics: cable fault to the component

Message class: General drive fault (19)

Reaction: NONE

Acknowledge: NONE

Cause: The fault counter (r9936[0...199]) to monitor the DRIVE-CLiQ connections/cables has been incremented.
Alarm value (r2124, interpret decimal):
Component number.
Note:
The component number specifies the component whose feeder cable from the direction of the Control Unit is faulted.
The alarm is automatically withdrawn after 5 seconds, assuming that no other data transfer error has occurred.

Remedy:
- check the corresponding DRIVE-CLiQ cables.
- check the electrical cabinet design and cable routing for EMC compliance

A01900 PN: Configuration telegram error

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: NONE

Acknowledge: NONE

Cause: A controller attempts to establish a connection using an incorrect configuring telegram.
Alarm value (r2124, interpret decimal):
1:
Connection established to more drive objects than configured in the device. The drive objects for process data exchange and their sequence are defined in p0978.
2:
Too many PZD data words for output or input to a drive object. The number of possible PZD items in a drive object is determined by the number of indices in r2050/p2051.
3:
Uneven number of bytes for input or output.
4:
Setting data for synchronization not accepted. For more information, see A01902.
211:
Unknown parameterizing block.
223:
Clock synchronization for the PZD interface set in p8815[0] is not permissible.
More than one PZD interface is operated in clock synchronism.
253:
PN Shared Device: Illegal mixed configuration of PROFIsafe and PZD.
254:
PN Shared Device: Illegal double assignment of a slot/subslot.
255:
PN: Configured drive object and existing drive object do not match.
256:
PN: configured telegram cannot be set.
257:
PN Shared Device: Too many PZD data words for the output or input in the overall device.
500:
Illegal PROFIsafe configuration for the interface set in p8815[1].
More than one PZD interface is operated with PROFIsafe.
501:
PROFIsafe parameter error (e.g. F_dest).
502:
PROFIsafe telegram does not match.
503:
PROFIsafe connection is rejected as long as there is no isochronous connection (p8969).
Additional values:
Only for internal Siemens troubleshooting.

Remedy: Check the bus configuration on the master and the slave sides.
For alarm value = 1, 2:
- check the list of the drive objects with process data exchange (p0978).
Note:
With p0978[x] = 0, all of the following drive objects in the list are excluded from the process data exchange.
For alarm value = 2:
- check the number of data words for output and input to a drive object.
For alarm value = 211:
- Ensure offline version <= online version.
For alarm value = 223, 500:
- check the setting in p8839 and p8815.
- check for inserted but not configured CBE20.
- ensure that only one PZD interface is operated in clock synchronism or with PROFIsafe.
For alarm value = 255:
- check configured drive objects.
For alarm value = 256:
- check the configured telegram.
For alarm value = 257:
- check the number of data words for output and input to the complete device.
For alarm value = 501:
- check the set PROFIsafe address (p9610).
For alarm value = 502:
- check the set PROFIsafe telegram (p60022, p9611).

A01902 PN: clock cycle synchronous operation parameterization not permissible

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: NONE

Acknowledge: NONE

Cause: Parameterization for isochronous operation is not permissible.
Alarm value (r2124, interpret decimal):
0: Bus cycle time Tdp < 0.5 ms.
1: Bus cycle time Tdp > 32 ms.
2: Bus cycle time Tdp is not an integer multiple of the current controller sampling time.
3: Instant of the actual value sensing Ti > Bus cycle time Tdp or Ti = 0.
4: Instant of the actual value sensing Ti is not an integer multiple of the current controller sampling time.
5: Instant of the setpoint acceptance To >= Bus cycle time Tdp or To = 0.
6: Instant of the setpoint acceptance To is not an integer multiple of the current controller sampling time.
7: Master application cycle time Tmapc is not an integer multiple of the speed controller sampling time.
8: Bus reserve bus cycle time Tdp - data exchange time Tdx less than two current controller sampling times.
10: Instant of the setpoint acceptance To <= data exchange time Tdx + current controller sampling time
11: Master application cycle time Tmapc > 14 x Tdp or Tmapc = 0.
12: PLL tolerance window Tpll_w > Tpll_w_max.
13: Bus cycle time Tdp is not a multiple of all basic clock cycles p0110[x].
16: For COMM BOARD, the instant in time for the actual value sensing Ti is less than two current controller sampling times.

Remedy: - Adapt the bus parameterization Tdp, Ti, To.
- adapt the sampling time for the current controller or speed controller.
For alarm value = 10:
- reduce Tdx by using fewer bus participants or shorter telegrams.
Note:
PN: PROFINET

F01910	**Fieldbus: setpoint timeout**
Message class:	Communication error to the higher-level control system (9)
Reaction:	OFF3
Acknowledge:	IMMEDIATELY
Cause:	The reception of setpoints from the fieldbus interface (onboard, PROFIBUS/PROFINET/USS) has been interrupted. - bus connection interrupted. - controller switched off. - controller set into the STOP state.
Remedy:	Restore the bus connection and set the controller to RUN. Note regarding PROFIBUS slave redundancy: For operation on a Y link, it must be ensured that "DP alarm mode = DPV1" is set in the slave parameterization.

F01911	**PN: Clock synchronous operation, clock cycle failure**
Message class:	Communication error to the higher-level control system (9)
Reaction:	OFF1
Acknowledge:	IMMEDIATELY
Cause:	The global control telegram to synchronize the clock cycles has failed - in cyclic operation - for several DP clock cycles or has violated the time grid specified in the parameterizing telegram over several consecutive DP clock cycles (refer to the bus cycle time, Tdp and Tpllw).
Remedy:	- check the physical bus configuration (cable, connector, terminating resistor, shielding, etc.). - check whether communication was briefly or permanently interrupted. - check the utilization level of the bus and controller (e.g. bus cycle time Tdp was set too short). Note: PN: PROFINET

F01912	**PN: Clock synchronous operation sign-of-life missing**
Message class:	Communication error to the higher-level control system (9)
Reaction:	OFF1
Acknowledge:	IMMEDIATELY
Cause:	The maximum permissible number of errors in the controller sign-of-life (clock synchronous operation) has been exceeded in cyclic operation.
Remedy:	- physically check the bus (cables, connectors, terminating resistor, shielding, etc.). - correct the interconnection of the controller sign-of-life (p2045). - check whether the controller correctly sends the sign-of-life (e.g. create a trace with STW2.12 ... STW2.15 and trigger signal ZSW1.3). - check the permissible telegram failure rate (p0925). - check the utilization level of the bus and controller (e.g. bus cycle time Tdp was set too short). Note: PN: PROFINET

A01932	**PN: clock cycle synchronization missing for DSC**
Message class:	Error in the parameterization / configuration / commissioning procedure (18)
Reaction:	NONE
Acknowledge:	NONE
Cause:	There is no clock synchronization or clock synchronous sign of life and DSC is selected. Note: DSC: Dynamic Servo Control See also: r0922 (PROFIdrive PZD telegram selection)
Remedy:	Set clock synchronization across the bus configuration and transfer clock synchronous sign-of-life.

A01940 PN: Clock cycle synchronism not reached

Message class: Communication error to the higher-level control system (9)

Reaction: NONE

Acknowledge: NONE

Cause: The bus is in the data exchange state and clock synchronous operation has been selected using the parameterizing telegram. It was not possible to synchronize to the clock cycle specified by the master.
- the master does not send a clock synchronous global control telegram although clock synchronous operation was selected when configuring the bus.
- the master is using an isochronous DP clock cycle that is different than was transferred to the slave in the parameterizing telegram.
- at least one drive object has a pulse enable (also not controlled from PROFINET).

Remedy: - check the master application and bus configuration.
- check the consistency between the clock cycle input when configuring the slave and clock cycle setting at the master.
- check that no drive object has a pulse enable. Only enable the pulses after synchronizing the PROFINET drives.

Note:
PN: PROFINET

A01941 PN: Clock cycle signal missing when the bus is being established

Message class: Communication error to the higher-level control system (9)

Reaction: NONE

Acknowledge: NONE

Cause: The bus is in the data exchange state and clock synchronous operation has been selected using the parameterizing telegram. The global control telegram for synchronization is not being received.

Remedy: Check the master application and bus configuration.

Note:
PN: PROFINET

A01943 PN: Clock cycle signal error when the bus is being established

Message class: Communication error to the higher-level control system (9)

Reaction: NONE

Acknowledge: NONE

Cause: The bus is in the data exchange state and clock synchronous operation has been selected using the parameterizing telegram.
The global control telegram for synchronization is being irregularly received.
-.the master is sending an irregular global control telegram.
- the master is using another clock synchronous DP clock cycle than was transferred to the slave in the parameterizing telegram.

Remedy: - check the master application and bus configuration.
- check the consistency between the clock cycle input when configuring the slave and clock cycle setting at the master.

Note:
PN: PROFINET

A01944 PN: Sign-of-life synchronism not reached

Message class: Communication error to the higher-level control system (9)

Reaction: NONE

Acknowledge: NONE

Cause: The bus is in the data exchange state and clock synchronous operation has been selected using the parameterizing telegram.
Synchronization with the master sign-of-life (STW2.12 ... STW2.15) could not be completed because the sign-of-life is changing differently to how it was configured in the Tmapc time grid.

Remedy: - ensure that the master correctly increments the sign-of-life in the master application clock cycle Tmapc.
- correct the interconnection of the master sign-of-life (p2045).
Note:
PN: PROFINET

F01950 PN: Clock synchronous operation, synchronization unsuccessful

Message class: Communication error to the higher-level control system (9)
Reaction: OFF1
Acknowledge: IMMEDIATELY
Cause: Synchronization of the internal clock cycle to the global control telegram has failed. The internal clock cycle exhibits an unexpected shift.
Remedy: Only for internal Siemens troubleshooting.
Note:
PN: PROFINET

A01980 PN: cyclic connection interrupted

Message class: Communication error to the higher-level control system (9)
Reaction: NONE
Acknowledge: NONE
Cause: The cyclic connection to the PROFINET controller is interrupted.
See also: r8936 (Cyclic connection status)
Remedy: Establish the PROFINET connection and activate the PROFINET controller in the cyclic mode.

A01981 PN: Maximum number of controllers exceeded

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: NONE
Acknowledge: NONE
Cause: A controller attempts to establish a connection to the drive, and as a consequence exceeds the permitted number of PROFINET connections.
The alarm is automatically withdrawn after approx. 30 seconds.
Alarm value (r2124, interpret hexadecimal):
yyyyxxxx hex: yyyy = info. 1, xxxx = info. 2
Info 1 = 0: number of RT connections exceeded
Info 1 > 0: number of IRT connections exceeded
Info 2: permitted number of connections
Remedy: Check the configuration of the PROFINET controllers.

A01989 PN: internal cyclic data transfer error

Message class: Communication error to the higher-level control system (9)
Reaction: NONE
Acknowledge: NONE
Cause: The cyclic actual values and/or setpoints were not transferred within the specified times.
Alarm value (r2124, interpret hexadecimal):
Only for internal Siemens troubleshooting.
Remedy: Correctly set T_io_input or T_io_output.

A02007 Function generator: Drive not SERVO / VECTOR / DC_CTRL

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: NONE
Acknowledge: NONE

Cause: The drive object specified for connection is not a SERVO / VECTOR or DC_CTRL.
Remedy: Use a SERVO / VECTOR / DC_CTRL drive object with the corresponding number.
Note:
The alarm is reset as follows:
- remove the cause of this alarm.
- restart the function generator.

F03001 NVRAM checksum incorrect

Message class: Hardware/software error (1)
Reaction: NONE
Acknowledge: IMMEDIATELY
Cause: A checksum error occurred when evaluating the non-volatile data (NVRAM) on the Control Unit.
The NVRAM data affected was deleted.
Remedy: Carry out a POWER ON (switch-off/switch-on) for all components.

A05000 Power unit: Overtemperature heat sink AC inverter

Message class: Power electronics faulted (5)
Reaction: NONE
Acknowledge: NONE
Cause: The alarm threshold for overtemperature at the inverter heat sink has been reached. The response is set using p0290.
If the heat sink temperature exceeds the value set in p0292[0], then fault F30004 is output.
Remedy: Check the following:
- is the ambient temperature within the defined limit values?
- have the load conditions and the load duty cycle been appropriately dimensioned?
- has the cooling failed?

A05001 Power unit: Overtemperature depletion layer chip

Message class: Power electronics faulted (5)
Reaction: NONE
Acknowledge: NONE
Cause: Alarm threshold for overtemperature of the power semiconductor in the AC converter has been reached.
Note:
- the response is set using p0290.
- if the temperature of the barrier layer increases by the value set in p0292[1], then fault F30025 is initiated.
Remedy: Check the following:
- is the ambient temperature within the defined limit values?
- have the load conditions and the load duty cycle been appropriately dimensioned?
- has the cooling failed?
- pulse frequency too high?
See also: r0037 (Drive temperatures)

A05003 Power unit: Internal overtemperature

Message class: Power electronics faulted (5)
Reaction: NONE
Acknowledge: NONE
Cause: The alarm threshold for internal overtemperature has been reached.
If the temperature inside the power unit increases by an additional 5 K, then fault F30036 is triggered.
Remedy: Check the following:
- is the ambient temperature within the defined limit values?
- has the fan failed? Check the direction of rotation.

A05006 Power unit: Overtemperature thermal model

Message class: Power electronics faulted (5)

Reaction: NONE

Acknowledge: NONE

Cause: The temperature difference between the chip and heat sink has exceeded the permissible limit value (blocksize power units only).
Depending on p0290, an appropriate overload response is initiated.
See also: r0037 (Drive temperatures)

Remedy: Not necessary.
This alarm is automatically withdrawn once the limit value has been fallen below.
Note:
If the alarm is not automatically withdrawn and the temperature continues to rise, this can result in fault F30024.

F06310 Supply voltage (p0210) incorrectly parameterized

Message class: Network fault (2)

Reaction: NONE

Acknowledge: IMMEDIATELY

Cause: For AC/AC drive units, the measured DC voltage lies outside the tolerance range after precharging has been completed.
The following applies for the tolerance range: 1.16 * p0210 < r0070 < 1.6 * p0210
Note:
The fault can only be acknowledged when the drive is switched off.
See also: p0210 (Drive unit line supply voltage)

Remedy: - check the parameterized supply voltage and if required change (p0210).
- check the line supply voltage.
See also: p0210 (Drive unit line supply voltage)

F07011 Drive: Motor overtemperature

Message class: Motor overload (8)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: The calculated motor temperature is too high.
Possible causes:
- motor overloaded.
- motor ambient temperature too high.
- sensor wire breakage
Fault value (r0949, interpret decimal):
200:
Motor temperature model 1 (I2t): temperature too high.
300:
Motor temperature model 3: after the monitoring time has expired, the temperature is still higher than the alarm threshold.
301:
Motor temperature model 3: temperature is too high, or the model has not been parameterized.
302:
Motor temperature model 3: Encoder temperature is not within the valid range.

Remedy: - reduce the motor load.
- check the ambient temperature and the motor ventilation.
- check the wiring and temperature sensor connection.
- check monitoring limits.

A07012 Drive: Motor temperature model 1/3 overtemperature

Message class: Motor overload (8)

Reaction: NONE

Acknowledge: NONE

Cause: The motor temperature model 1/3 identified that the alarm threshold was exceeded.
Hysteresis:2K
Alarm value (r2124, interpret decimal):
200:
Motor temperature model 1 (I2t): temperature too high.
300:
Motor temperature model 3: temperature too high.
See also: r0034 (Motor utilization thermal), p0613 (Motor temperature model ambient temperature)

Remedy: - check the motor load and if required, reduce.
- check the motor ambient temperature.
See also: r0034 (Motor utilization thermal)

F07085 Drive: Open-loop/closed-loop control parameters changed

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: NONE

Acknowledge: IMMEDIATELY

Cause: Open-loop/closed-loop control parameters have had to be changed.
Possible causes:
1. As a result of other parameters, they have exceeded the dynamic limits.
2. They cannot be used due to the fact that the hardware detected not having certain features.
3. The value is estimated as the thermal time constant is missing.
4. Motor temperature model 1 is activated as thermal motor protection is missing.
See also: p1082 (Maximum speed)

Remedy: Not necessary.
It is not necessary to change the parameters as they have already been correctly limited.

A07091 Drive: determined current controller dynamic response invalid

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: NONE

Acknowledge: NONE

Cause: When one button tuning is activated (p5300 = 1), the current controller is measured after the pulses have been enabled. Evaluation has indicated that the current control loop was not appropriately set.
Possible causes:
- incorrectly set current controller.
- PRBS amplitude set too high (p5296).
Alarm value (r2124, interpret hexadecimal):
1: Dynamic response too low.
2: Current controller unstable.
Note:
PRBS: Pseudo Random Binary Signal (binary noise)

Remedy: - the measurement can be repeated with a smaller excitation amplitude (p5296).
- if required, adapt the current controller proportional gain (p1715).

A07092 Drive: moment of inertia estimator still not ready

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: NONE

Acknowledge: NONE

Cause: The moment of inertia estimator has still not determined any valid values.
The acceleration cannot be calculated.
The moment of inertia estimator has stabilized, if the frictional values (p1563, p1564) as well as the moment of inertia value (p1493) have been determined and the appropriate status signal is set (r1407.26 = 1).
The following parameters influence the response of the moment of the inertia estimator:
p1560, p1561, p1562

Remedy: Traverse the axis until the moment of inertia estimator has stabilized.
This alarm is automatically withdrawn after the moment of inertia estimator has stabilized.

F07093 Drive: Test signal error

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: OFF3

Acknowledge: IMMEDIATELY

Cause: An error was identified when executing the "Test signal" function.
The function was not executed or was canceled.
Fault value (r0949, interpret decimal):
1: No distance limit has been defined (p5308 = 0).
2: The moment of inertia estimator has not stabilized in the parameterized time (p5309) (r1407.26).
3: The parameterized distance (p5308) was exceeded.
4: no motor encoder parameterized (closed-loop speed control without encoder).
5: Offset (p5297) is too high for the parameterized distance (p5308).
6: Pulse enable was withdrawn while traversing.
7: speed setpoint not equal to zero.
See also: p5308 (One Button Tuning distance limiting), p5309 (One Button Tuning duration)

Remedy: For fault value = 1:
- Define distance limiting (p5308).
For fault value = 2:
- increase the duration or distance limiting (p5309, p5308).
For fault value = 3:
- check distance limiting (p5308).
For fault value = 4:
- configure speed control with encoder.
For fault value = 5:
- increase distance limit p5308 or reduce offset p5297.
- the fault can only be acknowledged after p5300 was set = 0.
- for the factory setting, a test signal duration of approximately 1.3 s is obtained. If an offset (p5297) of 60 rpm is set, for example, then this results in a distance of approximately 1.3 revolutions. As a consequence, a value must be parameterized in parameter p5308, which is longer than this distance + 10% controller reserve (e.g. p5308=515°). Further, the distance depends on the speed controller sampling time (p0115[1]) and the controller configuration (p5271).
For fault value = 6:
- keep the drive switched on until the "Test signal" function has been completely exited.
For fault value = 7:
- set the speed setpoint to zero. It is possible that the setpoint was entered from the control panel.

A07094 General parameter limit violation

Message class: Hardware/software error (1)

Reaction: NONE

Acknowledge: NONE

Cause: As a result of the violation of a parameter limit, the parameter value was automatically corrected.
Minimum limit violated --> parameter is set to the minimum value.
Maximum limit violated --> parameter is set to the maximum value.
Alarm value (r2124, interpret decimal):
Parameter number, whose value had to be adapted.
Remedy: Check the adapted parameter values and if required correct.

A07095 Drive: One Button Tuning activated

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: NONE
Acknowledge: NONE
Cause: The One Button Tuning function is active.
One Button Tuning is performed at the next switch-on command.
See also: p5300 (One Button Tuning selection)
Remedy: Not necessary.
The alarm is automatically withdrawn after One Button Tuning has been exited (p5300 = 0).

F07097 Drive: Test signal error distance limiting

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: OFF3
Acknowledge: IMMEDIATELY
Cause: An error was identified when executing the "Test signal" function or auto tuning was selected (p5300 = 1).
The function was not executed or was canceled.
Fault value (r0949, interpret decimal):
yyyyxxxx hex: yyyy = error cause, xxxx = traversing distance
Fault cause = 4:
- travel distance to the EPOS software limit switch is not sufficient.
See also: p5308 (One Button Tuning distance limiting), p5309 (One Button Tuning duration)
Remedy: - enter the traversing path in parameter p5308 - or deselect the function involved in p5301.
- for fault cause = 1, 2, shorter traversing paths may be possible.
For fault cause = 1:
- deselect bit 0 and bit 1 in parameter p5301.
For fault cause = 2:
- deselect bit 2 in parameter p5301.
For fault cause = 3:
- deselect bit 4 and bit 5 in parameter p5301.
For fault cause = 4:
- change the travel direction of One Button Tuning via p5308.
- increase the clearance to the EPOS software limit switch by manually traversing.

A07200 Drive: Master control ON command present

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: NONE
Acknowledge: NONE
Cause: The ON/OFF1 command is present (no 0 signal).
The command is either influenced via binector input p0840 (current CDS) or control word bit 0 via the master control.
Remedy: Switch the signal via binector input p0840 (current CDS) or control word bit 0 via the master control to 0.

F07220 Drive: Master control by PLC missing

Message class: Communication error to the higher-level control system (9)

Reaction: OFF1
Acknowledge: IMMEDIATELY
Cause: The "master control by PLC" signal was missing in operation.
- interconnection of the binector input for "master control by PLC" is incorrect (p0854).
- the higher-level control has withdrawn the "master control by PLC" signal.
- data transfer via the fieldbus (master/drive) was interrupted.

Remedy:
- check the interconnection of the binector input for "master control by PLC" (p0854).
- check the "master control by PLC" signal and, if required, switch in.
- check the data transfer via the fieldbus (master/drive).

Note:
If the drive should continue to operate after withdrawing "master control by PLC" then fault response must be parameterized to NONE or the message type should be parameterized as alarm.

F07334 Function not possible

Message class: Application/technological function faulted (17)
Reaction: OFF1
Acknowledge: IMMEDIATELY
Cause: For this configuration, the selected function is not possible.
Fault value (r0949, interpret decimal):
0:
Function "Travel to fixed end stop" (p1545) was selected, although encoderless operation or U/f operation is active.

Remedy: For fault value = 0:
- Operate the closed-loop speed control with an encoder.
- If necessary, deselect function "Travel to fixed stop".

F07410 Drive: Current controller output limited

Message class: Application/technological function faulted (17)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: The condition "I_act = 0 and Uq_set_1 longer than 16 ms at its limit" is present and can be caused by the following:
- motor not connected or motor contactor open.
- no DC link voltage present.
- Motor Module defective.

Remedy:
- connect the motor or check the motor contactor.
- check the DC link voltage (r0070).
- check the Motor Module.

F07412 Drive: Commutation angle incorrect (motor model)

Message class: Actual position/speed value incorrect or not available (11)
Reaction: ENCODER
Acknowledge: IMMEDIATELY

Cause: An incorrect commutation angle was detected that can result in a positive coupling in the speed controller.
Possible causes:
- the phase sequence of the output phases for the motor is incorrect (e.g. the phases are interchanged).
- the motor encoder is incorrectly adjusted with respect to the magnet position.
- the motor encoder is damaged.
- the angular commutation offset is incorrectly set (p0431).
- data to calculate the motor model has been incorrectly set (p0356 (motor-stator leakage inductance) and/or p0350 (motor-stator resistance) and/or p0352 (cable resistance)).
- the changeover speed for the motor model is too low (p1752). The monitoring function only becomes effective above the changeover speed.
- pole position identification might have calculated an incorrect value when activated (p1982 = 1).
- the motor encoder speed signal is faulted.
- the control loop is instable due to incorrect parameterization.

Fault value (r0949, interpret decimal):
SERVO:
0: The comparison of the pole position angle from the encoder and motor model resulted in an excessively high value (p1778[1] > 80 ° electrical).
1: -
VECTOR:
0: The comparison of the pole position angle from the encoder and motor model resulted in an excessively high value (> 45 ° electrical).
1: The change in the speed signal from the motor encoder has changed by > p0492 within a current controller clock cycle.

Remedy:
- check the phase sequence for the motor, and if required, correct (wiring, p1820).
- if the encoder mounting was changed - re-adjust the encoder.
- replace the defective motor encoder.
- correctly set the angular commutation offset (p0431). If required, determine using p1990.
- correctly set the motor stator resistance, cable resistance and motor-stator leakage inductance (p0350, p0352, p0356).

Calculate the cable resistance from the cross-section and length, check the inductance and stator resistance using the motor data sheet, measure the stator resistance, e.g. using a multimeter - and if required, again identify the values using the stationary motor data identification (p1910).
- increase the changeover speed for the motor model (p1752). The monitoring is completely deactivated for p1752 > p1082 (maximum speed).
- with pole position identification activated (p1982 = 1) check the procedure for pole position identification (p1980) and force a new pole position identification procedure by means of deselection followed by selection (p1982 = 0 -> 1).

Note:
For High Dynamic Motors (1FK7xxx-7xxx), for applications with a higher current, if necessary, the monitoring should be disabled.

F07414 Drive: Encoder serial number changed

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: ENCODER
Acknowledge: IMMEDIATELY

Cause: The serial number of the motor encoder of a synchronous motor has changed. The change was only checked for encoders with serial number (e.g. EnDat encoders) and build-in motors (e.g. p0300 = 401) or third-party motors (p0300 = 2).
Cause 1:
- the encoder was replaced.
Cause 2:
- a third-party, built-in or linear motor was re-commissioned.
Cause 3:
- the motor with integrated and adjusted encoder was replaced.
Cause 4:
- the firmware was updated to a version that checks the encoder serial number.
Note:
With closed-loop position control, the serial number is accepted when starting the adjustment (p2507 = 2).
When the encoder is adjusted (p2507 = 3), the serial number is checked for changes and if required, the adjustment is reset (p2507 = 1).
Proceed as follows to hide serial number monitoring:
- set the following serial numbers for the corresponding Encoder Data Set: p0441= FF, p0442 = 0, p0443 = 0, p0444 = 0, p0445 = 0.
- parameterize F07414 as message type N (p2118, p2119).

Remedy: For causes 1, 2:
Carry out an automatic adjustment using the pole position identification routine. Acknowledge fault. Initiate the pole position identification routine with p1990 = 1. Then check that the pole position identification routine is correctly executed.
SERVO:
If a pole position identification technique is selected in p1980, and if p0301 does not contain a motor type with an encoder adjusted in the factory, then p1990 is automatically activated.
or
Set the adjustment via p0431. In this case, the new serial number is automatically accepted.
or
Mechanically adjust the encoder. Accept the new serial number with p0440 = 1.
For causes 3, 4:
Accept the new serial number with p0440 = 1.

F07432 Drive: Motor without overvoltage protection

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: In the case of a fault at maximum speed, the motor can generate an overvoltage that can destroy the converter.

Remedy: Limit the maximum speed (p1082) without any additional protection.
Note:
The maximum speed is calculated as follows:
p1082 <= 11.695 * DC link voltage overvoltage threshold/r0316
DC link voltage overvoltage threshold:
- line connection 1 AC: 410 V
- line connection 3 AC: 820 V
See also: r0316 (Motor torque constant), p1082 (Maximum speed)

F07433 Drive: Closed-loop control with encoder is not possible as the encoder has not been unparked

Message class: Actual position/speed value incorrect or not available (11)

Reaction: NONE

Acknowledge: IMMEDIATELY

Cause: The changeover to closed-loop control with encoder is not possible as the encoder has not been unparked.

Remedy: - check whether the encoder firmware supports the "parking" function (r0481.6 = 1).
- upgrade the firmware.
Note:
For long-stator motors (p3870.0 = 1), the following applies:
The encoder must have completed the unparking procedure (r3875.0 = 1) before a changeover can be made to closed-loop control with encoder. The encoder is unparked using binector input p3876 = 0/1 signal and remains until a 0 signal in this state.

F07434 Drive: It is not possible to change the direction of rotation with the pulses enabled

Message class: Application/technological function faulted (17)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: A drive data set was selected - with the pulses enabled - which has a different parameterized direction of rotation (p1821).
It is only possible to change the motor direction of rotation using p1821 when the pulses are inhibited.
Remedy: - change over the drive data set with the pulses inhibited.
- ensure that the changeover to a drive data set does not result in the motor direction of rotation being changed (i.e. for these drive data sets, the same value must be in p1821).
See also: p1821 (Direction of rotation)

A07565 Drive: Encoder error in PROFIdrive encoder interface 1

Message class: Actual position/speed value incorrect or not available (11)
Reaction: NONE
Acknowledge: NONE
Cause: An encoder error was signaled for encoder 1 via the PROFIdrive encoder interface (G1_ZSW.15).
Alarm value (r2124, interpret decimal):
Error code from G1_XIST2.
Remedy: Acknowledge the encoder error using the encoder control word (G1_STW.15 = 1).

F07575 Drive: Motor encoder not ready

Message class: Actual position/speed value incorrect or not available (11)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: The motor encoder signals that it is not ready.
- initialization of encoder 1 (motor encoder) was unsuccessful.
- the function "parking encoder" is active (encoder control word G1_STW.14 = 1).
- the encoder interface (Sensor Module) is deactivated (p0145).
- the Sensor Module is defective.
Remedy: Evaluate other queued faults via encoder 1.

F07801 Drive: Motor overcurrent

Message class: Motor overload (8)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: The permissible motor limit current was exceeded.
- active current limit too low.
- current controller not correctly set.
- load is too high.
- short-circuit in the motor cable or ground fault.
- motor current does not match the drive current.

Remedy: - reduce the load.
- check the motor and motor cables for short-circuit and ground fault.
- check the drive and motor combination.

F07802 Drive: Infeed not ready

Message class: Infeed faulted (13)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: The drive does not signal a ready state after an internal switch-on command.
- DC link voltage is not present.
- defective drive.
- supply voltage incorrectly set.

Remedy: - check the enable signals for the drive.
- replace the drive.
- check the line supply voltage setting (p0210).

A07805 Drive: Power unit overload I2t

Message class: Power electronics faulted (5)
Reaction: NONE
Acknowledge: NONE
Cause: The alarm threshold for I2t overload (p0294) of the power unit has been exceeded.
The response parameterized in p0290 becomes active.
Remedy: - reduce the continuous load.
- adapt the load duty cycle.
- check the assignment of the rated currents of the motor and Motor Module.

F07860 External braking resistor signals overtemperature

Message class: External measured value / signal state outside the permissible range (16)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: The temperature monitoring of the external braking resistor, connected via digital input 4 (DI 4, X130/2.6), responded.
Note:
This signal is triggered for a 1/0 edge at digital input 4.
Remedy: - Check the dimensioning of the external braking resistor for the application.
- Check the external braking resistor and temperature monitoring.
- Check the temperature monitoring connection (X130/2.6).

F07900 Drive: Motor blocked/speed controller at its limit

Message class: Application/technological function faulted (17)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: The motor operates longer than 0.2 seconds at the torque limit and below the speed threshold in p2175.
This signal can also be initiated if the speed actual value is oscillating and the speed controller output repeatedly goes to its limit.
See also: p2175 (Motor blocked speed threshold)
Remedy: - check that the motor can freely move.
- check the effective torque limit (r1538, r1539).
- check the parameter of the "Motor blocked" signal and possibly correct (p2175).

F07901 Drive: Motor overspeed

Message class: Application/technological function faulted (17)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: The maximum permissible speed was either positively or negatively exceeded (p1082).

Remedy:
- check the speed controller.
- check the maximum speed (p1082).

F07930 Drive: Brake control error

Message class: Application/technological function faulted (17)

Reaction: OFF1

Acknowledge: IMMEDIATELY

Cause: The "Safety Integrated" function integrated in the drive has identified a brake control fault in monitoring channel 2, and has initiated STO.
- OCC cable shield is not correctly connected.
- defect in the brake control circuit of the drive.

Fault value (r0949, interpret decimal):

10, 11:

Fault in "open holding brake" operation.
- brake not closed or interrupted cable.
- ground fault in brake cable.

20:

Fault in "brake open" state.
- short-circuit in brake winding.

30, 31:

Fault in "close holding brake" operation.
- brake not closed or interrupted cable.
- short-circuit in brake winding.

40:

Fault in "brake closed" state.

50:

Fault in the brake control of the drive or a communication error (brake control diagnostics).

Remedy:
- select STO and then deselect again.
- check the motor holding brake connection.
- check the function of the motor holding brake.
- carry out a diagnostics routine for the faults involved.
- check for EMC-compliant control cabinet design and cable routing (e.g. shield OCC cable with shield terminal and shield plate, check the connection of the brake conductors).
- replace drive.

Note:

OCC: One Cable Connection (one cable system)

SBC: Safe Brake Control

SI: Safety Integrated

STO: Safe Torque Off

See also: p1215 (Motor holding brake configuration)

F07935 Drive: Incorrect motor holding brake configuration

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: NONE

Acknowledge: IMMEDIATELY

Cause: An incorrect motor holding brake configuration was detected.
Fault value (r0949, interpret decimal):
0:
A motor holding brake was detected where the brake control has not been configured (p1215 = 0).
The brake control configuration was set to "motor holding brake the same as sequence control" (p1215 = 1) (only when commissioning for the first time).
1:
A motor holding brake was detected where the brake control has not been configured (p1215 = 0).
The brake control configuration was left at "No motor holding brake available" (p1215 = 0).

Remedy: For fault value = 0:
- no remedy required.
For fault value = 1:
- if required change the motor holding brake configuration (p1215 = 1, 2).
- if this fault value unexpectedly occurs, then the motor connections should be checked in order to rule out that they have been interchanged.
See also: p1215 (Motor holding brake configuration)

F07955 Drive: Motor has been changed

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: NONE

Acknowledge: IMMEDIATELY

Cause: The code number of the actual motor with DRIVE-CLiQ does not match the saved number.
If available:
The code numbers of the bearings, gearbox and brake do not match the saved numbers.

Remedy: Connect the original motor and switch on the converter again (POWER ON) - or restore the factory settings.
Note:
The data for bearings, gearbox and brake are reloaded.

F08501 PN/COMM BOARD: Setpoint timeout

Message class: Communication error to the higher-level control system (9)

Reaction: OFF3

Acknowledge: IMMEDIATELY

Cause: The reception of setpoints from the COMM BOARD has been interrupted.
- bus connection interrupted.
- controller switched off.
- controller set into the STOP state.
- COMM BOARD defective.

Remedy: - Restore the bus connection and set the controller to RUN.
- if the error is repeated, check the update time set in the bus configuration (HW Config).

A08511 PN/COMM BOARD: Receive configuration data invalid

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: NONE

Acknowledge: NONE

Cause: The drive unit did not accept the receive configuration data.
Alarm value (r2124, interpret decimal):
Return value of the receive configuration data check.
1: Connection established to more drive objects than configured in the device. The drive objects for process data exchange and their sequence are defined in p0978.
2: Too many PZD data words for output or input to a drive object. The number of possible PZD items in a drive object is determined by the number of indices in r2050/p2051 for PZD IF1, and in r8850/p8851 for PZD IF2.
3: Uneven number of bytes for input or output.
4: Setting data for synchronization not accepted. For more information, see A01902.
5: Cyclic operation not active.
17: CBE20 Shared Device: Configuration of the F-CPU has been changed.
223: Illegal clock synchronization for the PZD interface set in p8815[0].
257: PN Shared Device: Too many PZD data words for output or input in the overall device.
500: Illegal PROFIsafe configuration for the interface set in p8815[1].
501: PROFIsafe parameter error (e.g. F_dest).
503: PROFIsafe connection is rejected as long as there is no isochronous connection (p8969).
Additional values:
Only for internal Siemens troubleshooting.

Remedy: Check the receive configuration data.
For alarm value = 1, 2:
- check the list of the drive objects with process data exchange (p0978). With p0978[x] = 0, all of the following drive objects in the list are excluded from the process data exchange.
For alarm value = 2:
- check the number of data words for output and input to a drive object.
For alarm value = 17:
- CBE20 Shared Device: Unplug/plug A-CPU.
For alarm value = 223, 500:
- check the setting in p8839 and p8815.
- ensure that only one PZD interface is operated in clock synchronism or with PROFIsafe.
For alarm value = 257:
- check the number of data words for output and input to the complete device.
For alarm value = 501:
- check the set PROFIsafe address (p9610).

A08800 PROFIenergy energy-saving mode active

Message class: Communication error to the higher-level control system (9)

Reaction: NONE

Acknowledge: NONE

Cause: The PROFIenergy energy-saving mode is active
Alarm value (r2124, interpret decimal):
Mode ID of the active PROFIenergy energy-saving mode.
See also: r5600 (Pe energy-saving mode ID)

Remedy: The alarm is automatically withdrawn when the energy-saving mode is exited.
Note:
The energy-saving mode is exited after the following events:
- the PROFIenergy command end_pause is received from the higher-level control.
- the higher-level control has changed into the STOP operating state.
- the PROFINET connection to the higher-level control has been disconnected.

A09000 Web server user incorrectly configured

Message class: General drive fault (19)

Reaction: NONE

Acknowledge: NONE
Cause: An error occurred when configuring the web server user.
Fault value (r0949, interpret decimal):
0: No admin password
1: Invalid admin password
2: Invalid SINAMICS password
Remedy: Correct the user configuration, enter a correct password.

F13000 License not adequate

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: - For the converter, the options that require a license are being used but the licenses are not sufficient.
- an error occurred when checking the existing licenses.
Fault value (r0949, interpret decimal):
0:
The existing license is not sufficient.
1:
An adequate license was not able to be determined as the memory card with the required licensing data was withdrawn in operation.
2:
An adequate license was not able to be determined as there is no licensing data available on the memory card.
3:
An adequate license was not able to be determined as there is a checksum error in the license key.
4:
An internal error occurred when checking the license.
Remedy: For fault value = 0:
Additional licenses are required and must be activated.
For fault value = 1:
With the system powered down, re-insert the memory card that matches the system.
For fault value = 2:
Enter and activate the license key.
For fault value = 3:
Compare the license key entered with the license key on the Certificate of License.
Re-enter the license key and activate.
For fault value = 4:
- carry out a POWER ON.
- upgrade firmware to later version.
- contact Technical Support.
Note:
An overview of the converter functions requiring a license can be displayed using a commissioning tool in the online mode. Depending on the commissioning tool, you can obtain the necessary licenses (serial number, license Key, Trial License Mode).

A13001 Error in license checksum

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: NONE
Acknowledge: NONE
Cause: When checking the checksum of the license key, an error was detected.
Remedy: Compare the license key entered with the license key on the Certificate of License.
Re-enter the license key and activate.

F13009 Licensing Technology Extension not licensed

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: OFF1
Acknowledge: IMMEDIATELY
Cause: At least one Technology Extension that requires a license does not have a license.
Remedy: - enter and activate the license key for Technology Extensions that require a license.
- if necessary, deactivate non-licensed Technology Extensions.

F13010 Licensing function module not licensed

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: OFF1
Acknowledge: IMMEDIATELY
Cause: At least one function module requiring a license is not licensed.
Fault value (r0949, interpret hexadecimal):
Bit x = 1: The corresponding function module does not have a license.
Remedy: - enter and activate the license key for function modules that require a license.
- if necessary, deactivate non-licensed function modules.

A13021 Licensing for output frequencies > 550 Hz missing

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: NONE
Acknowledge: NONE
Cause: Configuring the converter results in an output frequency greater than 550 Hz. This function requires a license. The "High Output Frequency" license is required.
Note:
- in this specific case, the output frequency is limited to 550 Hz.
- the "Trial License" function is not effective for license "High Output Frequency".
Remedy: - enter and activate the license key for "High Output Frequency".
- if necessary operate the motor below the output frequency of 550 Hz.

A13030 Trial License activated

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: NONE
Acknowledge: NONE
Cause: The "Trial License" function was activated. One of the available periods is expiring.
Remedy: Not necessary.
The alarm is automatically withdrawn after the periods have expired.

A13031 Trial License period expired

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: NONE
Acknowledge: NONE
Cause: One of the available periods of the "Trial License" function has expired.
Remedy: - if required, start an additional period.
- deactivate functions requiring a license.
- appropriately license the drive unit.
Note:
A license that is not adequate will only become evident after the next time the system runs up.

A13032 Trial License last period activated

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: NONE
Acknowledge: NONE
Cause: The "Trial License" function was activated. The last of the available periods is expiring.
Remedy: Not necessary.
The alarm is automatically withdrawn after the last period has expired.

A13033 Trial License last period expired

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: NONE
Acknowledge: NONE
Cause: The last period of the "Trial License" function has expired. No additional periods available.
Remedy: - deactivate functions requiring a license.
- appropriately license the drive unit.
Note:
A license that is not adequate will only become evident after the next time the system runs up.

F13100 Know-how protection: Copy protection error

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: OFF1
Acknowledge: IMMEDIATELY
Cause: The know-how protection with copy protection for the memory card is active.
An error has occurred when checking the memory card.
Fault value (r0949, interpret decimal):
0: A memory card is not inserted.
2: An invalid memory card is inserted.
3: The memory card is being used in another Control Unit.
12: An invalid memory card is inserted (OEM input incorrect, p7769).
13: The memory card is being used in another Control Unit (OEM input incorrect, p7759).
Remedy: For fault value = 0:
- insert the correct memory card and carry out POWER ON.
For fault value = 2, 3, 12, 13:
- contact the responsible OEM.
- Deactivate copy protection (p7765) and acknowledge the fault (p3981).
- Deactivate know-how protection (p7766 ... p7768) and acknowledge the fault (p3981).
Note:
In general, the copy protection can only be changed when know-how protection is deactivated.
KHP: Know-How Protection

F13101 Know-how protection: Copy protection cannot be activated

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: NONE
Acknowledge: IMMEDIATELY
Cause: An error occurred when attempting to activate the copy protection for the memory card.
Fault value (r0949, interpret decimal):
0: A memory card is not inserted.
Note:
KHP: Know-How Protection

Remedy: - insert the memory card and carry out POWER ON.
- Try to activate copy protection again (p7765).

F13102 Know-how protection: Consistency error of the protected data

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: OFF1

Acknowledge: IMMEDIATELY

Cause: An error was identified when checking the consistency of the protected files. As a consequence, the project on the memory card cannot be run.
Fault value (r0949, interpret hexadecimal):
yyyyxxxx hex: yyyy = object number, xxxx = fault cause
xxxx = 1:
A file has a checksum error.
xxxx = 2:
The files are not consistent with one another.
xxxx = 3:
The project files, which were loaded into the file system via load (download from the memory card), are inconsistent.
Note:
KHP: Know-How Protection

Remedy: - Replace the project on the memory card or replace project files for download from the memory card.
- Restore the factory setting and download again.

F30001 Drive: overcurrent

Message class: Power electronics faulted (5)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: The drive has detected an overcurrent condition.
- closed-loop control is incorrectly parameterized.
- motor has a short-circuit or fault to ground (frame).
- the rated motor current is significantly higher than that of the drive.
- infeed: High discharge and post-charging currents for line voltage dip.
- infeed: High post-charging currents for overload when motoring and DC link voltage dip.
- infeed: Short-circuit currents at switch-on as there is no commutating reactor.
- power cables are not correctly connected.
- the power cables exceed the maximum permissible length.
- defective drive.
- line phase interrupted.

Fault value (r0949, interpret bitwise binary):
Bit 0: Phase U.
Bit 1: Phase V.
Bit 2: Phase W.
Bit 3: Overcurrent in the DC link.
Note:
Fault value = 0 means that the phase with overcurrent is not recognized.

Remedy: - check the motor data - if required, carry out commissioning.
- check the assignment of the rated motor and drive currents.
- infeed: Check the line supply quality.
- infeed: Reduce the motor load.
- infeed: Check the correct connection of the line filter and the line commutating reactor.
- check the power cable connections.
- check the power cables for short-circuit or ground fault.
- check the length of the power cables.
- replace drive.
- check the line supply phases.

F30002 Drive: DC link overvoltage

Message class: DC link overvoltage (4)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: The drive has detected an overvoltage condition in the DC link.
- motor regenerates too much energy.
- device supply voltage too high.
- line phase interrupted.

Fault value (r0949, interpret decimal):
DC link voltage at the time of trip [0.1 V].

Remedy: - increase the ramp-down time
- use a braking resistor.
- use a drive with a higher power rating.
- check the device supply voltage (p0210).
- check the line supply phases.

See also: p0210 (Drive unit line supply voltage)

F30003 Drive: DC link undervoltage

Message class: Infeed faulted (13)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: The power unit has detected an undervoltage condition in the DC link.
- line supply failure
- line supply voltage below the permissible value.
- line supply infeed failed or interrupted.
- line phase interrupted.

Remedy: - check the line supply voltage
- check the line supply infeed and observe the fault messages relating to it (if there are any)
- check the line supply phases.
- check the line supply voltage setting (p0210).

See also: p0210 (Drive unit line supply voltage)

F30004 Power unit: Overtemperature heat sink AC inverter

Message class: Power electronics faulted (5)
Reaction: OFF2
Acknowledge: IMMEDIATELY

Cause: The temperature of the power unit heat sink has exceeded the permissible limit value.
- insufficient cooling, fan failure.
- overload.
- ambient temperature too high.
- pulse frequency too high.

Fault value (r0949, interpret decimal):
Temperature [0.01 °C].

Remedy:
- check whether the fan is running.
- check the fan elements.
- check whether the ambient temperature is in the permissible range.
- check the motor load.
- reduce the pulse frequency if this is higher than the rated pulse frequency.

Notice:
This fault can only be acknowledged after the alarm threshold for alarm A05000 has been undershot.

F30005 Power unit: Overload I2t

Message class: Power electronics faulted (5)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: The power unit was overloaded (r0036 = 100 %).
- the permissible rated power unit current was exceeded for an inadmissibly long time.
- the permissible load duty cycle was not maintained.

Fault value (r0949, interpret decimal):
I2t [100 % = 16384].

Remedy:
- reduce the continuous load.
- adapt the load duty cycle.
- check the motor and power unit rated currents.

See also: r0307 (Rated motor power)

F30011 Power unit: Line phase failure in main circuit

Message class: Network fault (2)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: At the power unit, the DC link voltage ripple has exceeded the permissible limit value.
Possible causes:
- a line phase has failed.
- the 3 line phases are inadmissibly asymmetrical.
- the capacitance of the DC link capacitor forms a resonance frequency with the line inductance and the reactor integrated in the power unit.
- the fuse of a phase of a main circuit has ruptured.
- a motor phase has failed.
- for power units operated on a single phase, the permissible active power was exceeded.

Fault value (r0949, interpret decimal):
Only for internal Siemens troubleshooting.

Remedy:
- check the main circuit fuses.
- check whether a single-phase load is distorting the line voltages.
- Detune the resonant frequency with the line inductance by using an upstream line reactor.
- Dampen the resonant frequency with the line inductance by switching over the DC link voltage compensation in the software (see p1810) – or increase the smoothing (see p1806). However, this can have a negative impact on the torque ripple at the motor output.
- check the motor feeder cables.

F30015 Drive: phase failure motor cable

Message class: Application/technological function faulted (17)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: A phase failure in the motor feeder cable was detected.
The signal can also be output in the following case:
The motor is correctly connected, however the closed-speed control is instable and therefore an oscillating torque is generated.

Remedy: - check the motor feeder cables.
- check the speed controller settings.

A30016 Power unit: Load supply switched off

Message class: Network fault (2)

Reaction: NONE

Acknowledge: NONE

Cause: The DC link voltage is too low.
Alarm value (r2124, interpret decimal):
DC link voltage at the time of the trip [V].

Remedy: - switch on load supply.
- check the line supply if necessary.
- If necessary, insert the jumper for the internal braking resistor.
- For a 3 AC line connection, connect an internal or external braking resistor (X4).

F30017 Power unit: Hardware current limit has responded too often

Message class: Power electronics faulted (5)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: The hardware current limitation in the relevant phase (see A30031, A30032, A30033) has responded too often. The number of times the limit has been exceeded depends on the design and type of power unit.
For infeed units, the following applies:
- closed-loop control is incorrectly parameterized.
- load on the infeed is too high.
- line reactor missing or the incorrect type.
- power unit defective.
The following applies to Motor Modules:
- closed-loop control is incorrectly parameterized.
- fault in the motor or in the power cables.
- the power cables exceed the maximum permissible length.
- motor load too high
- power unit defective.
Fault value (r0949, interpret binary):
Bit 3: phase U
Bit 4: phase V
Bit 5: phase W
Additional bits:
Only for internal Siemens troubleshooting.
Note:
Fault value = 0 means that the phase with current limiting is not recognized (e.g. for blocksize device).

Remedy: For infeed units, the following applies:
- check the controller settings and reset and identify the controller if necessary (p0340 = 2, p3410 = 5)
- reduce the load and increase the DC link capacitance or use a higher-rating infeed if necessary
- check the connection and technical data of the commutating reactor.
- check the power cables for short-circuit or ground fault.
- replace power unit.

The following applies to Motor Modules:
- check the motor data and if required, recalculate the controller parameters (p0340 = 3). As an alternative, run a motor data identification (p1910 = 1, p1960 = 1).
- check the motor circuit configuration (star-delta).
- check the motor load.
- check the power cable connections.
- check the power cables for short-circuit or ground fault.
- check the length of the power cables.
- replace power unit.

F30021 Drive: ground fault

Message class: Ground fault / inter-phase short-circuit detected (7)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: The drive has detected a ground fault.
Possible causes:
- ground fault in the power cables.
- ground fault at the motor.
- when the brake closes, this causes the hardware DC current monitoring to respond.
- short-circuit at the braking resistor.

Fault value (r0949, interpret decimal):
0:
- the hardware DC current monitoring has responded.
- short-circuit at the braking resistor.

> 0:
Absolute value summation current amplitude.

Remedy:
- check the power cable connections.
- check the motor.
- check the cables and contacts of the brake connection (a wire is possibly broken).
- check the braking resistor.

F30024 Power unit: Overtemperature thermal model

Message class: Power electronics faulted (5)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: The temperature difference between the heat sink and chip has exceeded the permissible limit value.
- the permissible load duty cycle was not maintained.
- insufficient cooling, fan failure.
- overload.
- ambient temperature too high.
- pulse frequency too high.

See also: r0037 (Drive temperatures)

Remedy: - adapt the load duty cycle.
- check whether the fan is running.
- check the fan elements.
- check whether the ambient temperature is in the permissible range.
- check the motor load.
- reduce the pulse frequency if this is higher than the rated pulse frequency.

F30025 Power unit: Chip overtemperature

Message class: Power electronics faulted (5)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: The chip temperature of the semiconductor has exceeded the permissible limit value.
- the permissible load duty cycle was not maintained.
- insufficient cooling, fan failure.
- overload.
- ambient temperature too high.
- pulse frequency too high.

Fault value (r0949, interpret decimal):
Temperature difference between the heat sink and chip [0.01 °C].

Remedy: - adapt the load duty cycle.
- check whether the fan is running.
- check the fan elements.
- check whether the ambient temperature is in the permissible range.
- check the motor load.
- reduce the pulse frequency if this is higher than the rated pulse frequency.

Notice:
This fault can only be acknowledged after the alarm threshold for alarm A05001 has been undershot.
See also: r0037 (Drive temperatures)

F30027 Power unit: Precharging DC link time monitoring

Message class: Infeed faulted (13)
Reaction: OFF2
Acknowledge: IMMEDIATELY

Cause: The power unit DC link was not able to be precharged within the expected time.
1) There is no line supply voltage connected.
2) The line contactor/line side switch has not been closed.
3) The line supply voltage is too low.
4) Line supply voltage incorrectly set (p0210).
5) The precharging resistors are overheated as there were too many precharging operations per time unit.
6) The precharging resistors are overheated as the DC link capacitance is too high.
7) The precharging resistors are overheated because when there is no "ready for operation" (r0863.0) of the infeed unit, power is taken from the DC link.
8) The precharging resistors are overheated as the line contactor was closed during the DC link fast discharge through the Braking Module.
9) The DC link has either a ground fault or a short-circuit.
Fault value (r0949, interpret binary):
yyyyxxxx hex:
yyyy = power unit state
0: Fault status (wait for OFF and fault acknowledgment).
1: Restart inhibit (wait for OFF).
2: Overvoltage condition detected -> change into the fault state.
3: Undervoltage condition detected -> change into the fault state.
4: Wait for bridging contactor to open -> change into the fault state.
5: Wait for bridging contactor to open -> change into restart inhibit.
6: Wait for bypass contactor to open
7: Commissioning.
8: Ready for precharging.
9: Precharging started, DC link voltage lower than the minimum switch-on voltage
10: Precharging, DC link voltage end of precharging still not detected
11: Wait for the end of the de-bounce time of the main contactor after precharging has been completed.
12: Precharging completed, ready for pulse enable.
13: It was detected that the STO terminal was energized at the power unit
xxxx = Missing internal enable signals, power unit (inverted bit-coded, FFFF hex -> all internal enable signals available)
Bit 0: Power supply of the IGBT gating shut down.
Bit 1: Ground fault detected.
Bit 2: Peak current intervention.
Bit 3: I2t exceeded.
Bit 4. Thermal model overtemperature calculated.
Bit 5: (heat sink, gating module, power unit) overtemperature measured.
Bit 6: Reserved.
Bit 7: Overvoltage detected.
Bit 8: Power unit has completed precharging, ready for pulse enable.
Bit 9: STO terminal missing.
Bit 10: Overcurrent detected.
Bit 11: Armature short-circuit active.
Bit 12: DRIVE-CLiQ fault active.
Bit 13: Vce fault detected, transistor de-saturated due to overcurrent/short-circuit.
Bit 14: Undervoltage detected.
See also: p0210 (Drive unit line supply voltage)

Remedy: In general:
- check the line supply voltage at the input terminals.
- check the line supply voltage setting (p0210).

For 5):
- carefully observe the permissible precharging frequency (refer to the appropriate Manual).

For 6):
- check the total capacitance of the DC link and reduce in accordance with the maximum permissible DC link capacitance if necessary (refer to the appropriate Manual).

For 7):
- interconnect the ready-for-operation signal from the infeed unit (r0863.0) in the enable logic of the drives connected to this DC link

For 8):
- check the connections of the external line contactor. The line contactor must be open during DC link fast discharge.

For 9):
- check the DC link for ground faults or short circuits.

For 11):
- check the DC link voltage of the infeed (r0070) and Motor Modules (r0070).

If the DC link voltage generated by the infeed (or external) is not displayed for the Motor Modules (r0070), then a fuse has ruptured in the Motor Module.

See also: p0210 (Drive unit line supply voltage)

A30031 Power unit: Hardware current limiting in phase U

Message class: Power electronics faulted (5)

Reaction: NONE

Acknowledge: NONE

Cause: Hardware current limit for phase U responded. The pulsing in this phase is inhibited for one pulse period.
- closed-loop control is incorrectly parameterized.
- fault in the motor or in the power cables.
- the power cables exceed the maximum permissible length.
- motor load too high
- power unit defective.

Note:
Alarm A30031 is always output if, for a Power Module, the hardware current limiting of phase U, V or W responds.

Remedy:
- check the motor data and if required, recalculate the control parameters (p0340 = 3). As an alternative, run a motor data identification (p1910 = 1, p1960 = 1).
- check the motor circuit configuration (star/delta).
- check the motor load.
- check the power cable connections.
- check the power cables for short-circuit or ground fault.
- check the length of the power cables.

A30034 Power unit: Internal overtemperature

Message class: Power electronics faulted (5)

Reaction: NONE

Acknowledge: NONE

Cause: The alarm threshold for internal overtemperature has been reached.
If the temperature inside the power unit increases up to the fault threshold, then fault F30036 is triggered.
- ambient temperature might be too high.
- insufficient cooling, fan failure.
Alarm value (r2124, interpret binary):
Bit 0 = 1: Overtemperature in the control electronics area.
Bit 1 = 1: Overtemperature in the power electronics area.
Bit 2 = 1: Overtemperature in the processor area.
Bit 3 = 1: Overtemperature in the processor area.
Bit 4 = 1: Overtemperature when the internal fan is defective.
Bit 5 = 1: Intake air overtemperature.

Remedy: - check the ambient temperature.
- check the fan for the inside of the unit.

F30036 Power unit: Internal overtemperature

Message class: Power electronics faulted (5)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: The temperature inside the converter has exceeded the permissible limit value.
- insufficient cooling, fan failure.
- overload.
- ambient temperature too high.
Fault value (r0949, interpret binary):
Bit 0 = 1: Overtemperature in the control electronics area.
Bit 1 = 1: Overtemperature in the power electronics area.
Bit 2 = 1: Overtemperature in the processor area.
Bit 3 = 1: Overtemperature in the processor area.
Bit 4 = 1: Overtemperature when the internal fan is defective.
Bit 5 = 1: Intake air overtemperature.

Remedy: - check the internal fan.
- check the fan elements.
- check whether the ambient temperature is in the permissible range.
Notice:
This fault can only be acknowledged once the permissible temperature limit minus 5 K has been fallen below.

F30040 Drive: 24/48 V undervoltage

Message class: Supply voltage fault (undervoltage) (3)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: The undervoltage threshold of the 24 V power supply for the drive was fallen below for longer than 3 ms.
Fault value (r0949, interpret hexadecimal):
yyxxxx hex: yy = channel, xxxx = voltage [0.1 V]
yy = 0: 24 V power supply
yy = 1: 48 V power supply

Remedy: - check the drive power supply.
- carry out a POWER ON (switch-off/switch-on).

A30041 Power unit: Undervolt 24/48 V alarm

Message class: Supply voltage fault (undervoltage) (3)

Reaction: NONE

Acknowledge: NONE

Cause: For the power unit power supply, the lower threshold has been violated.
Alarm value (r2124, interpret hexadecimal):
yyxxxx hex: yy = channel, xxxx = voltage [0.1 V]
yy = 0: 24 V power supply
yy = 1: 48 V power supply

Remedy: - check the power supply of the power unit.
- carry out a POWER ON (switch-off/switch-on) for the component.

A30042 Power unit: Fan has reached the maximum operating hours

Message class: Power electronics faulted (5)

Reaction: NONE

Acknowledge: NONE

Cause: The maximum operating time of at least one fan will soon be reached, or has already been exceeded.
Alarm value (r2124, interpret binary):
Bit 0 = 1:
The operating hours counter of the heat sink fan will reach the maximum operating time in 500 hours. After 500 hours has elapsed, bit 0 is cleared and bit 2 is set in the alarm value.
Bit 1 = 1:
The wear counter of the heat sink fan has reached 99 %. The remaining service life is 1%. After this 1% has elapsed, bit 1 is cleared and bit 2 is set in the alarm value.
Bit 2 = 1:
The operating hours counter of the heat sink fan has exceeded the maximum operating time - and/or the wear counter has exceeded 100%.
Bit 8 = 1:
The operating hours counter of the fan inside the device will reach the maximum operating time in 500 hours. After 500 hours has elapsed, bit 8 is cleared and bit 10 is set in the alarm value.
Bit 10 = 1:
The operating hours counter of the fan inside the device has exceeded the maximum operating time.

Remedy: For the fan involved, carry out the following:
- replace the fan.
- reset the operating hours counter (p0251, p0254).
See also: p0251 (Power unit heat sink fan operating hours counter)

F30043 Power unit: Overvolt 24/48 V

Message class: Supply voltage fault (overvoltage) (3)

Reaction: OFF2

Acknowledge: POWER ON

Cause: For the power unit power supply, the upper threshold has been violated.
Fault value (r0949, interpret hexadecimal):
yyxxxx hex: yy = channel, xxxx = voltage [0.1 V]
yy = 0: 24 V power supply
yy = 1: 48 V power supply

Remedy: Check the power supply of the power unit.

A30044 Power unit: Overvolt 24/48 V alarm

Message class: Supply voltage fault (overvoltage) (3)

Reaction: NONE

Acknowledge: NONE

Cause: For the power unit power supply, the upper threshold has been violated.
Alarm value (r2124, interpret hexadecimal):
yyxxxx hex: yy = channel, xxxx = voltage [0.1 V]
yy = 0: 24 V power supply
yy = 1: 48 V power supply
Remedy: Check the power supply of the power unit.

F30050 Power unit: 24 V supply overvoltage

Message class: Supply voltage fault (overvoltage) (3)
Reaction: OFF2
Acknowledge: POWER ON
Cause: The voltage monitor signals an overvoltage fault on the module.
Remedy: - check the 24 V power supply.
- replace the module if necessary.

F30051 Power unit: Motor holding brake short circuit detected

Message class: External measured value / signal state outside the permissible range (16)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: A short-circuit at the motor holding brake terminals has been detected.
Fault value (r0949, interpret decimal):
Only for internal Siemens troubleshooting.
Remedy: - check the motor holding brake for a short-circuit.
- check the connection and cable for the motor holding brake.

F30052 EEPROM data error

Message class: Hardware/software error (1)
Reaction: OFF2
Acknowledge: POWER ON
Cause: EEPROM data error of the power unit module.
Fault value (r0949, interpret decimal):
0, 2, 3, 4:
The EEPROM data read in from the power unit module are incorrect.
1:
EEPROM data is not compatible to the firmware of the power unit application.
Additional values:
Only for internal Siemens troubleshooting.
Remedy: For fault value = 0, 2, 3, 4:
Replace the power unit module or update the EEPROM data.
For fault value = 1:
The following applies for CU31x and CUA31:
Update the firmware \SIEMENS\SINAMICS\CODE\SAC\cu31xi.ufw (cua31.ufw)

A30054 Power unit: Undervoltage when opening the brake

Message class: Supply voltage fault (undervoltage) (3)
Reaction: NONE
Acknowledge: NONE

Cause: When the brake is being opened, it is detected that the power supply voltage is less than 21.4 V
Alarm value (r2124, interpret decimal):
Supply voltage fault [0.1 V].
Example:
Alarm value = 195 --> voltage = 19.5 V
Remedy: Check the 24 V voltage for stability and value.

F30055 Power unit: Braking chopper overcurrent

Message class: Braking Module faulted (14)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: An overcurrent condition has occurred in the braking chopper.
Remedy: - check whether the braking resistor has a short circuit.
- for an external braking resistor, check whether the resistor may have been dimensioned too small.
Note:
The braking chopper is only enabled again at pulse enable after the fault has been acknowledged.

F30068 Power unit: undertemperature inverter heat sink

Message class: Power electronics faulted (5)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: The actual inverter heat sink temperature is below the permissible minimum value.
Possible causes:
- the power unit is being operated at an ambient temperature that lies below the permissible range.
- the temperature sensor evaluation is defective.
Fault value (r0949, interpret decimal):
Inverter heat sink temperature [0.1 °C].
Remedy: - ensure that higher ambient temperatures prevail.
- replace the power unit.

F30075 Configuration of the power unit unsuccessful

Message class: Internal (DRIVE-CLiQ) communication error (12)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: A communication error has occurred while configuring the power unit using the Control Unit. The cause is not clear.
Fault value (r0949, interpret decimal):
0:
The output filter initialization was unsuccessful.
1:
Activation/deactivation of the regenerative feedback functionality was unsuccessful.
2:
Activation/deactivation of the chopper function was unsuccessful.
Remedy: - acknowledge the fault and continue operation.
- if the fault reoccurs, carry out a POWER ON (switch-off/switch-on).
- if required, replace the power unit.

A30076 Power unit: thermal overload internal braking resistor alarm

Message class: Braking Module faulted (14)
Reaction: NONE
Acknowledge: NONE

Cause: The energy absorbed by the internal braking resistor has exceeded the alarm threshold of 80 %. If the power unit is still operated in the generator mode, then this can reach the shutdown threshold. To avoid overheating of the braking resistor, use of the braking resistor is inhibited and alarm A30077 is output.
Alarm value (r2124, interpret decimal):
Energy absorbed by the braking resistor [Ws].

Remedy: Reduce the power when generating.
Note:
For a DC link coupling, the generating power of all of the coupled power units must be taken into consideration.

A30077 Power unit: thermal overload internal braking resistor

Message class: Braking Module faulted (14)

Reaction: NONE

Acknowledge: NONE

Cause: The internal braking resistor is thermally overloaded. This is the reason that its use was inhibited.
Alarm value (r2124, interpret decimal):
Energy absorbed by the braking resistor [Ws].

Remedy: Reduce the power when generating.
Note:
- once the internal braking resistor has thermally recovered, it is enabled for further use.
- for a DC link coupling, the generating power of all the coupled power units must be taken into consideration.

F30078 Power unit: defective fan or line reactor has overheated

Message class: Overtemperature of the electronic components (6)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: The temperature monitoring of the internal braking resistor or the line reactor has responded. In addition to the OFF2 response, the use of the internal braking resistor was inhibited.
Note:
- an overtemperature condition of the internal braking resistor can only be initiated as a result of a defective fan.
- an overtemperature condition of the line reactor can occur when a DC link coupling is used – and if the power when motoring, which is fed into the DC link - is not evenly distributed across the rectifiers of the power units.

Remedy: - check the converter fan and replace if necessary.
- reduce the motoring power.

A30079 Power unit: referred to the supply voltage, the DC link voltage is too high

Message class: Infeed faulted (13)

Reaction: NONE

Acknowledge: NONE

Cause: The alarm is output if the following conditions are simultaneously satisfied:
1. The device supply voltage (p0210) was reduced.
2. A DC link voltage is present, which is too high when referred to the new supply voltage.
DC link precharging cannot be completed as this could place some converter components at risk.
Alarm value (r2124, interpret decimal):
Voltage value to which the DC link voltage must, in the meantime, be reduced in order to complete precharging [V].
See also: p0210 (Drive unit line supply voltage)

Remedy: As a minimum, reduce the DC link voltage to the voltage specified in the alarm value.
Note:
The alarm is automatically withdrawn if the DC link voltage drops below the voltage specified in the alarm value.
Fault F07802 is output if an attempt is made to enable the pulses even though an alarm is active.

A30502 Power unit: DC link overvoltage

Message class: DC link overvoltage (4)
Reaction: NONE
Acknowledge: NONE
Cause: The power unit has detected overvoltage in the DC link on a pulse inhibit.
- device supply voltage too high.
- line reactor incorrectly dimensioned.
Alarm value (r0949, interpret decimal):
DC link voltage [1 bit = 100 mV].
See also: r0070 (Actual DC link voltage)
Remedy:
- check the device supply voltage (p0210).
- check the dimensioning of the line reactor.
See also: p0210 (Drive unit line supply voltage)

F30600 SI P2: STO initiated

Message class: Safety monitoring channel has identified an error (10)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: The "Safety Integrated" function integrated in the drive has identified a fault in monitoring channel 2, and has initiated STO.
- forced checking procedure (test stop) of the safety switch-off signal path of monitoring channel 2 unsuccessful.
- subsequent response to fault F30611 (defect in a monitoring channel).
Fault value (r0949, interpret decimal):
0: Stop request from another monitoring channel.
1005: STO active, although no STO is selected and no stop response with STO is active.
1010: STO inactive, although STO is selected or a stop response with STO is active.
1011: internal error for STO deselected in monitoring channel 2.
9999: Subsequent response to fault F30611.
Remedy:
- select Safe Torque Off and deselect again.
- carry out a POWER ON (switch-off/switch-on) for all components.
- replace drive.
For fault value = 9999:
- carry out diagnostics for fault F30611.
Note:
SI: Safety Integrated
STO: Safe Torque Off

F30611 SI P2: Defect in a monitoring channel

Message class: Safety monitoring channel has identified an error (10)
Reaction: NONE
Acknowledge: IMMEDIATELY

Cause: The "Safety Integrated" function integrated in the drive has identified a fault in monitoring channel 2. As a result of this fault, after the parameterized transition time has elapsed (p9658), fault F01600 is output.

Fault value (r0949, interpret decimal):

0: Stop request from another monitoring channel.

1 ... 999:

Number of the cross-compared data that resulted in this fault.

2: SI enable safety functions (p9601). Crosswise data comparison is only carried out for the supported bits.

3: SI SGE changeover discrepancy time (p9650).

4: SI transition time from F01611 to STO (p9658).

5: SI enable Safe Brake Control (p9602).

6: SI Motion enable safety functions (p9501).

7: SI delay time of STO for Safe Stop 1 (p9652).

8: SI PROFIsafe address (p9610).

9: SI debounce time for STO/SBC/SS1 (p9651).

14: SI PROFIsafe telegram selection (p9611).

15: SI PROFIsafe bus failure response (p9612).

1000: Watchdog timer has expired.

Within the time of approx. 5 x p9650, alternatively, the following was defined:

- the signal at F-DI for STO continually changes with time intervals less than or equal to the discrepancy time (p9650).

- via PROFIsafe, STO (also as subsequent response) was continually selected and deselected with time intervals less than or equal to the discrepancy time (p9650).

1001, 1002: Initialization error, change timer / check timer.

1950: Module temperature outside the permissible temperature range.

1951: Module temperature not plausible.

2000: Status of the STO selection for both monitoring channels different.

2001: Feedback signal of STO shutdown for both monitoring channels different. This value can also subsequently occur as a result of other faults.

2002: Status of the delay timer SS1 on both monitoring channels are different (status of the timer in p9650).

2003: Status of the STO terminal for both monitoring channels different.

6000 ... 6999:

Error in the PROFIsafe control.

For these fault values, the failsafe control signals (Failsafe Values) are transferred to the safety functions. For p9612 = 1, the transfer of Failsafe Values is delayed.

The significance of the individual message values is defined in message F01611.

Remedy: For fault value = 1 ... 5 and 7 ... 999:
- check the data that caused the fault.
- upgrade the drive software.
- carry out a POWER ON (switch-off/switch-on).

For fault value = 1000:
- check the wiring of the safety-relevant inputs (SGE) in the first monitoring channel (contact problems).
- PROFIsafe: Resolve contact problems/faults at the PROFINET controller.
- check the discrepancy time, and if required, increase the value (p9650).

For fault value = 1001, 1002:
- carry out a POWER ON (switch-off/switch-on).
- upgrade the drive software.

For fault value = 1950:
- operate the module in the permissible range.
- test module fan, replace drive.

For fault value = 1951:
- operate the module in the permissible range.
- replace drive.

For fault value = 2000, 2001, 2002, 2003:
- check the discrepancy time, and if required, increase the value (p9650, p9652).
- check the wiring of the F-DI for STO/SBC/SS1 (contact problems).
- replace drive.
- diagnose the other active faults and resolve the causes.

Note:
This fault can be acknowledged after removing the cause of the error and after correct selection/deselection of STO.

For fault value = 6000 ... 6999:
Refer to the description of the message values for safety message F01611.

Note:
SGE: Safety-relevant input
F-DI: Failsafe Digital Input
SI: Safety Integrated
SS1: Safe Stop 1
STO: Safe Torque Off

N30620 SI P2: Safe Torque Off active

Message class: Safety monitoring channel has identified an error (10)

Reaction: NONE

Acknowledge: NONE

Cause: The "Safe Torque Off" (STO) function of the basic functions has been selected in monitoring channel 2 using the input terminal and is active.

Note:
- this message does not result in a safety stop response.
- this message is not output when STO is selected using the Extended Functions.

Remedy: Not necessary.

Note:
SI: Safety Integrated
STO: Safe Torque Off

N30621 SI P2: Safe Stop 1 active

Message class: Safety monitoring channel has identified an error (10)

Reaction: NONE

Acknowledge: NONE

Cause: The "Safe Stop 1" function (SS1) was selected in monitoring channel 2 and is active.
Note:
This message does not result in a safety stop response.
Remedy: Not necessary.
Note:
SI: Safety Integrated
SS1: Safe Stop 1

F30625 SI P2: Sign-of-life error in safety data

Message class: Hardware/software error (1)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: The "Safety Integrated" function integrated in the drive has identified an error in the sign-of-life of the safety data in monitoring channel 2, and has initiated STO.
- there is either a DRIVE-CLiQ communication error or communication has failed.
- a time slice overflow of the safety software has occurred.
- the enable of the safety functions in both monitoring channels is inconsistent.
Fault value (r0949, interpret decimal):
Only for internal Siemens troubleshooting.
Remedy: - select STO and then deselect again.
- carry out a POWER ON (switch-off/switch-on).
- check whether there is a DRIVE-CLiQ communication error between the two monitoring channels and, if required, carry out a diagnostics routine for the faults identified.
- deselect all drive functions that are not absolutely necessary.
- check the electrical cabinet design and cable routing for EMC compliance
- check whether the safety functions are enabled (p9601), copy the safety parameters using the commissioning tool, and confirm the data change.
Note:
P2: processor 2
SI: Safety Integrated
STO: Safe Torque Off

F30630 SI P2: Brake control error

Message class: Safety monitoring channel has identified an error (10)
Reaction: OFF2
Acknowledge: IMMEDIATELY

Cause: The "Safety Integrated" function integrated in the drive has identified a brake control fault in monitoring channel 2, and has initiated STO.
- OCC cable shield is not correctly connected.
- defect in the brake control circuit of the drive.

Fault value (r0949, interpret decimal):
100, 101, 102:
Fault in "open brake" operation.
- brake not closed or interrupted cable.
- ground fault in brake cable.

300, 301, 302:
Fault in "close brake" operation.
- brake not closed or interrupted cable.

200, 201, 202:
Fault in the "Brake open" state.
- short-circuit in brake winding.
- defective hardware.

400, 401, 402:
Fault in "brake closed" state.
60, 70:
Fault in the brake control of the drive or a communication error between the monitoring channels (brake control diagnostics).

Remedy:
- select STO and then deselect again.
- check the motor holding brake connection.
- check the function of the motor holding brake.
- carry out a diagnostics routine for the faults involved.
- check for EMC-compliant control cabinet design and cable routing (e.g. shield OCC cable with shield terminal and shield plate, check the connection of the brake conductors).
- replace drive.

Note:
OCC: One Cable Connection (one cable system)
SBC: Safe Brake Control
SI: Safety Integrated
STO: Safe Torque Off

F30649 SI P2: Internal software error

Message class: Hardware/software error (1)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: An internal error in the Safety Integrated software in monitoring channel 2 has occurred.
Note:
This fault results in an STO that cannot be acknowledged.
Fault value (r0949, interpret hexadecimal):
Only for internal Siemens troubleshooting.

Remedy:
- carry out a POWER ON (switch-off/switch-on).
- re-commission the "Safety Integrated" function and carry out a POWER ON.
- upgrade the drive firmware to a later version.
- contact Technical Support.
- replace drive.

Note:
SI: Safety Integrated
STO: Safe Torque Off

F30650 SI P2: Acceptance test required

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: The "Safety Integrated" function on monitoring channel 2 requires an acceptance test.
Note:
This fault results in an STO that can be acknowledged.
Fault value (r0949, interpret decimal):
130: Safety parameters for monitoring channel 2 not available.
Note:
This fault value is always output when Safety Integrated is commissioned for the first time.
1000: Reference and actual checksum in monitoring channel 2 are not identical (booting).
- safety parameters set offline and loaded to the drive.
- at least one checksum-checked piece of data is defective.
2000: Reference and actual checksum in monitoring channel 2 are not identical (commissioning mode).
2003: Acceptance test is required as a safety parameter has been changed.
3003: Acceptance test is required as a hardware-related safety parameter has been changed.
9999: Subsequent response of another safety-related fault that occurred when booting that requires an acceptance test.

Remedy: For fault value = 130:
- carry out safety commissioning routine.
For fault value = 1000:
- again carry out safety commissioning routine.
- replace the memory card or drive.
For fault value = 2000:
- confirm the data change using the commissioning tool.
For fault value = 2003:
- carry out an acceptance test and generate an acceptance report.
For fault value = 3003:
- carry out the function checks for the modified hardware and generate an acceptance report.
For fault value = 9999:
- carry out diagnostics for the other safety-related fault that is present.
Note:
SI: Safety Integrated
STO: Safe Torque Off

F30651 SI P2: synchronization with monitoring channel 1 unsuccessful

Message class: Hardware/software error (1)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: The "Safety Integrated" function requires synchronization of the safety time slices in both monitoring channels. This synchronization routine was unsuccessful.
Note:
This fault results in an STO that cannot be acknowledged.
Fault value (r0949, interpret decimal):
Only for internal Siemens troubleshooting.

Remedy: - carry out a POWER ON (switch-off/switch-on).
- upgrade the drive software.
Note:
SI: Safety Integrated
STO: Safe Torque Off

F30655 SI P2: Align monitoring functions

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: An error has occurred when aligning the Safety Integrated monitoring functions of both monitoring channels. No common set of supported SI monitoring functions was able to be determined.
- there is either a DRIVE-CLiQ communication error or communication has failed.

Note:
This fault results in an STO that cannot be acknowledged.
Fault value (r0949, interpret hexadecimal):
Only for internal Siemens troubleshooting.

Remedy:
- carry out a POWER ON (switch-off/switch-on) for all components.
- upgrade the drive software.
- check the electrical cabinet design and cable routing for EMC compliance

Note:
SI: Safety Integrated
STO: Safe Torque Off

F30656 SI P2: Parameter error monitoring channel 2

Message class: Hardware/software error (1)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: When accessing the Safety Integrated parameters for monitoring channel 2 in the non-volatile memory, an error has occurred.

Note:
This fault results in an STO that can be acknowledged.
Fault value (r0949, interpret decimal):
129:
- safety parameters for monitoring channel 2 corrupted.

131: Internal software error of monitoring channel 1.
255: Internal software error of monitoring channel 2.

Remedy:
- re-commission the safety functions.
- upgrade the drive software.
- replace the memory card or drive.

For fault value = 129:
- activate the Safety Integrated commissioning mode.
- adapt the PROFIsafe address.
- copy the safety parameters and confirm the data change.
- exit the Safety Integrated commissioning mode.
- save all parameters or "Copy RAM to ROM".
- carry out a POWER ON (switch-off/switch-on).

Note:
SI: Safety Integrated
STO: Safe Torque Off

F30657 SI P2: PROFIsafe telegram number invalid

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: OFF2

Acknowledge: POWER ON

Cause: The PROFIsafe telegram number that has been set is not valid.
When PROFIsafe is enabled (p9601.3 = 1), then telegram number 30 or 901 must be used.
The copy function was not used.
Note:
This fault does not result in a safety stop response.
See also: p9611 (SI PROFIsafe telegram selection), r60022 (PROFIsafe telegram selection)
Remedy: Enter a valid PROFIsafe telegram number (p9611 = 30, 901).

F30659 SI P2: Write request for parameter rejected

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: The write request for one or several Safety Integrated parameters in monitoring channel 2 was rejected.
Note:
See also fault F01659.
Remedy: Upgrade the firmware to later version.

F30674 SI Motion P2: Safety function not supported by PROFIsafe telegram

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: OFF2
Acknowledge: POWER ON
Cause: The monitoring function enabled in p9501 and p9601 is not supported by the currently set PROFIsafe telegram (p9611).
Note:
This fault does not result in a safety stop response.
Fault value (r0949, interpret bitwise binary):
Bit 18 = 1:
SS2E via PROFIsafe is not supported (p9501.18).
Bit 24 = 1:
Transfer SLS limit value via PROFIsafe not supported (p9501.24).
Remedy: - Deselect the monitoring function involved (p9501, p9601).
- set the matching PROFIsafe telegram (p9611).
- using the commissioning tool, copy the safety parameters and confirm the data change.
Note:
SI: Safety Integrated
SLS: Safely-Limited Speed
SS2E: Safe Stop 2 External (Safe Stop 2 with external stop)

F30680 SI Motion P2: Checksum error safety monitoring functions

Message class: Safety monitoring channel has identified an error (10)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: The calculated actual checksum over the safety-relevant parameters does not match the reference checksum saved at the last machine acceptance.
Safety-relevant parameters have been changed or a fault is present.
Note:
This fault results in an STO that can be acknowledged.
Fault value (r0949, interpret decimal):
0: Checksum error for SI parameters for motion monitoring.
1: Checksum error for SI parameters for component assignment.

Remedy: - check the safety-relevant parameters and if required, correct.
- execute the function "Copy RAM to ROM".
- if necessary carry out a POWER ON (switch-off/switch-on).
- carry out an acceptance test.
Note:
STO: Safe Torque Off

F30681 SI Motion P1: Incorrect parameter value

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: An internal parameter is not correctly set.
This message does not result in a safety stop response.
Fault value (r0949, interpret decimal):
Only for internal Siemens diagnostics.
Remedy: - resolve the cause of message F01681.
- complete the Safety commissioning.

F30682 SI Motion P2: Monitoring function not supported

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: The monitoring function enabled in p9501, p9506, p9507, p9601 is not supported in this firmware version.
Note:
This message does not result in a safety stop response.
Fault value (r0949, interpret decimal):
Monitoring function not supported.
Remedy: - deselect the monitoring function involved (p9501, p9506, p9507, p9601).
- restore the factory setting and repeat commissioning.
- upgrade the firmware.
Note:
SI: Safety Integrated
See also: p9501 (SI Motion enable safety functions), p9601 (SI enable, functions integrated in the drive)

F30683 SI Motion P2: SOS/SLS enable missing

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: The safety-relevant basic function "SOS/SLS" is not enabled, although other safety-relevant monitoring functions are enabled.
Note:
This message does not result in a safety stop response.
Remedy: Using the commissioning tool, copy the safety parameters, confirm the data change and carry out a power on.
Note:
SI: Safety Integrated
SLS: Safely-Limited Speed
SOS: Safe Operating Stop

F30685 SI Motion P2: Safely-Limited Speed limit value too high

Message class: Error in the parameterization / configuration / commissioning procedure (18)

Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: The limit value for the function "Safely-Limited Speed" (SLS) is greater than the speed that corresponds to an encoder limit frequency of 500 kHz.
Note:
This message does not result in a safety stop response.
Fault value (r0949, interpret decimal):
Maximum permissible speed.
Remedy: Correct the limit values for SLS and carry out a POWER ON.
Note:
SI: Safety Integrated
SLS: Safely-Limited Speed

A30693 SI P2: Safety parameter settings changed, warm restart/POWER ON required

Message class: Error in the parameterization / configuration / commissioning procedure (18)
Reaction: NONE
Acknowledge: NONE
Cause: Safety parameters have been changed; these will only take effect following a warm restart or POWER ON.
Alarm value (r2124, interpret decimal):
Only for internal Siemens diagnostics.
Remedy: - carry out a warm restart.
- carry out a POWER ON (switch-off/switch-on).
Note:
A POWER ON is required before carrying out the acceptance test.

F30700 SI Motion P2: STO initiated

Message class: Safety monitoring channel has identified an error (10)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: The drive is stopped using STO.
Possible causes:
- stop request from another monitoring channel.
- STO not active after parameterized time after test stop selection.
- subsequent response, following messages: A30706, A30714, F30701, A30716
Remedy: - remove the cause of the fault on the first monitoring channel.
- check the switch-off signal path of the first of monitoring channel (check DRIVE-CLiQ communication).
- carry out diagnostics for the active messages (A30706, A30714, F30701, A30716).
- replace drive.
Note:
SAM: Safe Acceleration Monitor (safe acceleration monitoring)
SI: Safety Integrated
STO: Safe Torque Off

F30701 SI Motion P2: SS1 initiated

Message class: Safety monitoring channel has identified an error (10)
Reaction: NONE
Acknowledge: IMMEDIATELY

Cause: The drive is stopped using SS1.
As a result of this fault, after the time parameterized in p9556 has expired, or the speed threshold parameterized in p9560 has been fallen below, message F30700 "SI Motion P2: STO initiated" is output.
Possible causes:
- stop request from another monitoring channel.
- subsequent response, following messages: A30714, A30711, A30707, A30716

Remedy: - remove the cause of the fault on the first monitoring channel.
- carry out diagnostics for the active messages (A30714, A30711, A30707, A30716).
Note:
SI: Safety Integrated
SS1: Safe Stop 1

A30706 SI Motion P2: SAM/SBR limit exceeded

Message class: Safety monitoring channel has identified an error (10)

Reaction: NONE

Acknowledge: NONE

Cause: Motion monitoring functions with encoder (SAM, p9506 = 0):
- after initiating SS1 or SS2, the speed exceeded the set tolerance.
Motion monitoring functions with encoder (SBR, p9506 = 2):
- after initiating SS1 or SLS switchover to the lower speed level, the speed exceeded the set tolerance.
The drive is stopped by message F30700.

Remedy: Check the braking behavior and, if necessary, adapt the parameterization of the parameter settings of the "SAM" or the "SBR" function.
Note:
This message can be acknowledged via PROFIsafe (safe acknowledgment).
SAM: Safe Acceleration Monitor (safe acceleration monitoring)
SBR: Safe Brake Ramp (safe ramp monitoring)
SI: Safety Integrated
SS1: Safe Stop 1
SS2: Safe Stop 2
SLS: Safely-Limited Speed
See also: p9548 (SI Motion SAM actual speed tolerance)

A30707 SI Motion P2: Tolerance for safe operating stop exceeded

Message class: Safety monitoring channel has identified an error (10)

Reaction: NONE

Acknowledge: NONE

Cause: The actual position has moved further away from the target position than the standstill tolerance.
The drive is stopped by message F30701.

Remedy: - check whether safety faults are present and if required carry out the appropriate diagnostic routines for the particular faults.
- check whether the standstill tolerance matches the accuracy and control dynamic performance of the axis.
- carry out a POWER ON (switch-off/switch-on).
Note:
SI: Safety Integrated
SOS: Safe Operating Stop
See also: p9530 (SI Motion standstill tolerance)

F30708 SI Motion P2: SS2 initiated

Message class: Safety monitoring channel has identified an error (10)

Reaction: STOP2

Acknowledge: IMMEDIATELY

Cause: The drive is stopped using SS2 (braking along the OFF3 down ramp).
"Safe Operating Stop" (SOS) is activated after the parameterized time has expired.
Possible causes:
Subsequent response, following messages: A30714, A30716
See also: p9552 (SI Motion transition time SS2 to SOS)

Remedy: Carry out diagnostics for the active messages (A30714, A30716).
Note:
SI: Safety Integrated
SOS: Safe Operating Stop
SS2: Safe Stop 2

A30709 SI Motion P2: SS2E initiated

Message class: Safety monitoring channel has identified an error (10)

Reaction: NONE

Acknowledge: NONE

Cause: The drive is stopped using SS2E (braking along a path).
"Safe Operating Stop" (SOS) is activated after the parameterized time has expired.
Possible causes:
Subsequent response, following messages: A30714, A30716
See also: p9553 (SI Motion transition time SS2E to SOS)

Remedy: - remove the cause of the fault at the control.
- carry out diagnostics for the active messages (A30714, A30716).
Note:
SI: Safety Integrated
SOS: Safe Operating Stop
SS2E: Safe Stop 2 External (Safe Stop 2 with external stop)

A30711 SI Motion P2: Defect in a monitoring channel

Message class: Safety monitoring channel has identified an error (10)

Reaction: NONE

Acknowledge: NONE

Cause: The drive has identified a difference between the input data or results of the monitoring functions and initiated A30711. Safe operation is no longer possible.

At least one monitoring function is active, so that after the parameterized timer has expired, message F30701 is output.

The following message values may also occur in the following cases if the cause that is explicitly mentioned does not apply:

- incorrect synchronization.

Message value (r2124, interpret decimal):

0 ... 999:

Number of the cross-compared data that resulted in this message.

The significance of the individual message values is described in message A01711.

1000: Watchdog timer has expired. Too many signal changes have occurred at safety-relevant inputs.

1001: Initialization error of watchdog timer.

1005: STO already active for test stop selection.

1011: Acceptance test status between the monitoring channels differ.

1012: Plausibility violation of the encoder actual value.

1020: Cyc. communication failure between the monit. channels.

1021: Cyclic communication failure between the monitoring channel and encoder evaluation.

1023: Error in the effectiveness test in the DRIVE-CLiQ encoder

1030: Encoder fault detected from another monitoring channel.

1045: CRC of the standstill position incorrect.

5000 ... 5140:

PROFIsafe message values.

For these message values, the failsafe control signals (Failsafe Values) are transferred to the safety functions.

The significance of the individual message values is described in message A01711.

6000 ... 6166:

PROFIsafe message values (PROFIsafe driver for PROFIBUS DP V1/V2 and PROFINET).

For these message values, the failsafe control signals (Failsafe Values) are transferred to the safety functions. If "SS1 after failure of PROFIsafe communication" is parameterized, then transfer of the Failsafe Values is delayed.

The significance of the individual message values is described in safety fault F01611.

See also: p9555 (SI Motion transition time A01711 to SS1), r9725 (SI Motion diagnostics A01711)

Remedy: For message value = 1005:
- check the conditions for deselecting STO.

For message value = 1012:
- upgrade the encoder evaluation firmware to a newer version.
- check encoder parameters to ensure that they are the same (p9515, p9519, p9523, p9524, p9525, p9529).
- start the copy function for encoder parameters (commissioning tool).
- the parameterized encoder does not correspond to the connected encoder - replace the encoder.
- check the electrical cabinet design and cable routing for EMC compliance
- carry out a POWER ON (switch off/switch on) or a warm restart (p0009 = 30, p0976 = 2, 3).
- replace the hardware.

For message value = 1024:
- check the communication link.
- carry out a POWER ON (switch off/switch on) or a warm restart (p0009 = 30, p0976 = 2, 3).
- replace the hardware.

For message value = 1030:
- check the encoder connection.
- if required, replace the encoder.

Adapt the encoder parameterization for the second channel as follows:
- activate the safety commissioning mode (p0010 = 95).
- start the copy function for encoder parameters (commissioning tool).
- exit the safety commissioning mode (p0010 = 0).
- save the parameters in a non-volatile fashion (copy RAM to ROM).
- carry out a POWER ON (switch off/switch on) or a warm restart (p0009 = 30, p0976 = 2, 3).

The following always applies:
- check the encoder connection.
- if required, replace the encoder.

For message value = 6000 ... 6999:
- the significance of the individual message values are described in fault F01611.

For other message values:
- the significance of the individual message values is described in message A01711.

Note:
SI: Safety Integrated
SS1: Safe Stop 1

A30714 SI Motion P2: Safely-Limited Speed exceeded

Message class: Safety monitoring channel has identified an error (10)

Reaction: NONE

Acknowledge: NONE

Cause: The drive had moved faster than that specified by the velocity limit value. The drive is stopped by the configured stop response.

Message value (r2124, interpret decimal):
100: SLS1 exceeded.
200: SLS2 exceeded.
300: SLS3 exceeded.
400: SLS4 exceeded.
1000: Encoder limit frequency exceeded.

Remedy:
- check the traversing/motion program in the control.
- check the limits for the "SLS" function and if required adapt.

Note:
SI: Safety Integrated
SLS: Safely-Limited Speed

A30716 SI Motion P2: Tolerance for safe motion direction exceeded

Message class: Safety monitoring channel has identified an error (10)
Reaction: NONE
Acknowledge: NONE
Cause: The tolerance for the "safe motion direction" function was exceeded. The drive is stopped by the configured stop response.
Message value (r2124, interpret decimal):
0: Tolerance for function "safe motion direction positive" exceeded.
1: Tolerance for function "safe motion direction negative" exceeded.
Remedy: - check the traversing/motion program in the control.
- check the tolerance for the "SDI" function and adapt if necessary.
This message can be acknowledged as follows:
Deselect/select SDI and perform safe acknowledgment via PROFIsafe.
Note:
SDI: Safe Direction (safe motion direction)
SI: Safety Integrated

A30730 SI Motion P2: Reference block for dynamic Safely-Limited Speed invalid

Message class: Safety monitoring channel has identified an error (10)
Reaction: NONE
Acknowledge: NONE
Cause: The reference block transferred via PROFIsafe is negative.
A reference block is used to generate a referred velocity limit value based on the reference quantity "Velocity limit value SLS1" (p9531[0]).
The drive is stopped by the configured stop response (p9563[0]).
Message value (r2124, interpret decimal):
requested, invalid reference block.
Remedy: In the PROFIsafe telegram, input data S_SLS_LIMIT_IST must be corrected.
This message can be acknowledged without a POWER ON as follows (safe acknowledgment):
- PROFIsafe.
Note:
SI: Safety Integrated
SLS: Safely-Limited Speed

A30788 Automatic test stop: wait for STO deselection via SMM

Message class: Safety monitoring channel has identified an error (10)
Reaction: NONE
Acknowledge: NONE
Cause: The automatic test stop was not able to be carried out after powering up.
Possible causes:
- the STO function is selected via Safety Extended Functions.
- a safety message is present, that resulted in a STO.
Note:
STO: Safe Torque Off
Remedy: - Deselect STO via Safety Extended Functions.
- remove the cause of the safety messages and acknowledge the messages.
Note:
The automatic test stop is performed after removing the cause.

A30798 SI Motion P2: Test stop for motion monitoring functions running

Message class: Safety monitoring channel has identified an error (10)

Reaction: NONE
Acknowledge: NONE
Cause: The forced checking procedure (test stop) for the safe motion monitoring functions is currently in progress.
Remedy: Not necessary.
The message is automatically withdrawn when the test stop has been completed.
Note:
SI: Safety Integrated

A30799 SI Motion P2: Acceptance test mode active

Message class: Safety monitoring channel has identified an error (10)
Reaction: NONE
Acknowledge: NONE
Cause: The acceptance test mode is active.
This means that the setpoint speed limiting is deactivated (r9733).
Remedy: Not necessary.
The message is automatically withdrawn when exiting the acceptance test mode.
Note:
SI: Safety Integrated

N30800 Power unit: Group signal

Message class: Power electronics faulted (5)
Reaction: OFF2
Acknowledge: NONE
Cause: The power unit has detected at least one fault.
Remedy: Evaluate the other messages that are presently available.

F30805 Power unit: EEPROM checksum error

Message class: Hardware/software error (1)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: Internal parameter data is corrupted.
Fault value (r0949, interpret decimal):
01: EEPROM access error.
02: Too many blocks in the EEPROM.
03: Safety EEPROM data error.
...
20: Safety EEPROM data error.
Remedy: Replace the power unit involved.

F30895 power module DRIVE-CLiQ: Alternating cyclic data transfer error

Message class: Internal (DRIVE-CLiQ) communication error (12)
Reaction: OFF2
Acknowledge: IMMEDIATELY
Cause: A DRIVE-CLiQ communication error has occurred from the power unit to the Control Unit involved.
Fault cause:
11 (= 0B hex):
Synchronization error during alternating cyclic data transfer.
Note regarding the message value:
The individual information is coded as follows in the message value (r0949/r2124):
0000yyxx hex: yy = component number, xx = error cause

Remedy: Carry out a POWER ON (switch-off/switch-on).

F30899 Power unit: Unknown fault

Message class: Power electronics faulted (5)
Reaction: NONE
Acknowledge: IMMEDIATELY
Cause: A fault occurred on the power unit that cannot be interpreted by the Control Unit firmware.
This can occur if the firmware on this component is more recent than the firmware on the Control Unit.
Fault value (r0949, interpret decimal):
Fault number.
Note:
If required, the significance of this new fault can be read about in a more recent description of the Control Unit.
Remedy: - replace the firmware on the power unit by an older firmware version (r0128).
- upgrade the firmware on the Control Unit (r0018).

F30950 Power unit: Internal software error

Message class: Hardware/software error (1)
Reaction: OFF2
Acknowledge: POWER ON
Cause: An internal software error has occurred.
Fault value (r0949, interpret decimal):
Information about the fault source.
Only for internal Siemens troubleshooting.
Remedy: - if necessary, upgrade the firmware in the power unit to a later version.
- contact Technical Support.

A30999 Power unit: Unknown alarm

Message class: Power electronics faulted (5)
Reaction: NONE
Acknowledge: NONE
Cause: An alarm occurred on the power unit that cannot be interpreted by the Control Unit firmware.
This can occur if the firmware on this component is more recent than the firmware on the Control Unit.
Alarm value (r2124, interpret decimal):
Alarm number.
Note:
If required, the significance of this new alarm can be read about in a more recent description of the Control Unit.
Remedy: - replace the firmware on the power unit by an older firmware version (r0128).
- upgrade the firmware on the Control Unit (r0018).

F31120 Encoder 1: Encoder power supply fault

Message class: Actual position/speed value incorrect or not available (11)
Reaction: ENCODER
Acknowledge: PULSE INHIBIT

Cause: An encoder power supply fault was detected.
Fault value (r0949, interpret binary):
Bit 0: Undervoltage condition on the sense line.
Bit 1: Overcurrent condition for the encoder power supply.
Bit 2: Overcurrent condition for encoder power supply on cable resolver excitation negative.
Bit 3: Overcurrent condition for encoder power supply on cable resolver excitation positive.
Bit 4: The 24 V power supply through the Power Module (PM) is overloaded.
Bit 5: Overcurrent at the EnDat connection of the converter.
Bit 6: Overvoltage at the EnDat connection of the converter.
Bit 7: Hardware fault at the EnDat connection of the converter.
Note:
If the encoder cables 6FX2002-2EQ00-.... and 6FX2002-2CH00-.... are interchanged, this can result in the encoder being destroyed because the pins of the operating voltage are reversed.

Remedy: For fault value, bit 0 = 1:
- correct encoder cable connected?
- check the plug connections of the encoder cable.
- SMC30: Check the parameterization (p0404.22).

For fault value, bit 1 = 1:
- correct encoder cable connected?
- replace the encoder or encoder cable.

For fault value, bit 2 = 1:
- correct encoder cable connected?
- replace the encoder or encoder cable.

For fault value, bit 3 = 1:
- correct encoder cable connected?
- replace the encoder or encoder cable.

For fault value, bit 5 = 1:
- Measuring unit correctly connected at the converter?
- Replace the measuring unit or the cable to the measuring unit.

For fault value, bit 6, 7 = 1:
- Replace the defective EnDat 2.2 converter.

F31135 Encoder 1: Fault when determining the position (single turn)

Message class: Actual position/speed value incorrect or not available (11)

Reaction: ENCODER

Acknowledge: PULSE INHIBIT

Cause: The encoder has identified a position determination fault (singleturn) and supplies status information bit by bit in an internal status/fault word.

Some of these bits cause this fault to be triggered. Other bits are status displays. The status/fault word is displayed in the fault value.

Note regarding the bit designation:

The first designation is valid for DRIVE-CLiQ encoders, the second for EnDat 2.2 encoders.

Fault value (r0949, interpret binary):

Bit 0: F1 (safety status display).

Bit 1: F2 (safety status display).

Bit 2: Reserved (lighting).

Bit 3: Reserved (signal amplitude).

Bit 4: Reserved (position value).

Bit 5: Reserved (overvoltage).

Bit 6: Reserved (undervoltage)/hardware fault EnDat supply (--> F3x110, x = 1, 2, 3).

Bit 7: Reserved (overcurrent)/EnDat encoder withdrawn when not in the parked state (--> F3x110, x = 1, 2, 3).

Bit 8: Reserved (battery)/overcurrent EnDat supply (--> F3x110, x = 1, 2, 3).

Bit 9: Reserved/overvoltage EnDat supply (--> F3x110, x = 1, 2, 3).

Bit 11: Reserved/internal communication error (--> F3x110, x = 1, 2, 3).

Bit 12: Reserved/internal communication error (--> F3x110, x = 1, 2, 3).

Bit 13: Reserved/internal communication error (--> F3x110, x = 1, 2, 3).

Bit 14: Reserved/internal communication error (--> F3x110, x = 1, 2, 3).

Bit 15: Internal communication error (--> F3x110, x = 1, 2, 3).

Bit 16: Lighting (--> F3x135, x = 1, 2, 3).

Bit 17: Signal amplitude (--> F3x135, x = 1, 2, 3).

Bit 18: Singleturn position 1 (--> F3x135, x = 1, 2, 3).

Bit 19: Overvoltage (--> F3x135, x = 1, 2, 3).

Bit 20: Undervoltage (--> F3x135, x = 1, 2, 3).

Bit 21: Overcurrent (--> F3x135, x = 1, 2, 3).

Bit 22: Temperature exceeded (--> F3x405, x = 1, 2, 3).

Bit 23: Singleturn position 2 (safety status display).

Bit 24: Singleturn system (--> F3x135, x = 1, 2, 3).

Bit 25: Singleturn power down (--> F3x135, x = 1, 2, 3)

Bit 26: Multiturn position 1 (--> F3x136, x = 1, 2, 3).

Bit 27: Multiturn position 2 (--> F3x136, x = 1, 2, 3).

Bit 28: Multiturn system (--> F3x136, x = 1, 2, 3).

Bit 29: Multiturn power down (--> F3x136, x = 1, 2, 3).

Bit 30: Multiturn overflow/underflow (--> F3x136, x = 1, 2, 3).

Bit 31: Multiturn battery (reserved).

Remedy: - determine the detailed cause of the fault using the fault value.

- replace the encoder if necessary.

Note:

An EnDat 2.2 encoder may only be removed and inserted in the "Park" state.

If an EnDat 2.2 encoder was removed when not in the "Park" state, then after inserting the encoder, a POWER ON (switch-off/switch-on) is necessary to acknowledge the fault.

F31136 Encoder 1: Fault when determining the position (multiturn)

Message class: Actual position/speed value incorrect or not available (11)

Reaction: ENCODER

Acknowledge: PULSE INHIBIT

Cause: The encoder has identified a position determination fault (multiturn) and supplies status information bit by bit in an internal status/fault word.

Some of these bits cause this fault to be triggered. Other bits are status displays. The status/fault word is displayed in the fault value.

Note regarding the bit designation:

The first designation is valid for DRIVE-CLiQ encoders, the second for EnDat 2.2 encoders.

Fault value (r0949, interpret binary):

Bit 0: F1 (safety status display).

Bit 1: F2 (safety status display).

Bit 2: Reserved (lighting).

Bit 3: Reserved (signal amplitude).

Bit 4: Reserved (position value).

Bit 5: Reserved (overvoltage).

Bit 6: Reserved (undervoltage)/hardware fault EnDat supply (--> F3x110, x = 1, 2, 3).

Bit 7: Reserved (overcurrent)/EnDat encoder withdrawn when not in the parked state (--> F3x110, x = 1, 2, 3).

Bit 8: Reserved (battery)/overcurrent EnDat supply (--> F3x110, x = 1, 2, 3).

Bit 9: Reserved/overvoltage EnDat supply (--> F3x110, x = 1, 2, 3).

Bit 11: Reserved/internal communication error (--> F3x110, x = 1, 2, 3).

Bit 12: Reserved/internal communication error (--> F3x110, x = 1, 2, 3).

Bit 13: Reserved/internal communication error (--> F3x110, x = 1, 2, 3).

Bit 14: Reserved/internal communication error (--> F3x110, x = 1, 2, 3).

Bit 15: Internal communication error (--> F3x110, x = 1, 2, 3).

Bit 16: Lighting (--> F3x135, x = 1, 2, 3).

Bit 17: Signal amplitude (--> F3x135, x = 1, 2, 3).

Bit 18: Singleturn position 1 (--> F3x135, x = 1, 2, 3).

Bit 19: Overvoltage (--> F3x135, x = 1, 2, 3).

Bit 20: Undervoltage (--> F3x135, x = 1, 2, 3).

Bit 21: Overcurrent (--> F3x135, x = 1, 2, 3).

Bit 22: Temperature exceeded (--> F3x405, x = 1, 2, 3).

Bit 23: Singleturn position 2 (safety status display).

Bit 24: Singleturn system (--> F3x135, x = 1, 2, 3).

Bit 25: Singleturn power down (--> F3x135, x = 1, 2, 3)

Bit 26: Multiturn position 1 (--> F3x136, x = 1, 2, 3).

Bit 27: Multiturn position 2 (--> F3x136, x = 1, 2, 3).

Bit 28: Multiturn system (--> F3x136, x = 1, 2, 3).

Bit 29: Multiturn power down (--> F3x136, x = 1, 2, 3).

Bit 30: Multiturn overflow/underflow (--> F3x136, x = 1, 2, 3).

Bit 31: Multiturn battery (reserved).

Remedy: - determine the detailed cause of the fault using the fault value.

- replace the encoder if necessary.

Note:

An EnDat 2.2 encoder may only be removed and inserted in the "Park" state.

If an EnDat 2.2 encoder was removed when not in the "Park" state, then after inserting the encoder, a POWER ON (switch-off/switch-on) is necessary to acknowledge the fault.

F31137 Encoder 1: Fault when determining the position (single turn)

Message class: Hardware/software error (1)

Reaction: ENCODER

Acknowledge: PULSE INHIBIT

Cause: A position determination fault has occurred in the DRIVE-CLiQ encoder.
Fault value (r0949, interpret binary):
yyxxxxxx hex: yy = encoder version, xxxxxx = bit coding of the fault cause
---
For yy = 8 (0000 1000 bin), the following applies:
Bit 1: Signal monitoring (sin/cos).
Bit 8: F1 (safety status display) error position word 1.
Bit 9: F2 (safety status display) error position word 2.
Bit 16: LED monitoring.
Bit 17: Fault when determining the position (multiturn).
Bit 18: Single-step capability monitoring singleturn from the Safety channel.
Bit 19: ECRC, configuration error in the safety channel.
Bit 23: Temperature outside the limit values.

For yy = 11 (0000 1011 bin), the following applies:
Bit 0: Position word 1 difference between rotation counter and software counter (XC_ERR).
Bit 1: Position word 1 track error of the incremental signals (LIS_ERR).
Bit 2: Position word 1 error when aligning between incremental track signals and absolute value (ST_ERR).
Bit 3: Maximum permissible temperature exceeded (TEMP_ERR).
Bit 4: Power supply overvoltage (MON_OVR_VOLT).
Bit 5: Power supply overcurrent (MON_OVR_CUR).
Bit 6: Power supply undervoltage (MON_UND_VOLT).
Bit 7: Rotation error counter (MT_ERR).
Bit 8: F1 (safety status display) error position word 1.
Bit 9: F2 (safety status display) error position word 2.
Bit 11: Position word 1 status bit: singleturn position OK (ADC_ready).
Bit 12: Position word 1 status bit: rotation counter OK (MT_ready).
Bit 13: Position word 1 memory error (MEM_ERR).
Bit 14: Position word 1 absolute position error (MLS_ERR).
Bit 15: position word 1 LED error, lighting unit error (LED_ERR).
Bit 18: Position word 2 error when aligning between incremental track signals and absolute value (ST_ERR).
Bit 21: Position word 2 memory error (MEM_ERR).
Bit 22: Position word 2 absolute position error (MLS_ERR).
Bit 23: position word 2 LED error, lighting unit error (LED_ERR).

For yy = 12 (0000 1100 bin), the following applies:
Bit 8: encoder fault.
Bit 10: error in the internal position data transport.

For yy = 14 (0000 1110 bin), the following applies:
Bit 0: Position word 1 temperature outside limit value.
Bit 1: Position word 1 position determination error (multiturn).
Bit 2: Position word 1 FPGA error.
Bit 3: Position word 1 velocity error.
Bit 4: Position word 1 communication error between FPGAs/error in the incremental signal.
Bit 5: Position word 1 timeout absolute value/error when determining the position (singleturn).
Bit 6: Position word 1 internal hardware fault (clock/power monitor IC/power).
Bit 7: Position word 1 internal error (FPGA communication/FPGA parameterization/self-test/software).
Bit 8: F1 (safety status display) error position word 1.
Bit 9: F2 (safety status display) error position word 2.
Bit 16: Position word 2 temperature outside limit value.
Bit 17: Position word 2 position determination error (multiturn).

Bit 18: Position word 2 FPGA error.
Bit 19: Position word 2 velocity error.
Bit 20: Position word 2 communication error between FPGAs.
Bit 21: Position word 2 position determination error (singleturn).
Bit 22: Position word 2 internal hardware fault (clock/power monitor IC/power).
Bit 23: Position word 2 internal error (self-test/software).

Note:
For an encoder version that is not described here, please contact the encoder manufacturer for more detailed information on the bit coding.

Remedy: - determine the detailed cause of the fault using the fault value.
- if required, replace the DRIVE-CLiQ encoder.

F31138 Encoder 1: Fault when determining the position (multiturn)

Message class: Hardware/software error (1)
Reaction: ENCODER
Acknowledge: PULSE INHIBIT

Cause: A position determination fault has occurred in the DRIVE-CLiQ encoder.
Fault value (r0949, interpret binary):
yyxxxxxx hex: yy = encoder version, xxxxxx = bit coding of the fault cause
---
For yy = 8 (0000 1000 bin), the following applies:
Bit 1: Signal monitoring (sin/cos).
Bit 8: F1 (safety status display) error position word 1.
Bit 9: F2 (safety status display) error position word 2.
Bit 16: LED monitoring.
Bit 17: Fault when determining the position (multiturn).
Bit 19: ECRC, configuration error in the safety channel.
Bit 23: Temperature outside the limit values.

For yy = 11 (0000 1011 bin), the following applies:
Bit 0: Position word 1 difference between rotation counter and software counter (XC_ERR).
Bit 1: Position word 1 track error of the incremental signals (LIS_ERR).
Bit 2: Position word 1 error when aligning between incremental track signals and absolute value (ST_ERR).
Bit 3: Maximum permissible temperature exceeded (TEMP_ERR).
Bit 4: Power supply overvoltage (MON_OVR_VOLT).
Bit 5: Power supply overcurrent (MON_OVR_CUR).
Bit 6: Power supply undervoltage (MON_UND_VOLT).
Bit 7: Rotation error counter (MT_ERR).
Bit 8: F1 (safety status display) error position word 1.
Bit 9: F2 (safety status display) error position word 2.
Bit 11: Position word 1 status bit: singleturn position OK (ADC_ready).
Bit 12: Position word 1 status bit: rotation counter OK (MT_ready).
Bit 13: Position word 1 memory error (MEM_ERR).
Bit 14: Position word 1 absolute position error (MLS_ERR).
Bit 15: position word 1 LED error, lighting unit error (LED_ERR).
Bit 18: Position word 2 error when aligning between incremental track signals and absolute value (ST_ERR).
Bit 21: Position word 2 memory error (MEM_ERR).
Bit 22: Position word 2 absolute position error (MLS_ERR).
Bit 23: position word 2 LED error, lighting unit error (LED_ERR).

For yy = 14 (0000 1110 bin), the following applies:
Bit 0: Position word 1 temperature outside limit value.
Bit 1: Position word 1 position determination error (multiturn).
Bit 2: Position word 1 FPGA error.
Bit 3: Position word 1 velocity error.
Bit 4: Position word 1 communication error between FPGAs/error in the incremental signal.
Bit 5: Position word 1 timeout absolute value/error when determining the position (singleturn).
Bit 6: Position word 1 internal hardware fault (clock/power monitor IC/power).
Bit 7: Position word 1 internal error (FPGA communication/FPGA parameterization/self-test/software).
Bit 8: F1 (safety status display) error position word 1.
Bit 9: F2 (safety status display) error position word 2.
Bit 16: Position word 2 temperature outside limit value.
Bit 17: Position word 2 position determination error (multiturn).
Bit 18: Position word 2 FPGA error.
Bit 19: Position word 2 velocity error.
Bit 20: Position word 2 communication error between FPGAs.
Bit 21: Position word 2 position determination error (singleturn).
Bit 22: Position word 2 internal hardware fault (clock/power monitor IC/power).

Bit 23: Position word 2 internal error (self-test/software).

Note:

For an encoder version that is not described here, please contact the encoder manufacturer for more detailed information on the bit coding.

Remedy: - determine the detailed cause of the fault using the fault value.
- if required, replace the DRIVE-CLiQ encoder.

F31405 Encoder 1: Temperature in the encoder evaluation exceeded

Message class: Overtemperature of the electronic components (6)

Reaction: ENCODER

Acknowledge: IMMEDIATELY

Cause: An inadmissibly high temperature was detected in the encoder electronics or the encoder evaluation.
Fault value (r0949, interpret hexadecimal):
yyxxxx hex: yy = temperature sensor number, xxxx = measured module temperature in 0.1 °C.

Remedy: Reduce the ambient temperature for the DRIVE-CLiQ connection of the motor.

A31700 Encoder 1: Functional safety monitoring initiated

Message class: Safety monitoring channel has identified an error (10)

Reaction: NONE

Acknowledge: NONE

Cause: Functional safety was activated. Self-test of the DRIVE-CLiQ encoder has detected a fault.
Alarm value (r2124, interpret binary):
Bit x = 1: Effectivity test x unsuccessful.

Remedy: Replace encoder.

F31801 Encoder 1 DRIVE-CLiQ: Sign-of-life missing

Message class: Internal (DRIVE-CLiQ) communication error (12)

Reaction: ENCODER

Acknowledge: IMMEDIATELY

Cause: A DRIVE-CLiQ communication error has occurred from the Control Unit to the encoder involved.
Fault cause:
10 (= 0A hex):
The sign-of-life bit in the receive telegram is not set.
Note regarding the message value:
The individual information is coded as follows in the message value (r0949/r2124):
0000yyxx hex: yy = component number, xx = error cause

Remedy: - check the electrical cabinet design and cable routing for EMC compliance
- replace the component involved.

F31802 Encoder 1: Time slice overflow

Message class: Hardware/software error (1)

Reaction: ENCODER

Acknowledge: IMMEDIATELY

Cause: A time slice overflow has occurred in encoder 1.
Fault value (r0949, interpret hexadecimal):
yx hex: y = function involved (Siemens-internal fault diagnostics), x = time slice involved
x = 9:
Time slice overflow of the fast (current controller clock cycle) time slice.
x = A:
Time slice overflow of the average time slice.
x = C:
Time slice overflow of the slow time slice.
yx = 3E7:
Timeout when waiting for SYNO (e.g. unexpected return to non-cyclic operation).

Remedy: Increase the current controller sampling time
Note:
For a current controller sampling time = 31.25 µs, use an SMx20 with Article No. 6SL3055-0AA00-5xA3.

F31804 Encoder 1: Sensor Module checksum error

Message class: Hardware/software error (1)

Reaction: ENCODER

Acknowledge: POWER ON

Cause: A checksum error has occurred when reading-out the program memory on the Sensor Module.
Fault value (r0949, interpret hexadecimal):
yyyyxxxx hex
yyyy: Memory area involved.
xxxx: Difference between the checksum at POWER ON and the actual checksum.

Remedy: - carry out a POWER ON (switch-off/switch-on).
- upgrade firmware to later version (>= V2.6 HF3, >= V4.3 SP2, >= V4.4).
- check whether the permissible ambient temperature for the component is maintained.
- replace the Sensor Module.

F31805 Encoder 1: EEPROM checksum error

Message class: Hardware/software error (1)

Reaction: ENCODER

Acknowledge: IMMEDIATELY

Cause: Data in the EEPROM corrupted .
Fault value (r0949, interpret hexadecimal):
01: EEPROM access error.
02: Too many blocks in the EEPROM.

Remedy: Replace the module.

F31806 Encoder 1: Initialization error

Message class: Actual position/speed value incorrect or not available (11)

Reaction: ENCODER

Acknowledge: PULSE INHIBIT

Cause: The encoder was not successfully initialized.
Fault value (r0949, interpret binary):
Bit 0, 1: Encoder initialization with the motor rotating has failed (deviation involving coarse and fine position in encoder pulses/4).
Bit 2: Mid-voltage matching for track A unsuccessful.
Bit 3: Mid-voltage matching for track B unsuccessful.
Bit 4: Mid-voltage matching for acceleration input unsuccessful.
Bit 5: Mid-voltage matching for track safety A unsuccessful.
Bit 6: Mid-voltage matching for track safety B unsuccessful.
Bit 7: Mid-voltage matching for track C unsuccessful.
Bit 8: Mid-voltage matching for track D unsuccessful.
Bit 9: Mid-voltage matching for track R unsuccessful.
Bit 10: The difference in mid-voltages between A and B is too great (> 0.5 V)
Bit 11: The difference in mid-voltages between C and D is too great (> 0.5 V)
Bit 12: The difference in mid-voltages between safety A and safety B is too great (> 0.5 V)
Bit 13: The difference in mid-voltages between A and safety B is too great (> 0.5 V)
Bit 14: The difference in mid-voltages between B and safety A is too great (> 0.5 V)
Bit 15: The standard deviation of the calculated mid-voltages is too great (> 0.3 V)
Bit 16: Internal fault - fault when reading a register (CAFE)
Bit 17: Internal fault - fault when writing a register (CAFE)
Bit 18: Internal fault: No mid-voltage matching available
Bit 19: Internal error - ADC access error.
Bit 20: Internal error - no zero crossover found.
Bit 28: Error while initializing the EnDat 2.2 measuring unit.
Bit 29: Error when reading out the data from the EnDat 2.2 measuring unit.
Bit 30: EEPROM checksum of the EnDat 2.2 measuring unit incorrect.
Bit 31: Data of the EnDat 2.2 measuring unit inconsistent.
Note:
Bit 0, 1: Up to 6SL3055-0AA00-5*A0
Bits 2 ... 20: 6SL3055-0AA00-5*A1 and higher

Remedy: Acknowledge fault.
If the fault cannot be acknowledged:
Bits 2 ... 9: Check encoder power supply.
Bits 2 ... 14: Check the corresponding cable.
Bit 15 with no other bits: Check track R, check settings in p0404.
Bit 28: Check the cable between the EnDat 2.2 converter and the measuring unit.
Bit 29 ... 31: Replace the defective measuring unit.

F31813 Encoder 1: Hardware logic unit failed

Message class: Hardware/software error (1)
Reaction: ENCODER
Acknowledge: PULSE INHIBIT
Cause: The logic unit of the DRIVE-CLiQ encoder has failed.
Fault value (r0949, interpret binary):
Bit 0: ALU watchdog has responded.
Bit 1: ALU has detected a sign-of-life error.
Remedy: When the error reoccurs, replace the encoder.

F31820 Encoder 1 DRIVE-CLiQ: Telegram error

Message class: Internal (DRIVE-CLiQ) communication error (12)
Reaction: ENCODER

Acknowledge: IMMEDIATELY

Cause: A DRIVE-CLiQ communication error has occurred from the Control Unit to the encoder concerned.
Fault cause:
1 (= 01 hex):
Checksum error (CRC error).
2 (= 02 hex):
Telegram is shorter than specified in the length byte or in the receive list.
3 (= 03 hex):
Telegram is longer than specified in the length byte or in the receive list.
4 (= 04 hex):
The length of the receive telegram does not match the receive list.
5 (= 05 hex):
The type of the receive telegram does not match the receive list.
6 (= 06 hex):
The address of the component in the telegram and in the receive list do not match.
7 (= 07 hex):
A SYNC telegram is expected - but the received telegram is not a SYNC telegram.
8 (= 08 hex):
No SYNC telegram is expected - but the received telegram is one.
9 (= 09 hex):
The error bit in the receive telegram is set.
16 (= 10 hex):
The receive telegram is too early.
Note regarding the message value:
The individual information is coded as follows in the message value (r0949/r2124):
0000yyxx hex: yy = component number, xx = error cause

Remedy: - carry out a POWER ON (switch-off/switch-on).
- check the electrical cabinet design and cable routing for EMC compliance
- check the DRIVE-CLiQ wiring (interrupted cable, contacts, ...).

F31835 Encoder 1 DRIVE-CLiQ: Cyclic data transfer error

Message class: Internal (DRIVE-CLiQ) communication error (12)

Reaction: ENCODER

Acknowledge: IMMEDIATELY

Cause: A DRIVE-CLiQ communication error has occurred from the Control Unit to the encoder concerned. The nodes do not send and receive in synchronism.
Fault cause:
33 (= 21 hex):
The cyclic telegram has not been received.
34 (= 22 hex):
Timeout in the telegram receive list.
64 (= 40 hex):
Timeout in the telegram send list.
Note regarding the message value:
The individual information is coded as follows in the message value (r0949/r2124):
0000yyxx hex: yy = component number, xx = error cause

Remedy: - carry out a POWER ON.
- replace the component involved.

F31836 Encoder 1 DRIVE-CLiQ: Send error for DRIVE-CLiQ data

Message class: Internal (DRIVE-CLiQ) communication error (12)

Reaction: ENCODER
Acknowledge: IMMEDIATELY
Cause: A DRIVE-CLiQ communication error has occurred from the Control Unit to the encoder involved. Data were not able to be sent.
Fault cause:
65 (= 41 hex):
Telegram type does not match send list.
Note regarding the message value:
The individual information is coded as follows in the message value (r0949/r2124):
0000yyxx hex: yy = component number, xx = error cause
Remedy: Carry out a POWER ON.

F31837 Encoder 1 DRIVE-CLiQ: Component fault

Message class: Internal (DRIVE-CLiQ) communication error (12)
Reaction: ENCODER
Acknowledge: IMMEDIATELY
Cause: Fault detected on the DRIVE-CLiQ component concerned. Faulty hardware cannot be excluded.
Fault cause:
32 (= 20 hex):
Error in the telegram header.
35 (= 23 hex):
Receive error: The telegram buffer memory contains an error.
66 (= 42 hex):
Send error: The telegram buffer memory contains an error.
67 (= 43 hex):
Send error: The telegram buffer memory contains an error.
Note regarding the message value:
The individual information is coded as follows in the message value (r0949/r2124):
0000yyxx hex: yy = component number, xx = error cause
Remedy: - check the DRIVE-CLiQ wiring (interrupted cable, contacts, ...).
- check the electrical cabinet design and cable routing for EMC compliance
- if required, use another DRIVE-CLiQ socket (p9904).
- replace the component involved.

F31845 Encoder 1 DRIVE-CLiQ: Cyclic data transfer error

Message class: Internal (DRIVE-CLiQ) communication error (12)
Reaction: ENCODER
Acknowledge: IMMEDIATELY
Cause: A DRIVE-CLiQ communication error has occurred from the Control Unit to the encoder involved.
Fault cause:
11 (= 0B hex):
Synchronization error during alternating cyclic data transfer.
Note regarding the message value:
The individual information is coded as follows in the message value (r0949/r2124):
0000yyxx hex: yy = component number, xx = error cause
Remedy: Carry out a POWER ON (switch-off/switch-on).

F31850 Encoder 1: Encoder evaluation internal software error

Message class: Hardware/software error (1)
Reaction: ENCODER

Acknowledge: POWER ON

Cause: An internal software error has occurred in the Sensor Module of encoder 1.
Fault value (r0949, interpret decimal):
1: Background time slice is blocked.
2: Checksum over the code memory is not OK.
10000: OEM memory of the EnDat encoder contains data that cannot be interpreted.
11000 ... 11499: Descriptive data from EEPROM incorrect.
11500 ... 11899: Calibration data from EEPROM incorrect.
11900 ... 11999: Configuration data from EEPROM incorrect.
12000 ... 12008: communication with analog/digital converter faulted.
16000: DRIVE-CLiQ encoder initialization application error.
16001: DRIVE-CLiQ encoder initialization ALU error.
16002: DRIVE-CLiQ encoder HISI / SISI initialization error.
16003: DRIVE-CLiQ encoder safety initialization error.
16004: DRIVE-CLiQ encoder internal system error.

Remedy: - replace the Sensor Module.
- if required, upgrade the firmware in the Sensor Module.
- contact Technical Support.

F31851 Encoder 1 DRIVE-CLiQ (CU): Sign-of-life missing

Message class: Internal (DRIVE-CLiQ) communication error (12)

Reaction: ENCODER

Acknowledge: IMMEDIATELY

Cause: A DRIVE-CLiQ communication error has occurred from the Sensor Module (encoder 1) involved to the Control Unit.
The DRIVE-CLiQ component did not set the sign-of-life to the Control Unit.
Fault cause:
10 (= 0A hex):
The sign-of-life bit in the receive telegram is not set.
Note regarding the message value:
The individual information is coded as follows in the message value (r0949/r2124):
0000yyxx hex: yy = component number, xx = error cause

Remedy: - Upgrade the firmware of the component involved.
- carry out a POWER ON (switch-off/switch-on) for the component involved.

F31860 Encoder 1 DRIVE-CLiQ (CU): Telegram error

Message class: Internal (DRIVE-CLiQ) communication error (12)

Reaction: ENCODER

Acknowledge: IMMEDIATELY

Cause: A DRIVE-CLiQ communication error has occurred from the Sensor Module (encoder 1) involved to the Control Unit.
Fault cause:
1 (= 01 hex):
Checksum error (CRC error).
2 (= 02 hex):
Telegram is shorter than specified in the length byte or in the receive list.
3 (= 03 hex):
Telegram is longer than specified in the length byte or in the receive list.
4 (= 04 hex):
The length of the receive telegram does not match the receive list.
5 (= 05 hex):
The type of the receive telegram does not match the receive list.
6 (= 06 hex):
The address of the power unit in the telegram and in the receive list do not match.
9 (= 09 hex):
The DRIVE-CLiQ communication from the DRIVE-CLiQ component involved to the Control Unit signals that the supply voltage has failed.
16 (= 10 hex):
The receive telegram is too early.
17 (= 11 hex):
CRC error and the receive telegram is too early.
18 (= 12 hex):
The telegram is shorter than that specified in the length byte or in the receive list and the receive telegram is too early.
19 (= 13 hex):
The telegram is longer than that specified in the length byte or in the receive list and the receive telegram is too early.
20 (= 14 hex):
The length of the receive telegram does not match the receive list and the receive telegram is too early.
21 (= 15 hex):
The type of the receive telegram does not match the receive list and the receive telegram is too early.
22 (= 16 hex):
The address of the power unit in the telegram and in the receive list does not match and the receive telegram is too early.
25 (= 19 hex):
The error bit in the receive telegram is set and the receive telegram is too early.
Note regarding the message value:
The individual information is coded as follows in the message value (r0949/r2124):
0000yyxx hex: yy = component number, xx = error cause

Remedy: - carry out a POWER ON (switch-off/switch-on).
- check the electrical cabinet design and cable routing for EMC compliance
- check the DRIVE-CLiQ wiring (interrupted cable, contacts, ...).

F31875 Encoder 1: power supply voltage failed

Message class: Supply voltage fault (undervoltage) (3)

Reaction: ENCODER

Acknowledge: IMMEDIATELY

Cause: The DRIVE-CLiQ communication from the DRIVE-CLiQ component involved to the Control Unit signals that the supply voltage has failed.
Fault cause:
9 (= 09 hex):
The power supply voltage for the components has failed.
Note regarding the message value:
The individual information is coded as follows in the message value (r0949/r2124):
0000yyxx hex: yy = component number, xx = error cause

Remedy: - carry out a POWER ON (switch-off/switch-on).
- check the power supply voltage wiring for the DRIVE-CLiQ component (interrupted cable, contacts, ...).
- check the dimensioning of the power supply for the DRIVE-CLiQ component.

F31885 Encoder 1 DRIVE-CLiQ: Cyclic data transfer error

Message class: Internal (DRIVE-CLiQ) communication error (12)
Reaction: ENCODER
Acknowledge: IMMEDIATELY
Cause: There is a DRIVE-CLiQ communication error between the converter and motor.
The nodes do not send and receive in synchronism.
Fault cause:
26 (= 1A hex):
Sign-of-life bit in the receive telegram not set and the receive telegram is too early.
33 (= 21 hex):
The cyclic telegram has not been received.
34 (= 22 hex):
Timeout in the telegram receive list.
64 (= 40 hex):
Timeout in the telegram send list.
98 (= 62 hex):
Error at the transition to cyclic operation.
Note regarding the message value:
The individual information is coded as follows in the message value (r0949/r2124):
0000yyxx hex: yy = component number, xx = error cause
Remedy: - check the OCC cable between the converter and motor.
- check the power supply voltage of the component involved.
- carry out a POWER ON (switch-off/switch-on).
- replace the component involved.
Note:
OCC: One Cable Connection (one cable system)

F31886 Encoder 1 DRIVE-CLiQ (CU): Error when sending DRIVE-CLiQ data

Message class: Internal (DRIVE-CLiQ) communication error (12)
Reaction: ENCODER
Acknowledge: IMMEDIATELY
Cause: A DRIVE-CLiQ communication error has occurred from the Sensor Module (encoder 1) involved to the Control Unit.
Data were not able to be sent.
Fault cause:
65 (= 41 hex):
Telegram type does not match send list.
Note regarding the message value:
The individual information is coded as follows in the message value (r0949/r2124):
0000yyxx hex: yy = component number, xx = error cause
Remedy: - carry out a POWER ON.
- check whether the firmware version of the encoder (r0148) matches the firmware version of Control Unit (r0018).

F31887 Encoder 1 DRIVE-CLiQ (CU): Component fault

Message class: Internal (DRIVE-CLiQ) communication error (12)
Reaction: ENCODER
Acknowledge: IMMEDIATELY

Cause: Fault detected on the DRIVE-CLiQ component involved (Sensor Module for encoder 1). Faulty hardware cannot be excluded.
Fault cause:
32 (= 20 hex):
Error in the telegram header.
35 (= 23 hex):
Receive error: The telegram buffer memory contains an error.
66 (= 42 hex):
Send error: The telegram buffer memory contains an error.
67 (= 43 hex):
Send error: The telegram buffer memory contains an error.
96 (= 60 hex):
Response received too late during runtime measurement.
97 (= 61 hex):
Time taken to exchange characteristic data too long.
Note regarding the message value:
The individual information is coded as follows in the message value (r0949/r2124):
0000yyxx hex: yy = component number, xx = error cause

Remedy: - check the DRIVE-CLiQ wiring (interrupted cable, contacts, ...).
- check the electrical cabinet design and cable routing for EMC compliance
- if required, use another DRIVE-CLiQ socket (p9904).
- replace the component involved.

F31895 Encoder 1 DRIVE-CLiQ (CU): Alternating cyclic data transfer error

Message class: Internal (DRIVE-CLiQ) communication error (12)

Reaction: ENCODER

Acknowledge: IMMEDIATELY

Cause: A DRIVE-CLiQ communication error has occurred from the Sensor Module (encoder 1) involved to the Control Unit.
Fault cause:
11 (= 0B hex):
Synchronization error during alternating cyclic data transfer.
Note regarding the message value:
The individual information is coded as follows in the message value (r0949/r2124):
0000yyxx hex: yy = component number, xx = error cause

Remedy: Carry out a POWER ON.

F31896 Encoder 1 DRIVE-CLiQ (CU): Inconsistent component properties

Message class: Internal (DRIVE-CLiQ) communication error (12)

Reaction: OFF2

Acknowledge: IMMEDIATELY

Cause: The properties of the DRIVE-CLiQ component (Sensor Module for encoder 1), specified by the fault value, have changed in an incompatible fashion with respect to the properties when booted. One cause can be, e.g. that a DRIVE-CLiQ cable or DRIVE-CLiQ component has been replaced.
Fault value (r0949, interpret decimal):
Component number.

Remedy: - carry out a POWER ON.
- when a component is replaced, the same component type and if possible the same firmware version should be used.
- when a cable is replaced, only cables whose length is the same as or as close as possible to the length of the original cables should be used (ensure compliance with the maximum cable length).

F31950 Encoder 1: Internal software error

Message class: Hardware/software error (1)

Reaction: ENCODER
Acknowledge: POWER ON
Cause: An internal software error has occurred.
Fault value (r0949, interpret decimal):
The fault value contains information regarding the fault source.
Only for internal Siemens troubleshooting.
Remedy: - if necessary, upgrade the firmware in the Sensor Module to a later version.
- contact Technical Support.

F40000 Fault at DRIVE-CLiQ socket X100

Message class: General drive fault (19)
Reaction: NONE
Acknowledge: IMMEDIATELY
Cause: A fault has occurred at the drive object at the DRIVE-CLiQ socket X100.
Fault value (r0949, interpret decimal):
First fault that has occurred for this drive object.
Remedy: Evaluate the fault buffer of the specified object.

A40100 Alarm at DRIVE-CLiQ socket X100

Message class: General drive fault (19)
Reaction: NONE
Acknowledge: NONE
Cause: An alarm has occurred at the drive object at the DRIVE-CLiQ socket X100.
Alarm value (r2124, interpret decimal):
First alarm that has occurred for this drive object.
Remedy: Evaluate the alarm buffer of the specified object.

Appendix

A

A.1 Communication telegrams

The converter supports a standard telegram with two supplementary telegrams and a PROFIsafe telegram.

The bit assignments of the individual process data can be found in the section "Bit assignments of the process data (Page 665)".

A.1.1 Standard telegrams

The telegrams are suitable for IRT communication. Telegrams 3 and 102 are also suitable for RT communication. IRT communication is mandatory for telegram 5 or 105.

Telegram 3

PZD01	PZD02	PZD03	PZD04	PZD05	PZD06	PZD07	PZD08	PZD09
STW1	NSET_B		STW2	G1_STW	-			
ZSW1	NACT_B		ZSW2	G1_ZSW	G1_XIST1		G1_XIST2	

Telegram 3 transmits the following data:

- Control words 1 and 2 (STW1, STW2)
- Status words 1 and 2 (ZSW1, ZSW2)
- Speed setpoint and actual value (NSOLL_B, NIST_B)
- Control word and status word of encoder 1 (G1_STW, G1_ZSW)
- Actual position value 1 and 2 of encoder 1 (G1_XIST1, G1_XIST2)

Telegram 5

PZD01	PZD02	PZD03	PZD04	PZD05	PZD06	PZD07	PZD08	PZD09
STW1	NSET_B		STW2	G1_STW	XERR		KPC	
ZSW1	NACT_B		ZSW2	G1_ZSW	G1_XIST1		G1_XIST2	

Telegram 5 transmits the values of telegram 3 and additionally the following data:

- Value for position deviation (XERR)
- Gain factor for the position controller (KPC)

Telegram 102

PZD01	PZD02	PZD03	PZD04	PZD05	PZD06	PZD07	PZD08	PZD09	PZD10
STW1	NSET_B		STW2	MOMRED	G1_STW	-			
ZSW1	NACT_B		ZSW2	MSGW	G1_ZSW	G1_XIST1		G1_XIST2	

Telegram 102 transmits the values of telegram 3 and additionally the following data:

- Value for torque reduction (MOMRED)
- Message word (MELDW)

Telegram 105

PZD01	PZD02	PZD03	PZD04	PZD05	PZD06	PZD07	PZD08	PZD09	PZD10
STW1	NSET_B		STW2	MOMRED	G1_STW	XERR		KPC	
ZSW1	NACT_B		ZSW2	MSGW	G1_ZSW	e.g.: G1_XIST1		e.g.: G1_XIST2	

Telegram 105 transmits the values of telegram 3 and additionally the following data:

- Value for torque reduction (MOMRED)
- Message word (MELDW)
- Value for position deviation (XERR)
- Gain factor for the position controller (KPC)

A.1.2 Supplementary telegrams

In addition to the main telegram, you can configure one or two supplementary telegrams:

- Telegrams 700 and 701 transfer information about the safety functions.
  Transfer of telegrams 700 and 701 is not fail-safe. For fail-safe data transfer, use PROFIsafe telegrams; see section "PROFIsafe Telegrams (Page 665)".
- Using telegram 750, you can implement an electronic weight compensation for a vertical axis.
- Telegram 750 can be transferred in addition to telegram 700 or telegram 701. The sequence can be set in HW Config.

Telegram 700

PZD01	PZD02	PZD03

S_ZSW1B	S_V_LIMIT_B	

Telegram 700 transmits the following data about the Safety Info Channel (SIC)

- The safety status word 1B (S_ZSW1B)
- The value for the limitation of the setpoint velocity (S_V_LIMIT_B)

Telegram 701

PZD01	PZD02	PZD03	PZD04	PZD05
S_STW1B	S_STW3B	---		
S_ZSW1B	S_ZSW2B	S_V_LIMIT_B		S_ZSW3B

In addition to telegram 700, telegram 701 transfers the following data:

- Via the Safety Control Channel (SCC) the safety control word 1B (S_STW1B) and the safety control word 3B (S_STW3B).
- Via the Safety Info Channel (SIC) the safety status word 2B (S_ZSW2B) and the safety status word 3B (S_ZSW3B).

Telegram 750

PZD01	PZD02	PZD03
M_ADD	M_LIMIT_POS	M_LIMIT_NEG
M_ACT	---	

Telegram 750 is a supplementary telegram for the torque control with the following data:

- The controller sends the additional torque (M_ADD) and the positive and negative torque limit (M_LIMIT_POS, M_LIMIT_NEG) to the converter.
- The converter sends the current torque (M_ACT) to the control.
- Negative values for M_LIMIT_POS and positive values for M_LIMIT_NEG can result in quickly increasing motor speeds ("runaway").

A.1.3 PROFIsafe Telegrams

The converter supports the PROFIsafe telegrams 30 and 901. One of these telegrams is required to control the safety functions via PROFIsafe.

You only require telegram 901 if you use the SS2E or SLS function via PROFIsafe.

Telegram 30

PZD01	---
S_STW1	
S_ZSW1	

Telegram 30 transmits the following data:

- Safety control word 1 (S_STW1)
- Safety status word 1 (S_ZSW1)

Telegram 901

PZD01	PZD02	PZD03	PZD04	PZD05
S_STW2		S_SLS_LIM_A	---	
S_ZSW2		S_SLS_LIM_A_ACT	S_CYC_COUNT	S_XIST16

Telegram 901 transmits the following data:

- Safety control word 2 (S_STW2)
- Safety status word 2 (S_ZSW2)
- Variable SLS limit (S_SLS_LIM_A)
- Active SLS value of level 1 (S_SLS_LIM_A_ACT)
- Count value (S_CYC_COUNT)
- The safe position value in 16-bit format (S_XIST16)

A.1.4 Bit assignments of the process data

Note

Representation of the transmit direction control → converter and converter → control

The left column always shows the process data that is sent from the controller to the converter (control words and setpoints).

The process data that is sent from the converter to the controller is displayed in the right column (status words and actual values).

A.1.4.1 Control word 1 and status word 1

Control word 1 (STW1)		**Status word 1 (ZSW1)**	
Bit	**Meaning**	**Bit**	**Meaning**
00	ON / OFF1	00	Ready for switching on
01	OFF2	01	Ready for operation
02	OFF3	02	Operation enabled
03	Enable operation	03	Fault active
04	Enable ramp-function generator	04	No coasting down active
05	Continue ramp-function generator	05	No fast stop active
06	Enable speed setpoint	06	Switching on inhibited active
07	Acknowledge fault	07	Alarm active
08	Reserved	08	Speed setp - act val deviation in tolerance t_off
09	Reserved	09	Control request
10	Control by PLC	10	Comparison value reached/exceeded
11	Reserved	11	Alarm class bit 0
12	Open holding brake	12	Alarm class bit 1
13	Reserved	13	Reserved
14	Torque / speed control	14	Closed-loop torque control active
15	Reserved	15	Reserved

A.1.4.2 Control word 2 and status word 2

Control word 2 (STW2)		Status word 2 (ZSW2)	
Bit	**Meaning**	**Bit**	**Meaning**
00	Reserved	00	Reserved
01	Reserved	01	Reserved
02	Reserved	02	Reserved
03	Reserved	03	Reserved
04	Reserved	04	Reserved
05	Reserved	05	Open holding brake
06	Integrator disable, speed controller	06	Integrator disable, speed controller
07	Parking axis selection	07	Parking axis active
08	Travel to fixed stop	08	Travel to fixed stop
09	Reserved	09	Reserved
10	Reserved	10	Reserved
11	Reserved	11	Reserved
12	Controller sign-of-life bit 0	12	Device sign-of-life bit 0
13	Controller sign-of-life bit 1	13	Device sign-of-life bit 1
14	Controller sign-of-life bit 2	14	Device sign-of-life bit 2
15	Controller sign-of-life bit 3	15	Device sign-of-life bit 3

A.1.4.3 Encoder-1 control word and encoder-1 status word

Control word 1 (G1_STW)		Status word 1 (G1_ZSW)	
Bit	**Meaning**	**Bit**	**Meaning**
00	Request function 1	00	Function 1 active
01	Request function 2	01	Function 2 active
02	Request function 3	02	Function 3 active
03	Request function 4	03	Function 4 active
04	Request command bit 0	04	Value 1
05	Request command bit 1	05	Value 2
06	Request command bit 2	06	Value 3
07	Mode	07	Value 4
08	Reserved	08	Measuring input 1 deflected
09	Reserved	09	Measuring input 2 deflected
10	Reserved	10	Reserved
11	Reserved	11	Acknowledge encoder fault active
12	Reserved	12	Reserved
13	Request absolute value cyclically	13	Cyclic absolute value
14	Request parking encoder	14	Parking encoder active
15	Acknowledge encoder fault	15	Encoder fault

A.1.4.4 Safety control word 1 and safety status word 1

Safety control word 1 (S_STW1)		**Safety status word 1 (S_ZSW1)**	
Bit	**Meaning**	**Bit**	**Meaning**
00	Deselect STO	00	STO active
01	Deselect SS1	01	SS1 active
02	Deselect SS2	02	SS2 active
03	Deselect SOS	03	SOS active
04	Deselect SLS	04	SLS active
05	Reserved	05	Reserved
06	Reserved	06	Reserved
07	Safe acknowledgment	07	Internal event
08	Deselect SLA	08	SLA active
09	Select SLS bit 0	09	SLS Limit Bit 0 active
10	Select SLS bit 1	10	SLS limit bit 1 active
11	Reserved	11	SOS selected
12	Deselect SDI positive	12	SDI positive active
13	Deselect SDI negative	13	SDI negative active
14	Reserved	14	Reserved
15	Reserved	15	SSM (speed, low limit)

A.1.4.5 Safety control word 2 and safety status word 2

Safety control word 2 (S_STW2)		Safety status word 1 (S_ZSW2)	
Bit	**Meaning**	**Bit**	**Meaning**
00	Deselect STO	00	STO active
01	Deselect SS1	01	SS1 active
02	Deselect SS2	02	SS2 active
03	Deselect SOS	03	SOS active
04	Deselect SLS	04	SLS active
05	Reserved	05	Reserved
06	Reserved	06	Reserved
07	Safe acknowledgment	07	Internal event
08	Deselect SLA	08	SLA active
09	Select SLS bit 0	09	SLS Limit Bit 0 active
10	Select SLS bit 1	10	SLS limit bit 1 active
11	Reserved	11	Reserved
12	Deselect SDI positive	12	SDI positive active
13	Deselect SDI negative	13	SDI negative active
14	Reserved	14	Reserved
15	Reserved	15	SSM (speed, low limit)
16	Reserved	16	Reserved
17	Reserved	17	Reserved
18	Reserved	18	Reserved
19	Reserved	19	Reserved
20	Reserved	20	Reserved
21	Reserved	21	Reserved
22	Reserved	22	Reserved
23	Reserved	23	Reserved
24	Reserved	24	Reserved
25	Reserved	25	Reserved
26	Reserved	26	Reserved
27	Reserved	27	Reserved
28	Deselect SSE2	28	SS2E active
29	Reserved	29	SOS selected
30	Reserved	30	Reserved
31	Reserved	31	Reserved

A.1.4.6 Safety control word 1B and safety status word 1B

Safety control word 1B (S_STW1B)		**Safety status word 1B (S_ZSW1B)**	
Bit	**Meaning**	**Bit**	**Meaning**
00	Reserved	00	STO active
01	Reserved	01	SS1 active
02	Reserved	02	SS2 active
03	Reserved	03	SOS active
04	Reserved	04	SLS active
05	Reserved	05	SOS selected
06	Reserved	06	SLS selected
07	Reserved	07	Internal event
08	Extended Functions Test stop selection	08	SLA selected
09	Reserved	09	Select SLS Bit 0
10	Reserved	10	Select SLS Bit 1
11	Reserved	11	Reserved
12	Extended Functions Premature SOS after SS2E	12	SDI positive selected
13	Reserved	13	SDI negative selected
14	Reserved	14	Reserved
15	Reserved	15	Safety message active

A.1.4.7 Safety status word 2B

---	---	**Safety status word 2B (S_ZSW2B)**	
		Bit	**Meaning**
---	---	00	Reserved
		01	Reserved
		02	Reserved
		03	Reserved
		04	Reserved
		05	Reserved
		06	Reserved
		07	Reserved
		08	SDI positive selected
		09	SDI negative selected
		10	Reserved
		11	Reserved
		12	Test stop active
		13	Test stop required
		14	Reserved
		15	Reserved

A.1.4.8 Safety control word 3B and safety status word 3B

Safety control word 3B (S_STW3B)		Safety status word 3B (S_ZSW3B)	
Bit	**Meaning**	**Bit**	**Meaning**
00	Selecting the brake test	00	Brake test selected
01	Start brake test	01	Setpoint specification, drive/external
02	Reserved	02	Reserved
03	Select test torque sign	03	Brake test active
04	Select test sequence	04	Brake test result
05	Reserved	05	Brake test completed
06	Reserved	06	Reserved
07	Reserved	07	Current load sign
08	Reserved	08	Reserved
09	Reserved	09	Reserved
10	Reserved	10	Reserved
11	Reserved	11	SS2E
12	Reserved	12	Reserved
13	Reserved	13	Reserved
14	Reserved	14	Reserved
15	Reserved	15	Acceptance test mode selected

A.1.4.9 Message word

---	---	Message word 2B (MELDW)	
		Bit	**Meaning**
---	---	00	Reserved
		01	Torque utilization < threshold 2
		02	|n_actual| < speed threshold 3
		03	|n_actual| < speed threshold 2
		04	Reserved
		05	Reserved
		06	No warning motor overtemperature
		07	No warning converter overtemperature
		08	n-target/actual deviation within tolerance
		09	Reserved
		10	Reserved
		11	Servo enable
		12	Drive ready
		13	"Pulses enabled"
		14	Reserved
		15	Reserved

A.2 Use of SSL/TLS certificates for secure data transmission

Overview

You require a valid SSL/TLS certificate to establish a secure HTTPS connection between your commissioning device (PG/PC, tablet or smartphone) and the web server.

Establishing an HTTPS connection using a valid SSL/TLS certificate

The following options are available to establish a secure HTTPS connection using a valid SSL/TLS certificate:

- Use an SSL/TLS certificate from a certificate authority
- Use a user-defined SSL/TLS certificate
  When doing this, the user generates an SSL/TLS certificate using suitable software (e.g. OpenSSL). The user must ensure that the browser being used trusts the user-defined certificate and the HTTPS connection can be classified as secure.
  Additional information about calling a secure HTTPS connection when using a user-defined certificate is provided in Chapter "Using a self-created or purchased certificate (Page 674)".
- Using a self-signed certificate
  This certificate type is automatically generated when calling an HTTPS connection. The user must trust the self-signed certificate in order that a secure HTTPS connection can be established.
  Additional information about calling a secure HTTPS connection when using a self-signed certificate is provided in Chapter "Using a self-signed certificate (Page 676)".

Duration of validity

The certificates generated from the firmware files are valid until 01.01.2030. After expiration of the validity period, install new valid certificates on all the relevant drives.

Validating user-defined and purchased server certificates

When calling an HTTPS connection to the web server, the validity of a user-defined or purchased server certificate is validated **by the browser being used**. The following criteria are used for the validation:

Criterion	Browser	Web server
The server certificate originates from a certificate authority, whose private server key is contained in the Windows certificate store or in the certificate store of the browser being used in the list of trustworthy certification authorities.	X	–
The server certificate specifies the maximum validity period of the certificate.	X	–
The server certificate includes the currently valid IP address of the interface, via which communication is established. **Note** The server certificate can contain IP addresses set in the factory (e.g.: https://169.254.11.22 for service interface X127 at the converter) as well as user-defined IP addresses.	X	–

All criteria that are used as basis must be satisfied in order that a server certificate is validated. Server certificates that are not validated are classified as invalid.

Validation failed

When calling an HTTP connection to the web server, if a user-defined or purchased SSL/TLS certificate is not validated, then a secure HTTPS connection cannot be established. The user must ensure that the user-defined or purchased SSL/TLS certificate complies with all of the criteria listed above, and is validated by the browser being used.

Validating self-signed certificates

When calling an HTTPS connection to the web server, the validity of an self-signed certificate is validated **by the browser being used and the web server**. The following criteria are used for the validation:

Criterion	Browser	Web server
The server certificate originates from a certificate authority, whose private server key is contained in the Windows certificate store or in the certificate store of the browser being used in the list of trustworthy certification authorities.	X	–
The server certificate specifies the maximum validity period of the certificate.	X	X
The server certificate contains the currently valid IP addresses of service interface X127 and PROFINET interface X150. **Note** The server certificate can contain IP addresses set in the factory (e.g.: https://169.254.11.22 for service interface X127 at the converter) as well as user-defined IP addresses.	X	X

All criteria that are used as basis must be satisfied in order that a server certificate is validated. Server certificates that are not validated are classified as invalid.

Validation failed

When calling an HTTPS connection to the web server, if a self-signed certificate is not validated, the certificate is overwritten by a self-signed certificate that the converter automatically generates.

Overwriting the previously used server certificate by a self-signed certificate can cause the web server to slow down significantly. To prevent this, depending on the browser being used, proceed as described in one of the following chapters:

- Internet Explorer 11 application (Page 677)
- Using Google Chrome and Microsoft edge (Page 684)
- Using Mozilla Firefox (Page 692)

Important notes

- Using an invalid server certificate:
  When calling an HTTPS connection to the web server, if you use a server certificate that is classified as invalid then this can significantly slow down the web server.
- Firmware version V5.2 SP3:
  If you upgrade your drive to the current firmware version V5.2 SP3, and the previously used server certificate is not validated when calling an HTTPS connection, the previously used server certificate is overwritten by a new self-signed certificate.
  Validating a self-signed certificate can fail for the following reasons, for example:
  – After the upgrade, the IP addresses of service interface X127 and/or PROFINET interface X150, included in the newly generated server certificate, do not match the IP addresses contained in the previously used server certificate.

A.2.1 Using a self-created or purchased certificate

Overview

You can either generate your own SSL/TLS certificates for secure data transfer or purchase them from a certificate authority. You can find certificate authorities for purchasing certificates as well as software to generate certificates (e.g. OpenSSL) on the Internet.

As shown in the following example, a valid SSL/TLS certificate comprises a server certificate and a private server key. The server certificate and the private key must be individualized for the relevant IP address.

• Server certificate:	<IP addr>.TLS.crt	Example: 192.168.2.90.TLS.crt
• Private server key:	<IP addr>.TLS.key	Example: 192.168.2.90.TLS.key

Requirements

- You have connected your commissioning device to service interface X127 or PROFINET interface X150.
- You have administrator rights on your commissioning device.
- You have an approved memory card
  Additional information regarding permissible memory cards is provided in Chapter "Memory cards (Page 435)".
- You have a user-defined or purchased SSL/TLS certificate comprising server certificate (*.crt) and private server key (*.key). Certificate files (*.crt and *.key) are saved in your commissioning device in a folder that only you can access.

Copying certificate files to an approved memory card

To copy a user-defined or purchased SSL/TLS certificate to an approved memory card, proceed as follows:

1. Switch off your drive.
2. Ensure that the memory card is inserted in your commissioning device or card reader
3. Ensure that the memory card in your file browser is displayed as available memory card.
4. Open the corresponding drive in your file browser.
5. Create a new folder if the memory card is empty.
6. Rename the new folder "OEM".
   Observe the uppercase syntax for the folder name.
7. Open folder "OEM" and create the following directory structure in it:
   – Folder "OEM" → Folder "SINAMICS" → Folder "WEB" → Folder "WEBCONF" → Folder "CERT"

   Observe the uppercase syntax for folder names.
   OR
8. Copy the certificate files (*.crt and *.key) into the existing directory if the memory card contains the firmware files for the converter:
   – OEM\SINAMICS\WEB\WEBCONF\CERT
9. If required, rename the server certificate to be "SINAMICS.crt".
10. If required, rename of the private key to be "SINAMICS.key".
11. Insert the memory card into your drive.
12. Switch on your drive.
    The drive powers up.
13. Wait until the drive has finished ramping up.
14. Proceed as described in the following section.

Establishing a secure HTTPS connection

Proceed as follows to establish a secure HTTPS connection between the browser and the web server:

1. Open the browser.
2. Call the web server using the IP address of your drive (e.g.: https://169.254.11.22 for service interface X127 at the converter).
   The login page of the web server opens.
   Generally, a secure connection is indicated using a lock symbol in the browser address line.

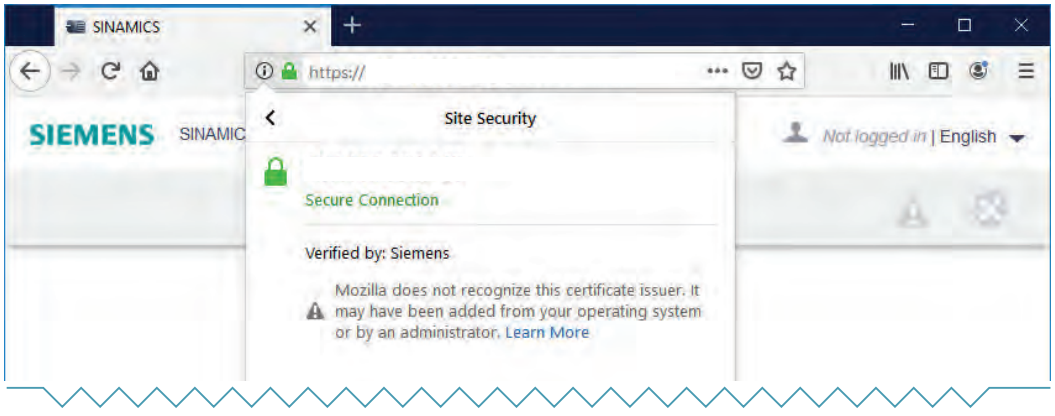


Figure A-1 Example: Mozilla Firefox

Result

By copying the certificate files (*.crt and *.key) to the Siemens memory card of your SINAMICS drive, the user-defined or purchased server certificate is validated, and the HTTPS connection is classified as being secure.

A.2.2 Using a self-signed certificate

Overview

The converter automatically generates a server certificate when first establishing an HTTPS connection to the web server. The certificate files required (*.crt and *key) are included in the firmware files of the converter.

In this case, the self-signed certificate is individualized for the IP address of the interface, via which communication is established (e.g.: https://169.254.11.22 for service interface X127 at the converter).

Security warning with non-secure HTTPS connection

The usual Internet browsers do not validate self-signed certificates. As a consequence, the browser classifies these certificates as invalid, and when calling an HTTPS connection first issues a security warning.

For the browser to trust a self-signed certificate, the self-signed certificate must first be exported from the browser and then installed or imported into the certificate store of the Windows system.

A secure HTTPS connection can be established once the self-signed certificate has been successfully installed or has been imported into the certificate store of the Window system.

Managing certificates in common browsers

The essential features and special issues relating to the following browsers in conjunction with certificate management in the Window system are listed in the following table:

Browser	Version	Engine	Certificate management
Google Chrome	80.0.3987.122 [64 bit]	Chromium	The browser only accesses certificates that are saved in the certificate store of the Windows system. A self-signed certificate cannot be directly installed from the browser.
Microsoft Edge	81.0.416.72 [64 bit]		
Mozilla Firefox	68.8.0 ESR [32 bit]	Gecko	Data relating to Google Chrome and Microsoft Edge are applicable. Mozilla Firefox also has its own certificate management integrated in the browser.
Internet Explorer 11	11.1425.17134.0	Trident	A self-signed certificate can be directly installed from the browser. The certificate is saved in the certificate store of the Windows system.

Restrictions

The descriptions in this chapter refer exclusively to the browser versions listed above. Browser response can deviate depending on the browser version being used. The display examples contained in this chapter may differ from the displays in your browser or commissioning device.

Important notes

- Using a self-signed certificate as subsequently described does not represent the most secure form of data transfer via an HTTPS connection. Only use the self-signed certificate in secure networks (e.g. PROFINET below a PLC) or for direct point-to-point connections to the service interface X127 or PROFINET interface X150.

A.2.3 Internet Explorer 11 application

Overview

Internet Explorer 11 uses the "Trident" browser engine and accesses the Windows certificate store. Using Internet Explorer 11 self-signed certificates can be installed in the Window certificate store directly from the browser.

It is crucial that the subsequently described steps are complied with to establish a secure HTTPS connection between the browser and the web server.

Important notes

- Certificates, which are installed in the Windows certificate store using Internet Explorer 11 and are classified as valid, are also available for other browsers (e.g. Chrome, Edge, Firefox). This applies to all certificate types.

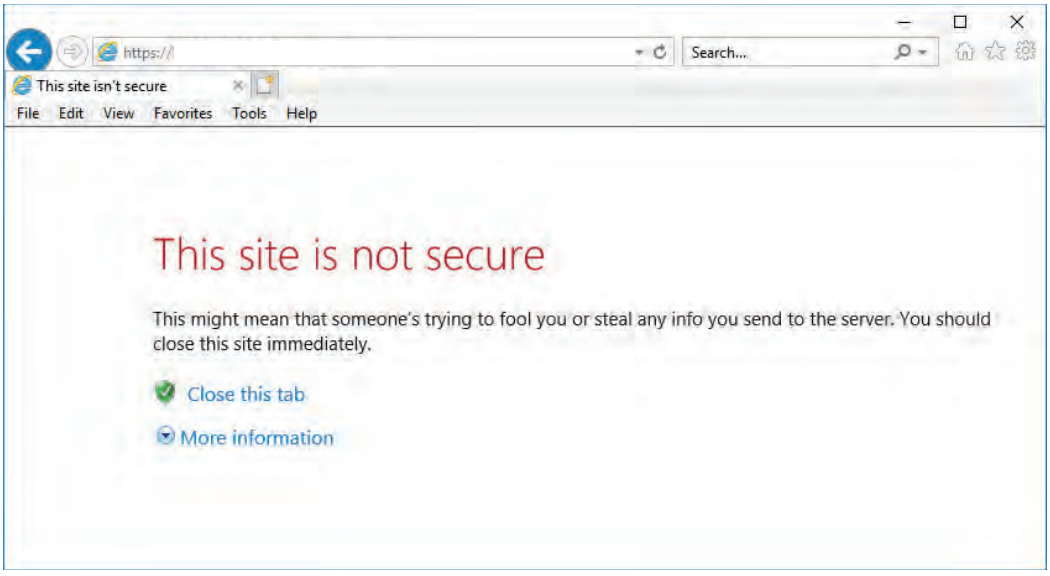
Requirements

- You have connected your commissioning device to service interface X127 or PROFINET interface X150.
- You have administrator rights on your commissioning device.

Calling the web server via an HTTPS connection

Proceed as follows to establish an HTTPS connection between the browser and the web server:

1. Open the browser.
2. Call the web server using the IP address of your drive (e.g.: https://169.254.11.22 for service interface X127 at the converter).
   When establishing the HTTPS connection, the converter automatically generates a server certificate. The self-signed certificate is individualized for the IP address of the interface being used.
   The browser classifies the certificate as being invalid, and responds with a security warning.

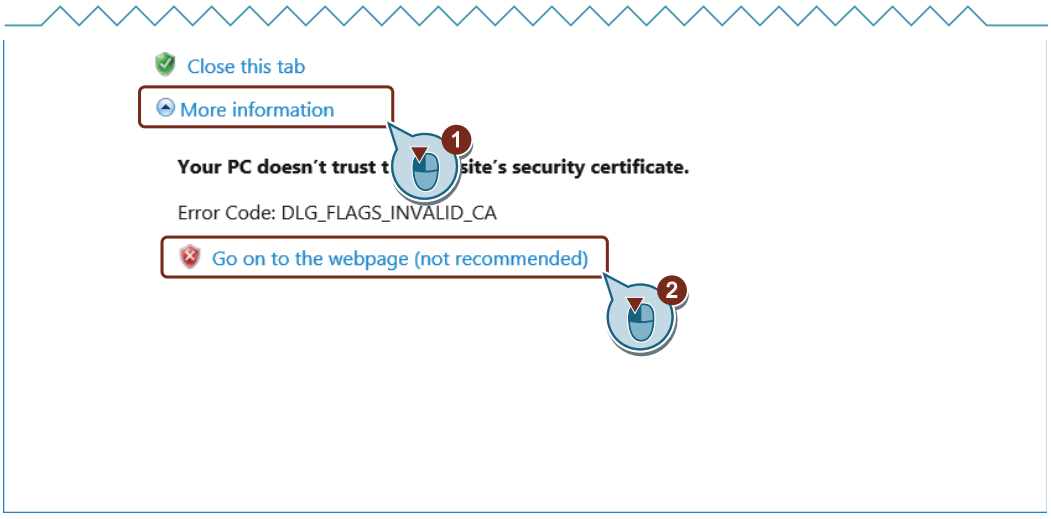


3. Proceed as described in the following section.

Installing a certificate

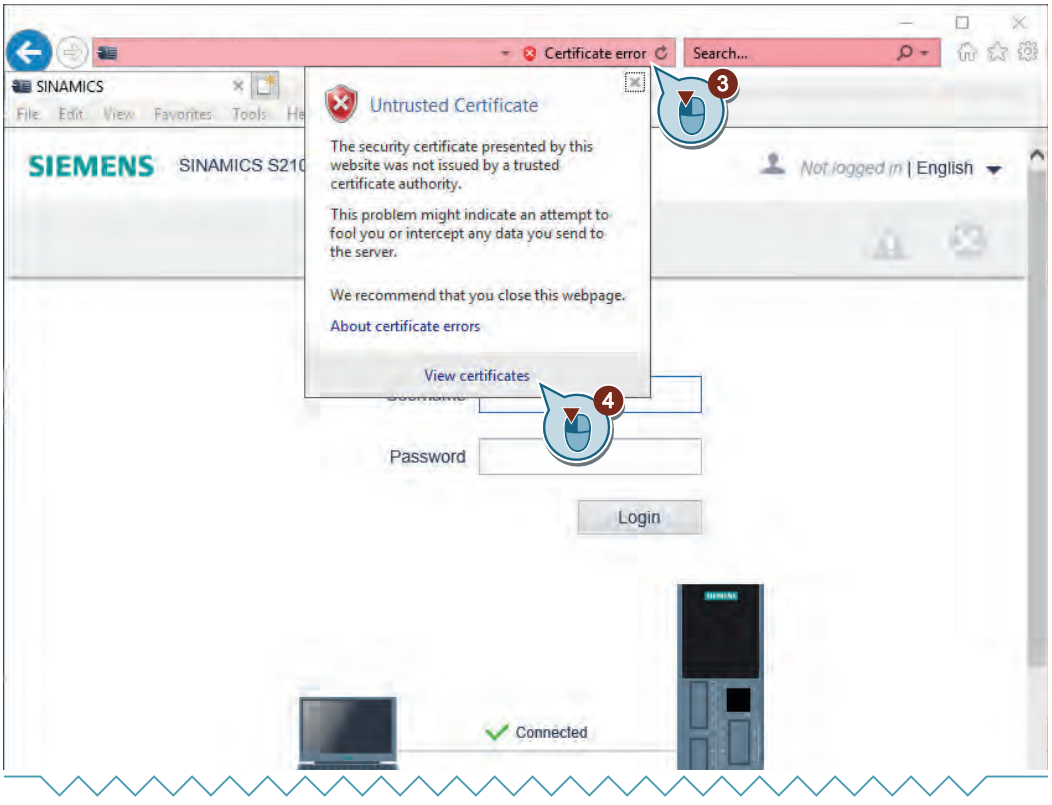
Proceed as follows to install the self-signed certificate:

1. In the the opened webpage, click on option "More information" ①.



2. Click on "Go on to the web page (not recommended)" ②.
   The login page of the web server opens.
   Status "Certificate error" is displayed in the browser address line.

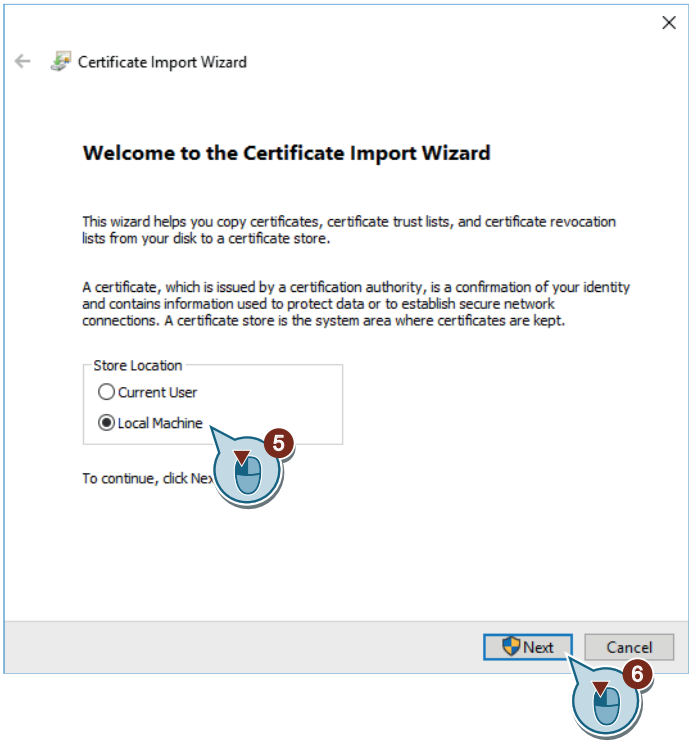
3. In the browser address line, click on status display "Certificate error" ③.



A corresponding dialog is displayed.

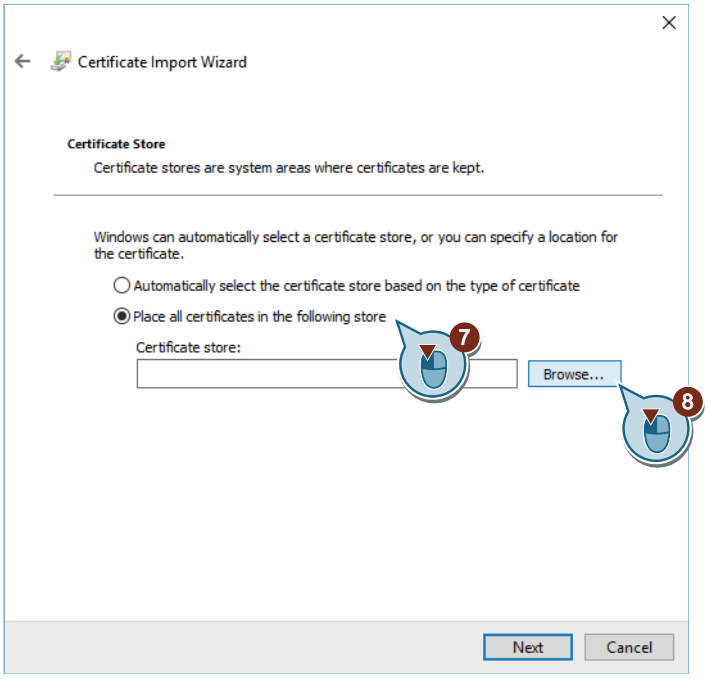
4. Click on "Display certificate" ④.
   Dialog "certificate" opens.
5. Under tab "General", click on "Install certificate...".
   The "Certificate Export Wizard" opens.

6. On the wizard welcome page, select option "Local computer" ⑤.

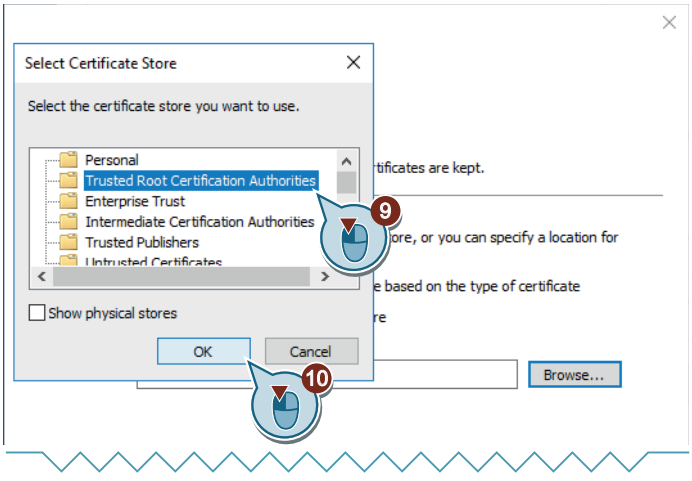


7. To continue the operation, click on "Next" ⑥.
   The "User Account Control" dialog opens.
8. Acknowledge the confirmation prompt with "Yes".
   The dialog to select the certificate store opens.

9. Select option "Place all certificates in the following store" ⑦.



10. Click on "Browse..." ⑧.
    A corresponding dialog opens.
11. Select the certificate store "Trusted Root Certification Authorities" ⑨.



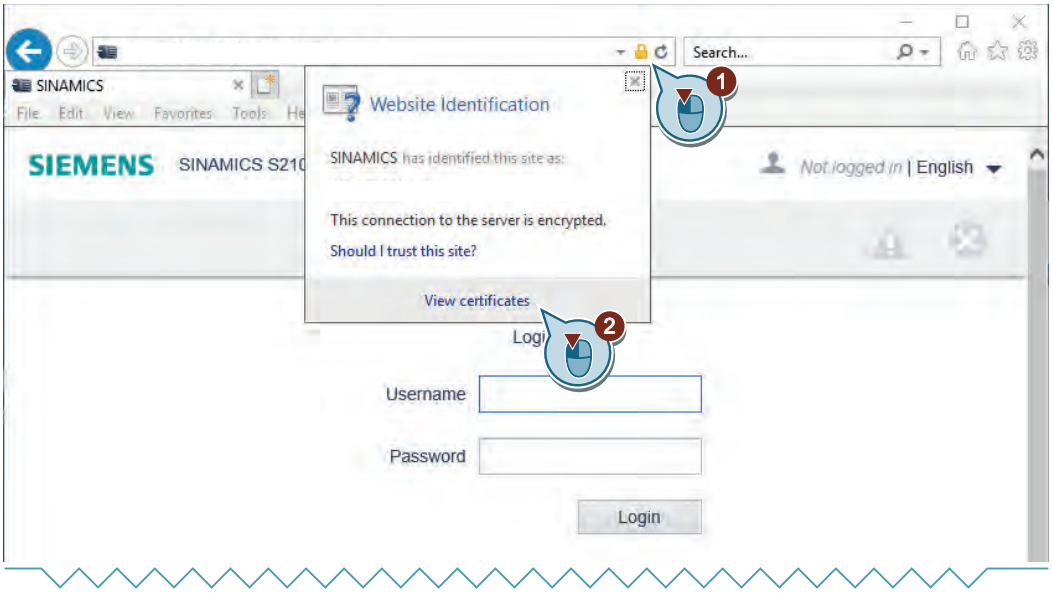
12. Click "OK" ⑩ to confirm the selection.
13. To continue the operation, click on "Next".
    An overview of the settings made is displayed for you to check.
14. Click "Finish" to apply the settings.
    The Wizard reports that the export has been completed successfully.
15. Confirm the procedure with "OK".
    The Wizard closes.

16. Close dialog "Certificate".
17. Close the browser.
18. Proceed as described in the following section.

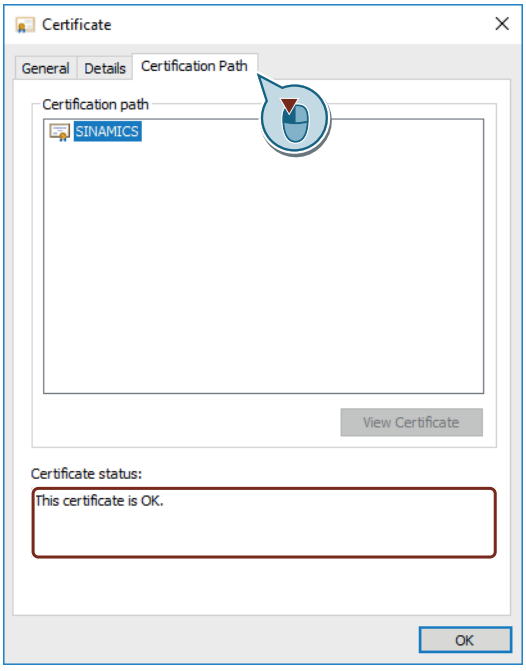
Establishing a secure HTTPS connection

Proceed as follows to establish a secure HTTPS connection between the browser and the web server:

1. Open the browser.
2. Call the web server using the IP address of your drive (e.g.: https://169.254.11.22 for service interface X127 at the converter).
   The login page of the web server opens.
   A secure connection is indicated using a lock symbol in the browser address line.
3. Click on the lock symbol ① to check the certification status .



4. Click on "View certificates".
   Dialog "certificate" opens.
5. Click on tab "Certification Path".
   The certification status is displayed in the lower part of the window.



Result

The self-signed certificate is validated, and the HTTPS connection is classified as secure by installing the automatically generated server certificate in the Windows certificate store.

A.2.4 Using Google Chrome and Microsoft edge

Overview

Google Chrome and Microsoft Edge use the "Chromium" browser engine, and when checking certificates, access the Windows certificate store. This applies to all browsers that use "Chromium" as browser engine.

To keep it simple, only screen examples from Google Chrome are subsequently shown. The term "Browser" refers to both Google Chrome and Microsoft Edge.

It is crucial that the subsequently described steps are complied with to establish a secure HTTPS connection between the browser and the web server.

Important notes

- Certificates that are installed in the Windows certificate store using Internet Explorer 11 and are classified as valid are also available for other browsers (e.g. Chrome, Edge, Firefox). This applies to all certificate types.
  If you have already installed the self-signed certificate using Internet Explorer 11, then you can skip the steps described below and go directly to section "Establishing a secure HTTPS connection". Otherwise, proceed as described below.

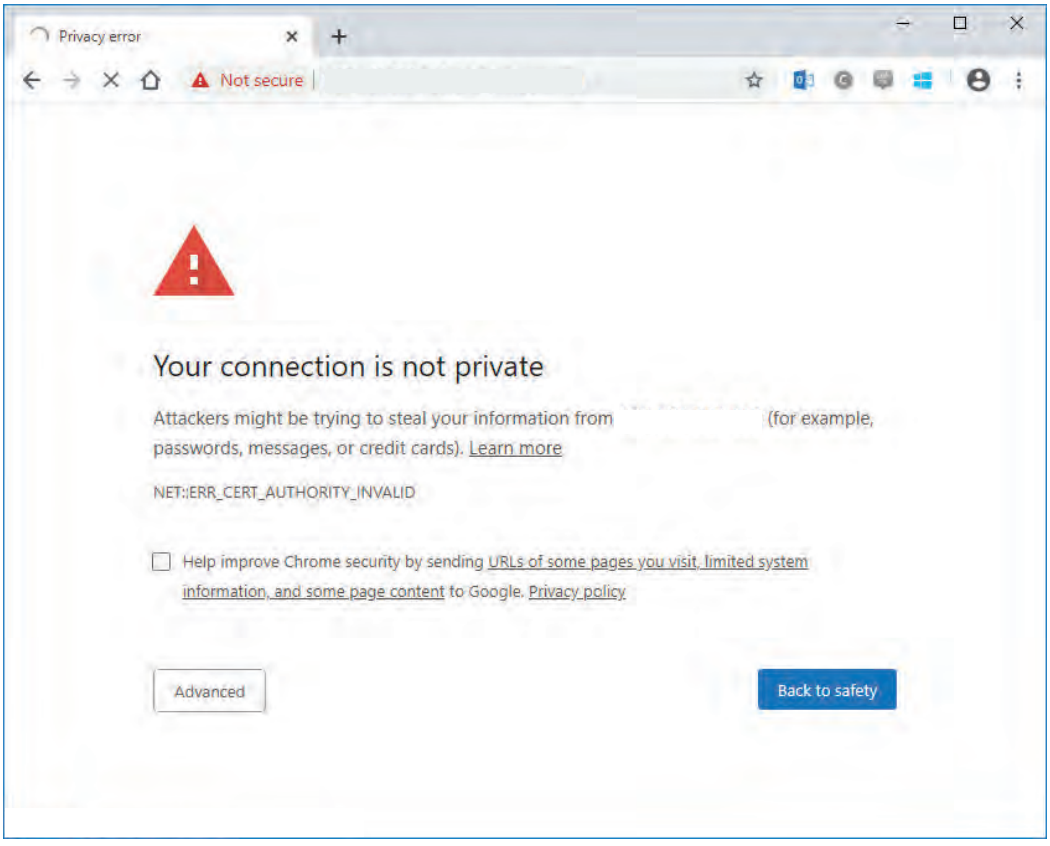
Requirements

- You have connected your commissioning device to service interface X127 or PROFINET interface X150.
- You have administrator rights on your commissioning device.

Calling the web server via an HTTPS connection

Proceed as follows to establish an HTTPS connection between the browser and the web server:

1. Open the browser.
2. Call the web server using the IP address of your drive (e.g.: https://169.254.11.22 for service interface X127 at the converter).
   When establishing the HTTPS connection, the converter automatically generates a server certificate. The self-signed certificate is individualized for the IP address of the interface being used.
   The browser classifies the certificate as being invalid, and responds with a security warning.

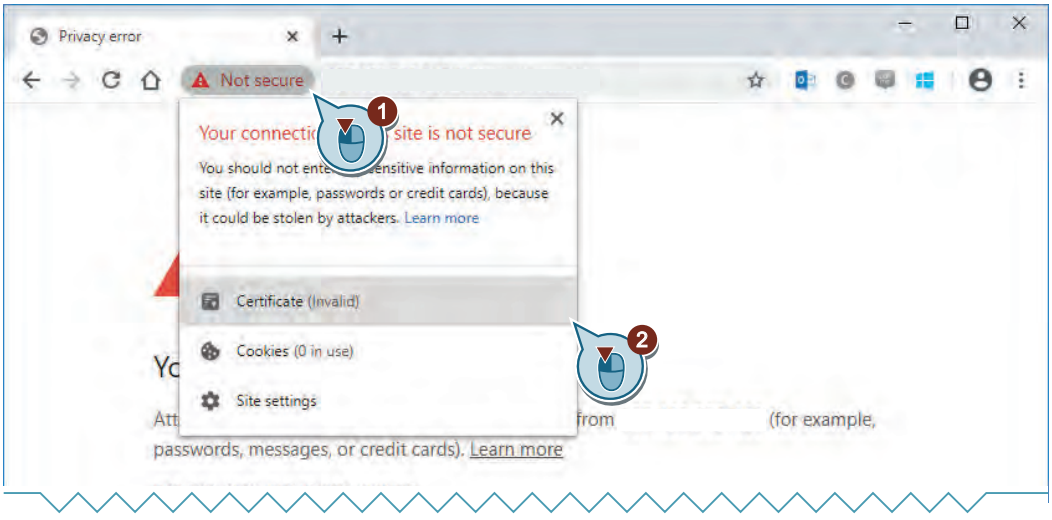


3. Proceed as described in the following section.

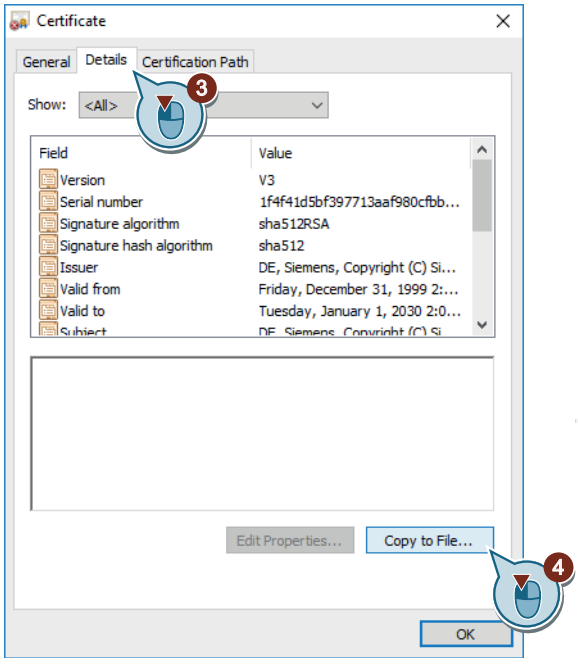
Exporting a certificate

Proceed as follows to export the generated certificate:

1. In the browser address line, click on status display "Not secure" ①.
   A corresponding dialog opens.

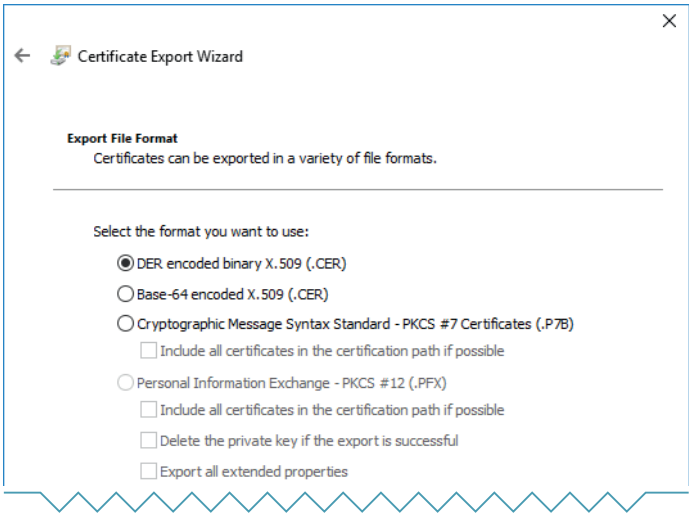


2. Click on "Certificate (invalid)" ②.
   Dialog "certificate" opens.
3. Click the "Details" tab ③.

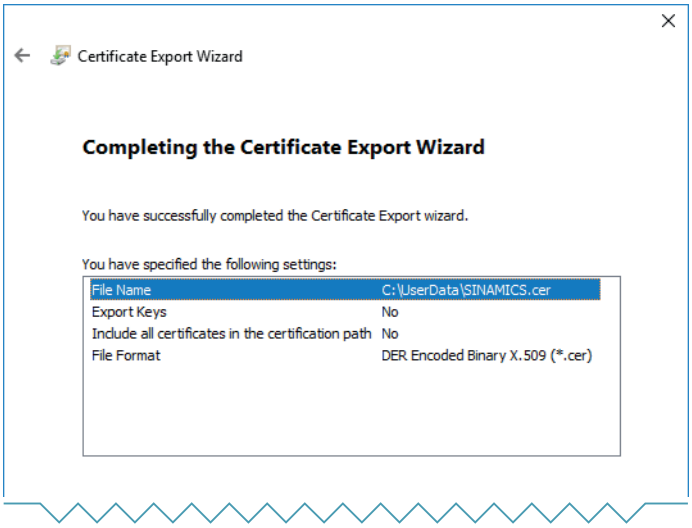


4. To export the certificate, click on "Copy to File..." ④.
   The "Certificate Export Wizard" opens.

5. On the Wizard welcome page, click on "Next".
   The dialog for selecting the export format opens.
   In the default setting, format "DER-coded-binary X.509 (.CER)" is selected.



6. To continue the operation, click on "Next".
   The dialog for selecting the storage location opens.
7. Click on "Browse...".
   The file explorer opens.
8. Navigate to the desired storage location.
9. Assign a descriptive name to the certificate and then click on "Save".
   The file explorer closes.
10. To continue the operation, click on "Next".
    An overview of the settings made is displayed for you to check.



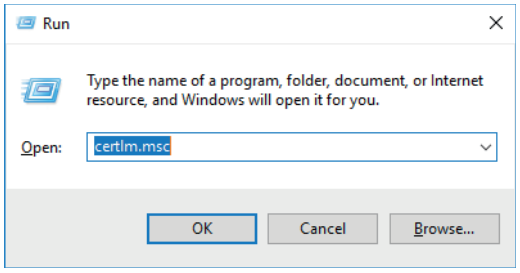
11. Click "Finish" to apply the settings.
    The Wizard reports that the export has been completed successfully.

12. Confirm the procedure with "OK".
    The Wizard closes.
13. Close dialog "Certificate".
14. Close the browser.
15. Proceed as described in the following section.

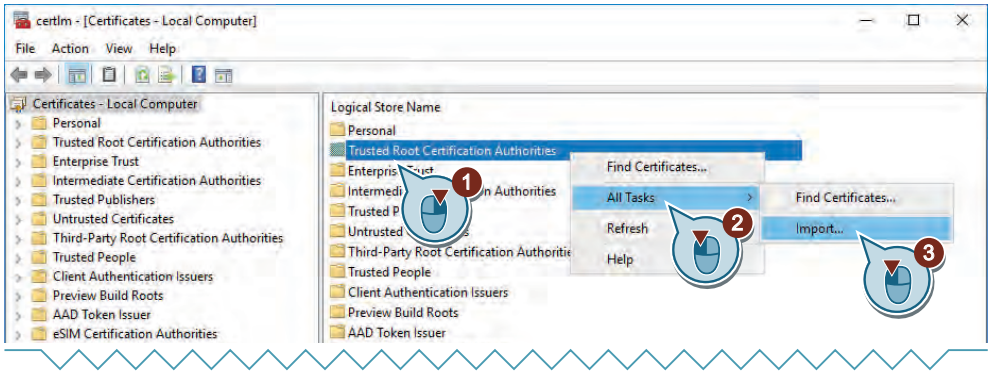
Importing a certificate

Proceed as follows to import the certificate that was exported to the Windows certificate store:

1. Press the keys + R at the same time.
   The command line input opens.
2. Enter the command "certlm.msc" and click "OK".

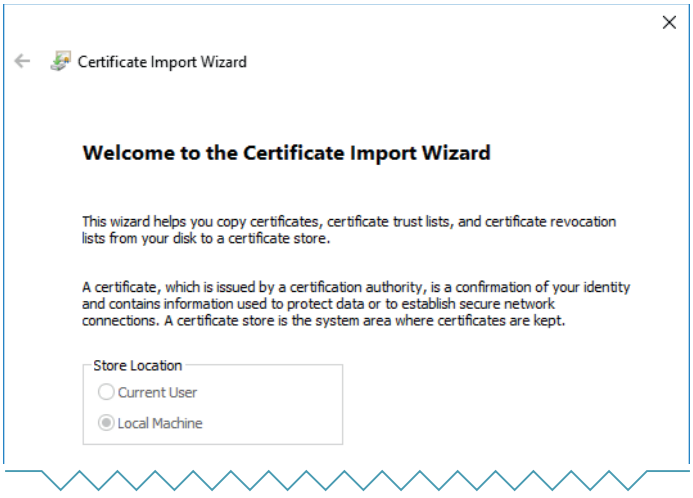


   The "User Account Control" dialog opens.
3. Confirm the prompt in the "User Account Control" dialog with "Yes".
   The certificate store opens.
4. Right-click the "Trusted Root Certification Authorities" folder ①.

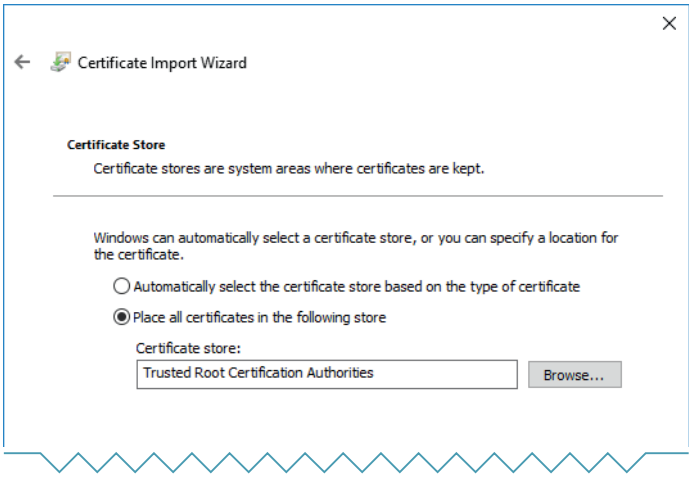


   The possible actions are displayed.
5. Click "All Tasks" ②.
   The tasks are displayed.

6. Click "Import" ③.
   The "Certificate Import Wizard" opens.
   "Local Machine" is preset as storage location.



7. To continue the operation, click on "Next".
   The dialog for specifying the certificate to be imported opens.
8. Click "Browse...".
   The file explorer opens.
9. Go to the storage location of the exported certificate.
10. Click on the certificate to be imported.
    The path is displayed in the "File name" input field.
11. To continue the operation, click on "Next".
    The dialog for selecting the certificate store opens.
    The "Trusted Root Certification Authorities" certificate store is already set.



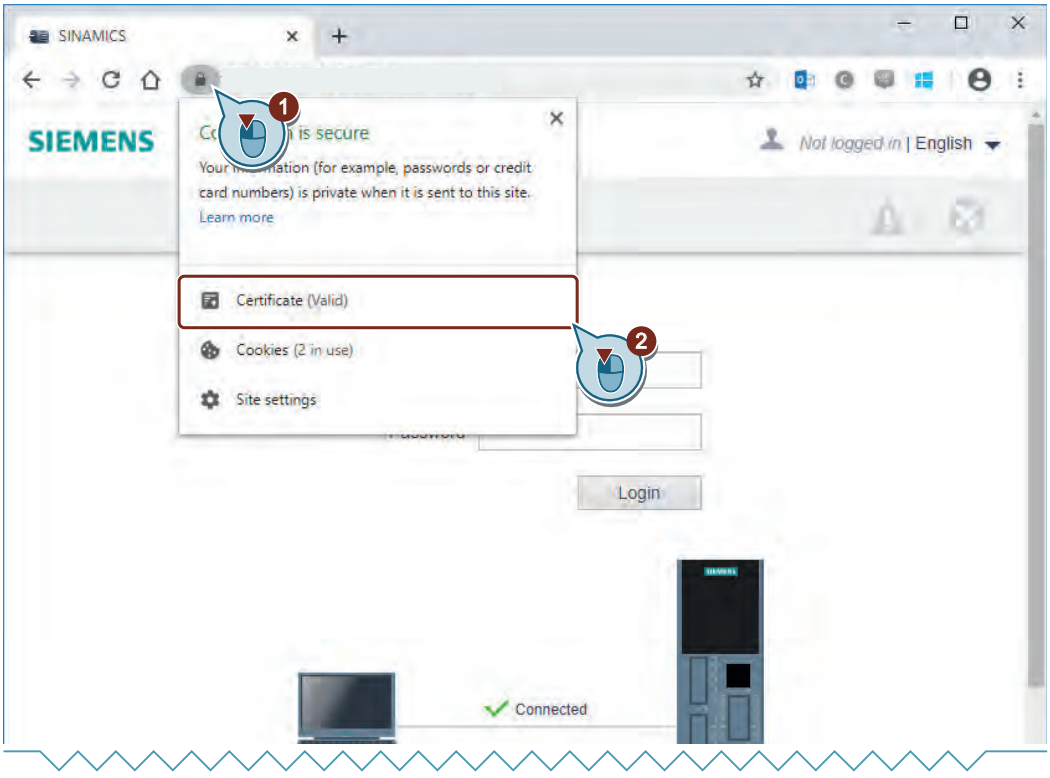
12. Confirm the settings with "Next".
    An overview of the settings made is displayed for you to check.

13. Click "Finish" to apply the settings.
    The Wizard reports that the import has been successfully completed.
14. Confirm the procedure with "OK".
    The Wizard closes.
15. Close the certificate store.
16. Proceed as described in the following section.

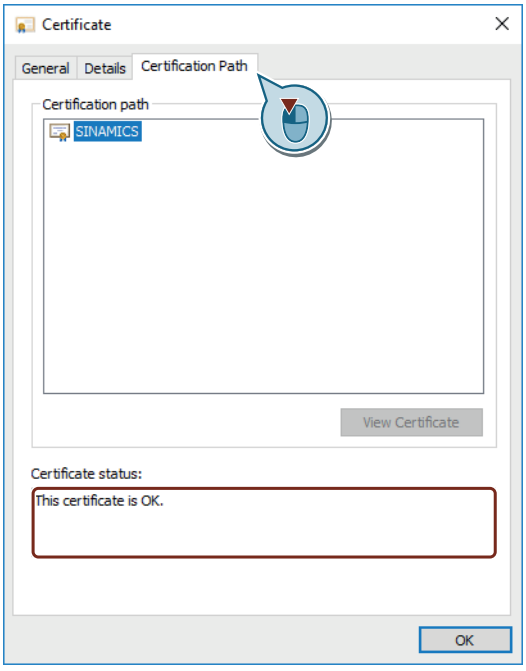
Establishing a secure HTTPS connection

Proceed as follows to establish a secure HTTPS connection between the browser and the web server:

1. Open the browser.
2. Call the web server using the IP address of your drive (e.g.: https://169.254.11.22 for service interface X127 at the converter).
   The login page of the web server opens.
   A secure connection is indicated using a lock symbol in the browser address line.
3. Click on the lock symbol ① in the browser address line to check the certification status.



4. Click on "Certificate (valid)" ②.
   Dialog "certificate" opens.
5. Click on tab "Certification Path".
   The certification status is displayed in the lower part of the window.



Result

The self-signed certificate is validated, and the HTTPS connection is classified as secure by installing the self-signed certificate in the Windows certificate store.

A.2.5 Using Mozilla Firefox

Overview

Mozilla Firefox uses browser engine "Gecko", and in addition to its own browser certificate management, it also accesses the Windows certificate store.

It is crucial that the subsequently described steps are complied with to establish a secure HTTPS connection between the browser and the web server.

Important notes

- Certificates that are installed in the Windows certificate store using Internet Explorer 11 and are classified as valid are also available for other browsers (e.g. Chrome, Edge, Firefox). This applies to all certificate types.
  If you have already installed the self-signed certificate using Internet Explorer 11, then you can skip the steps described below and go directly to section "Establishing a secure HTTPS connection". Otherwise, proceed as described below.

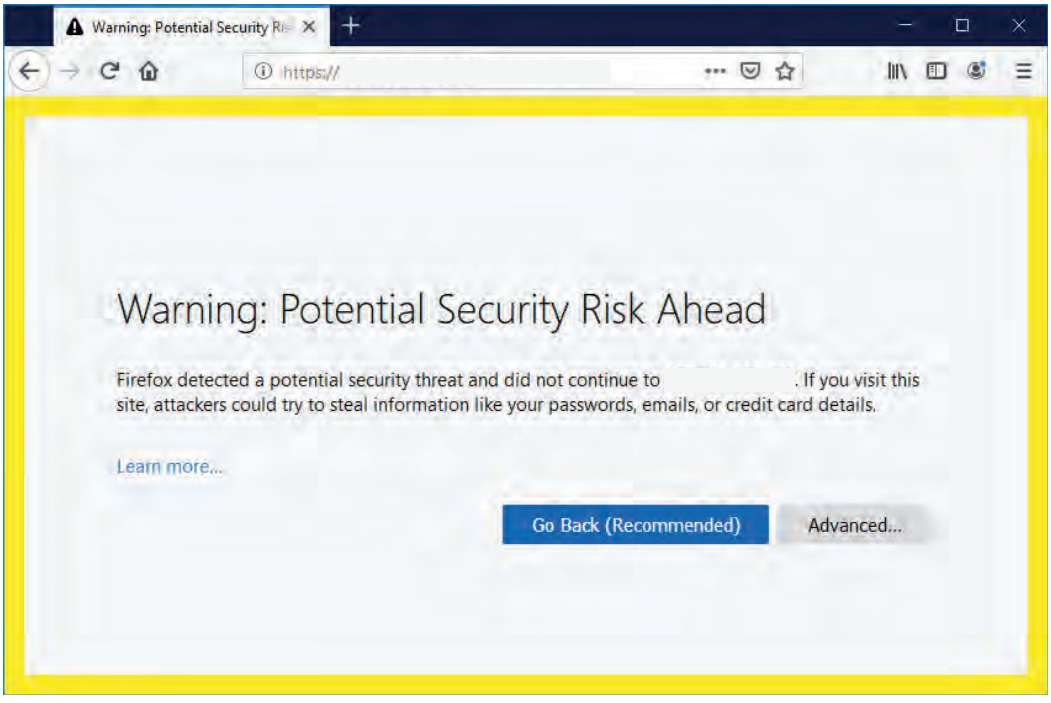
Requirements

- You have connected your commissioning device to service interface X127 or PROFINET interface X150.
- You have administrator rights on your commissioning device.

Calling the web server via an HTTPS connection

Proceed as follows to establish an HTTPS connection between the browser and the web server:

1. Open the browser.
2. Call the web server using the IP address of your drive (e.g.: https://169.254.11.22 for service interface X127 at the converter).
   When establishing the HTTPS connection, the converter automatically generates a server certificate. The self-signed certificate is individualized for the IP address of the interface being used.
   The browser classifies the certificate as being invalid, and responds with a security warning.

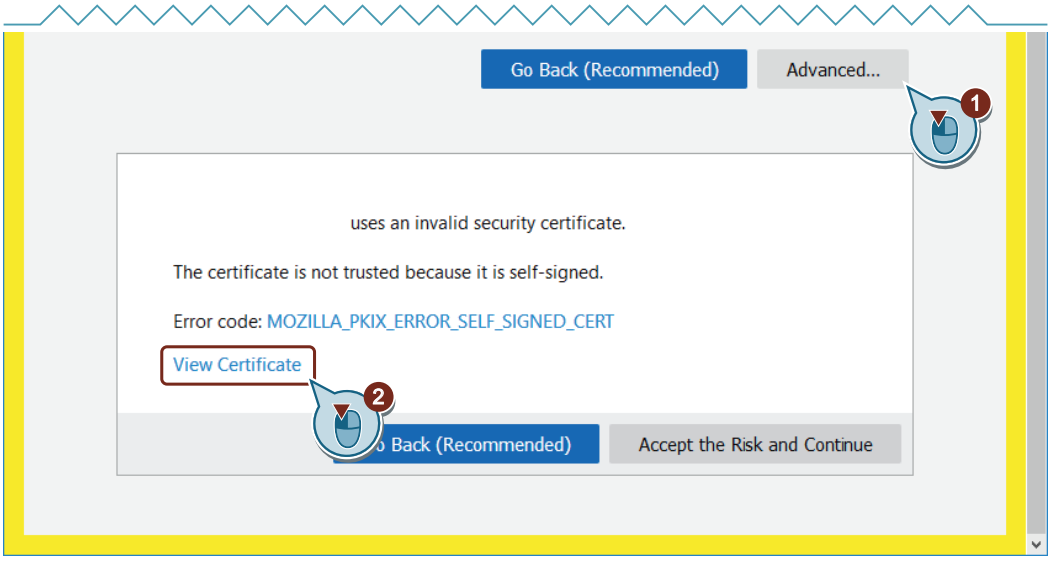


3. Proceed as described in the following section.

Exporting a certificate

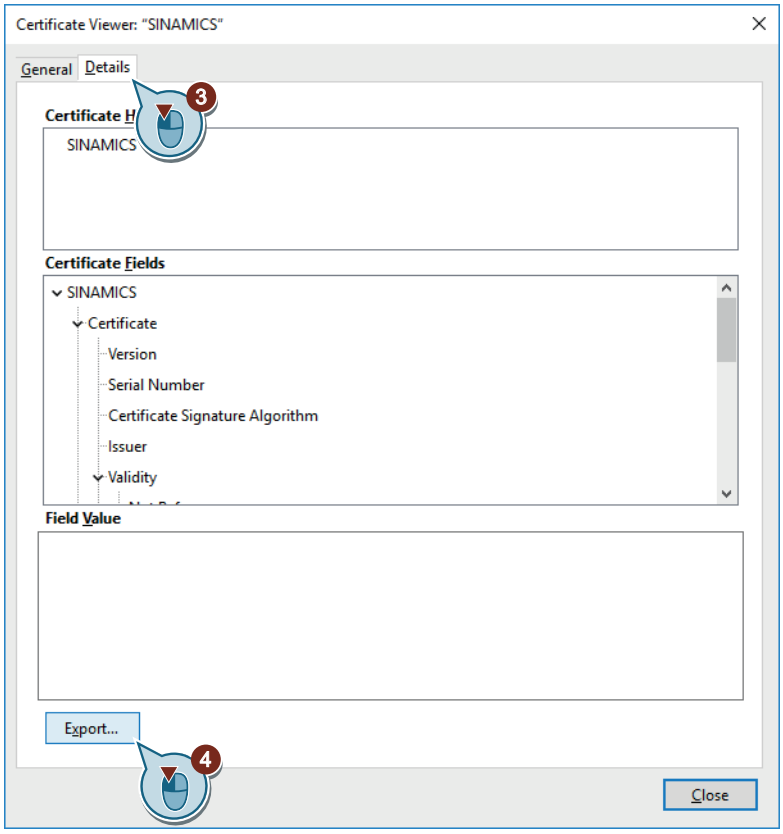
Proceed as follows to export the generated certificate:

1. In the open page, click on "Advanced" ①.
   A field with additional details and options is displayed.



2. Click on "View Certificate" ②.
   Dialog "Certificate view: SINAMICS" opens.

3. Click the "Details" tab ③.

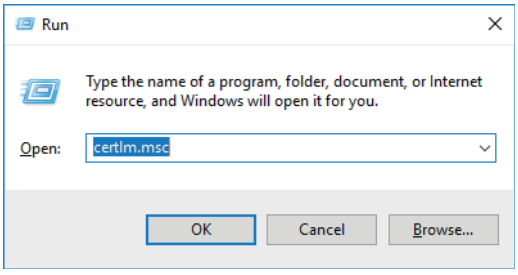


4. To export the certificate, click on "Export..." ④.
   The file explorer opens.
5. Navigate to the desired storage location.
6. Assign a descriptive name to the certificate and then click on "Save".
   The file explorer closes.
7. Close the dialog.
8. Close the browser.
9. Proceed as described in the following section.

Importing a certificate

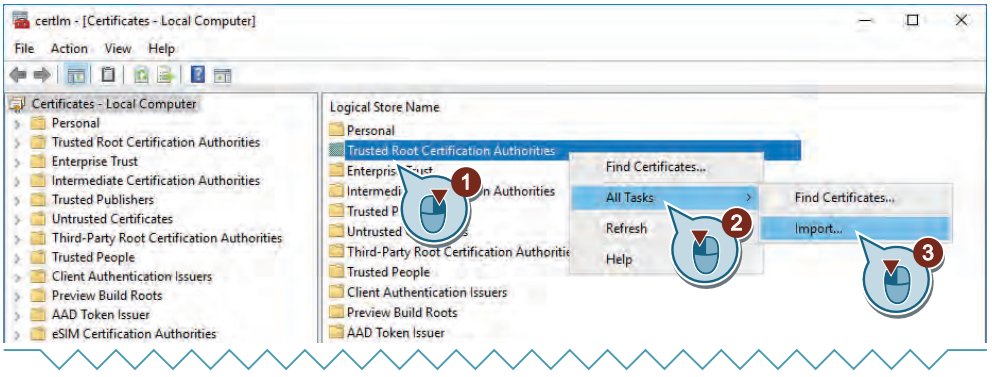
Proceed as follows to import the certificate that was exported to the Windows certificate store:

1. Press the keys + R at the same time.
   The command line input opens.
2. Enter the command "certlm.msc" and click "OK".



   The "User Account Control" dialog opens.

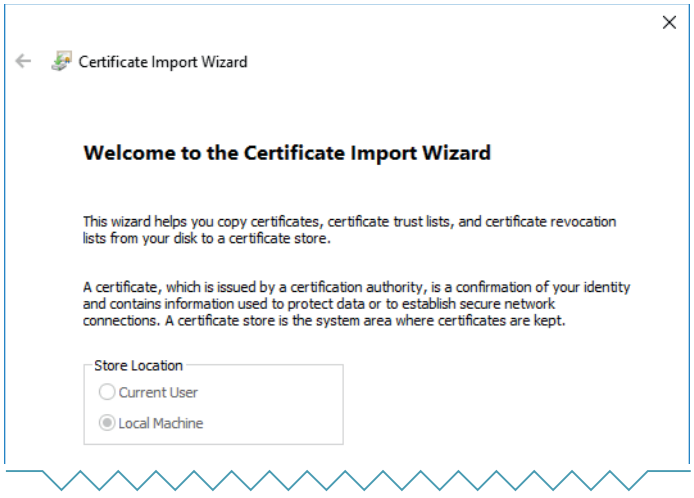
3. Confirm the prompt in the "User Account Control" dialog with "Yes".
   The certificate store opens.
4. Right-click the "Trusted Root Certification Authorities" folder ①.



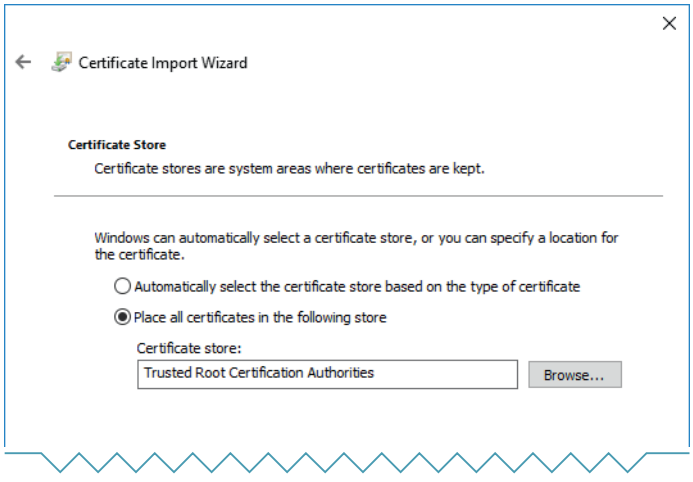
   The possible actions are displayed.

5. Click "All Tasks" ②.
   The tasks are displayed.

6. Click "Import" ③.
   The "Certificate Import Wizard" opens.
   "Local Machine" is preset as storage location.



7. To continue the operation, click on "Next".
   The dialog for specifying the certificate to be imported opens.
8. Click "Browse...".
   The file explorer opens.
9. Go to the storage location of the exported certificate.
10. Click on the certificate to be imported.
    The path is displayed in the "File name" input field.
11. To continue the operation, click on "Next".
    The dialog for selecting the certificate store opens.
    The "Trusted Root Certification Authorities" certificate store is already set.



12. Confirm the settings with "Next".
    An overview of the settings made is displayed for you to check.

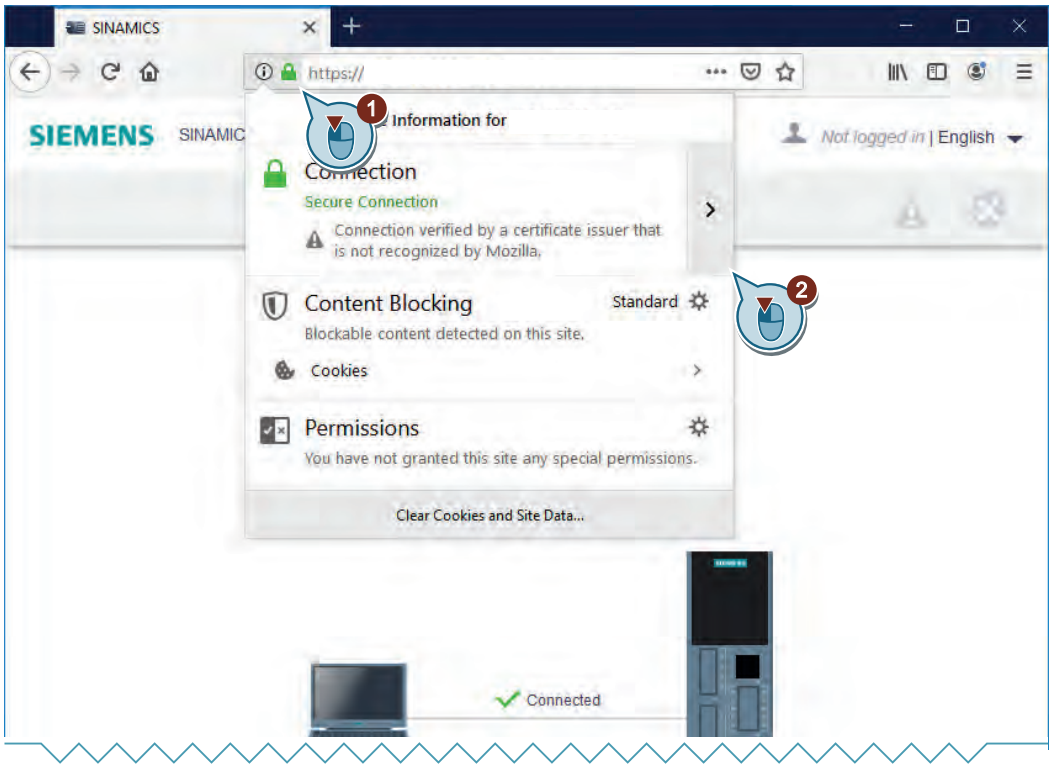
13. Click "Finish" to apply the settings.
    The Wizard reports that the import has been successfully completed.
14. Confirm the procedure with "OK".
    The Wizard closes.
15. Close the certificate store.
16. Proceed as described in the following section.

Establishing a secure HTTPS connection

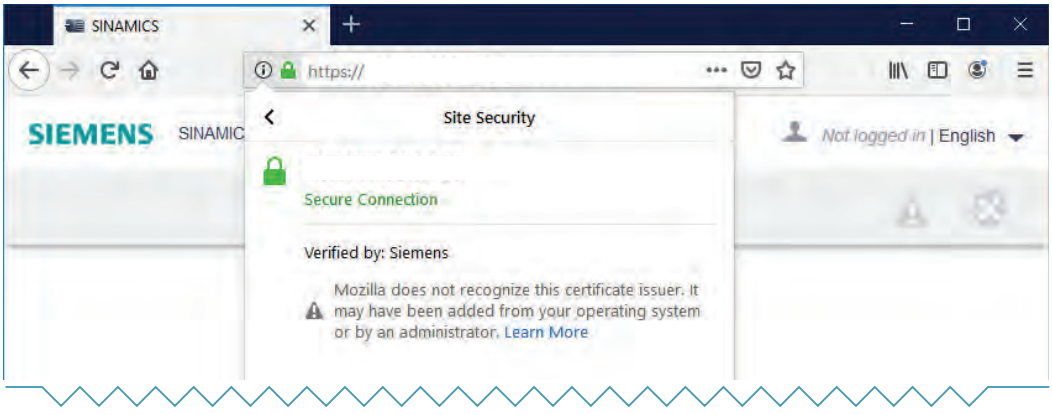
Proceed as follows to establish a secure HTTPS connection between the browser and the web server:

1. Open the browser.
2. Call the web server using the IP address of your drive (e.g.: https://169.254.11.22 for service interface X127 at the converter).
   The login page of the web server opens.
   A secure connection is indicated using a lock symbol in the browser address line.

3. Click on the lock symbol ① in the browser address line to check the status of the HTTPS connection.



4. To obtain additional details, click on button ② next to the displayed status message.



Result

The self-signed certificate is validated, and the HTTPS connection is classified as secure by installing the self-signed certificate in the Windows certificate store.

A.3 What is the difference between the Emergency Off and Emergency Stop functions?

"Emergency Off" and "Emergency Stop" are commands that minimize different risks in the machine or plant.

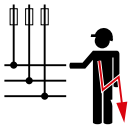
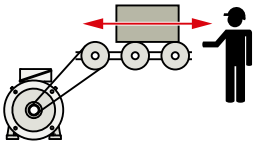
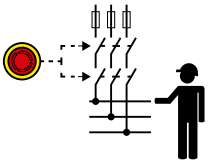
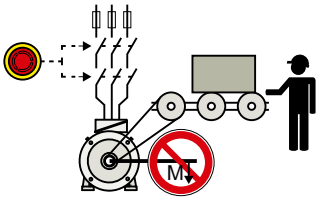
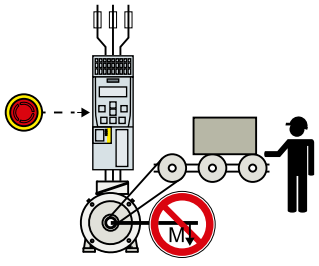
Emergency Off	**Emergency Stop**
Risk of electric shock. 	Risk of unexpected motion. 

Table A-1 Measures and solutions

Command	**Emergency Off**	**Emergency Stop**
Measure to minimize risk	**Safe switch off** Switching off the electric power supply for the installation, either completely or partially.	**Safely stop and safely prevent re-starting** Stopping or preventing the dangerous movement
Classic solution	Switch off the power supply. 	Switch off the drive power supply. 
Solution with the STO safety function integrated in the drive	STO is not suitable for safely switching off a voltage.	Select STO.  It is permissible that you switch off the converter power supply as well. However, switching off the voltage is not required as a risk-reduction measure.

A.4 Directives and standards

A.4.1 Directives, standards and certificates for the converter

Directives and standards that are complied with

The converters comply with the following directives and standards:

European Low-Voltage Directive

The converter fulfills the requirements stipulated in the Low-Voltage Directive 2014/35/EU, if they are covered by the field of application of this directive.

European Machinery Directive

The converter fulfills the requirements stipulated in the Machinery Directive 2006/42/EU, if they are covered by the field of application of this directive.

However, the use of the converter in a typical machine application has been fully assessed for compliance with the main regulations in this directive concerning health and safety.

European EMC Directive

The compliance of the converters with the regulations of the Directive 2014/30/EU has been verified through full compliance with IEC 61800-3.

Safety Integrated

The converters comply with the requirements relating to functional safety/safety of machinery.

RoHS

The converters comply with directive 2011/65/EU regarding limiting the use of certain hazardous substances.

Underwriters Laboratories (North American market)

Converters provided with one of the test symbols displayed on the left fulfill the requirements stipulated for the North American market as a component of drive applications, and are appropriately listed.

- UL file number for converters with 1 AC line connection: E355661
- UL file number for converters with 3 AC line connection: E192450

Eurasian conformity

The converter complies with the requirements of the Russia/Belarus/Kazakhstan customs union (EAC).

Australia and New Zealand (RCM formerly C-Tick)

The converters showing the test symbols fulfill the EMC requirements for Australia and New Zealand.

EMC requirements for South Korea

Converters with the KC marking on the rating plate satisfy the EMC requirements for South Korea.
At the present time, converters with 1 AC line connection satisfy the requirements.

It is scheduled that converters with a 3 AC line connection will satisfy this requirement in the fourth quarter of 2020.

Certificates for download

- EC declaration of conformity: (https://support.industry.siemens.com/cs/de/de/view/60438382)
- Certificates for the relevant directives, prototype test certificates, manufacturers declarations and test certificates for functions relating to functional safety ("Safety Integrated"): (https://support.industry.siemens.com/cs/ww/en/ps/13229/cert)
- Certificates of products that were certified by UL: (https://iq.ulprospector.com)

Standards that are not relevant

China Compulsory Certification

The converter does not fall in the area of validity of the China Compulsory Certification (CCC).

Standards that are complied with

The motors of the type series SIMOTICS S, SIMOTICS M, SIMOTICS L, SIMOTICS T, SIMOTICS A, called "SIMOTICS motor series" below, fulfill the requirements of the following directives and standards:

- EN 60034-1 - Rotating electrical machines – Dimensioning and operating behavior
- EN 60204-1 - Safety of machinery – Electrical equipment of machines; general requirements

Where applicable, the SIMOTICS motor series are in conformance with the following parts of EN 60034:

Feature	Standard
Degree of protection	EN 60034-5
Cooling [1)]	EN 60034-6
Type of construction	EN 60034-7
Connection designations	EN 60034-8
Noise levels [1)]	EN 60034-9
Temperature monitoring	EN 60034-11
Vibration severity grades [1)]	EN 60034-14

[1)] Standard component, e.g. cannot be applied to built-in motors

Relevant directives

The following directives are relevant for SIMOTICS motors.

European Low-Voltage Directive

SIMOTICS motors comply with the Low-Voltage Directive 2014/35/EU.

European Machinery Directive

SIMOTICS motors do not fall within the scope covered by the Machinery Directive.

However, the use of the products in a typical machine application has been fully assessed for compliance with the main regulations in this directive concerning health and safety.

European EMC Directive

SIMOTICS motors do not fall within the scope covered by the EMC Directive. The products are not considered as devices in the sense of the directive. Installed and operated with a converter, the motor - together with the Power Drive System - must comply with the requirements laid down in the applicable EMC Directive.

European RoHS Directive

The SIMOTICS motor series complies with the Directive 2011/65/EU regarding limiting the use of certain hazardous substances.

European Directive on Waste Electrical and Electronic Equipment (WEEE)

The SIMOTICS motor series complies with the 2012/19/EU directive on taking back and recycling waste electrical and electronic equipment.

Eurasian conformity

SIMOTICS motors comply with the requirements of the Russia/Belarus/Kazakhstan (EAC) customs union.

China Compulsory Certification

SIMOTICS motors do not fall within the scope covered by the China Compulsory Certification (CCC).

CCC negative certification:

CCC product certification (https://support.industry.siemens.com/cs/products?search=CCC&dtp=Certificate&mfn=ps&o=DefaultRankingDesc&pnid=13347&lc)

China RoHS

SIMOTICS motors comply with the China RoHS.

You can find additional information at:

China RoHS (https://support.industry.siemens.com/cs/ww/de/view/109738656/en)

Underwriters Laboratories

SIMOTICS motors are generally in compliance with UL and cUL as components of motor applications, and are appropriately listed.

Specifically developed motors and functions are the exceptions in this case. Here, it is crucial that you carefully observe the content of the quotation and that there is a UL or cUL mark on the rating plate!

Quality systems

Siemens AG employs a quality management system that meets the requirements of ISO 9001 and ISO 14001.

Certificates for SIMOTICS motors can be downloaded from the Internet at the following link:

Certificates for SIMOTICS motors (https://support.industry.siemens.com/cs/ww/de/ps/13347/cert)

China Energy Label

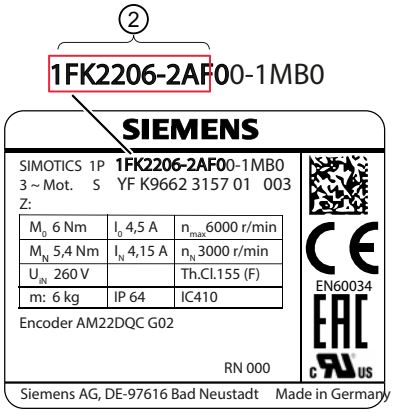
Name of the standard	Minimum allowable values for energy efficiency and energy efficiency class of permanent-magnet synchronous motors (GB30253-2013).
Date of entry into force	July 1, 2020
Affected motors	Permanent-magnet synchronous motors (without incorporated brake) with a rated power of 0.55kW to 90kW and a rated speed of 500 rpm to 3000 rpm driven by variable-frequency equipment on a power supply below 1000V.
Motor requirements	As of the implementation date of the standard, all affected motors must be provided with the "China Energy Label".
Affected Siemens products	Affected Siemens motors are subject to the requirements of standard GB30253-2013: SIMOTICS S-1FK2 motors

Examples of the "China Energy Label" and the motor rating plate:

China Energy Label

Figure A-2 ① Article number

Motor rating plate



② Article number of the basic motor type

Note

The article number ① stated on the China Energy Label corresponds to the article number of the basic motor type ② (boldface type) in the motor article number.

A.5 UL Markings

1 AC devices

Underwriters Laboratories

For US/Canadian installations (UL/cUL): The products are cULus-listed under File E355661 Vol. 3 Sec. 8.

- Solid-state motor overload protection: 300% of the FLA motor.
- Suitable for use in a circuit that cannot provide more than 65 kA rms (symmetrical), max. 240 V.
- Protection of the branch circuit for individual drives must be guaranteed using Class J fuses in accordance with the technical data.
  Protection of the branch circuit for the group installation must be guaranteed using fuses of Class J with up to 30 amps.
  For other protective equipment and SCCRs (Short Circuit Current Rating) for individual drives and group installations, see:
  https://support.industry.siemens.com/cs/document/109748999 (https://support.industry.siemens.com/cs/document/109748999)
- This device must be installed in an enclosure that provides an environment with degree of pollution 2 (controlled).
- Maximum ambient air temperature 50 °C.
- The device does not provide internal motor overtemperature protection. Overtemperature protection is guaranteed by evaluating the temperature sensor.
- Use copper wires with a permissible temperature of 75 °C for all power cables. You can also use cables with a higher rated temperature value. It is not permissible to reduce the conductor cross-section.

Additional requirements relating to CSA compliance:

- Overvoltage category OVC III must be guaranteed for all primary circuit connections of the device. This can have the result that surge protective devices (SPDs) need to be installed on the line side of the device.

3 AC devices

Underwriters Laboratories

- For US/Canadian installations (UL/cUL): The products are cULus-listed under File E192450 Vol. 13 Sec. 5.
- Only for use in 200-240 V or 380-480 V supply systems with grounded neutral point (solidly grounded wye).
- Solid-state motor overload protection: 300% of the FLA motor.

- Suitable for use in a circuit that cannot provide more than 65 kA rms (symmetrical), max. 480 V.
- Protection of the branch circuit for individual drives must be guaranteed using Class J fuses in accordance with the technical data.
  Protection of the branch circuit for the group installation must be guaranteed using fuses of Class J with up to 100 amps.
  For other protective equipment and SCCRs (Short Circuit Current Rating) for individual drives and group installations, see:
  https://support.industry.siemens.com/cs/document/109748999 (https://support.industry.siemens.com/cs/document/109748999)
- This device must be installed in an enclosure that provides an environment with degree of pollution 2 (controlled).
- Maximum ambient air temperature 50 °C. Maximum height 4000 m.
- The device does not provide internal motor overtemperature protection. Overtemperature protection is guaranteed by evaluating the temperature sensor.
- Use copper wires with a permissible temperature of 60/75 °C for all power cables. You can also use cables with a higher rated temperature value. It is not permissible to reduce the conductor cross-section.

Additional requirements relating to CSA compliance:

- Overvoltage category OVC III must be guaranteed for all primary circuit connections of the device. This can have the result that surge protective devices (SPDs) need to be installed on the line side of the device.
- Maximum height for CSA: 2000 m.

A.6 Certifications

The safety functions of the SINAMICS S drive system meet the following requirements:

- Category 3 to DIN EN ISO 13849-1
- Performance level (PL) d according to DIN EN ISO 13849-1
- Safety integrity level 2 (SIL 2) according to IEC 61508 and EN 61800-5-2

In addition, the safety functions of the SINAMICS S have been certified by independent institutes. A list of currently certified components is available on request from your local Siemens office.

A.7 List of abbreviations S210

Note

The following list of abbreviations includes the abbreviations and meanings as used for the SINAMICS.

Abbreviation	Derivation of abbreviation	Meaning
A...	Alarm	Alarm
AC	Alternating Current	Alternating current
C...	-	Safety message
CoL	Certificate of License	Certificate of License
COM	Communication LED	Status display of the communication
COMM	Commissioning	Commissioning
CU	Control Unit	Control Unit
DC	Direct Current	Direct current
DI	Digital Input	Digital input
DO	Drive Object	Drive object
DP	Decentralized Peripherals	Distributed I/O
DSC	Dynamic Servo Control	Dynamic servo control
EEPROM	Electrically Erasable Programmable Read-Only Memory	Electrically Erasable Programmable Read-Only Memory
EMV	Elektromagnetische Verträglichkeit	Electromagnetic compatibility
EN	Europäische Norm	European standard
F...	Fault	Fault
F-DI	Failsafe Digital Input	Failsafe digital input
FAQ	Frequently Asked Questions	Frequently asked questions
GB	Gigabyte	Gigabyte
GSD	Gerätestammdatei	Generic station description file: Describes the features of a PROFIBUS slave
HW	Hardware	Hardware
IBN	Inbetriebnahme	Commissioning
ID	Identifier	Identification
IEC	International Electrotechnical Commission	International Electrotechnical Commission
IP	Internet Protocol	Internet protocol
Kp	-	Proportional gain
LED	Light Emitting Diode	Light emitting diode
M	Masse	Reference potential for all signal and operating voltages, usually defined as 0 V (also referred to as GND)
MB	Megabyte	Megabyte
MT	Messtaster	Measuring input

Abbreviation	Derivation of abbreviation	Meaning
N...	No Report	No message or internal message (only as part of the alarm list)
NTP	Network Time Protocol	Synchronizes the clocks in computer systems and networks
NVRAM	Non-Volatile Random Access Memory	Non-volatile read/write memory
OCC	One Cable Connection	One cable technology
OEM	Original Equipment Manufacturer	Original Equipment Manufacturer
p...	-	Adjustable parameters
PDS	Power Drive System	Drive system
PE	Protective Earth	Protective ground
PELV	Protective Extra Low Voltage	Safety extra-low voltage
PFH	Probability of dangerous failure per hour	Probability of dangerous failure per hour
PLC	Programmable Logical Controller	Programmable logic controller
PN	PROFINET	PROFINET
PZD	Prozessdaten	Process data
r...	-	Display parameters (read-only)
RAM	Random Access Memory	Memory for reading and writing
RJ45	Registered Jack 45	Term for an 8-pin socket system for data transmission with shielded or non-shielded multi-wire copper cables
ROM	Read-Only Memory	Read-only memory
S1	-	Continuous operation
SAM	Safe Acceleration Monitor	Safe acceleration monitoring
SBC	Safe Brake Control	Safe brake control
SBR	Safe Brake Ramp	Safe brake ramp monitoring
SBT	Safe Brake Test	Safe brake test
SD-Card	SecureDigital Card	Secure digital memory card
SCC	Safety Control Channel	Safety Control Channel
SDI	Safe Direction	Safe motion direction
SI	Safety Integrated	Safety Integrated
SIC	Safety Info Channel	Safety Info Channel
SIL	Safety Integrity Level	Safety integrity level
SLS	Safely-Limited Speed	Safely-limited speed
SOS	Safe Operating Stop	Safe operating stop
SP	Service Pack	Service pack
SPS	Speicherprogrammierbare Steuerung	Programmable logic controller
SS1	Safe Stop 1	Safe stop 1 (monitored for time and ramp)
SS1E	Safe Stop 1 External	Safe stop 1 with external stop
SS2	Safe Stop 2	Safe stop 2
SS2E	Safe Stop 2 External	Safe stop 2 with external stop
SSM	Safe Speed Monitor	Safe feedback from speed monitor
STO	Safe Torque Off	Safe torque off

Abbreviation	Derivation of abbreviation	Meaning
STW	Steuerwort	Control word
TIA	Totally Integrated Automation	Totally Integrated Automation
Tn	-	Integral time
UL	Underwriters Laboratories Inc.	Underwriters Laboratories Inc.
UTC	Universal Time Coordinated	Universal time coordinated
Vdc	-	DC-link voltage
VDE	Verband Deutscher Elektrotechniker	Association of German Electrical Engineers
ZSW	Zustandswort	Status word

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Additional information

Siemens:
www.siemens.com

Industry Online Support (service and support):
www.siemens.com/online-support

IndustryMall:
www.siemens.com/industrymall

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For additional information on the SINAMICS S210, scan the QR code