

Operating instructions | EN

AX1000

Economy servo drives

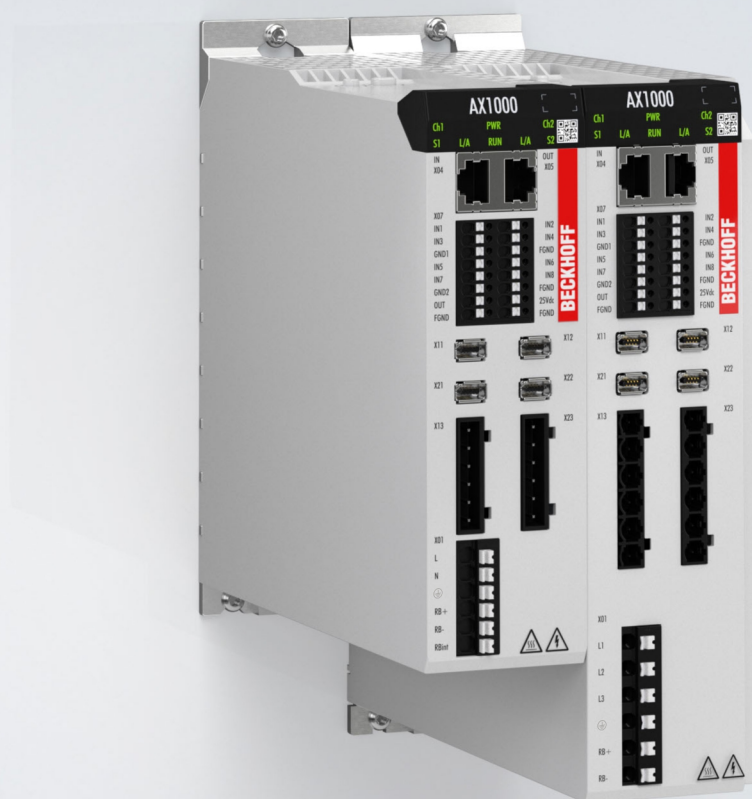


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1 Documentation notes

1.1 Disclaimer

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The following is excluded from the liability:

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1.2 Version numbers

On request we can send you a list of revision levels for changes to the documentation. Please send your request to:

✉ support@beckhoff.com

Origin of the document

This documentation was originally written in German. All other languages are derived from the German original.

Product features

The valid product features are always those specified in the current documentation. Further information given on the product pages of the Beckhoff homepage, in emails or in other publications is not authoritative.

1.3 Scope of the documentation

In addition to this documentation, the following documents are part of the complete documentation:

Documentation	Definition
Short information AX1000	Accompanying document with general notes on handling the economy servo drive. Included with each product.

1.4 Staff qualification

This documentation is aimed at trained specialists working in control technology and automation who have knowledge of the applicable and required standards and directives.

Specialists must have knowledge of drive technology and electrical equipment as well as knowledge of safe working on electrical systems and machines. This includes knowledge of proper setup and preparation of the workplace as well as securing the working environment for other persons.

The documentation published at the time must be used for each installation and commissioning. The products must be used in compliance with all safety requirements, including all applicable laws, regulations, provisions and standards.

Instructed person

Instructed persons have a clearly defined task area and have been informed about the work to be carried out. Instructed persons are familiar with:

- the necessary protective measures and protective devices
- the intended use and risks that can arise from use other than for the intended purpose

Trained person

Trained persons meet the requirements for instructed persons. Trained persons have additionally received training from the machine builder or vendor:

- machine-specific or
- plant-specific

Trained specialists

Trained specialists have received specific technical training and have specific technical knowledge and experience. Trained specialists can:

- apply relevant standards and directives
- assess tasks that they have been assigned
- recognize possible hazards
- prepare and set up workplaces

Electricians

Electricians have extensive technical knowledge from their studies, apprenticeships, or specialist training. They have an understanding of control technology and automation. They are familiar with relevant standards and directives. Electricians can:

- independently recognize, avoid and eliminate sources of danger
- implement specifications from the accident prevention regulations
- assess the work environment
- independently optimize and carry out their work

1.5 Safety and instruction

Read the contents that are related to the activities you will perform with the product. Always read the "For your safety", [Page 13] chapter in the documentation. Observe the warning notes in the chapters so that you can handle the product and work with it properly and safely.

1.5.1 Notes on information security

The products of Beckhoff Automation GmbH & Co. KG (Beckhoff), insofar as they can be accessed online, are equipped with security functions that support the secure operation of plants, systems, machines and networks. Despite the security functions, the creation, implementation and constant updating of a holistic security concept for the operation are necessary to protect the respective plant, system, machine and networks against cyber threats. The products sold by Beckhoff are only part of the overall security concept. The customer is responsible for preventing unauthorized access by third parties to its equipment, systems, machines and networks. The latter should be connected to the corporate network or the Internet only if appropriate protective measures have been set up.

In addition, the recommendations from Beckhoff regarding appropriate protective measures should be observed. Further information regarding information security and industrial security can be found in our <https://www.beckhoff.com/secguide>.

Beckhoff products and solutions undergo continuous further development. This also applies to security functions. In light of this continuous further development, Beckhoff expressly recommends that the products are kept up to date at all times and that updates are installed for the products once they have been made available. Using outdated or unsupported product versions can increase the risk of cyber threats.

To stay informed about information security for Beckhoff products, subscribe to the RSS feed at <https://www.beckhoff.com/secinfo>.

1.6 Explanation of symbols

Various symbols are used for a clear arrangement:

- ▶ The triangle indicates instructions that you should execute.
- The bullet point indicates an enumeration.
- [...] The square brackets indicate cross-references to other text passages in the document.
- [1] The number in the square brackets refers to the position in the adjacent figure.
- [+] The plus sign in square brackets indicates ordering options and accessories.

In order to make it easier for you to find text passages, pictograms and signal words are used in warning notices:

DANGER

Failure to comply will result in serious or fatal injuries.

WARNING

Failure to comply may result in serious or fatal injuries.

CAUTION

Failure to comply may result in minor or moderate injuries.

NOTICE

Notes are used for important information on the product. The possible consequences of failure to observe these include:

- product malfunctions
- damage to the product
- damage to the environment



Information

This symbol indicates information, tips, and notes for handling the product or the software.



Examples

This symbol shows examples of how to use the product or software.



Required tool

This symbol indicates a tool that is required for the following steps.



Required accessories [+]

This symbol shows the accessories required for the following steps. The accessories are not included in the scope of delivery and can be ordered from Beckhoff.



Assembly material required

This symbol shows the assembly material required for the following steps. The assembly material is not included in the scope of delivery and must be purchased separately.



QR codes

This symbol shows a QR code that you can scan to watch videos or animations. Internet access is required in order to use it.

1.7 Beckhoff Services

Beckhoff and its international partner companies offer comprehensive support and service.

 www.beckhoff.com/en-en/support/global-availability/

1.7.1 Support services

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 support@beckhoff.com

 www.beckhoff.com/en-en/support/our-support-services/

1.7.2 Training offerings

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1.7.3 Service offerings

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1.7.4 Headquarters Germany

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1.7.5 Downloadfinder

In the Download finder you will find configuration files, technical documentation and application reports to download.

 www.beckhoff.com/documentations

2 For your safety

Read this chapter containing general safety information. Furthermore, the chapters in this documentation contain warning notices. Always observe the safety instructions for your own safety, the safety of other persons and the safety of the product.

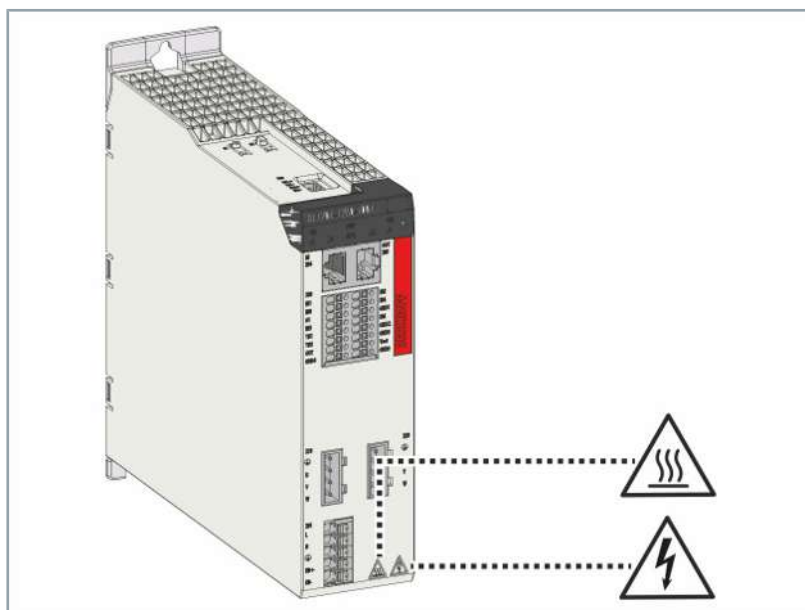
When working with control and automation products, many dangers can result from careless or incorrect use. Work particularly thoroughly, not under time pressure and responsibly towards other people.

2.1 Safety pictograms

You will find safety symbols on Beckhoff products and packaging. The symbols may be glued, printed, or lasered on and may vary depending on the product. They serve to protect people and to prevent damage to the products. Safety pictograms may not be removed and must be legible for the user.

2.1.1 Module front

The following safety pictograms are affixed to the front of the Economy servo drive:



Warning: High voltage

The DC link on the modules can have a life-threatening voltage of over 420 V_{DC} or 848 V_{DC}.



Warning: Hot surface

During and after operation, there is a risk of burns on the modules due to hot surfaces above 60 °C. Allow the module housing to cool down for at least 15 minutes.

2.2 General safety instructions

This chapter provides you with instructions on safety when handling the product. This product is not capable of stand-alone operation and is therefore categorized as an incomplete machine. The product must be installed in a machine or plant by the machine manufacturer. Read the documentation prepared by the machine manufacturer.

2.2.1 Before operation

Correctly ground electrical components or modules

Prevent electric shocks due to incorrect grounding of electrical components or modules. Ground all conductive components according to the specifications in the chapter "Electrical installation", [Page 63].

Keep the immediate environment clean

Keep your workplace and the surrounding area clean. Ensure safe working.

Check safety signs

Check to see if the safety signs are present on the product. Replace any missing or illegible safety signs.

Observe tightening torques

Mount and repeatedly check connections and components, complying with the prescribed tightening torques.

Use only the original packaging

Use the original packaging for dispatch, transportation and storage.

2.2.2 During operation

Do not touch hot surfaces

Check the temperature of the surfaces with a thermometer. Do not touch the components during and immediately after operation. Allow the components to cool sufficiently after switching off.

Avoid overheating

Operate the components according to the technical specifications. Refer here to the chapter "Technical data", [Page 22]. Provide for sufficient cooling. Switch the components off immediately if the temperature is too high.

2.2.3 After operation

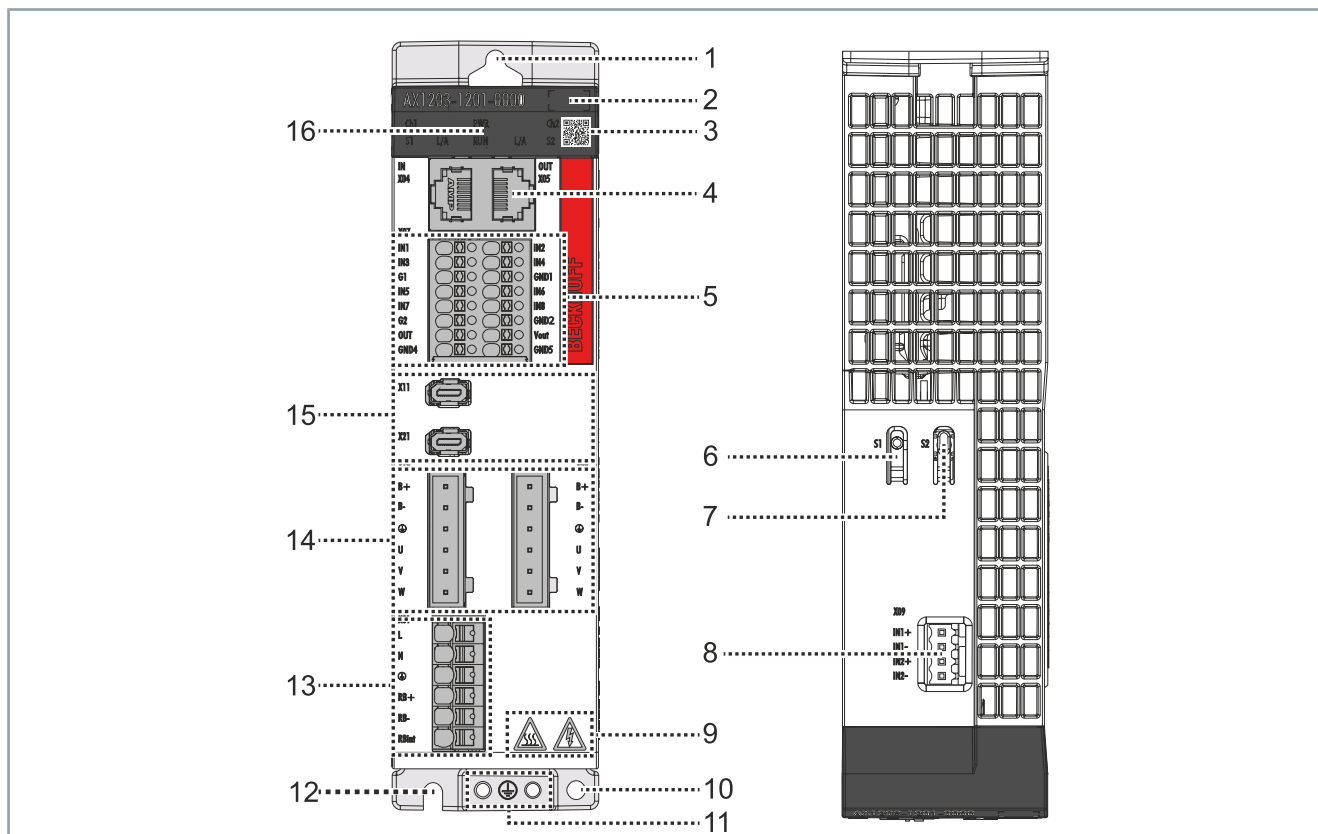
De-energize and switch off components before working on them

Check the functionality of all safety-relevant devices. Secure the working environment. Secure the machine or plant against being inadvertently started up. Observe the chapter "Decommissioning", [Page 102].

3 Product overview

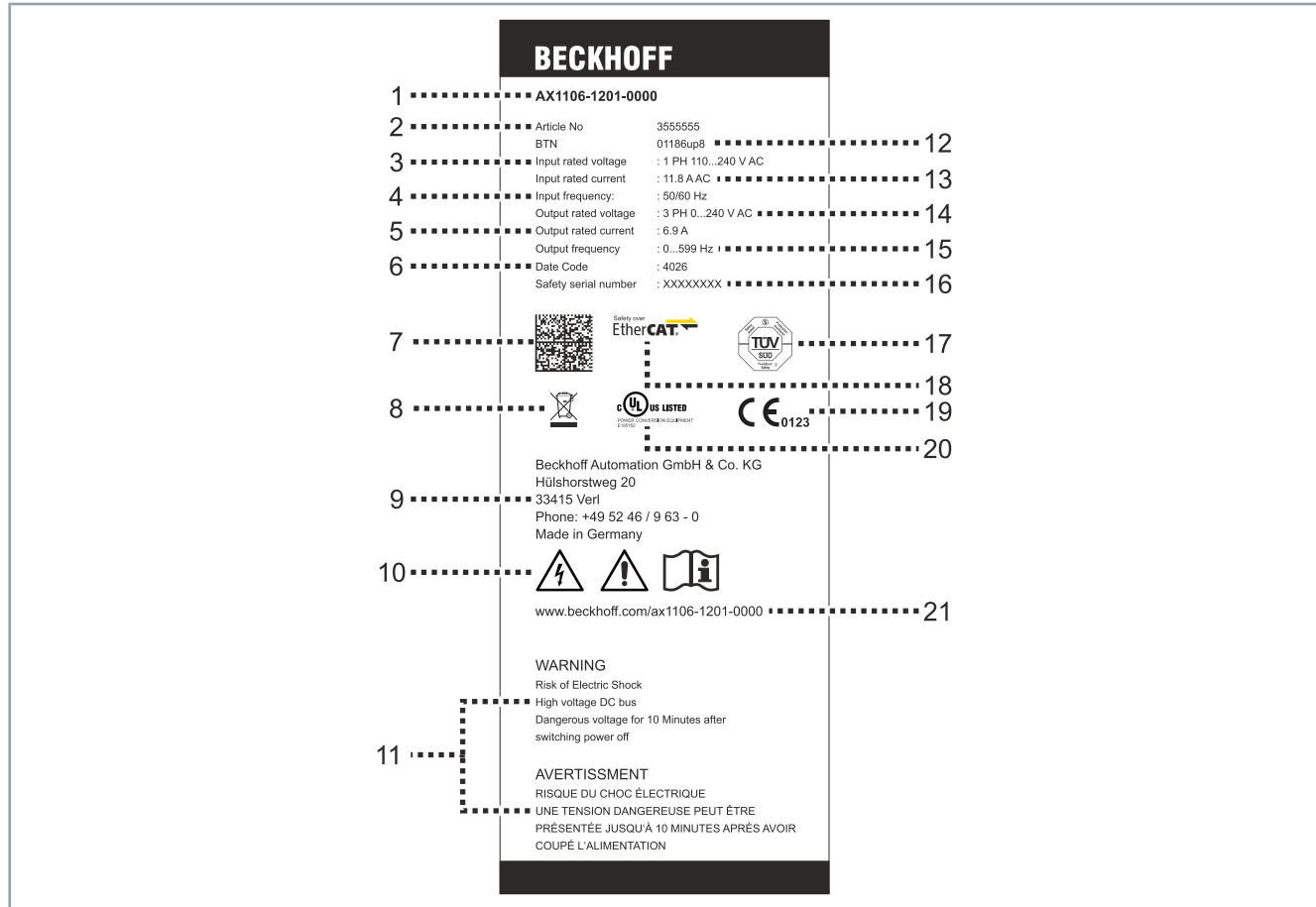


The areas, functions and slots shown in the figure may vary depending on the module version and are provided here for clarity.



Position	Name	Explanation
1	Mounting hole	For mounting the servo drive in the control cabinet
2	Position field	for equipment identification
3	Data Matrix code	contains BTN for identification; for further information, see "name plate", [Page 16]
4	EtherCAT slot	For connecting the EtherCAT connector to "IN X04/OUT X05", [Page 85]
5	I/O connection	For connecting the I/O signals to "X06", [Page 86] and "X07", [Page 87]
6	Push button S1	for internal purposes
7	Push button S2	TwinSAFE actuation button
8	TwinSAFE slot	For connecting the TwinSAFE plug to "X09", [Page 89]
9	Safety pictograms	for further information, see "For your safety", [Page 13]
10	Mounting hole	For attaching the optional footprint filter to the economy servo drive
11	Grounding	Grounding symbol and double connection point with pre-assembled grounding screws for connecting the protective conductor
12	Mounting hole	For mounting the servo drive in the control cabinet
13	Mains connection	For connecting the mains supply to "X01", [Page 81]
14	Motor slot	For connecting the motor connector to "X13/X23", [Page 92]
15	OCT slot	For connecting the OCT connector "X11/X21", [Page 89]
16	Display	Display for showing function and status display, see "Display", [Page 56]

3.1 Name plate



Item number	Explanation
1	Product name
2	Order number
3	Mains input voltage range
4	Input frequency
5	Rated output current
6	Date of manufacture
7	BIC (Beckhoff Identification Code) ¹⁾
8	WEEE conformity
9	Manufacturer's address
10	Safety pictograms
11	Hazard warnings
12	Beckhoff Traceability Number, BTN
13	Rated input current
14	Output voltage
15	Output frequency range
16	Serial number Safety
17	TÜV certification
18	EtherCAT conformity
19	CE conformity
20	cULus approval
21	Product URL

1) Further information can be found at www.beckhoff.com/bic

3.2 Type key

AX a b cd – e fg h – i j k l	Explanation
AX	<i>Product area</i> • Servo drive
a	<i>Series</i> • 1 = AX1000
b	<i>Channels</i> • 1 = single-axis module • 2 = dual-axis module
cd	<i>Rated output current single-axis module/dual-axis module</i> • 01 = 1.65 A • 03 = 3.4 A / 3.0 A • 06 = 6.9 A / 6.0 A
e	<i>Supply</i> • 1 = 1-phase • 3 = 3-phase
fg	<i>TwinSAFE</i> • 10 = STO/SS1 (FSOE) • 20 = STO/SS1 (I/O + FSOE) • 30 = SafeMotion
h	<i>Device type</i> • 1 = standard
i	<i>Version</i> • 0 = standard
j	not used
k	<i>Dual Use</i> • 0 = no Dual Use • 8 = Dual Use
l	not used

3.3 Product characteristics

Cost-efficient series

The economy servo drive AX1000 series is a particularly cost-effective series that meets the highest technological standards. DC link capacitors, a braking resistor control and, in most variants, a braking resistor are integrated.

Integrated 24 V DC power supply

An integrated 24 V DC power supply generates the control voltage from the DC link voltage.

Supply

Devices with a single-phase supply of 1 x 110...240 V AC are available for applications in the low power range. For higher power ranges, there are devices with 3-phase power supply 3 x 208...480 V AC.

Single-axis and dual-axis module

Both supply variants are available as single-axis and dual-axis modules. Synchronous servomotors with One Cable Technology (OCT) and asynchronous and reluctance motors are supported.

Drive-integrated safety functions

The economy servo drive AX1000 supports TwinSAFE by default for the implementation of the drive-integrated safety functions STO/SS1 in accordance with IEC 61800-5-2. It is optionally available with the following TwinSAFE Safe Motion safety functions:

- Stop functions (STO, SOS, SS1, SS2)
- Speed functions (SLS, SSM, SSR, SMS)
- Position functions (SLP, SCA, SLI)
- Acceleration functions (SAR, SMA)
- Direction of rotation functions (SDIp, SDIn)
- Brake function (SBC, SBT)

3.4 Ordering options

Ordering options [+] are defined via the type key and must be ordered separately. It is not possible to fit one at a later date.

3.4.1 TwinSAFE Drive-integrated safety technology

The TwinSAFE safety-related drive technology can be used to implement both basic functions (TwinSAFE STO/SS1) and sophisticated safety functions (TwinSAFE Safe Motion). Depending on the product, the functionality can be implemented via safe FSoE communication and/or fixed wiring via fail-safe inputs on servo drive.

AX1xxx-x1xx-xxxx

Axis module with TwinSAFE STO/SS1 (FSoE)

Technical data	
Function	servo drive with STO/SS1
Implementation STO	through local TwinSAFE Logic or via FSoE
Safe stop functions	Safe Torque Off (STO), Safe Stop 1 (SS1)
Safety standard	EN ISO 13849-1:2023 (Cat 4, PL e), EN 61508:2010 (SIL 3) and EN 62061:2005 + A1:2013/A2:2015 (SIL CL3)

AX1xxx-x2xx-xxxx

Axis module with TwinSAFE STO/SS1 (FSoE and I/O)

Technical data	
Function	servo drive with STO/SS1 and I/O
Implementation STO	via local TwinSAFE Logic, via FSoE or fixed wiring via safe inputs
Safe stop functions	Safe Torque Off (STO), Safe Stop 1 (SS1)
Safety standard	EN ISO 13849-1:2023 (Cat 4, PL e), EN 61508:2010 (SIL 3) and EN 62061:2005 + A1:2013/A2:2015 (SIL CL3)

AX1xxx-x3xx-xxxx

Axis module with TwinSAFE Safe Motion (FSoE)

Technical data	
Function	servo drive with TwinSAFE Safe Motion
Implementation STO	through local TwinSAFE Logic, via FSoE
Safe stop functions	Safe Torque Off (STO), Safe Operating Stop (SOS), Safe Stop 1 (SS1), Safe Stop 2 (SS2)
Safe acceleration function	Safe Maximum Acceleration (SMA), Safe Acceleration Range (SAR)
Safe brake functions	Safe Brake Control (SBC), Safe Brake Test (SBT)
Safe direction functions	Safe Direction positive (SDIp), Safe Direction negative (SDIn)
Safe speed functions	Safely Limited Speed (SLS), Safe Speed Range (SSR), Safe Speed Monitor (SSM), Safe Maximum Speed (SMS)
Safe position functions	Safely Limited Position (SLP), Safe CAM (SCA), Safely Limited Increment (SLI)
Safety standard	EN ISO 13849-1:2023 (Cat 4, PL e*), EN 61508:2010 (SIL 3*) and EN 62061:2005 + A1:2013/A2:2015 (SIL CL3*)

*) Depending on the position encoder used

3.5 Intended use

The modules of the economy servo drive AX1000 may only be operated for the intended use defined in this documentation under the specified environmental conditions.

The components are to be installed only in closed control cabinets in electrical plants or machines and put into operation only as integrated components of the plant or machine.



Read the entire drive system documentation:

- These operating instructions
- Complete machine documentation provided by the machine manufacturer

3.5.1 Improper use

Any type of use that exceeds the permissible values from the technical data is regarded as inappropriate and is thus prohibited.



Non-approved areas of application

The economy servo drive AX1000 is not approved for use in the following areas:

- hazardous areas
- Areas with aggressive environments, for example aggressive gases or chemicals
- Areas with ionizing radiation and nuclear plants
- Aerospace industry

The relevant standards and directives for EMC interference emissions must be complied with in residential areas.

3.6 Dual Use

Dual-use listing information

AX1abcd-efgh-ijkl

According to the published EU Regulation No. 2021/821, commercially available servo drive are categorized as dual-use items. This means that the Beckhoff economy servo drive AX1000 belongs to the category of goods that is included in a dual-use listing.

The goods list, “ANNEX 1” of the Dual-Use Regulation 2021/821 has been amended accordingly:

- servo drive, listed in goods list position 3A225, with a rotating field frequency of ≥ 600 Hz are subject to export control.
- servo drive, listed in goods list position 3A225, with a rotating field frequency of ≤ 599 Hz are not subject to export control.

The type key of the economy servo drive AX1000 determines whether export control in accordance with a dual-use listing is required.

In the type key of the Beckhoff economy servo drive AX1000, the dual-use listing is indicated in the letter “k”.

Ordering information	Description
k =	Dual Use
0	product not subject to authorization as the rotary field frequency is limited to 599 Hz
8	product may require an export license, as the maximum rotary field frequency exceeds 599 Hz

4 Technical data

4.1 Definitions and technical terms

SCCR (Short-Circuit Current Rating)

This chapter provides information on various technical terms and their meaning.

The maximum short-circuit current that a component or control cabinet can safely withstand without risk of fire, explosion, or electric shock. The value is determined by the component with the lowest individual value in the main circuit.



Determination of power loss

The software
TE5910 | TwinCAT 3 Motion Designer is available for determining the power loss:



[TE5910 | TwinCAT 3 Motion Designer](#)

4.2 Data for operation and environment

NOTICE

Shorter service life due to high temperatures

Temperatures above 45 °C and encapsulated installation can shorten the service life of the product.

- Operate the only under the operating and environmental conditions specified in this chapter

NOTICE

Damage caused by conductive dusts

Penetration or deposition of conductive dust can lead to short circuits, malfunctions, fire or explosion hazards.

- Do not use in environments with conductive dusts

Beckhoff products are designed for operation under certain environmental conditions, which vary according to the product. The following specifications must be observed for operation and environment in order to achieve the optimum service life of the products.

Environmental requirements	
Ambient temperature during operation: Nominal range	0...45°C
Ambient temperature during operation: Extended temperature range	45...55°C
Ambient temperature during transport	-25°C to +70°C, maximum fluctuation 20 K per hour
Ambient temperature during storage	-25°C to +55°C, maximum fluctuation 20 K per hour
Power derating	No power derating up to 1000 m above sea level Power derating of 1% / 100 m from 1000 m up to a maximum of 3000 m above sea level
Installation altitude	A reduction of the overvoltage category is necessary from an installation altitude of 2000 m up to a maximum of 3000 m above sea level. Observe the derating.
Permissible humidity during operation	5% to 95% relative humidity, no condensation
Permissible humidity during transport and storage	5% to 95% relative humidity, no condensation
Corrosion protection	Not required: Special measures are to be taken in consultation with the vendor if the environmental conditions are extreme or if they differ from those described in this chapter.
Pollution degree	2 according to EN 60204 and EN 50178
Overvoltage category	3 according to EN 61800-5-1
Ventilation	• Free convection • Integrated and temperature-controlled fan
Insulation material class	F according to IEC 60085 and UL1446 class F
Protection rating	Devices IP20 Terminals IP20
Installation position	Vertical
Vibration resistance	1 g, 150 Hz according to EN 60068-2-6
Shock resistance	5 g, 30 ms according to EN 60068-2-27
EMC requirements	Conforms to EN 61800-3

Environmental requirements	
Approvals	CE See chapter "Guidelines and Standards", [Page 104]

4.3 AX1101-1xxx | Economy servo drive, single-phase, single-axis module, 1.65 A

Electrical data							
Channels		1					
Mains supply							
Rated supply voltage	[V AC]	1 x 110 V AC _{-7%} ...240 V AC ^{+10%}					
Rated input current	[A AC]	3.0					
Mains filter		external					
SCCR value	[kA]	65					
Internal braking resistor - not available for this device							
Continuous braking power	[W]	–					
Maximum braking power	[kW]	–					
External braking resistor - Values dependent on the connected resistor							
Continuous braking power	[kW]	0.75					
Maximum braking power	[kW]	5.0					
Minimum braking resistor	[Ω]	35.0					
Output current per channel*		up to 45°C			45...55°C		
Valid for a control frequency of	[kHz]	4	8	16	4	8	16
Rated output current I _n	[A]	1.65	1.65	1.65	1.5	1.5	0.5
Peak output current I _{peak} for max. 1 s	[A]	6.6	6.6	6.6	6.6	6.6	6.6
Peak output current I _{peak} for max. 3 s	[A]	5.8	5.8	5.8	5.8	5.8	5.8
* depending on the ambient temperature during operation							
DC link							
Voltage range	[V DC]	0...420					
Capacitance	[μF]	660					
Output voltage 24 V DC (Vout)							
Voltage range	[V DC]	24 _{-5%} ...24 ^{+6%}					
Max. output current	[A DC]	1.0					
Motor brake							
Maximum current brake output	[A]	0.7					
Output frequency							
Limited frequency of the standard version	[Hz]	0...599					
Frequency of the dual use version	[Hz]	0...2000					
Mechanical data							
Width	[mm]	50					
Height without connectors	[mm]	185					
Depth without connectors	[mm]	185					
Weight	[kg]	1.0					

4.4 AX1103-1xxx | Economy servo drive, single-phase, single-axis module, 3.4 A

Electrical data							
Channels							1
Mains supply							
Rated supply voltage	[V AC]						1 x 110 V AC _{-7%} ...240 V AC ^{+10%}
Rated input current	[A AC]						5.8
Mains filter							external
SCCR value	[kA]						65
Internal braking resistor - not available for this device							
Continuous braking power	[W]						–
Maximum braking power	[kW]						–
External braking resistor - Values dependent on the connected resistor							
Continuous braking power	[kW]						0.75
Maximum braking power	[kW]						5.0
Minimum braking resistor	[Ω]						35
Output current per channel*		up to 45°C			45...55°C		
Valid for a control frequency of	[kHz]	4	8	16	4	8	16
Rated output current I _n	[A]	3.4	3.4	4.5	3.4	3.4	3.4
Peak output current I _{peak} for max. 1 s	[A]	13.6	13.6	13.6	13.6	13.6	13.6
Peak output current I _{peak} for max. 3 s	[A]	11.9	11.9	11.9	11.9	11.9	11.9
* depending on the ambient temperature during operation							
DC link							
Voltage range	[V DC]						0...420
Capacitance	[μF]						660
Output voltage 24 V DC (Vout)							
Voltage range	[V DC]						24 _{-5%} ...24 ^{+6%}
Max. output current	[A DC]						1.0
Motor brake							
Maximum current brake output	[A]						0.7
Output frequency							
Limited frequency of the standard version	[Hz]						0...599
Frequency of the dual use version	[Hz]						0...2000
Mechanical data							
Width	[mm]						50
Height without connectors	[mm]						185
Depth without connectors	[mm]						185
Weight	[kg]						1.0

4.5 AX1106-1xxx | Economy servo drive, single-phase, single-axis module, 6.9 A

Electrical data							
Channels							1
Mains supply							
Rated supply voltage	[V AC]						1 x 110 V AC _{-7%} ...240 V AC ^{+10%}
Rated input current	[A AC]						11.8
Mains filter							external
SCCR value	[kA]						65
Internal braking resistor							
Continuous braking power	[W]						35
Maximum braking power	[kW]						3.5
External braking resistor - Values dependent on the connected resistor							
Continuous braking power	[kW]						1.5
Maximum braking power	[kW]						3.5
Minimum braking resistor	[Ω]						36
Output current per channel*		up to 45°C			45...55°C		
Valid for a control frequency of	[kHz]	4	8	16	4	8	16
Rated output current I_n	[A]	6.9	6.9	4.5	6.9	5.5	3.4
Peak output current I_{peak} for max. 1 s	[A]	27.6	27.6	18.0	27.6	27.6	18.0
Peak output current I_{peak} for max. 3 s	[A]	24.2	24.2	15.7	24.2	24.2	15.7
* depending on the ambient temperature during operation							
DC link							
Voltage range	[V DC]						0...400
Capacitance	[μF]						1,000
Output voltage 24 V DC (Vout)							
Voltage range	[V DC]						24 _{-5%} ...24 ^{+6%}
Max. output current	[A DC]						1.0
Motor brake							
Maximum current brake output	[A]						0.7
Output frequency							
Limited frequency of the standard version	[Hz]						0...599
Frequency of the dual use version	[Hz]						0...2000
Mechanical data							
Width	[mm]						50
Height without connectors	[mm]						185
Depth without connectors	[mm]						185
Weight	[kg]						1.0

4.6 AX1201-1xxx | Economy servo drive, single-phase, dual-axis module, 1.65 A

Electrical data							
Channels							2
Mains supply							
Rated supply voltage	[V AC]						1 x 110 V AC _{-7%} ...240 V AC ^{+10%}
Rated input current	[A AC]						5.8
Mains filter							external
SCCR value	[kA]						65
Internal braking resistor - not available for this device							
Continuous braking power	[W]						–
Maximum braking power	[kW]						–
External braking resistor - Values dependent on the connected resistor							
Continuous braking power	[kW]						0.75
Maximum braking power	[kW]						5.0
Minimum braking resistor	[Ω]						35
Output current per channel*		up to 45°C			45...55°C		
Valid for a control frequency of	[kHz]	4	8	16	4	8	16
Rated output current I_n	[A]	1.65	1.65	1.65	1.65	1.65	1.5
Max. rated output current $I_{n\ max}$	[A]	3.3	3.3	3.3	3.3	3.3	2.0
I_n as total device current	[A]	3.3	3.3	3.3	3.3	3.3	2.0
Peak output current I_{peak} for max. 1 s	[A]	6.6	6.6	6.6	6.6	6.6	6.6
Peak output current I_{peak} for max. 3 s	[A]	5.8	5.8	5.8	5.8	5.8	5.8
* depending on the ambient temperature during operation							
DC link							
Voltage range	[V DC]						0...420
Capacitance	[μF]						660
Output voltage 24 V DC (Vout)							
Voltage range	[V DC]						24 _{-5%} ...24 ^{+6%}
Max. output current	[A DC]						1.0
Motor brake							
Maximum current brake output	[A]						0.7
Output frequency							
Limited frequency of the standard version	[Hz]						0...599
Frequency of the dual use version	[Hz]						0...2000
Mechanical data							
Width	[mm]						50
Height without connectors	[mm]						185
Depth without connectors	[mm]						185
Weight	[kg]						1.0

4.7 AX1203-1xxx | Economy servo drive, single-phase, dual-axis module, 3.4 A

Electrical data							
Channels							2
Mains supply							
Rated supply voltage	[V AC]						1 x 110 V AC _{-7%} ...240 V AC ^{+10%}
Rated input current	[A AC]						11.8
Mains filter							external
SCCR value	[kA]						65
Internal braking resistor							
Continuous braking power	[W]						35
Maximum braking power	[kW]						3.5
External braking resistor - Values dependent on the connected resistor							
Continuous braking power	[kW]						1.0
Maximum braking power	[kW]						4.8
Minimum braking resistor	[Ω]						33
Output current per channel*		up to 45°C			45...55°C		
Valid for a control frequency of	[kHz]	4	8	16	4	8	16
Rated output current I_n	[A]	3.4	3.4	2.0	2.0	2.0	1.0
Max. rated output current $I_{n \max}$	[A]	3.4	3.4	2.0	2.0	2.0	1.0
I_n as total device current	[A]	6.8	6.8	4.0	4.0	4.0	2.0
Peak output current I_{peak} for max. 1 s	[A]	13.6	13.6	13.6	13.6	13.6	13.6
Peak output current I_{peak} for max. 3 s	[A]	11.9	11.9	11.9	11.9	11.9	11.9
* depending on the ambient temperature during operation							
DC link							
Voltage range	[V DC]						0...400
Capacitance	[μF]						1,000
Output voltage 24 V DC (Vout)							
Voltage range	[V DC]						24 _{-5%} ...24 ^{+6%}
Max. output current	[A DC]						1.0
Motor brake							
Maximum current brake output	[A]						0.7
Output frequency							
Limited frequency of the standard version	[Hz]						0...599
Frequency of the dual use version	[Hz]						0...2000
Mechanical data							
Width	[mm]						50
Height without connectors	[mm]						185
Depth without connectors	[mm]						185
Weight	[kg]						1.0

4.8 AX1103-3xxx | Economy servo drive, three-phase, single-axis module, 3.4 A

Electrical data							
Channels							1
Mains supply							
Rated supply voltage	[V AC]						3 x 200 V AC _{-7%} ...480 V AC ^{+10%}
Rated input current	[A AC]						6.7
Mains filter							external
SCCR value	[kA]						65
Internal braking resistor							
Continuous braking power	[W]						60
Maximum braking power	[kW]						14.1
External braking resistor - Values dependent on the connected resistor							
Continuous braking power	[kW]						3.0
Maximum braking power	[kW]						14.2
Minimum braking resistor	[Ω]						45
Output current per channel*		up to 45°C			45...55°C		
Valid for a control frequency of	[kHz]	4	8	16	4	8	16
Rated output current I _n	[A]	3.4	3.4	3.4	3.4	3.4	3.4
Peak output current I _{peak} for max. 1 s	[A]	10.5	10.5	8.2	10.5	10.5	8.2
Peak output current I _{peak} for max. 3 s	[A]	9.0	9.0	7.0	9.0	9.0	7.0
* depending on the ambient temperature during operation							
DC link							
Voltage range	[V DC]						0...800
Capacitance	[μF]						235
Output voltage 24 V DC (Vout)							
Voltage range	[V DC]						24 _{-5%} ...24 ^{+6%}
Max. output current	[A DC]						1.0
Motor brake							
Maximum current brake output	[A]						0.7
Output frequency							
Limited frequency of the standard version	[Hz]						0...599
Frequency of the dual use version	[Hz]						0...2000
Mechanical data							
Width	[mm]						60
Height without connectors	[mm]						225
Depth without connectors	[mm]						185
Weight	[kg]						1.5

4.9 AX1106-3xxx | Economy servo drive, three-phase, single-axis module, 6.9 A

Electrical data							
Channels							1
Mains supply							
Rated supply voltage	[V AC]						3 x 200 V AC _{-7%} ...480 V AC ^{+10%}
Rated input current	[A AC]						10.0
Mains filter							external
SCCR value	[kA]						65
Internal braking resistor							
Continuous braking power	[W]						60
Maximum braking power	[kW]						14.1
External braking resistor - Values dependent on the connected resistor							
Continuous braking power	[kW]						6.0
Maximum braking power	[kW]						26.7
Minimum braking resistor	[Ω]						24
Output current per channel*		up to 45°C			45...55°C		
Valid for a control frequency of	[kHz]	4	8	16	4	8	16
Rated output current I_n	[A]	6.9	6.9	6.9	6.9	6.9	6.9
Peak output current I_{peak} for max. 1 s	[A]	21.0	21.0	11.5	21.0	21.0	11.5
Peak output current I_{peak} for max. 3 s	[A]	18.0	18.0	9.9	18.0	18.0	9.9
* depending on the ambient temperature during operation							
DC link							
Voltage range	[V DC]						0...800
Capacitance	[μF]						235
Output voltage 24 V DC (Vout)							
Voltage range	[V DC]						24 _{-5%} ...24 ^{+6%}
Max. output current	[A DC]						1.0
Motor brake							
Maximum current brake output	[A]						0.7
Output frequency							
Limited frequency of the standard version	[Hz]						0...599
Frequency of the dual use version	[Hz]						0...2000
Mechanical data							
Width	[mm]						60
Height without connectors	[mm]						225
Depth without connectors	[mm]						185
Weight	[kg]						1.5

4.10 AX1112-3xxx | Economy servo drive, three-phase, single-axis module, 12 A

Electrical data							
Channels		1					
Mains supply							
Rated supply voltage	[V AC]	3 x 200 V AC _{-7%} ...480 V AC ^{+10%}					
Rated input current	[A AC]	13.0					
Mains filter		external					
SCCR value	[kA]	65					
Internal braking resistor							
Continuous braking power	[W]	60					
Maximum braking power	[kW]	14.1					
External braking resistor - Values dependent on the connected resistor							
Continuous braking power	[kW]	6.0					
Maximum braking power	[kW]	26.7					
Minimum braking resistor	[Ω]	24					
Output current per channel*		up to 45°C			45...55°C		
Valid for a control frequency of	[kHz]	4	8	16	4	8	16
Rated output current I _n	[A]	12.0	12.0	12.0	12.0	12.0	11.2
Peak output current I _{peak} for max. 1 s	[A]	36.0	36.0	20.0	36.0	36.0	20.0
Peak output current I _{peak} for max. 3 s	[A]	30.0	30.0	17.0	30.0	30.0	17.0
* depending on the ambient temperature during operation							
DC link							
Voltage range	[V DC]	0...800					
Capacitance	[μF]	470					
Output voltage 24 V DC (Vout)							
Voltage range	[V DC]	24 _{-5%} ...24 ^{+6%}					
Max. output current	[A DC]	1.0					
Motor brake							
Maximum current brake output	[A]	0.7					
Output frequency							
Limited frequency of the standard version	[Hz]	0...599					
Frequency of the dual use version	[Hz]	0...2000					
Mechanical data							
Width	[mm]	60					
Height without connectors	[mm]	225					
Depth without connectors	[mm]	185					
Weight	[kg]	1.5					

4.11 AX1203-3xxx | Economy servo drive, three-phase, dual-axis module, 3.0 A

Electrical data							
Channels							2
Mains supply							
Rated supply voltage	[V AC]						3 x 200 V AC _{-7%} ...480 V AC ^{+10%}
Rated input current	[A AC]						10.4
Mains filter							external
SCCR value	[kA]						65
Internal braking resistor							
Continuous braking power	[W]						60
Maximum braking power	[kW]						14.1
External braking resistor - Values dependent on the connected resistor							
Continuous braking power	[kW]						3.0
Maximum braking power	[kW]						14.2
Minimum braking resistor	[Ω]						45
Output current per channel*		up to 45°C			45...55°C		
Valid for a control frequency of	[kHz]	4	8	16	4	8	16
Rated output current I_n	[A]	3.0	3.0	3.0	3.0	3.0	3.0
Max. rated output current $I_{n \max}$	[A]	6.0	6.0	6.0	6.0	6.0	6.0
I_n as total device current	[A]	6.0	6.0	6.0	6.0	6.0	6.0
Peak output current I_{peak} for max. 1 s	[A]	10.5	10.5	8.2	10.5	10.5	8.2
Peak output current I_{peak} for max. 3 s	[A]	9.0	9.0	7.0	9.0	9.0	7.0
* depending on the ambient temperature during operation							
DC link							
Voltage range	[V DC]						0...800
Capacitance	[μF]						235
Output voltage 24 V DC (Vout)							
Voltage range	[V DC]						24 _{-5%} ...24 ^{+6%}
Max. output current	[A DC]						1.0
Motor brake							
Maximum current brake output	[A]						0.7
Output frequency							
Limited frequency of the standard version	[Hz]						0...599
Frequency of the dual use version	[Hz]						0...2000
Mechanical data							
Width	[mm]						60
Height without connectors	[mm]						225
Depth without connectors	[mm]						185
Weight	[kg]						1.5

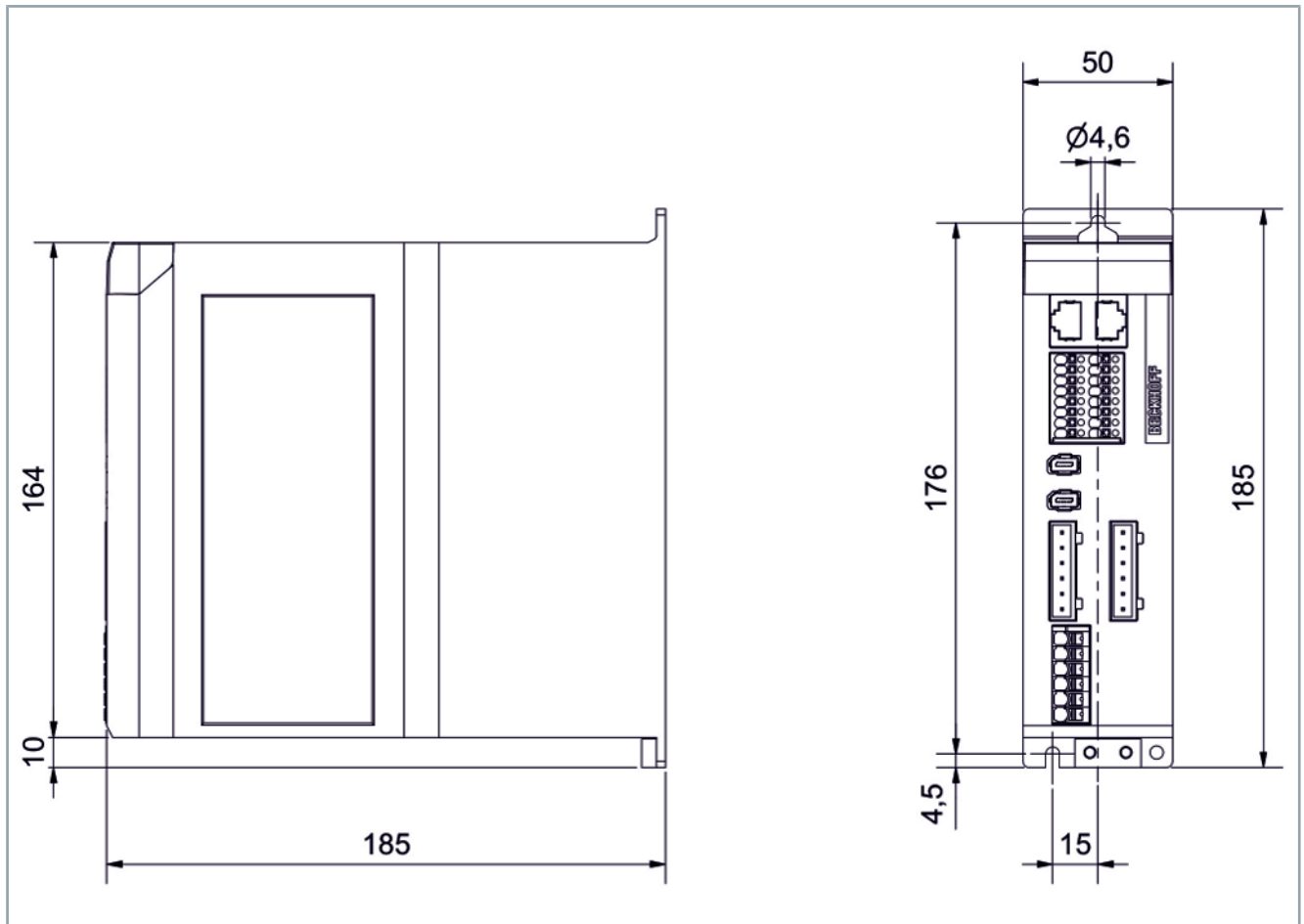
4.12 AX1206-3xxx | Economy servo drive, three-phase, dual-axis module, 6.0 A

Electrical data							
Channels							2
Mains supply							
Rated supply voltage	[V AC]						3 x 200 V AC _{-7%} ...480 V AC ^{+10%}
Rated input current	[A AC]						12.3
Mains filter							external
SCCR value	[kA]						65
Internal braking resistor							
Continuous braking power	[W]						60
Maximum braking power	[kW]						14.1
External braking resistor - Values dependent on the connected resistor							
Continuous braking power	[kW]						6.0
Maximum braking power	[kW]						26.7
Minimum braking resistor	[Ω]						24.0
Output current per channel*		up to 45°C			45...55°C		
Valid for a control frequency of	[kHz]	4	8	16	4	8	16
Rated output current I_n	[A]	6.0	6.0	5.7	4.6	4.6	4.0
Max. rated output current $I_{n\ max}$	[A]	7.5	7.5	7.5	7.5	7.5	7.0
I_n as total device current	[A]	12.0	12.0	12.0	9.2	9.2	8.0
Peak output current I_{peak} for max. 1 s	[A]	21.0	21.0	11.5	21.0	21.0	11.5
Peak output current I_{peak} for max. 3 s	[A]	18.0	18.0	9.9	18.0	18.0	9.9
* depending on the ambient temperature during operation							
DC link							
Voltage range	[V DC]						0...800
Capacitance	[μF]						470
Output voltage 24 V DC (Vout)							
Voltage range	[V DC]						24 _{-5%} ...24 ^{+6%}
Max. output current	[A DC]						1.0
Motor brake							
Maximum current brake output	[A]						0.7
Output frequency							
Limited frequency of the standard version	[Hz]						0...599
Frequency of the dual use version	[Hz]						0...2000
Mechanical data							
Width	[mm]						60
Height without connectors	[mm]						225
Depth without connectors	[mm]						185
Weight	[kg]						1.5

4.13 Dimensional drawings

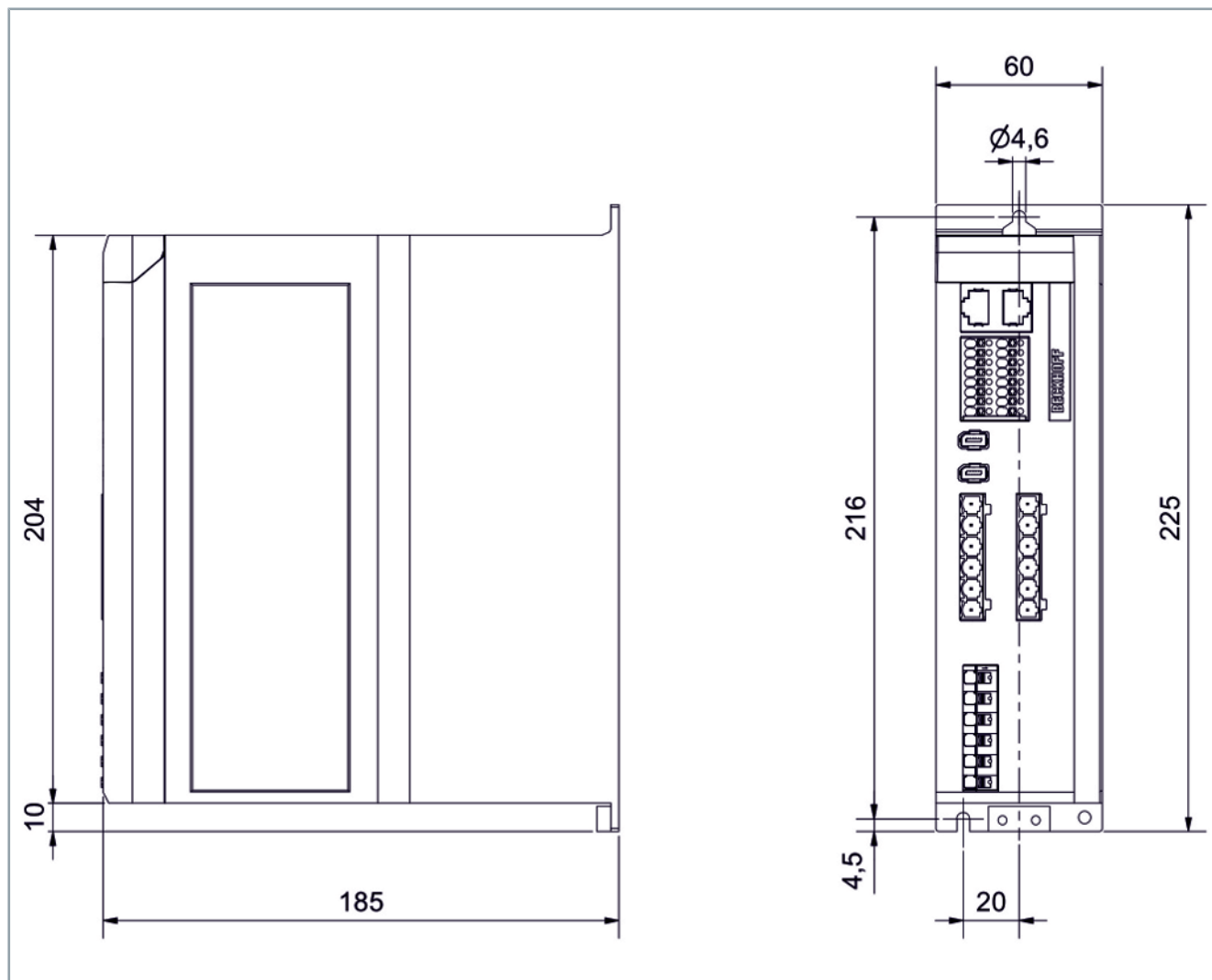
All dimensions in mm

4.13.1 AX1xxx-1xxx



Mechanical data		
Width	[mm]	50
Height without connectors	[mm]	185
Depth without connectors	[mm]	185
Weight	[kg]	1.0

4.13.2 AX1xxx-3xxx



Mechanical data		
Width	[mm]	60
Height without connectors	[mm]	225
Depth without connectors	[mm]	185
Weight	[kg]	1.5

5 Scope of supply



Check the scope of supply for missing or damaged parts

Check your delivery for completeness. If any parts are missing or became damaged during transport, contact the carrier, vendor or our service department immediately.

Depending on the application, the scope of supply may consist of different components and documents. Please check the delivery.

The connector for motor connection via socket X13/X23 is not included in the scope of delivery and must be ordered separately.

AX1xxx-x1xx-xxx

Axis module with TwinSAFE STO/SS1 (FSoE)

Name	Function
Quick reference guide	Information
Grounding screws	2 pieces, pre-assembled

AX1xxx-x2xx-xxx

Axis module with TwinSAFE STO/SS1 (FSoE and I/O)

Name	Function
Quick reference guide	Information
Grounding screws	2 pieces, pre-assembled
Mating connector for X09	TwinSAFE safe digital inputs "slot X09", [Page 89]

AX1xxx-x3xx-xxx

Axis module with TwinSAFE Safe Motion (FSoE)

Name	Function
Quick reference guide	Information
Grounding screws	2 pieces, pre-assembled

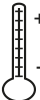
5.1 Product packaging

Instructions for handling are printed on the packaging:



The product packaging is not suitable for transporting the product. It is used to show important information such as the storage temperature range, stacking direction and information for transport in shipping packaging. Shipping packaging is required to transport the product safely. There is a note on the product packaging.

Shipping instructions

Symbol	Explanation
	Highest and lowest temperature to store the product safely.
	This is the correct position for the packaging.
	The packaging must be protected from moisture.
	The contents are fragile.

6 Transport and storage

⚠ WARNING

Serious injuries due to damaged components

Damage may result in hazardous voltages being present on the housing or exposed components and can lead to serious or even fatal injuries.

- Protect components from damage during transport and storage
- Follow the conditions for transport and storage

NOTICE

Loss of warranty due to disregard of transport and storage conditions

Failure to observe the conditions may result in damage to the economy servo drive and void the warranty.

- Observe the conditions in the following chapter for transport and storage

NOTICE

Damage due to moisture in the economy servo drive AX1000

Condensation can form during transport in cold weather or in the event of extreme temperature differences. If the device is not completely dry, condensed water can lead to a short circuit when switching on and damage the product.

- Make sure that no moisture accumulates in the economy servo drive.
- Adjust the room temperature slowly
- Only switch on the device when it is in a dry state

6.1 Conditions

During transport and storage, ensure that the economy servo drive and individual components are not damaged. Observe the following chapters, comply with the "specifications for operation, and environment", [Page 23] and observe the following instructions:

- ▶ Avoid electrostatic charging.
- ▶ Avoid contact with highly insulating materials.
- ▶ Use of appropriate means of transportation.
- ▶ Use the vendor's original packaging.

The table shows the maximum stacking height at which you may store and transport the economy servo drive on a pallet in its original packaging:

economy servo drive AX1000	Stacking height [pieces]
Without interlayer	5
With interlayer every 5 boxes	15

6.2 Transport

NOTICE

Damage due to high mechanical load

High mechanical loads will damage the economy servo drive and individual components.

- Use suitable means of transport
- Protect the economy servo drive from high mechanical loads

All modules can be transported without aids.

6.3 Long-term storage

The economy servo drive can be stored for shorter or longer periods.

- ▶ Store the product in its original packaging
- ▶ Adhere to the conditions specified in the chapter: Transport and storage
- ▶ Ensure the storage space is vibration-free

6.3.1 Forming the capacitors

During long storage periods, the installed DC link capacitors must be reformed. The following steps must be carried out:

- ▶ Connecting the mains voltage to the drive system
- ▶ Leave the drive system connected to the mains voltage for 60 minutes and do not operate under load

The device can then be used as usual.

The time interval at which the capacitors must be formed varies depending on the storage temperature.

Storage temperature	Forming interval
< 25°C	5 years
> 25°C	3 years

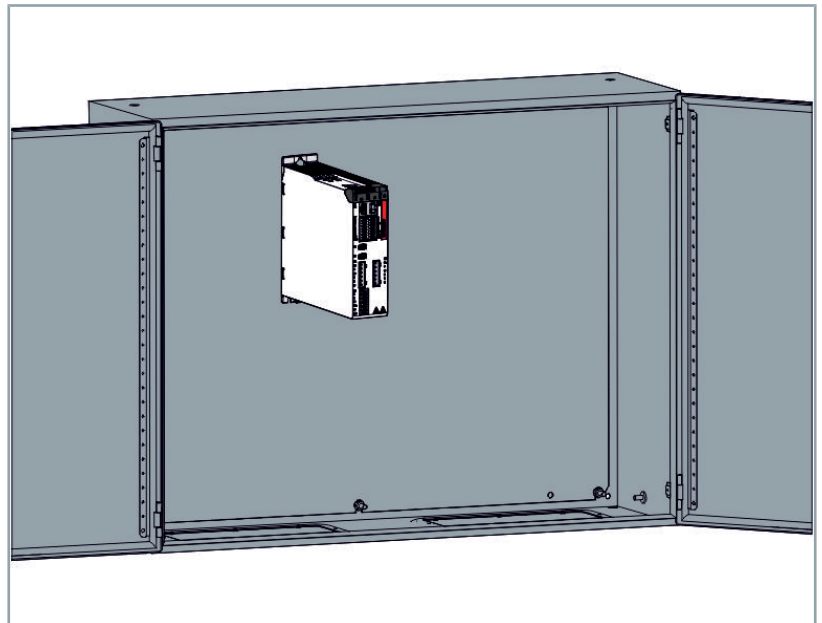
7 Technical description

7.1 Installation location and environment

This chapter outlines the basic requirements for the installation location and installation environment. You will learn the general requirements necessary for safe installation and reliable operation.

- ▶ Install the servo drive in an enclosure that complies with the required protection rating for the installation environment.
- ▶ Keep the installation location free of conductive particles (e.g., metal dust, grinding debris).
- ▶ Keep the installation location free of corrosive or otherwise chemically aggressive substances.
- ▶ Take appropriate protective or cleaning measures if contamination cannot be reliably ruled out, e.g., filtering the ventilation system, regular cleaning.
- ▶ Maintain the required clearance above and below the device. For more information, see "Control cabinet installation dimensions", [Page 61].

The standard installation position of the economy servo drive in the control cabinet is the vertical installation position.



7.2 Length of the motor cable

For the servo drive AX1000, the following maximum total motor cable lengths per motor apply in industrial applications:

Motor cable configuration	Max. total motor cable length per motor
Partially shielded	30 m
Shielded	25 m



Requirements for CE

The use of mains filters is mandatory to ensure CE compliance. Please refer to the information in chapter "Electromagnetic interference emission", [Page 65].

7.3 Braking resistor

The economy servo drive AX1000 offers the option of converting braking energy into heat via the external braking resistor. The external braking resistor is connected to "Mains connection | X01", [Page 81].

In addition, the larger devices in the AX1000 series offer an internal braking resistor. Depending on the device type, the internal braking resistor is led out via a separate, external terminal point or connected internally.

External braking resistor

The following table provides an overview of the available braking resistors and the minimum permissible braking resistance values.

AX1xxx-1xxx* with 35 Ω min. braking resistor

Braking resistor	Rated power
AX2090-BW10-1001	0.10 kW
AX2090-BW10-1002	0.15 kW

*for 1 x 100...240 V AC

AX1xxx-3xxx* with 45 Ω min. braking resistor

Braking resistor	Rated power
AX2090-BW10-3003	0.30 kW
AX2090-BW10-3005	0.48 kW

*for 3 x 200...480 V AC



Check braking resistor power

Check the braking resistor power with the TE5910 | TwinCAT 3 Motion Designer design software.

- Install TE5910 from the Beckhoff homepage.
- Enter the data for your configuration.
- Check your configuration.
- Select the braking resistor according to the result.

[TE5910 | TwinCAT 3 Motion Designer](#)

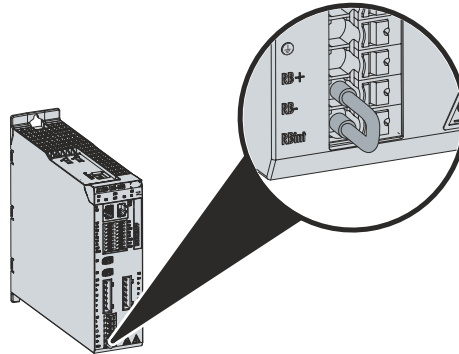
Internal braking resistor

Device	Internal braking resistor	Terminal point on X01
AX1101-1xxx	—	—
AX1103-1xxx	—	—
AX1106-1xxx	present*	RB _{int}
AX1201-1xxx	—	—
AX1203-1xxx	present*	RB _{int}
AX1103-3xxx	present*	RB _{int}
AX1106-3xxx	present*	RB _{int}
AX1112-3xxx	present*	RB _{int}
AX1203-3xxx	present	— (internally connected)
AX1206-3xxx	present	— (internally connected)

*Observe the instructions for removing the external jumper on X01 when using an external braking resistor

**Do not remove the bridge between RBint and RB-**

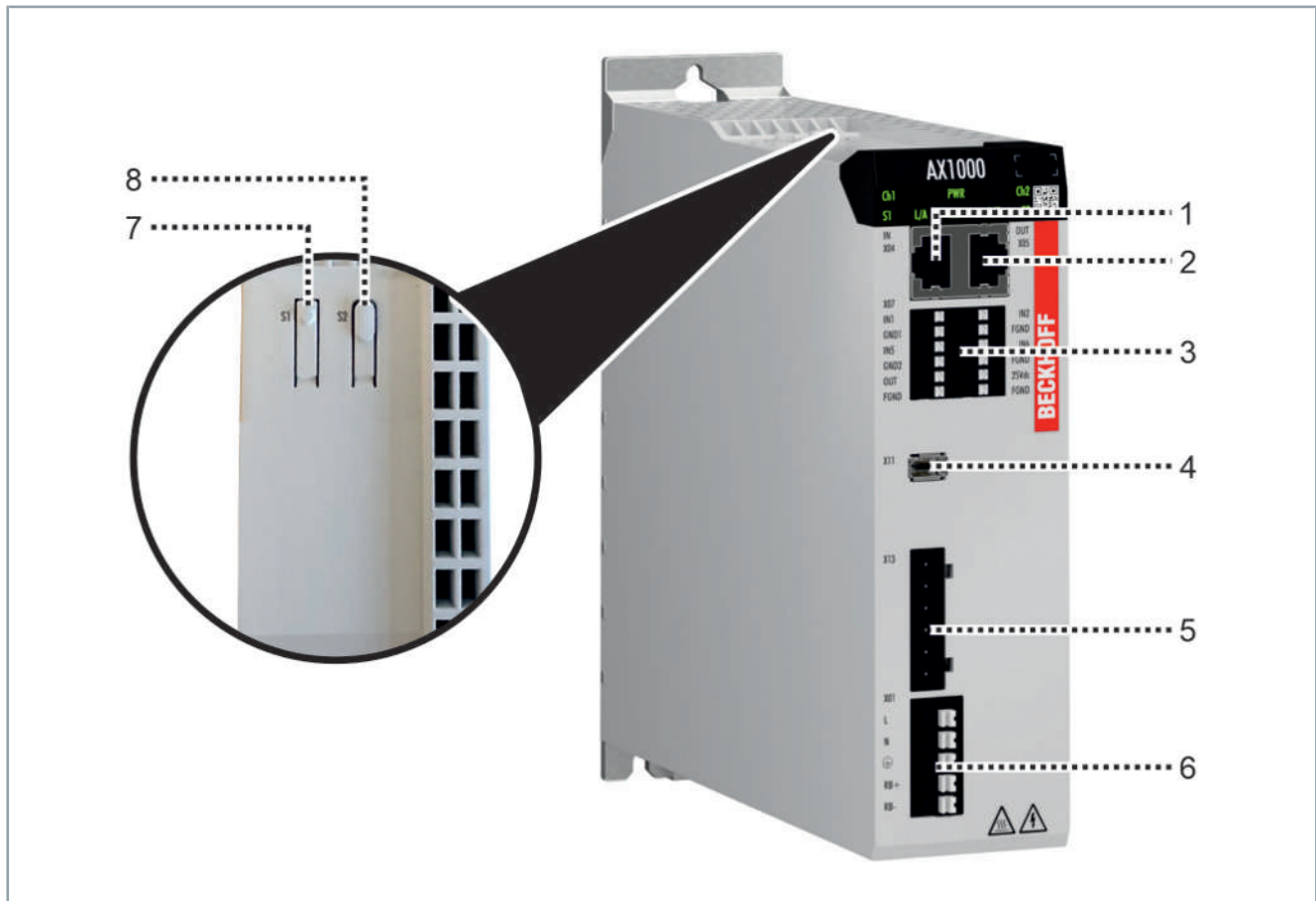
The jumper may only be removed if an external braking resistor is connected. Otherwise, the DC link will not be charged, and the axis cannot be commissioned.



7.4 Connections on the device

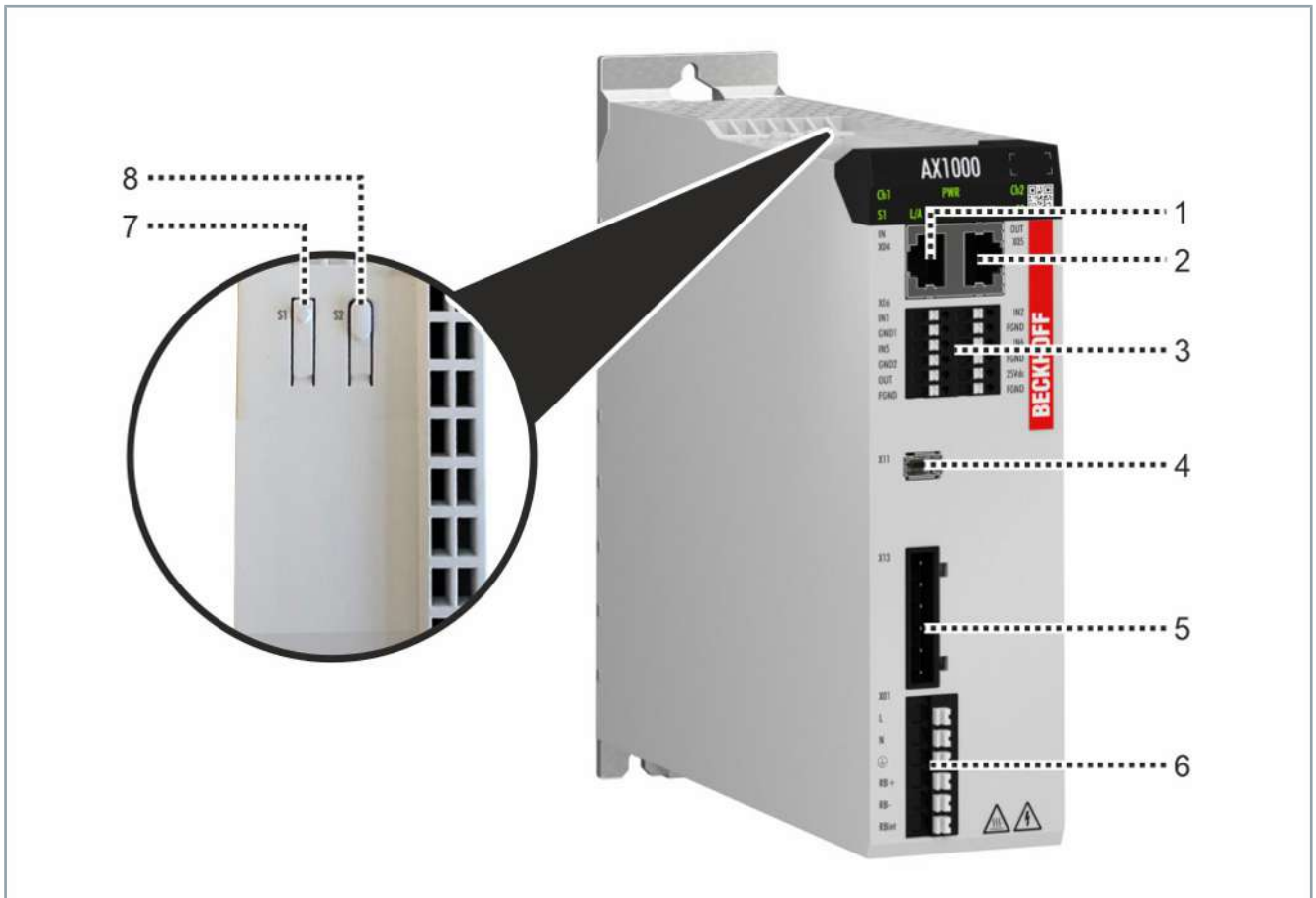
7.4.1 AX11xx-1xxx

7.4.1.1 AX1101-110x, AX1101-130x, AX1103-110x, AX1103-130x



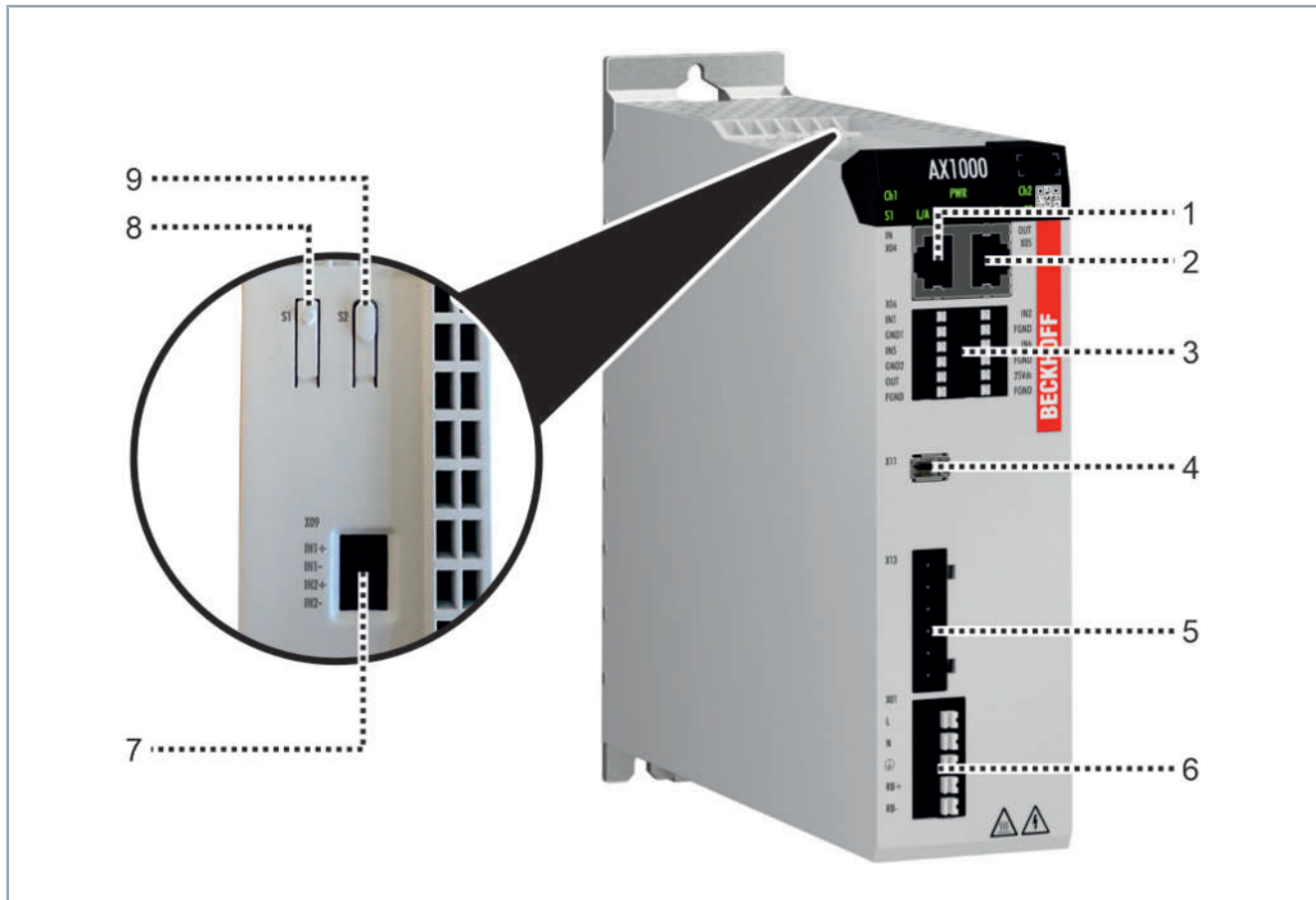
Position	Labeling	Explanation
1	IN X04	RJ45 socket for the incoming EtherCAT cable, see "EtherCAT slot IN X04, OUT X05", [Page 85]
2	OUT X05	RJ45 socket for the downstream EtherCAT cable, see "EtherCAT slot IN X04, OUT X05", [Page 85]
3	X06	Connection I/O: 12-pin terminal point for digital input/output signals, see "I/O connection X06", [Page 86]
4	X11	Slot OCT channel 1: see "OCT slot X11", [Page 89]
5	X13	Slot motor channel 1, see "Motor slot X13", [Page 92]
6	X01	Single-phase network connection, see "Mains connection X01", [Page 81]
7	S1	Push button for internal purposes
8	S2	TwinSAFE actuation button

7.4.1.2 AX1106-110x, AX1106-130x



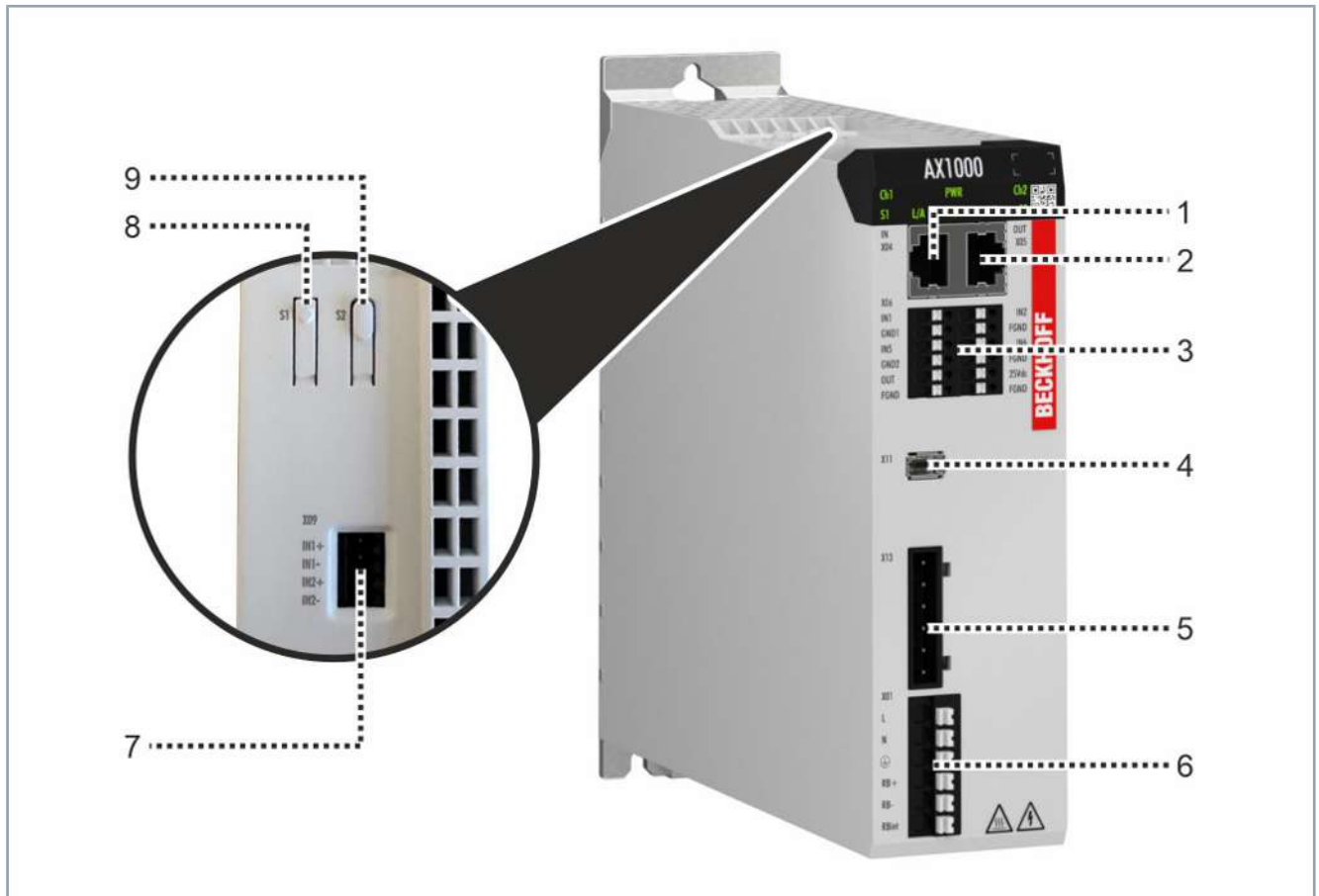
Position	Labeling	Explanation
1	IN X04	RJ45 socket for the incoming EtherCAT cable, see "EtherCAT slot IN X04, OUT X05", [Page 85]
2	OUT X05	RJ45 socket for the downstream EtherCAT cable, see "EtherCAT slot IN X04, OUT X05", [Page 85]
3	X06	Connection I/O: 12-pin terminal point for digital input/output signals, see "I/O connection X06", [Page 86]
4	X11	Slot OCT channel 1: see "OCT slot X11", [Page 89]
5	X13	Slot motor channel 1, see "Motor slot X13", [Page 92]
6	X01	Single-phase network connection, see "Mains connection X01", [Page 81]
7	S1	Push button for internal purposes
8	S2	TwinSAFE actuation button

7.4.1.3 AX1101-120x, AX1103-120x



Position	Labeling	Explanation
1	IN X04	RJ45 socket for the incoming EtherCAT cable, for more information, see "EtherCAT slot IN X04, OUT X05", [Page 85]
2	OUT X05	RJ45 socket for the downstream EtherCAT cable, for more information, see "EtherCAT slot IN X04, OUT X05", [Page 85]
3	X06	Connection I/O: 12-pin terminal point for digital input/output signals, for more information, see "I/O connection X06", [Page 86]
4	X11	Slot OCT channel 1: for more information, see "OCT slot X11", [Page 89]
5	X13	Slot motor channel 1, for more information, see "Motor slot X13", [Page 92]
6	X01	Single-phase network connection, for more information, see "Mains connection X01", [Page 81]
7	X09	TwinSAFE slot: safe inputs for more information, see "TwinSAFE slot X09", [Page 89]
8	S1	Push button for internal purposes
9	S2	TwinSAFE actuation button

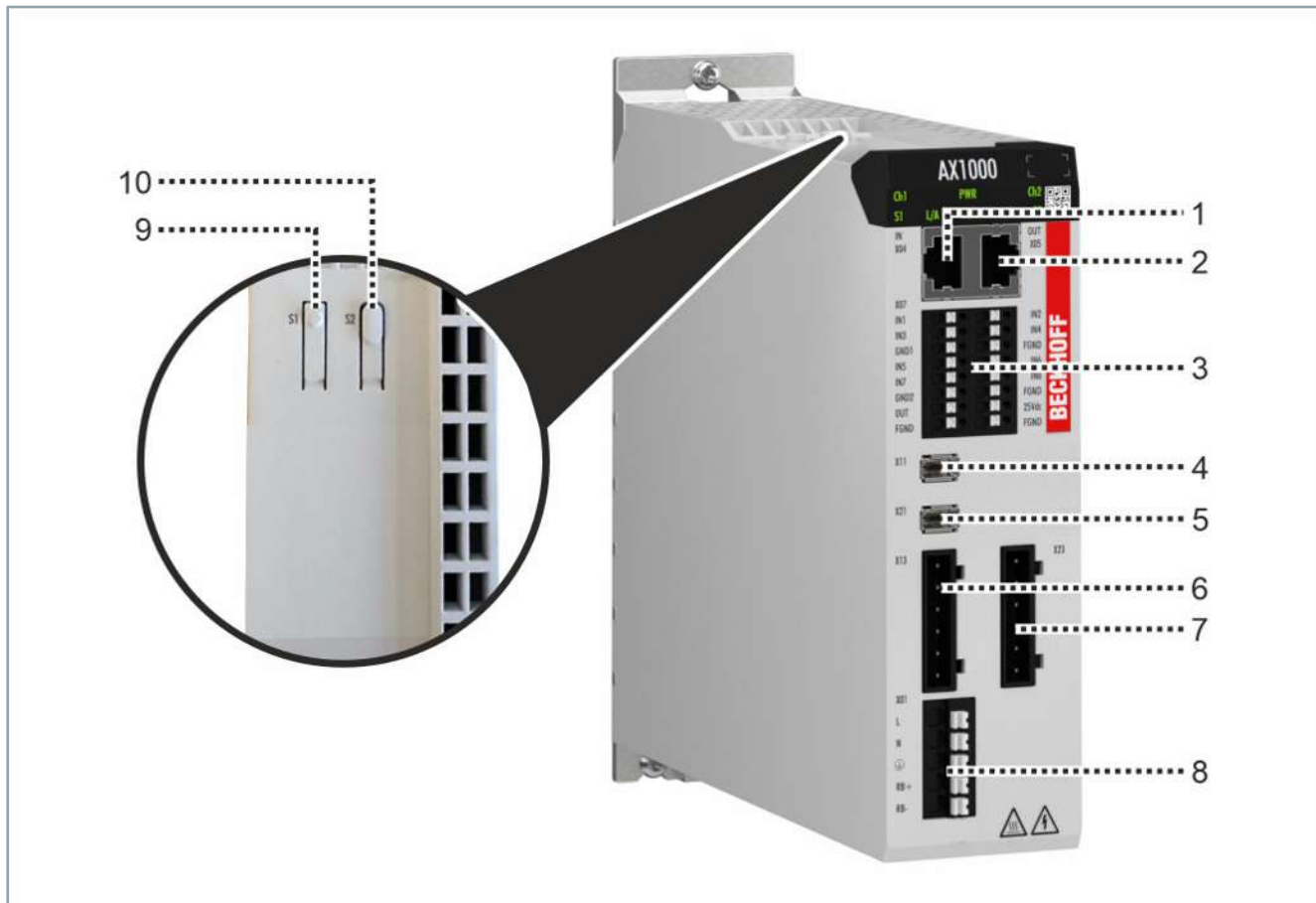
7.4.1.4 AX1106-120x



Position	Labeling	Explanation
1	IN X04	RJ45 socket for the incoming EtherCAT cable, for more information, see "EtherCAT slot IN X04, OUT X05", [Page 85]
2	OUT X05	RJ45 socket for the downstream EtherCAT cable, for more information, see "EtherCAT slot IN X04, OUT X05", [Page 85]
3	X06	Connection I/O: 12-pin terminal point for digital input/output signals, for more information, see "I/O connection X06", [Page 86]
4	X11	Slot OCT channel 1: for more information, see "OCT slot X11", [Page 89]
5	X13	Slot motor channel 1, for more information, see "Motor slot X13", [Page 92]
6	X01	Single-phase network connection, for more information, see "Mains connection X01", [Page 81]
7	X09	TwinSAFE slot: safe inputs for more information, see "TwinSAFE slot X09", [Page 89]
8	S1	Push button for internal purposes
9	S2	TwinSAFE actuation button

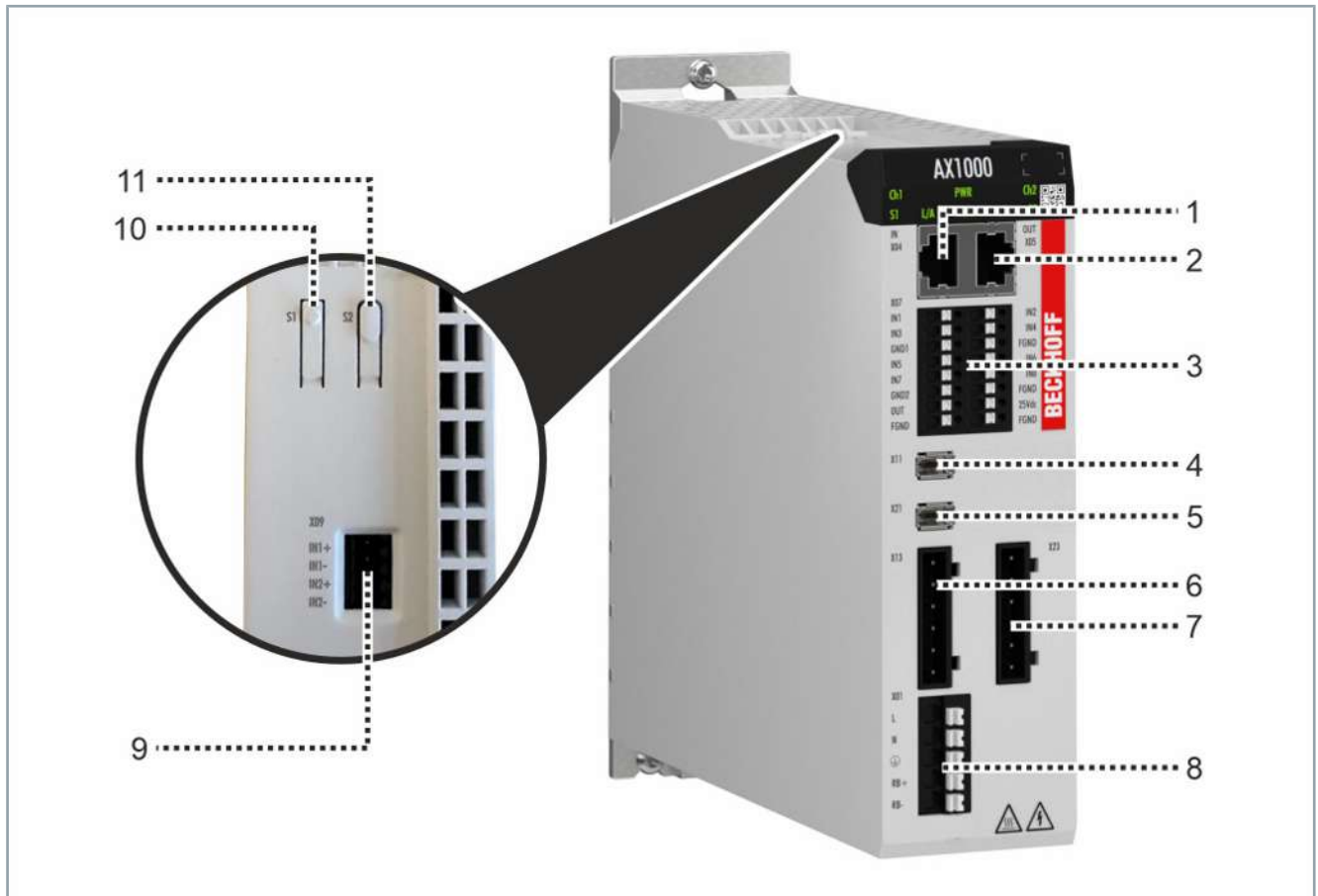
7.4.2 AX12xx-1xxx

7.4.2.1 AX1201-110x, AX1201-130x

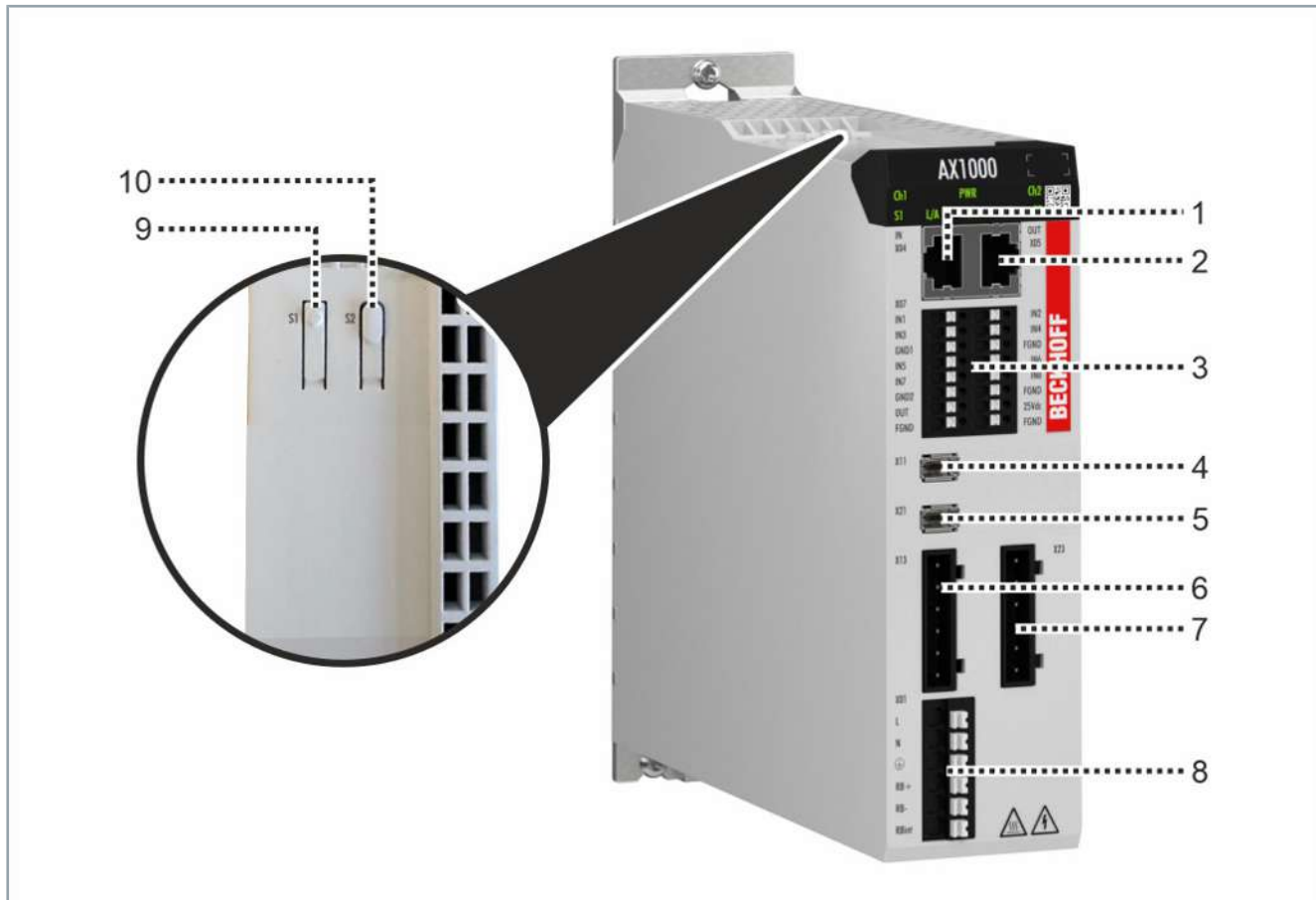


Position	Labeling	Explanation
1	IN X04	RJ45 socket for the incoming EtherCAT cable, for more information, see "EtherCAT slot IN X04, OUT X05", [Page 85]
2	OUT X05	RJ45 socket for the downstream EtherCAT cable, for more information, see "EtherCAT slot IN X04, OUT X05", [Page 85]
3	X07	Connection I/O: 16-pin terminal point for digital input/output signals, for more information, see "I/O connection X07", [Page 87]
4	X11	Slot OCT channel 1: for more information, see "OCT slot X11", [Page 89]
5	X21	Slot OCT channel 2: for more information, see "OCT slot X11", [Page 89]
6	X13	Slot motor channel 1 for more information, see "Motor slot X13", [Page 92]
7	X23	Slot motor channel 2, for more information, see "Motor slot X13", [Page 92]
8	X01	Single-phase network connection, for more information, see "Mains connection X01", [Page 81]
9	S1	Push button for internal purposes
10	S2	TwinSAFE actuation button

7.4.2.2 AX1201-120x

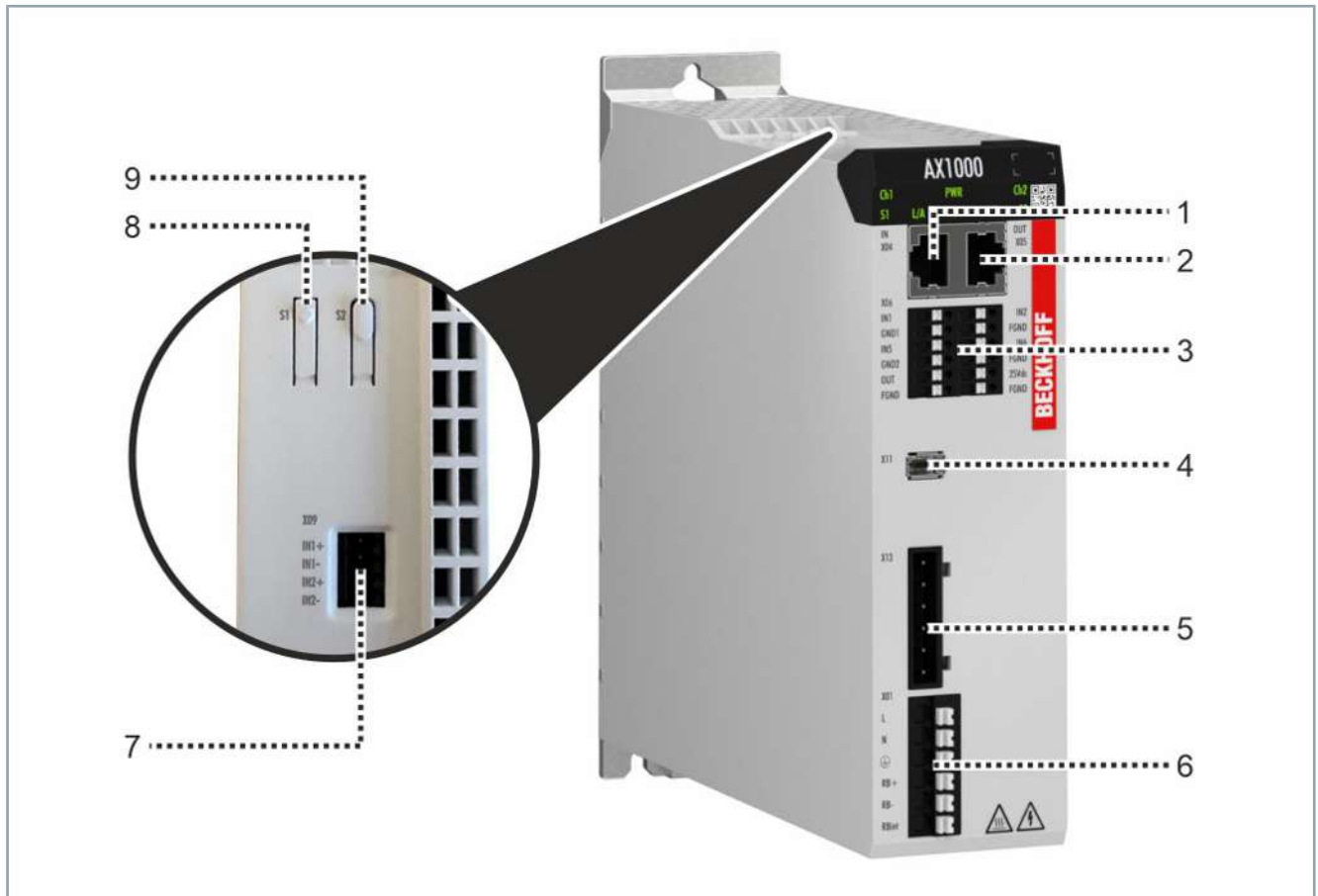


Position	Labeling	Explanation
1	IN X04	RJ45 socket for the incoming EtherCAT cable, for more information, see "EtherCAT slot IN X04, OUT X05", [Page 85]
2	OUT X05	RJ45 socket for the downstream EtherCAT cable, for more information, see "EtherCAT slot IN X04, OUT X05", [Page 85]
3	X07	Connection I/O: 16-pin terminal point for digital input/output signals, for more information, see "I/O connection X07", [Page 87]
4	X11	Slot OCT channel 1: for more information, see "OCT slot X11", [Page 89]
5	X21	Slot OCT channel 2: for more information, see "OCT slot X11", [Page 89]
6	X13	Slot motor channel 1 for more information, see "Motor slot X13", [Page 92]
7	X23	Slot motor channel 2, for more information, see "Motor slot X13", [Page 92]
8	X01	Single-phase network connection, for more information, see "Mains connection X01", [Page 81]
9	X09	TwinSAFE slot: safe inputs for more information, see "TwinSAFE slot X09", [Page 89]
10	S1	Push button for internal purposes
11	S2	TwinSAFE actuation button



Position	Labeling	Explanation
1	IN X04	RJ45 socket for the incoming EtherCAT cable, for more information, see "EtherCAT slot IN X04, OUT X05", [Page 85]
2	OUT X05	RJ45 socket for the downstream EtherCAT cable, for more information, see "EtherCAT slot IN X04, OUT X05", [Page 85]
3	X07	Connection I/O: 16-pin terminal point for digital input/output signals, for more information, see "I/O connection X07", [Page 87]
4	X11	Slot OCT channel 1: for more information, see "OCT slot X11", [Page 89]
5	X21	Slot OCT channel 2: for more information, see "OCT slot X11", [Page 89]
6	X13	Slot motor channel 1 for more information, see "Motor slot X13", [Page 92]
7	X23	Slot motor channel 2, for more information, see "Motor slot X13", [Page 92]
8	X01	Single-phase network connection, for more information, see "Mains connection X01", [Page 81]
9	S1	Push button for internal purposes
10	S2	TwinSAFE actuation button

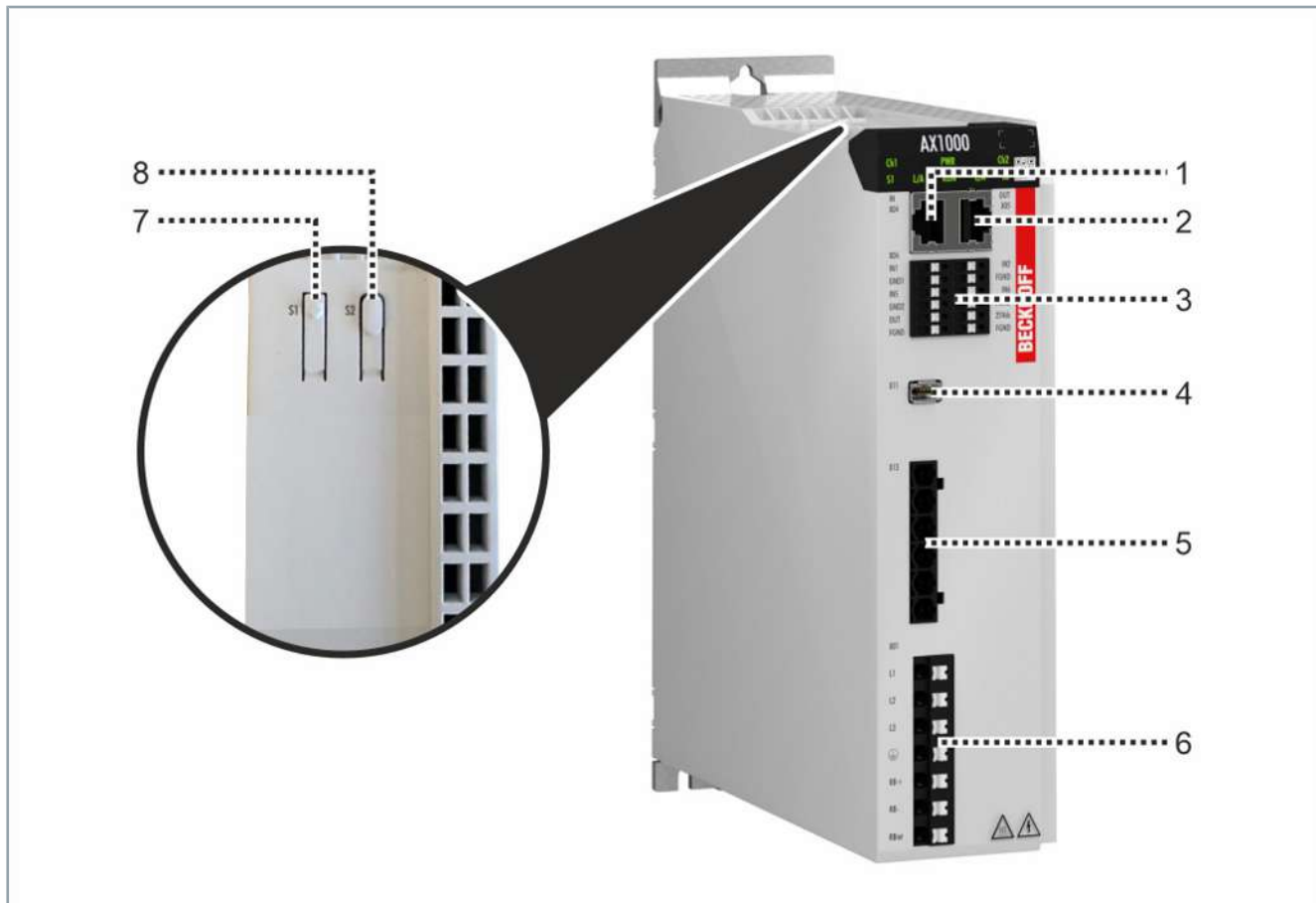
7.4.2.4 AX1203-120x



Position	Labeling	Explanation
1	IN X04	RJ45 socket for the incoming EtherCAT cable, for more information, see "EtherCAT slot IN X04, OUT X05", [Page 85]
2	OUT X05	RJ45 socket for the downstream EtherCAT cable, for more information, see "EtherCAT slot IN X04, OUT X05", [Page 85]
3	X07	Connection I/O: 16-pin terminal point for digital input/output signals, for more information, see "I/O connection X07", [Page 87]
4	X11	Slot OCT channel 1: for more information, see "OCT slot X11", [Page 89]
5	X21	Slot OCT channel 2: for more information, see "OCT slot X11", [Page 89]
6	X13	Slot motor channel 1 for more information, see "Motor slot X13", [Page 92]
7	X23	Slot motor channel 2, for more information, see "Motor slot X13", [Page 92]
8	X01	Single-phase network connection, for more information, see "Mains connection X01", [Page 81]
9	X09	TwinSAFE slot: safe inputs for more information, see "TwinSAFE slot X09", [Page 89]
10	S1	Push button for internal purposes
11	S2	TwinSAFE actuation button

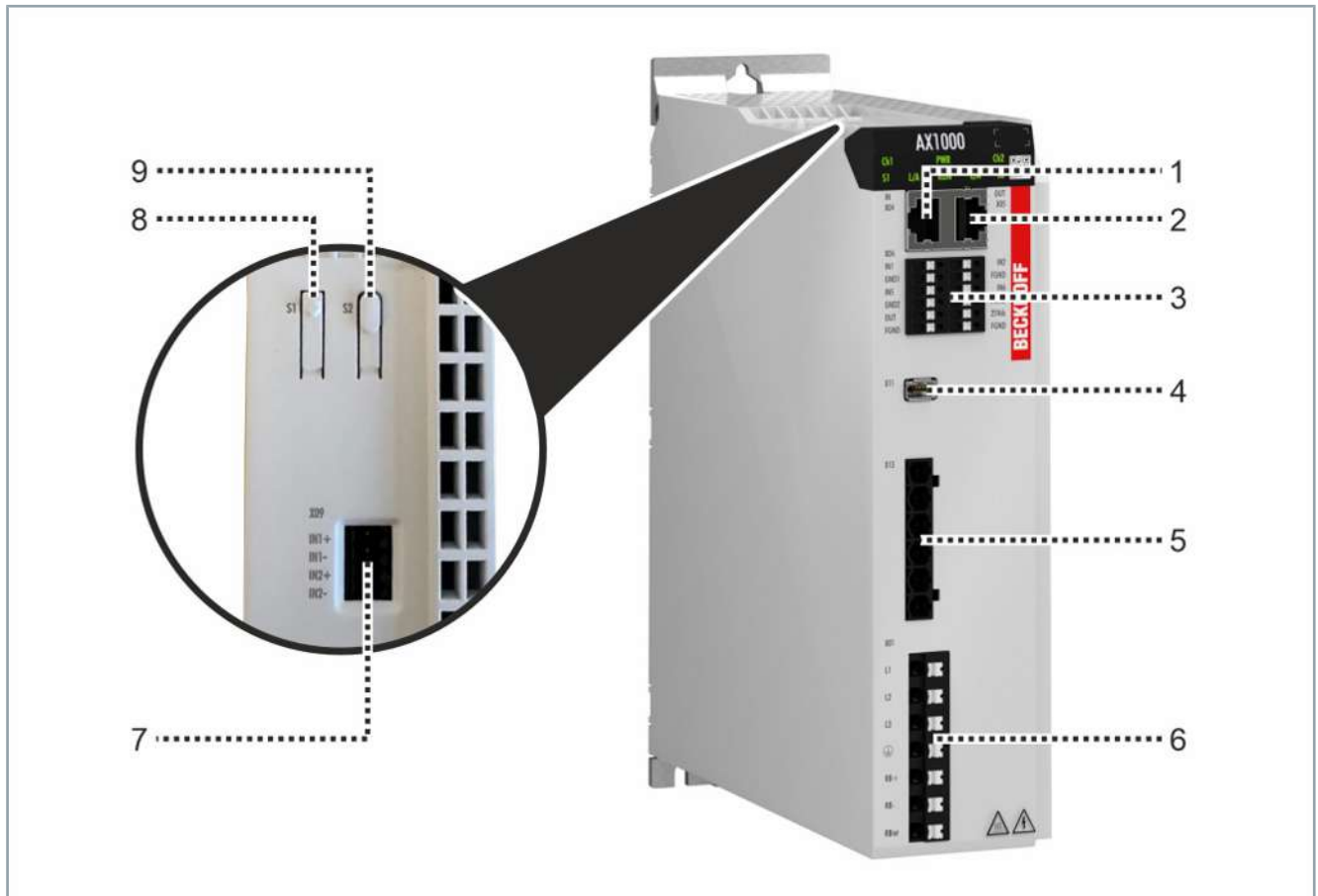
7.4.3 AX11xx-3xxx

7.4.3.1 AX11xx-3101, AX11xx-3301



Position	Labeling	Explanation
1	IN X04	RJ45 socket for the incoming EtherCAT cable, see "EtherCAT slot IN X04, OUT X05", [Page 85]
2	OUT X05	RJ45 socket for the downstream EtherCAT cable, see "EtherCAT slot IN X04, OUT X05", [Page 85]
3	X06	Connection I/O: 12-pin terminal point for digital input/output signals, see "I/O connection X06", [Page 86]
4	X11	Slot OCT channel 1: see "OCT slot X11", [Page 89]
5	X13	Slot motor channel 1, see "Motor slot X13", [Page 92]
6	X01	Three-phase network connection, see "Mains connection X01", [Page 81]
7	S1	Push button for internal purposes
8	S2	TwinSAFE actuation button

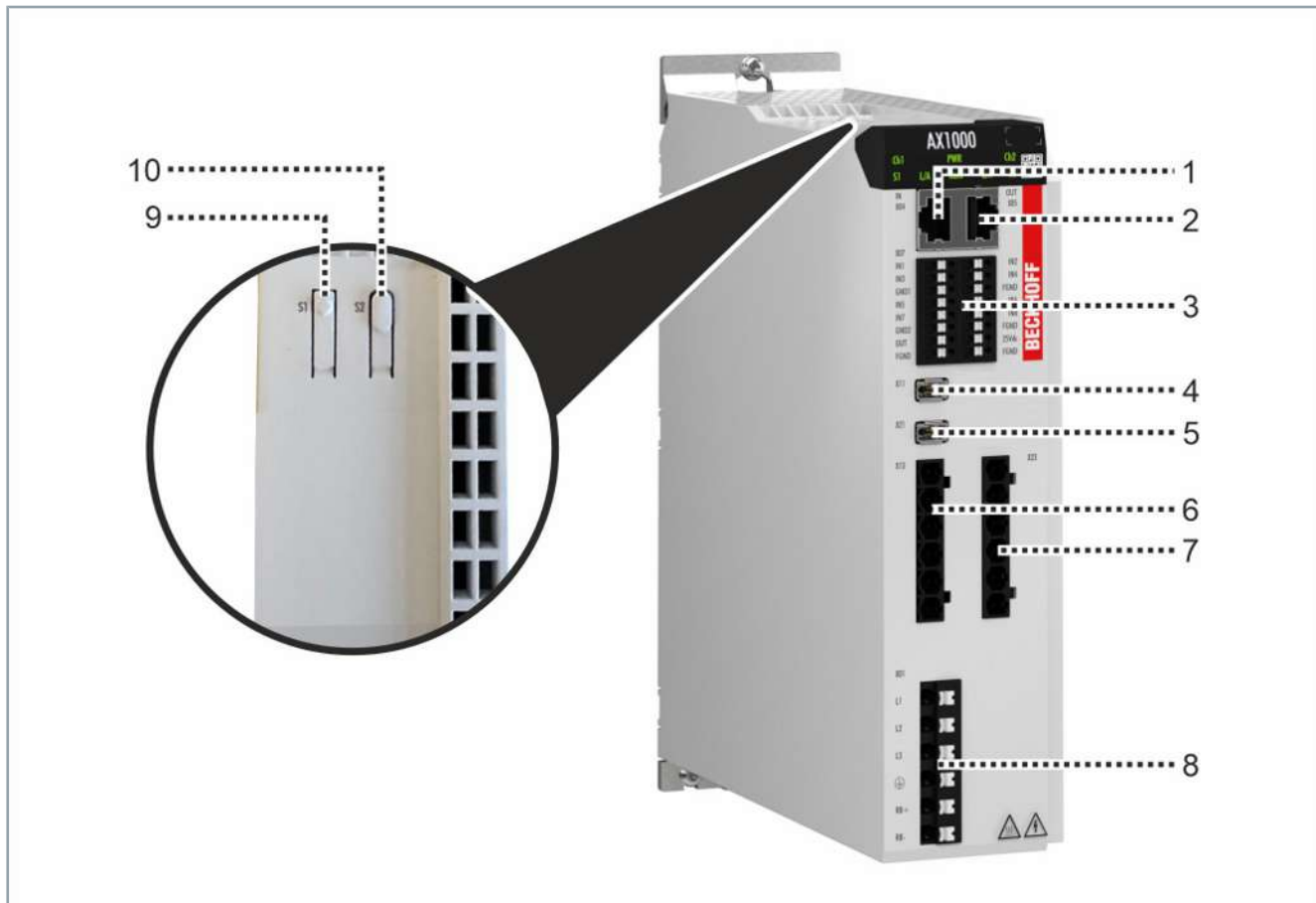
7.4.3.2 AX11xx-3201



Position	Labeling	Explanation
1	IN X04	RJ45 socket for the incoming EtherCAT cable, for more information, see "EtherCAT slot IN X04, OUT X05", [Page 85]
2	OUT X05	RJ45 socket for the downstream EtherCAT cable, for more information, see "EtherCAT slot IN X04, OUT X05", [Page 85]
3	X06	Connection I/O: 12-pin terminal point for digital input/output signals, for more information, see "I/O connection X06", [Page 86]
4	X11	Slot OCT channel 1: for more information, see "OCT slot X11", [Page 89]
5	X13	Slot motor channel 1, for more information, see "Motor slot X13", [Page 92]
6	X01	Three-phase network connection, for more information, see "Mains connection X01", [Page 81]
7	X09	TwinSAFE slot: safe inputs for more information, see "TwinSAFE slot X09", [Page 89]
8	S1	Push button for internal purposes
9	S2	TwinSAFE actuation button

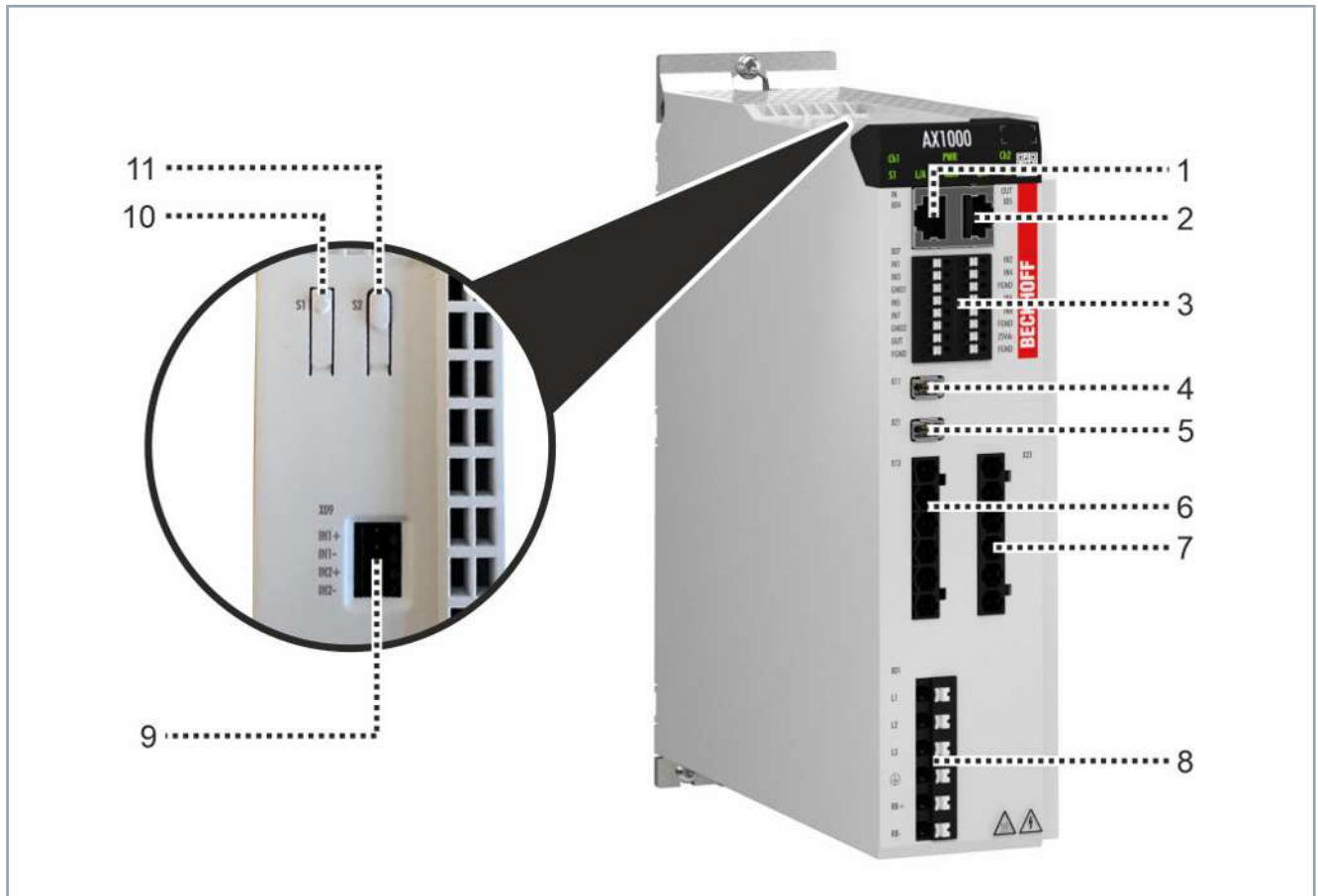
7.4.4 AX12xx-3xxx

7.4.4.1 AX12xx-3101, AX12xx-3301



Position	Labeling	Explanation
1	IN X04	RJ45 socket for the incoming EtherCAT cable, for more information, see "EtherCAT slot IN X04, OUT X05", [Page 85]
2	OUT X05	RJ45 socket for the downstream EtherCAT cable, for more information, see "EtherCAT slot IN X04, OUT X05", [Page 85]
3	X07	Connection I/O: 16-pin terminal point for digital input/output signals, for more information, see "I/O connection X07", [Page 87]
4	X11	Slot OCT channel 1: for more information, see "OCT slot X11", [Page 89]
5	X21	Slot OCT channel 2: for more information, see "OCT slot X11", [Page 89]
6	X13	Slot motor channel 1 for more information, see "Motor slot X13", [Page 92]
7	X23	Slot motor channel 2, for more information, see "Motor slot X13", [Page 92]
8	X01	Three-phase network connection, for more information, see "Mains connection X01", [Page 81]
9	S1	Push button for internal purposes
10	S2	TwinSAFE actuation button

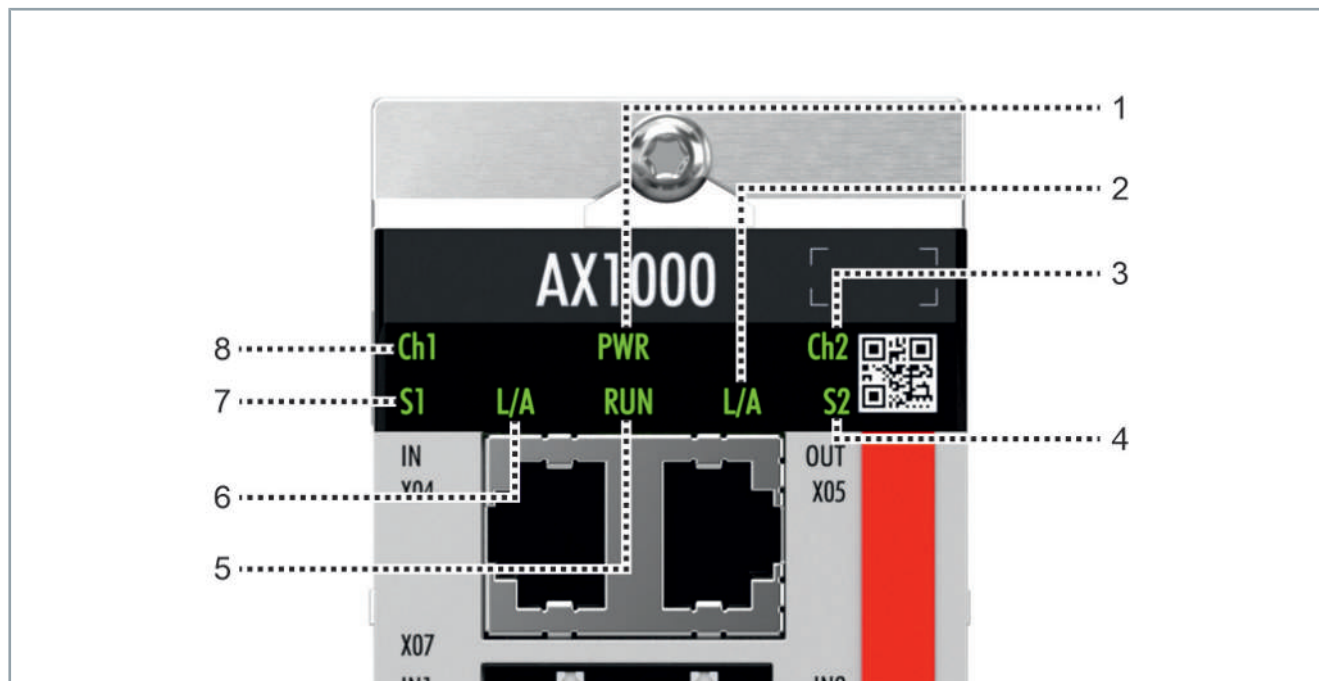
7.4.4.2 AX12xx-3201



Position	Labeling	Explanation
1	IN X04	RJ45 socket for the incoming EtherCAT cable, for more information, see "EtherCAT slot IN X04, OUT X05", [Page 85]
2	OUT X05	RJ45 socket for the downstream EtherCAT cable, for more information, see "EtherCAT slot IN X04, OUT X05", [Page 85]
3	X07	Connection I/O: 16-pin terminal point for digital input/output signals, for more information, see "I/O connection X07", [Page 87]
4	X11	Slot OCT channel 1: for more information, see "OCT slot X11", [Page 89]
5	X21	Slot OCT channel 2: for more information, see "OCT slot X11", [Page 89]
6	X13	Slot motor channel 1 for more information, see "Motor slot X13", [Page 92]
7	X23	Slot motor channel 2, for more information, see "Motor slot X13", [Page 92]
8	X01	Three-phase network connection, for more information, see "Mains connection X01", [Page 81]
9	X09	TwinSAFE slot: safe inputs for more information, see "TwinSAFE slot X09", [Page 89]
10	S1	Push button for internal purposes
11	S2	TwinSAFE actuation button

7.5 Display

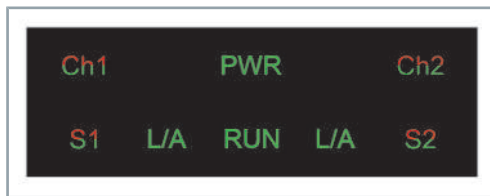
The economy servo drive AX1000 display provides information about the state of the module.



Item number	Function - designation	Explanation
1	PWR	DC link
2	L/A	Communication OUT X05
3	Ch2	Operating state axis 2 ¹⁾
4	S2	Safety status axis 2 ¹⁾²⁾
5	RUN	EtherCAT operating state
6	L/A	Communication IN X04
7	S1	Safety status axis 1
8	Ch1	Operating state axis 1 ²⁾

¹⁾ for 2-channel modules

²⁾ for modules with TwinSAFE



DC link status | PWR symbol

LED/status	Status
Off	The module is switched off
Lights up green	DC link charged
Flashes green	DC link is charging

Axis operating state | Ch1 symbol / Ch2 symbol

LED/status	Status
Off	The axis is not active
Lights up red	The servo drive is in EtherCAT Init state
Flashes red	There is an error
Flashing red and green alternately	An error reaction of the axis is active
Lights up green	The axis is enabled and free from errors
Flashes green quickly	The axis is disabled and is being initialized
Flashes green slowly	The axis is disabled and free from errors

Safety status axis | S1 symbol / S2 symbol

LED/status	Status
Off	Safety is not active
Lights up red	The axis is in "STO" state
Lights up green	There is no safety error

Communication state | L/A symbol

LED/status	Status
Off	No connection to the connected EtherCAT module
Lights up green	Connection to the connected EtherCAT module (LINK)
Flashes green	Communication with connected EtherCAT module (ACT)

EtherCAT operating state | RUN symbol

LED/status	Status
Off	The module is in EtherCAT INIT status
Lights up green	The module is in EtherCAT Operational status
Flashes green steadily	The module is in EtherCAT Pre-Operational status
Flashes green irregularly	The module is in EtherCAT Safe-Operational status

7.6 Digital I/Os

Wiring of digital inputs with internal power supply and external power supply

7.6.1 Wiring X06 (1-channel)

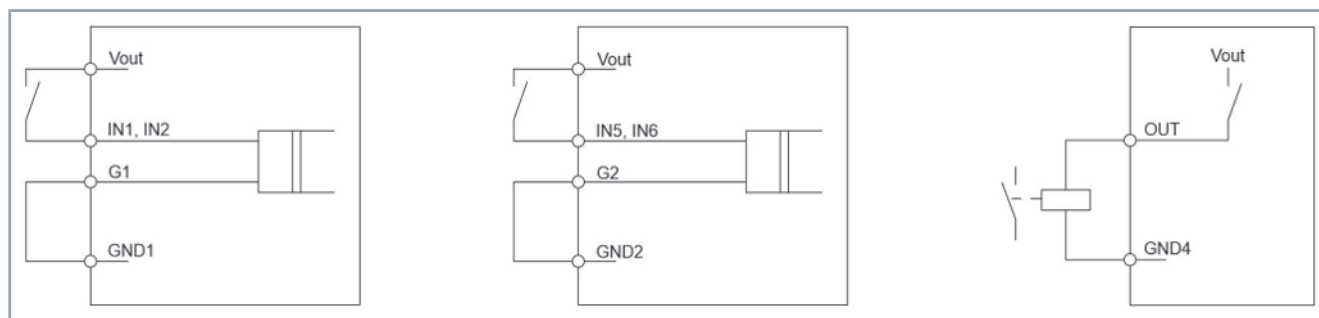
NOTICE

Damage due to improper connection of external 24 V

Connecting an external 24 V power supply to the internal 24 V power supply Vout can lead to excess voltage and instability of the internal voltage control. This can damage electronic components and circuit breakers, trigger short circuits or thermal overheating and cause fire or electric shock hazards.

- Never connect the internal power supply to an external power supply
- Only use supply points approved by the manufacturer

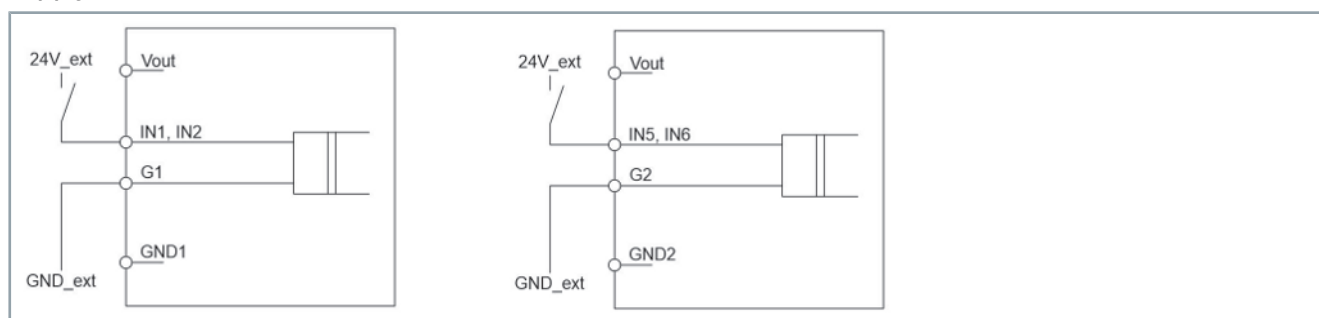
Use of the internal 24 V power supply Vout



GND1, GND2, GND4 and GND5 are connected internally

- GND = GND1 = GND2 = GND4 = GND5

Use of an external 24 V power supply



7.6.2 Wiring X07 (2-channel)

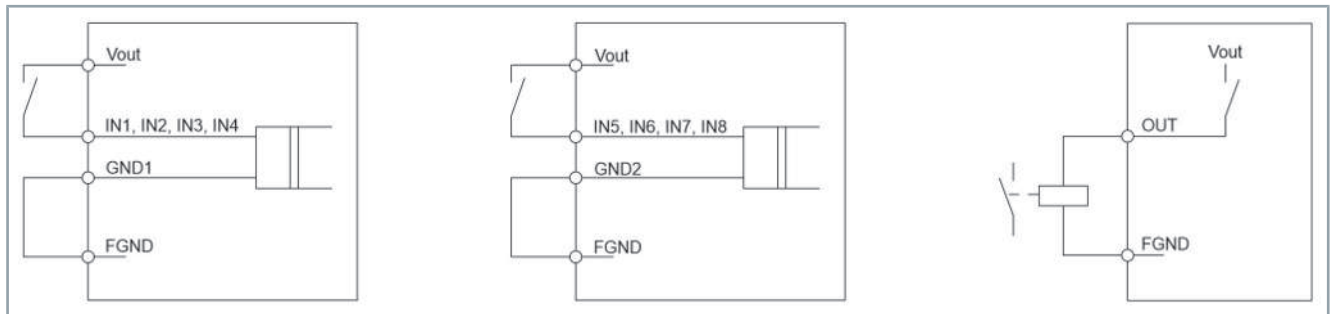
NOTICE

Damage due to improper connection of external 24 V

Connecting an external 24 V power supply to the internal 24 V power supply Vout can lead to excess voltage and instability of the internal voltage control. This can damage electronic components and circuit breakers, trigger short circuits or thermal overheating and cause fire or electric shock hazards.

- Never connect the internal power supply to an external power supply
- Only use supply points approved by the manufacturer

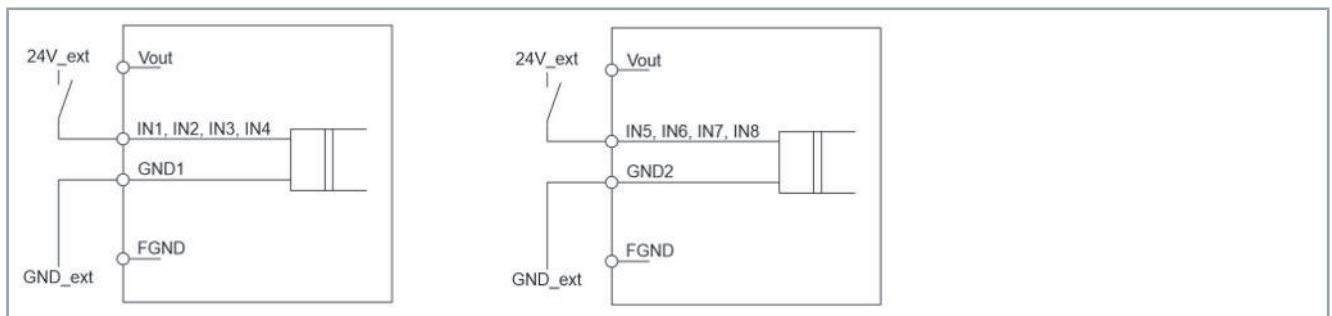
Use of the internal 24 V power supply Vout



GND1, GND2, GND4 and GND5 are connected internally

- GND = GND1 = GND2 = GND4 = GND5

Use of an external 24 V power supply



8 Mechanical installation

8.1 Preparation

NOTICE

Damage due to high heat development

Inadequate ventilation and incorrect installation can lead to damage to the servo drive and its components due to heat development.

- Observe the permissible "data for operation and environment", [Page 23] as well as the notes in this chapter.



Provide sufficient space in the control cabinet

Note that when dimensioning the control cabinet you may have to mount input filters, mains chokes and braking resistors for your application. Allow sufficient space in the control cabinet for these components so that cooling air circulation is ensured.

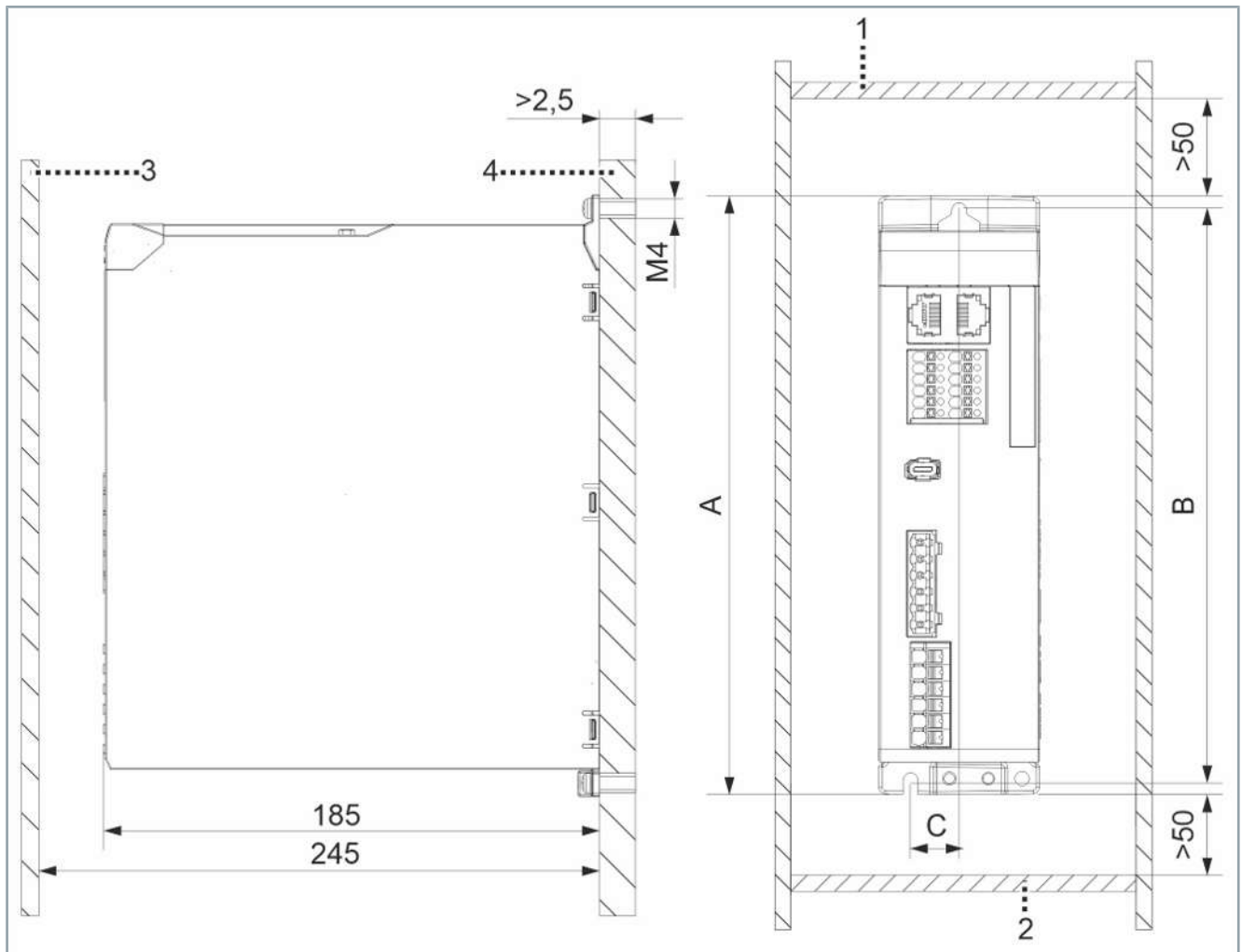
8.2 Control cabinet installation dimensions

Installation in the control cabinet

The following illustration contains recommended dimensions that you should observe when mounting the economy servo drive in the control cabinet.



The areas, functions and slots shown in the figure may vary depending on the module version and are provided here for clarity.



Position	Explanation
1	Control cabinet top side
2	Control cabinet base
3	Control cabinet door
4	Conductive and galvanized mounting plate

Position	Dimensions AX1xxx-1xxx [mm]	Dimensions AX1xxx-3xxx [mm]
A	185	225
B	176	216
C	15	20

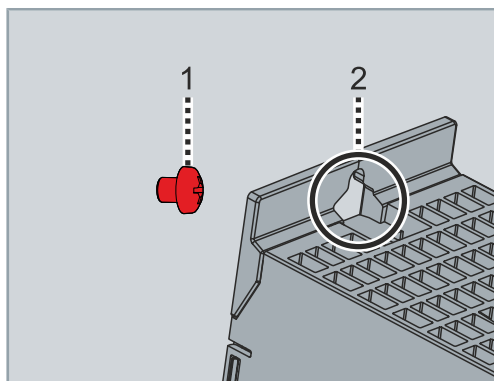
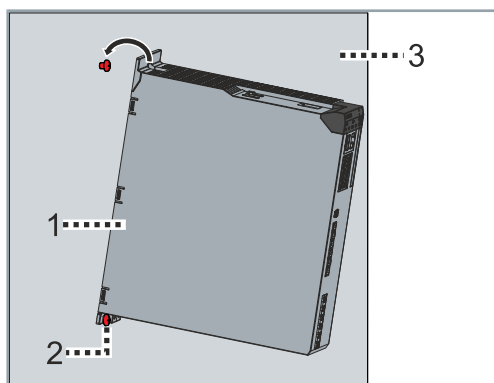
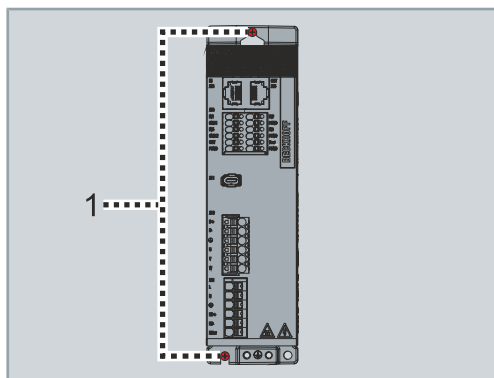
8.3 Mounting in the control cabinet



Installation example

This chapter provides information on installing the economy servo drive AX1000. A single device is mounted as an example.

The economy servo drive AX1000 has two mounting points [1], which are used to secure it to the mounting plate with mounting screws.



- ▶ Screw the screws into the control cabinet mounting plate
- ▶ Place product [1] on the lower screw [2] and carefully press it against the mounting plate [3]

- ▶ Guide the upper screw [1] through the large recess on the upper flange of the housing [2]
- ▶ Tighten all the screws in the elongated holes in the module housing
- ▶ Observe tightening torques

Components	Tightening torque [Nm]
M4x12 screws with washers Strength class 8.8	3

9 Electrical installation

NOTICE

Damage caused by faulty grounding

Improper grounding or faulty contact can lead to damage to the product or EMC interference emissions.

- Establish a conductive connection of all components
- Place the star point centrally on the unpainted mounting plate
- For larger applications, implement the potential equalization via PE rails
- Observe the minimum cross-sections of separate protective conductors in DIN EN 61439-1

9.1 Project planning

The project planning is the detailed planning of your drivetrain. Taking into account various views, you can design your drive system with the help of the following information. Please note that this support is only an example.

9.1.1 Project planning of the drivetrain

The application, servo drive, motors, and gear units must be matched to one another so that sufficient safety is ensured for all components. Mechanical stiffness can occur after a while due to wear.

- Ensure sufficient reserves in the design of the components involved in the working area of the system so that the service life is not impaired and the required control quality can be maintained.

The following software is available for designing the drivetrain and selecting the appropriate components:

 [TE5910 | TwinCAT 3 Motion Designer](#)

9.1.2 Energy management

If the supply network is impaired due to high voltage fluctuations, you must consider the specifications of the economy servo drive and the speed range of the connected motor.

- Observe the upper limit value of the tolerance of the rated supply voltage.
- Check whether a reduction in speed is permissible due to a lack of voltage.
- If the supply network does not meet the specifications for operating a economy servo drive, use isolating transformers, mains chokes, mains filters, and other measures to achieve the required specifications.

The economy servo drive AX1000 stores energy in the internal DC link. If the regenerative energy generated when braking a connected motor is higher than the energy that can be stored in the DC link, an internal or external braking resistor is required.

For existing drive systems, you can determine the utilization of the braking resistor using the measuring and diagnostic functions available in the drive system and transfer the values.

The following software is available for energy management:

 [TE5910 | TwinCAT 3 Motion Designer](#)

9.1.3 Supported third-party motors

The AX1000 Economy servo drives support the connection of third-party motors. These include, for example, asynchronous motors, reluctance motors and synchronous motors.

- Asynchronous motors can be operated in U/f mode without feedback.
- Reluctance motors and synchronous motors can be operated without feedback in "sensorless vector control" mode.

9.1.4 Wiring

Performance data

- ▶ Check the assignment of servo drive and motor. Compare the mains voltage and rated current of the devices.
- ▶ Make sure that the maximum rated voltage at the connections does not exceed the tolerance limits. Otherwise, the servo drive may be destroyed.

Protection

- ▶ Ensure that the mains voltage is adequately protected with fuses. Please also note the information in the chapter "Protection", [Page 76].

Cable routing

- ▶ Route the power and control cables separately. A distance greater than 20 cm improves the EMC interference immunity.
- ▶ Keep the cable from the mains filter to the mains connection X01 as short as possible. When using single wires or strands, twist the wires or strands.

Shielding

- ▶ Apply shielding over a large area (low resistance). Use metalized connector housings or shield terminals. Information about the connection technology can be found in section "Description of connections", [Page 81].
- ▶ In the case of shielded cables, the shield must be continuous. Interruptions must be bridged over a large area.

Connection cables

- ▶ Lay all power cables with a sufficient cross-section. Use cable material of the quality required in the "Description of connections", [Page 81] section to achieve the maximum cable length.
- ▶ Use suitable motor cables from the Beckhoff accessories range.

9.2 EMC and grounding measures

The ground connection of all relevant components must be executed with the largest possible cross-section, with a low impedance, over a large area and via a short connection to a conductive fastener with a large area. The shields have to be applied with a sufficiently large contact area on both sides.

Grounding measures are essential to ensure effective electromagnetic compatibility (EMC). The following points should be observed:

- ▶ Connect all grounding points directly to the central grounding bar or mounting plate.
- ▶ Ensure that the connections have low resistance and good conductivity.
- ▶ Use the shortest possible connections.
- ▶ Design the connections to the grounding bar in a star configuration.
- ▶ Ensure that the connections are protected against corrosion.
- ▶ Use flexible ground straps for moving parts such as machine parts or doors. These straps should be as short and large as possible.

9.2.1 Electromagnetic interference emission

The products described in the present manual meet the EMC requirements as per IEC 61800-3 if the EMC measures described in the present manual are implemented.

WARNING

Electromagnetic interference of signals and devices

Failure to follow these instructions can result in death, serious injury, or equipment damage.

- Ensure that the EMC measures are implemented correctly in accordance with IEC 61800-3 to prevent unintended device behavior.

These device types are not intended to be used on a low-voltage public network which supplies domestic premises. Radio frequency interference is expected if used in such a network.

WARNING

Radio interference when operating on public low-voltage networks

This device is not intended for use in public low-voltage power grids that supply residential buildings. When operating on such networks, radio interference may occur and other devices may be affected.

- Operate this device only in a suitable industrial environment in accordance with IEC 61800-3

EMC categories with external mains filter

For the economy servo drive AX1000, the following categories for emission as per IEC 61800-3 are reached with a motor cable length ≤ 25 m if the EMC measures described in the present manual are implemented and if the external mains filters offered as accessories are used.

Emission type	Category
Conducted emission	Category C2
Radiated emission	Category C3

Motor cable length ≤ 25 m

External mains filters as sum filters

Several devices can be connected to a common external mains filter.

The following mains filters are available for this purpose:

- AX2090-NF12-1020
- AX2090-NF12-3020

Prerequisites:

- Single-phase devices may only be connected to single-phase mains filters; three-phase devices may only be connected to three-phase devices.
- The total input current of the connected devices must be smaller than or equal to the permissible rated current of the mains filter.

9.2.2 Measuring the insulation resistance

NOTICE

Damage to the servo drive due to dielectric strength or insulation resistance tests

Dielectric strength or insulation tests at servo drive can destroy internal components or protective components. Induced voltages can cause insulation breakdowns, partial discharges, or latent damage leading to malfunctions, fire, or electric shock risks.

- Do not carry out any dielectric strength or insulation tests on servo drive
- When measuring the insulation resistance of the motor, disconnect the motor cable from the output terminals of the Economy servo drive



For servo drive, the insulation between the main circuit and the housing was tested at the factory.

The servo drive is equipped with voltage-limiting circuits that automatically limit the test voltage.

Insulation resistance measurement of the motor and motor cable

Check the insulation of the mains cable before connecting it to the servo drive. Follow the local regulations. The following points must be observed when measuring the motor and motor cable:

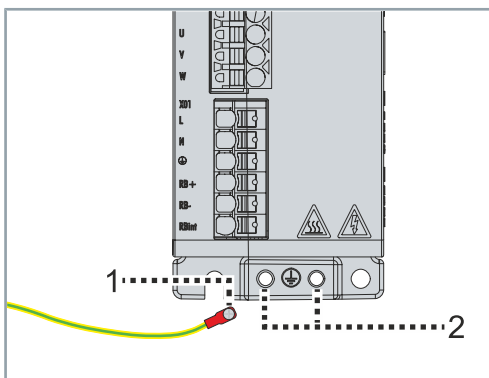
- ▶ Check that the motor cable is connected to the motor and disconnected from the output terminals U, V and W of the economy servo drive.
- ▶ Test the insulation resistance between each phase conductor and the protective earth (PE) with a voltage of 1000 V DC.
- The insulation resistance of a motor must be more than 100 MΩ (at 25°C/77°F).
- Moisture in the motor housing reduces the insulation resistance.
- ▶ If the motor housing is damp, dry the motor and take the measurement again

9.2.3 Protective earth



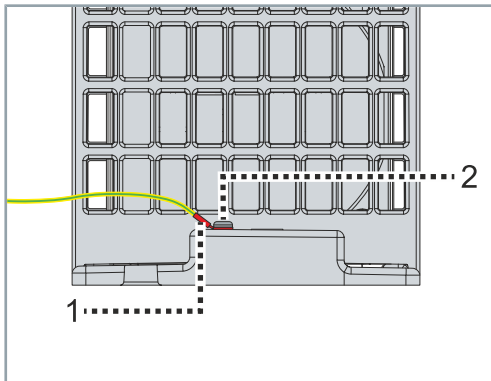
Mounting material required for proper installation of the protective earth

- Ring cable lug for M4



The protective earth is established via the connection between the ground connection of the device and the mounting plate on the control cabinet. The economy servo drive has two ground connections [2] on the bottom flange of the device. The connection is made via a cable with a ring-shaped cable lug [1]. Use the same cross-section of the supply cable to connect the second protective earth conductor.

Single device

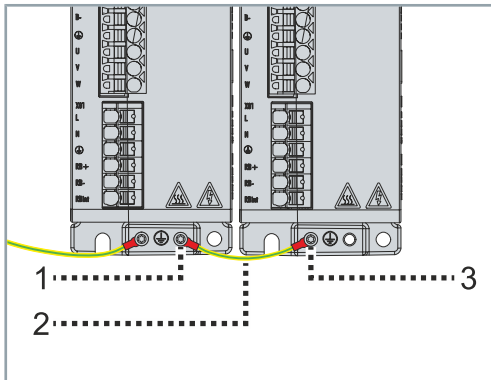


- ▶ Assemble cables with a sufficient cross-section using a ring-shaped cable lug [1]
- ▶ Align cable with cable lug [1] to one of the two ground connections [2] of the economy servo drive
- ▶ Fix the cable lug [1] to the economy servo drive with the pre-assembled screw [2]
- ▶ Observe tightening torques

Components	Tightening torque [Nm]
Screws M4x8 Strength class 8.8	2

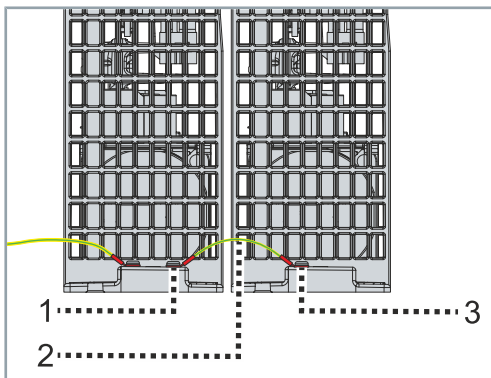
- ▶ Clean the contact surfaces
- ▶ Ensure that the mounting plate is not painted.
- ▶ Attach the ready-made cable properly to the control cabinet mounting plate.

Drive system



In a drive system, multiple devices can be grounded by connecting the grounding terminals.

- ▶ Align the cable lugs of the connection cable [2] so that they can be connected to the ground connection of a economy servo drive [1] and a ground connection of the next device [3]



- ▶ Secure the cable lugs to the devices using the pre-assembled fixing screws [1] [3]
- ▶ Observe tightening torques

Components	Tightening torque [Nm]
Screws M4x8 Strength class 8.8	2

9.3 Supply networks

The economy servo drive AX1000 is suitable for operation on grounded single-phase or three-phase networks with the following voltage systems:

- Single-phase: 1 x 110 V AC_{-15%}...240 V AC^{+10%}
- Three-phase: 3 x 208 V AC_{-15%}...480 V AC^{+8%}

The economy servo drive AX1000 can be operated on the following supply networks without any additional measures:

- TN network
- TT network

For all other network forms, operation is only possible with an up-stream isolating transformer. An isolating transformer is a mains transformer that transmits the mains voltage to the secondary winding via a protective isolation. A star point grounded network is made available with the help of this protective isolation.

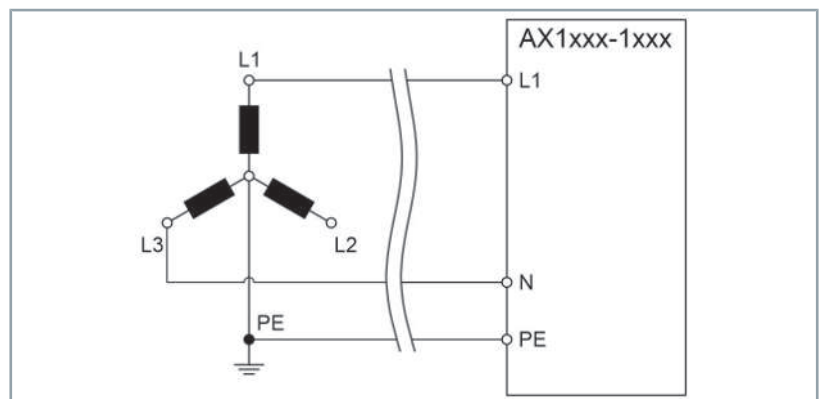
Network types

The supply networks differ in the type of ground connection. For a better understanding, the table below contains examples with the associated meaning:

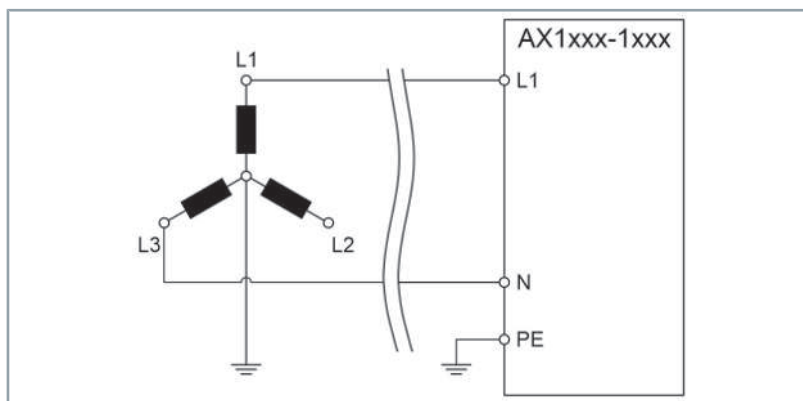
Network configuration	French term	Meaning
TN	Terre Neutre	Neutral grounding of a point
TT	Terre Terre	Direct grounding of a point
TN-C	Terre Neutre Combiné	Combined neutral grounding: Neutral conductor and protective conductor combined to form PEN conductor
TN-S	Terre Neutre Combiné Séparé	Separate neutral grounding: Separate neutral conductor and protective conductor
IT	Isolé Terre	Isolation of all active parts from ground

9.3.1 Direct connection to single-phase networks

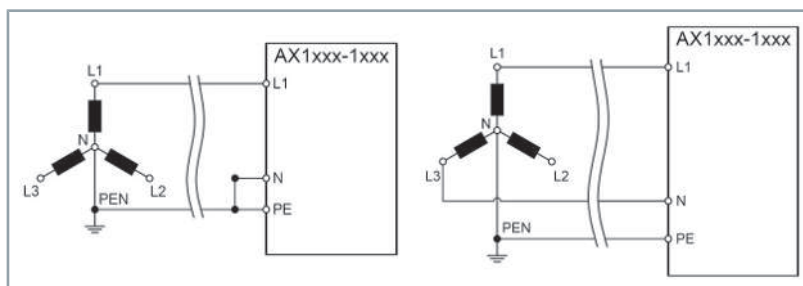
TN network



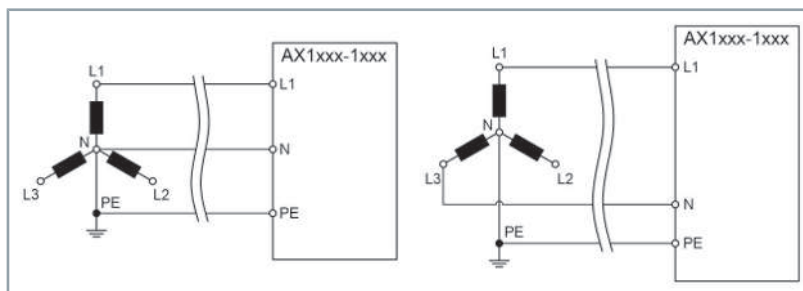
TT network



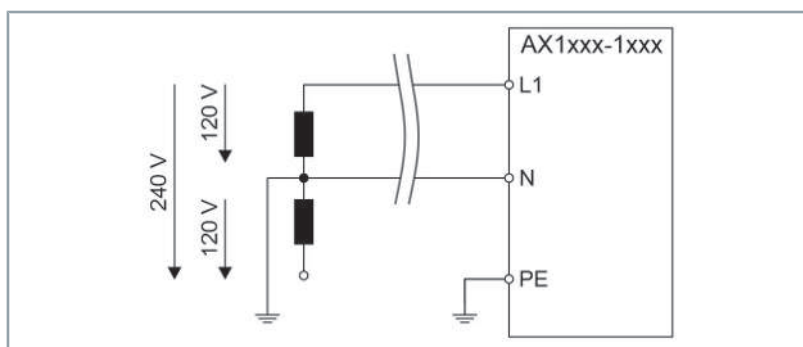
TN-C network



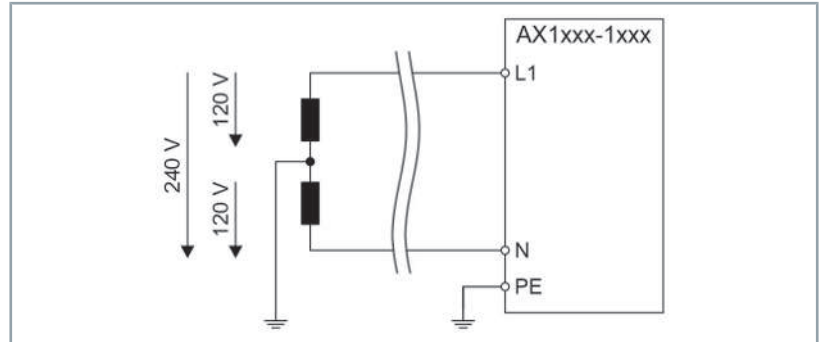
TN-S network



Split-phase with grounded center tap 120 V



Split-phase with grounded center tap 240 V



9.3.2 Connection to single-phase networks with isolating transformer

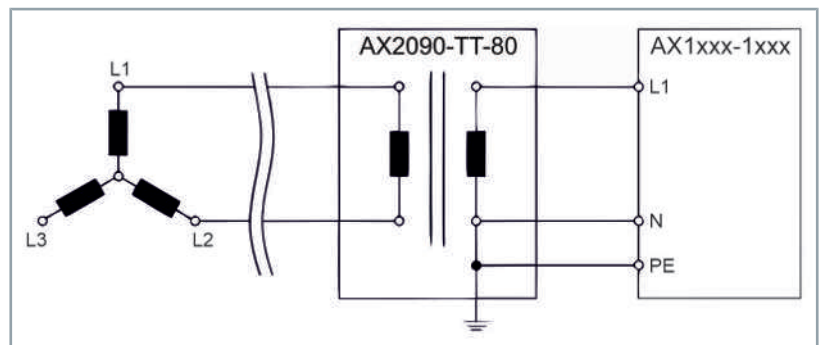
NOTICE

Damage caused by the absence of an isolating transformer

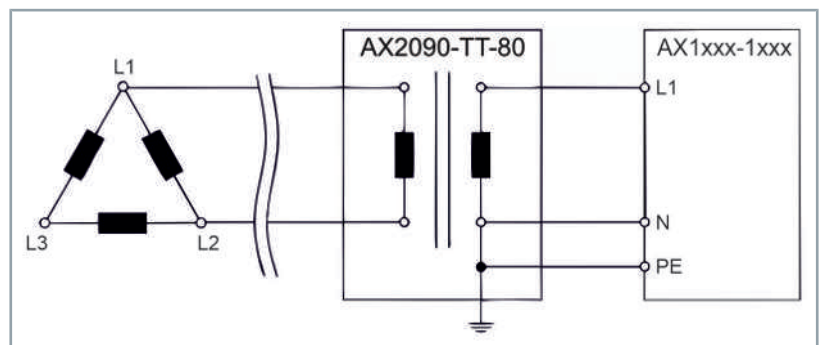
Using the following types of power sources without an isolating transformer may damage the economy servo drive AX1000 and its components.

- Connection only with upstream isolating transformer

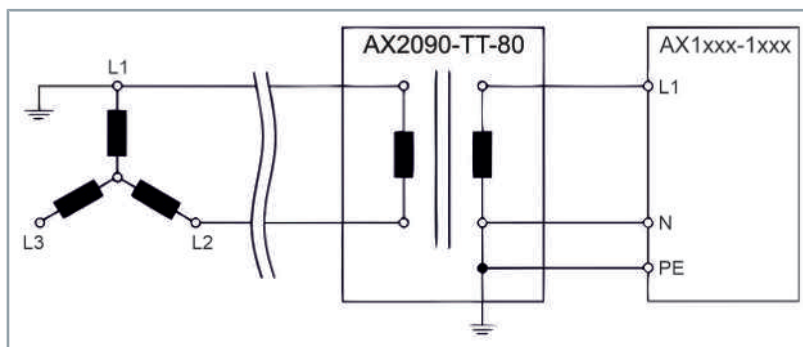
IT network with star point



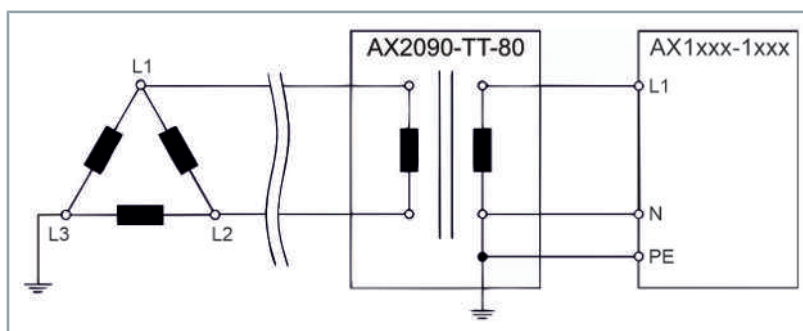
IT delta network



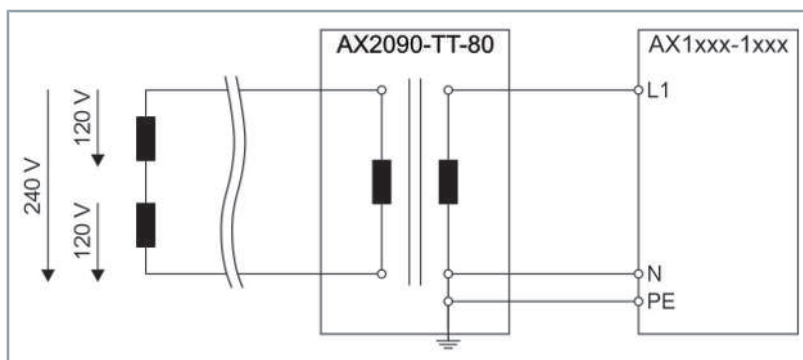
Asymmetrically grounded network with star point



Asymmetrically grounded delta network

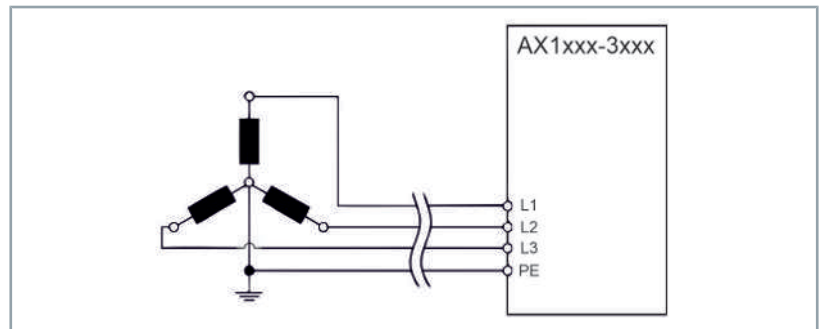


Split-phase ungrounded networks

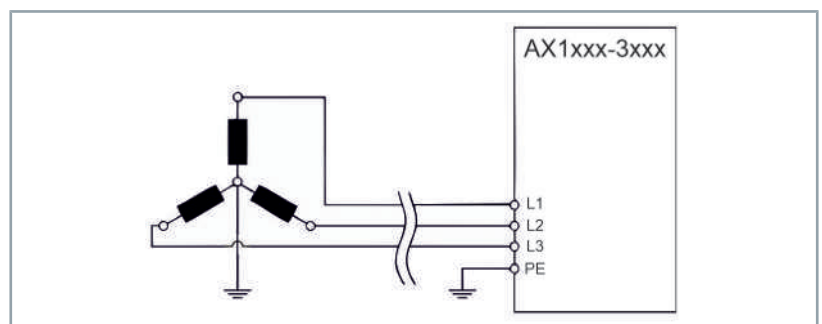


9.3.3 Direct connection to three-phase networks

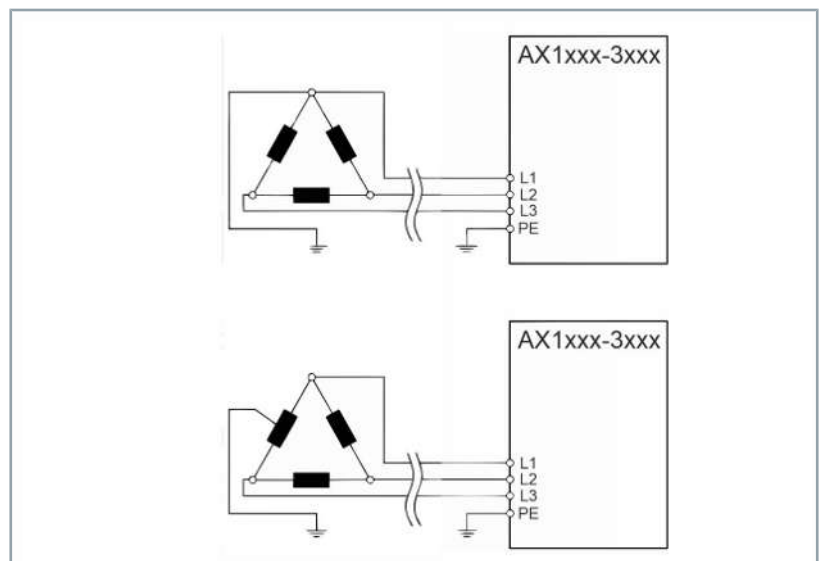
TN network



TT network



Asymmetrically grounded delta network 200...240 V AC



9.3.4 Connection to three-phase networks with isolating transformer

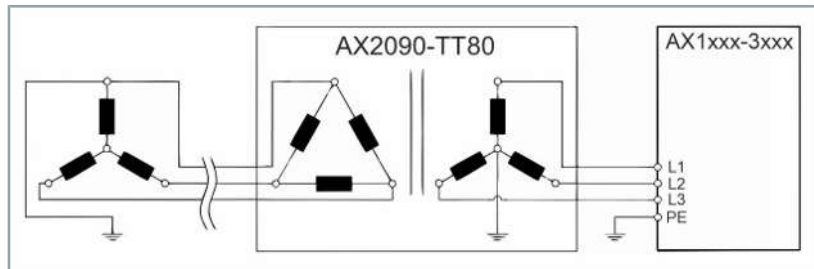
NOTICE

Damage caused by the absence of an isolating transformer

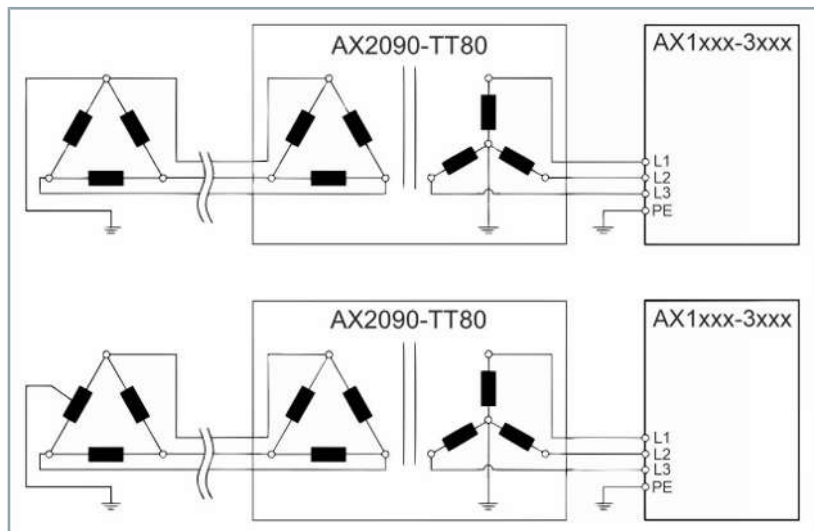
Using the following types of power sources without an isolating transformer may damage the economy servo drive AX1000 and its components.

- Connection only with upstream isolating transformer

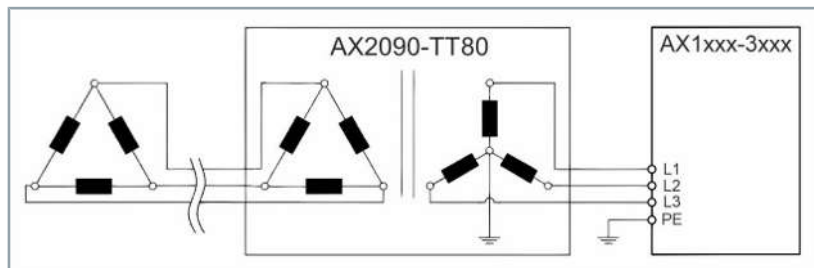
Asymmetrically grounded network with star point



Asymmetrically grounded delta network 400...480 V AC



IT delta network



9.3.5 Connection to special network types

For special mains forms, an upstream isolating transformer is required that can provide the full peak current for a short time. If the maximum feed-in power is not required in the application, isolating transformers with lower power can also be used.



Checking the isolating transformer power rating with the TwinCAT 3 Motion Designer

Check the isolating transformer power rating with the design software TE5910 | TwinCAT 3 Motion Designer.

This can be found on the Beckhoff homepage:

- [TE5910 | TwinCAT 3 Motion Designer](#)
- Select the isolating transformer according to the result.

The following table shows an overview of the available isolating transformers for the corresponding feed-in power.

Power supply 1 x 230 V AC for AX1xxx-1xxx

Isolating transformer	Output current
AX2090-TT80-0002; 230 V, 1.6 kVA	7 A

Power supply 3 x 400...480 V AC for AX1xxx-3xxx

Isolating transformer	Output current
AX2090-TT80-0010; 400 V, 10 kVA	14.4 A
AX2090-TT80-0020; 400 V, 20 kVA	28.9 A

Isolating transformers

9.4 Fuse protection

NOTICE

Damage to the device due to inadequate line protection

The economy servo drive AX1000 are equipped with integrated self-protection. The drive system requires additional line protection.

- Provide additional fuses as line protection.
- Use the recommended fuse types.
- Adhere to the dimensioning according to the prescribed data for operation and environment.

9.4.1 CE conform

9.4.1.1 External fuse protection

Fuse type gG

Use mains fuses of operating class “gG” in accordance with IEC 60269.

Device	Fuse type
AX1xxx-xxxx	gG max. 20 A

9.4.1.2 Internal fuse protection

Fuse protection	Fuse
24 V power supply Vout	electronic
Internal braking resistor	electronic
External braking resistor	electronic Requirements: • Active thermal model for selected braking resistor • Correct braking resistor line

9.4.2 UL-compliant

⚠ WARNING

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.

⚠ AVERTISSEMENT

LE DÉCLENCHEMENT DU DISPOSITIF DE PROTECTION DU CIRCUIT DE DÉRIVATION PEUT ÊTRE DÙ À UNE COUPURE QUI RÉSULTE D'UN COURANT DE DÉFAUT.

POUR LIMITER LE RISQUE D'INCENDIE OU DE CHOC ÉLECTRIQUE, EXAMINER LES PIÈCES PORTEUSES DE COURANT ET LES AUTRES ÉLÉMENTS DU CONTRÔLEUR ET LES REMPLACER S'ILS SONT ENDOMMAGÉS.



Fuse holders with UL approval

Before implementing a UL configuration, it is mandatory that you contact your UL certificate authority and discuss the necessary boundary conditions. When using fuse holders, care must be taken that they have also been tested and manufactured in accordance with the applicable standards of the UL certificate authority.

The integrated protection against short circuit is no substitute for the external fuse protection of the supply network. The fuse protection must comply with the manufacturer's data as well as the national and international regulations and laws.

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

Use UL mains fuses of the class "J".

For alternatives to Class J UL fuses, be sure to refer to the UL standard "UL 508A, Chapter SB4.2.3, Exception No. 1".

Depending on the achievable SCCR level, various fuse protection options are available.

9.4.2.1 External fuse protection

With regard to alternatives to the UL fuses, be sure to refer to the UL standard "UL 508A, Chapter SB4.2.3, Exception No. 1". For further questions about UL fuses, please contact the responsible certificate authority.

SB4.2.3 A high fault short-circuit current value for a motor controller, overload relay, or combined motor controller as specified in SB4.2.2 (a) or (c) may be used as the short-circuit current value of the component only if the specified branch circuit protection device is provided.

Exception 1: Where the specified BCPD is a Class CC, G, J, L, RK1, RK5, or T fuse with respect to the high-fault SCCR, a fuse of a different class may be used at the same high-fault short-circuit current rating, provided that the I_p let-through current and I_{2t} of the new fuse do not exceed those of the specified fuse. See Table SB4.2 for maximum let-through currents (I_p) and I_{2t} .

Fuse type Class J

For alternatives to the UL fuses of the class "J", be sure to refer to the UL standard "UL 508A, Chapter SB4.2.3, Exception No. 1".

Suitable For Use On A Circuit Capable Of Delivering Not More Than 5000 rms Symmetrical Amperes, # Volts Maximum, When Protected by Class J Fuses rated 20A Maximum.

480V for models designated with suffix -3 or 240V for models designated with suffix -1.

Fuse type Class CC

Suitable For Use On A Circuit Capable Of Delivering Not More Than 65000 rms Symmetrical Amperes, # Volts Maximum, When Protected by Class CC fuses rated 20A Maximum.

480V for models designated with suffix -3 or 240V for models designated with suffix -1.

9.4.2.2 Internal fuse protection

Fuse protection	Fuse
24 V power supply Vout	electronic
Internal braking resistor	electronic
External braking resistor	electronic Requirements: • Active thermal model for selected braking resistor • Correct braking resistor line

9.5 Mains connection

The following are examples of connection scenarios for economy servo drive AX1000.

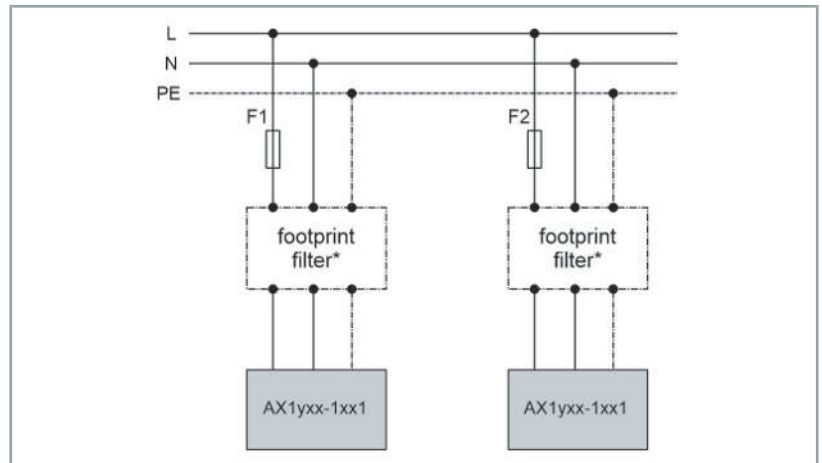
A mains filter is required for CE compliance.

To improve EMC, the wiring distance from the filter to the mains connection of the device should be kept as short as possible.

If single wires or strands are used, the wiring route from the filter to the mains connection must be realized with twisted wires or strands.

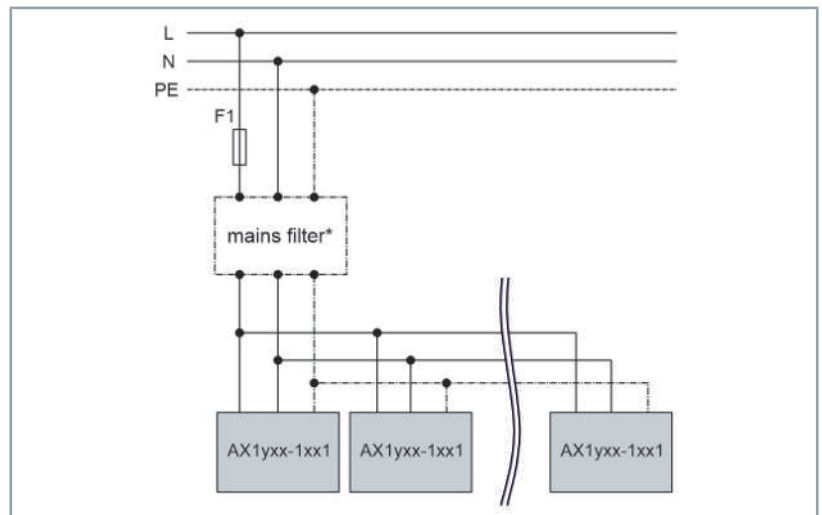
9.5.1 single-phase mains connection

Use of footprint filters



* Required for compliance with CE

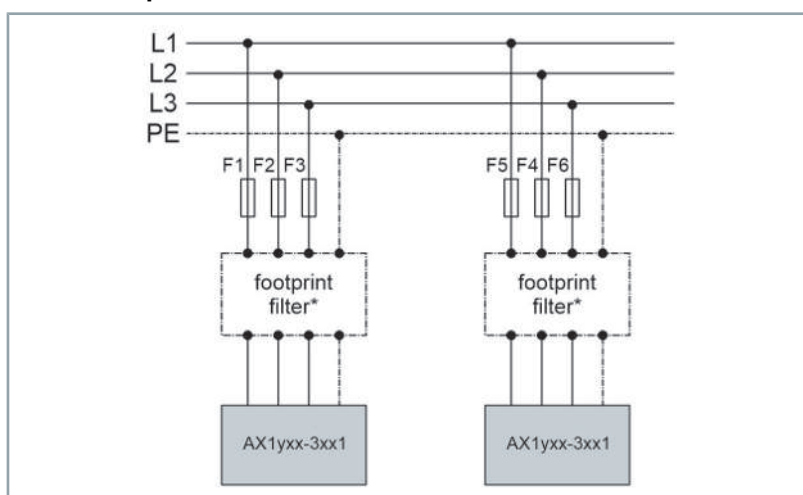
Use of central mains filters



* Required for compliance with CE

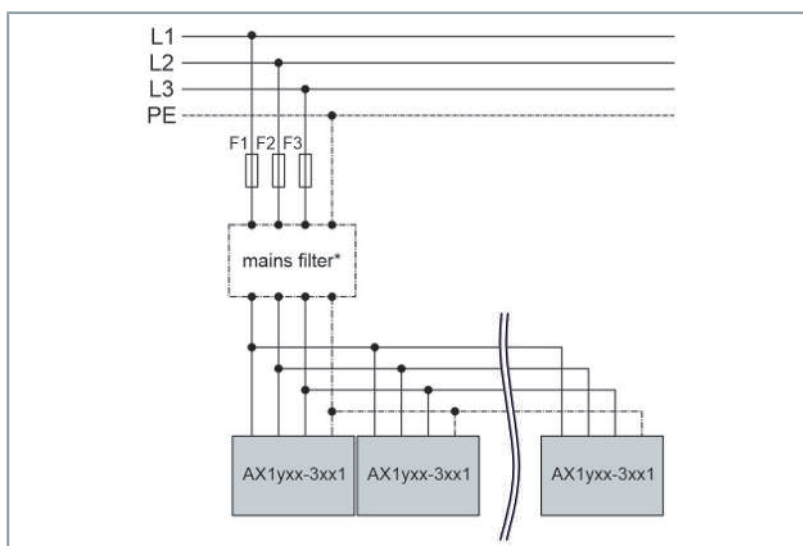
9.5.2 three-phase mains connection

Use of footprint filters



* Required for compliance with CE

Use of central mains filters



* Required for compliance with CE

9.6 Description of connections

9.6.1 Mains connection | X01

The power supply and the braking resistor are connected to the X01 connection strip. The connection differs according to the number of phases of the network input and depends on the device type:

Some **single-phase** AX1xxx-1xxx devices have an internal braking resistor. The internal braking resistor (if present) and an external braking resistor are connected to X01.

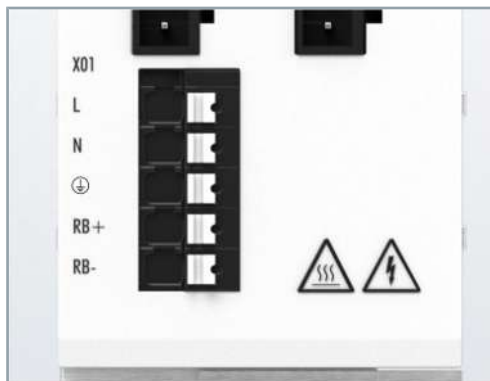
Three-phase AX1xxx-3xxx devices have an internal braking resistor. The internal braking resistor and an external braking resistor are connected to X01.

9.6.1.1 X01 for single-phase devices

Valid for:

- All single-phase devices in the AX1000 series without internal braking resistor
 - AX1101-1xxx
 - AX1103-1xxx
 - AX1201-1xxx

Network connection on connection strip X01



Feature	Implementation
Connection type	Connection strip
Contact type	Direct plug-in technique
Number of contacts	5-pin

Connectable conductors at this connection

Technical parameter	Unit	min.	max.
Clamping range	mm ²	0.34	4
Conductor connection cross-section AWG	AWG	20	12
solid wire H05(07) V-U	mm ²	0.5	2.5
stranded wire H05(07) V-K	mm ²	0.5	4
with ferrule DIN 46 228/1	mm ²	0.5	2.5
Stripping length	mm	8	10

If single wires or strands are used, the wiring route from the filter to the mains connection must be realized with twisted wires or strands.

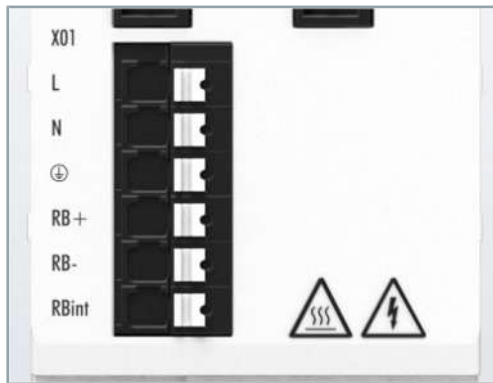
Contact assignment at this connection

Terminal point	Connection
L	Phase L
N	Neutral conductor N
PE	Protective conductor
RB+	External braking resistor +
RB-	External braking resistor -

Valid for:

- All single-phase devices in the AX1000 series with internal braking resistor

- AX1106-1xxx
- AX1203-1xxx



Network connection on the X01 connection strip

Feature	Implementation
Connection type	Connection strip
Contact type	Direct plug-in technique
Number of contacts	6-pin

Connectable conductors at this connection

Technical parameter	Unit	min.	max.
Clamping range	mm ²	0.34	4
Conductor connection cross-section AWG	AWG	20	12
solid wire H05(07) V-U	mm ²	0.5	2.5
stranded wire H05(07) V-K	mm ²	0.5	4
with ferrule DIN 46 228/1	mm ²	0.5	2.5
Stripping length	mm	8	10

If single wires or strands are used, the wiring route from the filter to the mains connection must be realized with twisted wires or strands.

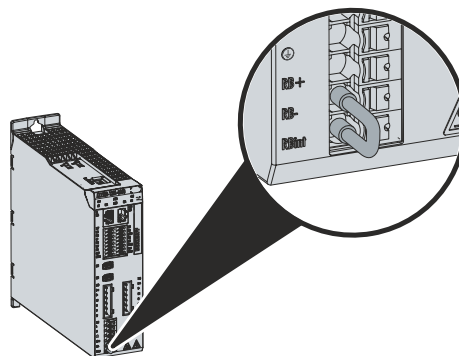
Contact assignment at this connection

Terminal point	Connection
L	Phase L
N	Neutral conductor N
PE	Protective conductor
RB+	External braking resistor +
RB-	External braking resistor -
RBint	Internal braking resistor +



Do not remove the bridge between RBint and RB-

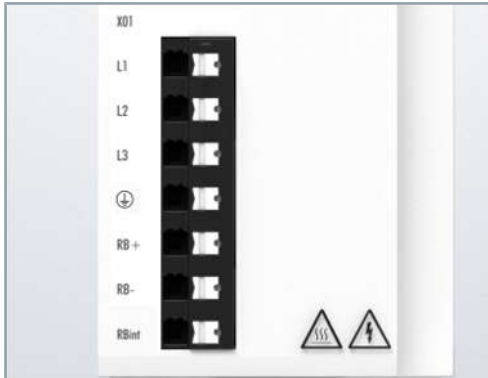
The jumper may only be removed if an external braking resistor is connected. Otherwise, the DC link will not be charged, and the axis cannot be commissioned.



9.6.1.2 X01 for three-phase devices

Valid for:

- All three-phase, 1-channel devices in the AX1000 series
 - AX1103-3xxx
 - AX1106-3xxx
 - AX1112-3xxx

Network connection on connection strip X01

Feature	Implementation
Connection type	Connection strip
Contact type	Direct plug-in technique
Number of contacts	7-pin

Connectable conductors at this connection

Technical parameter	Unit	min.	max.
Clamping range	mm ²	0.34	4
Conductor connection cross-section AWG	AWG	20	12
solid wire H05(07) V-U	mm ²	0.5	2.5
stranded wire H05(07) V-K	mm ²	0.5	4
with ferrule DIN 46 228/1	mm ²	0.5	2.5
Stripping length	mm	8	10

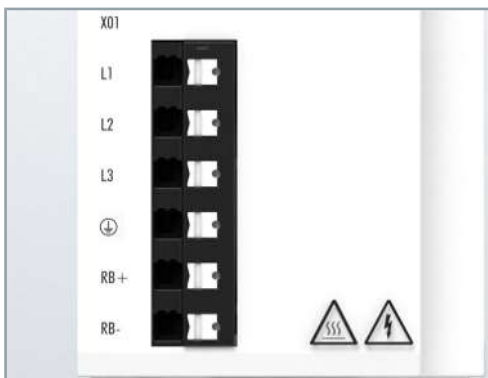
If single wires or strands are used, the wiring route from the filter to the mains connection must be realized with twisted wires or strands.

Contact assignment at this connection

Terminal point	Connection
L1	Phase L1
L2	Phase L2
L3	Phase L3
PE	Protective conductor
RB+	External braking resistor +
RB-	External braking resistor -
RBint	Internal braking resistor +

Valid for:

- All three-phase, 2-channel devices in the AX1000 series
 - AX1203-3xxx
 - AX1206-3xxx

Network connection on connection strip X01

Feature	Implementation
Connection type	Connection strip
Contact type	Direct plug-in technique
Number of contacts	6-pin

Connectable conductors at this connection

Technical parameter	Unit	min.	max.
Clamping range	mm ²	0.34	4
Conductor connection cross-section AWG	AWG	20	12

Technical parameter	Unit	min.	max.
solid wire H05(07) V-U	mm ²	0.5	2.5
stranded wire H05(07) V-K	mm ²	0.5	4
with ferrule DIN 46 228/1	mm ²	0.5	2.5
Stripping length	mm	8	10

If single wires or strands are used, the wiring route from the filter to the mains connection must be realized with twisted wires or strands.

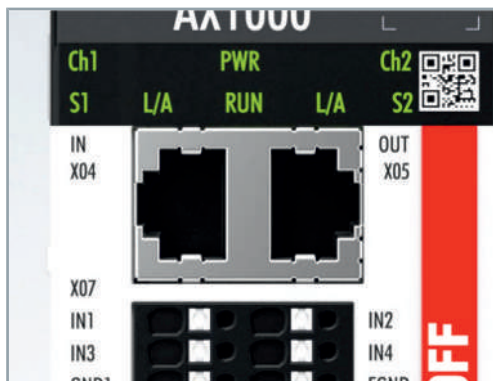
Contact assignment at this connection

Terminal point	Connection
L1	Phase L1
L2	Phase L2
L3	Phase L3
PE	Protective conductor, PE
RB+	External braking resistor +
RB-	External braking resistor -

9.6.2 EtherCAT slot | IN X04, OUT X05

Valid for:

- all devices in the series AX1000

Fieldbus connection to EtherCAT slot

Feature	Implementation
Connection type	RJ45 socket
Cable type	Industrial Ethernet/EtherCAT patch cable
Suitable cable (pre-assembled)	ZK1090-9191-xxxx, green
Configuration	RJ45, plug, 8-pin - RJ45, plug, 8-pin
Topology structure	continuously shielded transmission lines recommended, e.g. SF/FTP, S/FTP, SF/UTP

Contact assignment at this connection

Terminal point	Connection
IN X04	Incoming EtherCAT line
OUT X05	Outgoing EtherCAT line



Thanks to automatic line detection (auto-crossing), Beckhoff EtherCAT devices can be operated both with straight through (1:1) cables and with cross-over cables.

9.6.3 I/O connection | X06

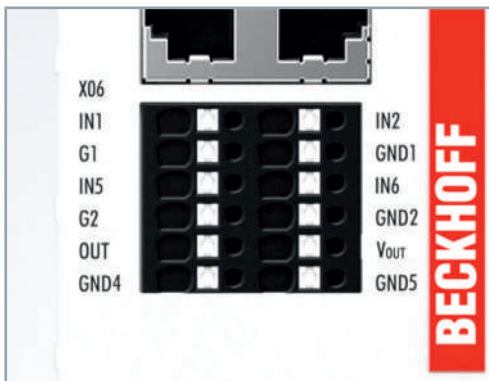


Observe the conditions for wiring the 1-channel modules from the chapter "Wiring X06 (single-channel)", [Page 58]

Valid for:

- All 1-channel devices in the AX1000 series
 - AX11xx-1xxx
 - AX11xx-3xxx

Digital I/Os on X06 connection strip



Feature	Implementation
Connection type	Connection strip
Contact type	Direct plug-in technique
Number of contacts	12-pin

Connectable conductors at this connection

Technical parameter	Unit	min.	max.
Clamping range	mm ²	0.2	1.5
Conductor connection cross-section AWG	AWG	26	16
solid wire H05(07) V-U	mm ²	0.2	1.5
stranded wire H05(07) V-K	mm ²	0.2	1.5
with wire end sleeve DIN46 228/1	mm ²	0.2	1.5
Striping length	mm	8	8

Contact assignment at this connection

Terminal point	Function	Reference potential	Input filter/switching times
IN1	Digital input 1	G1	5 µs typ.
IN2	Digital input 2	G1	125 µs
G1	Reference potential for inputs 1 and 2	G1	
GND1	Reference potential of the 24 V DC supply voltage V_{out}	FGND	
IN5	Digital input 5	G2	5 µs typ.
IN6	Digital input 6	G2	125 µs
G2	Reference potential for inputs 5 and 6	G2	
GND2	Reference potential of the 24 V DC supply voltage V_{out}	FGND	
OUT	Digital output	FGND	$t_{on} = 100 \mu s$ $t_{off} = 150 \mu s$
V_{out}	Output 24 V DC supply voltage	FGND	
GND4	Reference potential of the 24 V DC supply voltage V_{out}	FGND	
GND5	Reference potential of the 24 V DC supply voltage V_{out}	FGND	

9.6.4 I/O connection | X07



Observe the conditions for wiring the 2-channel modules from chapter "Wiring X07 (2-channel)", [Page 59]

Valid for:

- All 2-channel devices in the AX1000 series
 - AX12xx-1xxx
 - AX12xx-3xxx

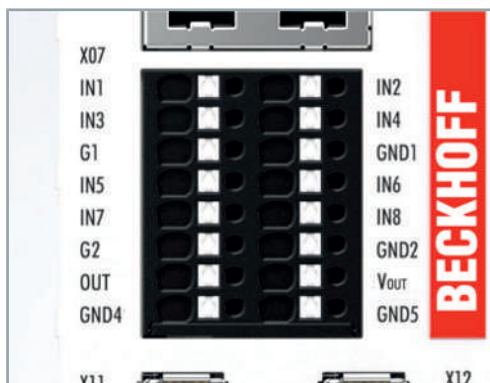
Digital I/Os on X07 connection strip

Illustration:

Feature	Implementation
Connection type	Connection strip
Contact type	Direct plug-in technique
Number of contacts	16-pin

Connectable conductors at this connection

Technical parameter	Unit	min.	max.
Clamping range	mm ²	0.2	1.5
Conductor connection cross-section AWG	AWG	26	16
solid wire H05(07) V-U	mm ²	0.2	1.5
stranded wire H05(07) V-K	mm ²	0.2	1.5
with wire end sleeve DIN46 228/1	mm ²	0.2	1.5
Stripping length	mm	8	8

Contact assignment at this connection

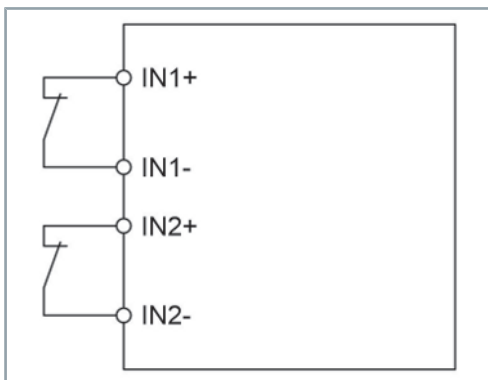
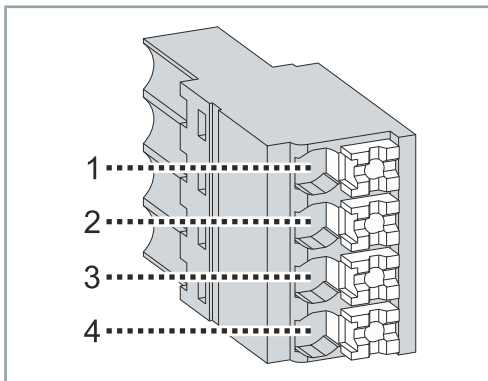
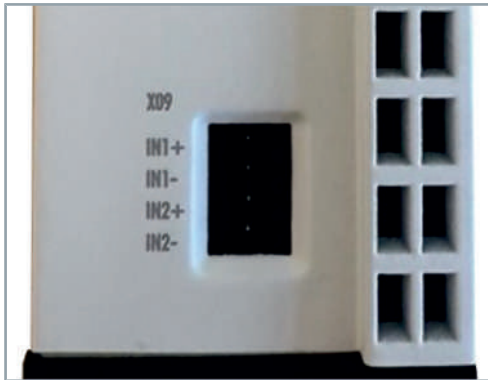
Terminal point	Function	Reference potential	Input filter/switching times
IN1	Digital input 1	G1	5 µs typ.
IN2	Digital input 2	G1	125 µs
IN3	Digital input 3	G1	5 µs typ.
IN4	Digital input 4	G1	125 µs
G1	Reference potential for input 1 to 4	GND1	
GND1	Reference potential of the 24 V DC supply voltage V_{out}	FGND	
IN5	Digital input 5	G2	5 µs typ.
IN6	Digital input 6	G2	125 µs
IN7	Digital input 7	G2	5 µs typ.
IN8	Digital input 8	G2	125 µs
G2	Reference potential for input 5 to 8	GND2	
GND2	Reference potential of the 24 V DC supply voltage V_{out}	FGND	
OUT	Digital output	FGND	$t_{on} = 100 \mu s$ $t_{off} = 150 \mu s$
Vout	Output 24 V DC supply voltage	FGND	
GND4	Reference potential of the 24 V DC supply voltage V_{out}	FGND	

Terminal point	Function	Reference potential	Input filter/ switching times
GND5	Reference potential of the 24 V DC supply voltage V_{out}	FGND	

9.6.5 TwinSAFE slot | X09

Valid for:

- all devices in the AX1000 series with TwinSAFE STO/SS1 via FSoE and I/O
 - AX1xxx-x2xx

Safe inputs at the TwinSAFE slot

Feature	Implementation
Connection type	Slot
Plug connector	4-pin, included in scope of supply
Contact type of the plug connector	Direct plug-in technique
Replacement part	ZS4010-xxxx

Connectable conductors at this connection

Technical parameter	Unit	min.	max.
Clamping range	mm ²	0.14	1.5
Conductor connection cross-section AWG	AWG	26	16
solid wire H05(07) V-U	mm ²	0.14	1.5
stranded wire H05(07) V-K	mm ²	0.14	1.5
with ferrule DIN46 228/1	mm ²	0.25	1
Striping length	mm	10	10

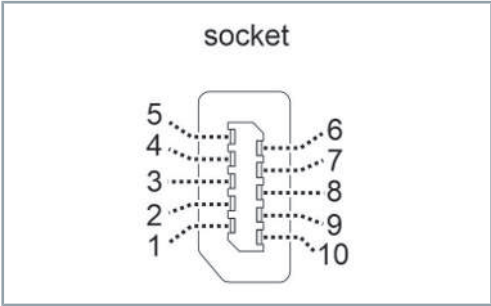
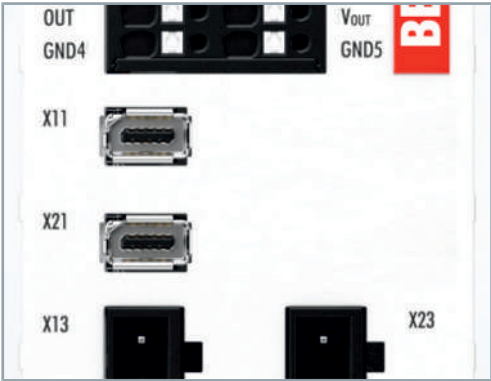
Contact assignment at this connection

Position	Terminal point	Signal	Reference potential
1	IN1+	Fail-safe input 1+	FGND
2	IN1-	Fail-safe input 1-	FGND
3	IN2+	Fail-safe input 2+	FGND
4	IN2-	Fail-safe input 2-	FGND

9.6.6 OCT slot | X11

Valid for:

- All AX1000 series devices with feedback OCT for channel 1
 - AX11xx-xxxx
 - AX12xx-xxxx



Motor feedback channel 1 on connection X11

Feature	Implementation
Contact type	Standard ix Industrial® socket
Connector	Part of the pre-assembled motor connection cable
Encoding	A-coded
Number of contacts	10-pin

Contact assignment at this connection

Terminal point	Connection
1	n.c.
2	OCT+
3	n.c.
4	OCT-
6...10	n.c.



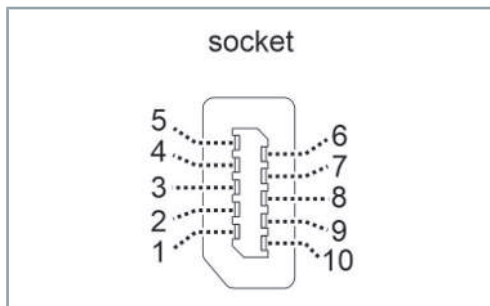
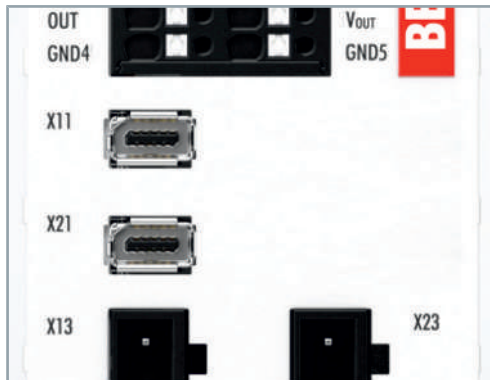
Preassembled cable

The connector for this connection is part of the preassembled motor cable. The selection of the cable depends on the servomotor series used.

9.6.7 OCT slot | X21

Valid for:

- All 2-channel devices in the AX1000 series with feedback OCT for channel 2
 - AX12xx-xxxx

Motor feedback channel 2 on connection X21

Feature	Implementation
Contact type	Standard ix Industrial® socket
Connector	Part of the pre-assembled motor connection cable
Encoding	A-coded
Number of contacts	10-pin

Contact assignment at this connection

Terminal point	Connection
1	n.c.
2	OCT+
3	n.c.
4	OCT-
6...10	n.c.

Preassembled cable

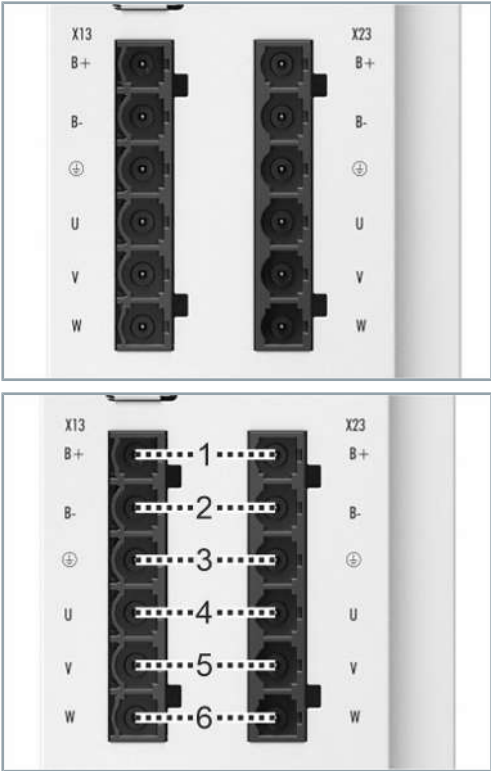
The connector for this connection is part of the preassembled motor cable. The selection of the cable depends on the servomotor series used.



9.6.8 Motor slot | X13

- Valid for:**
- All devices in the AX1000 series
 - AX11xx-xxxx
 - AX12xx-xxxx

Motor connection for channel 1 to connection X13



Feature	Implementation
Contact type	Connector
Number of contacts	6-pin
Connector	is part of the motor connection cable

Contact assignment at this connection

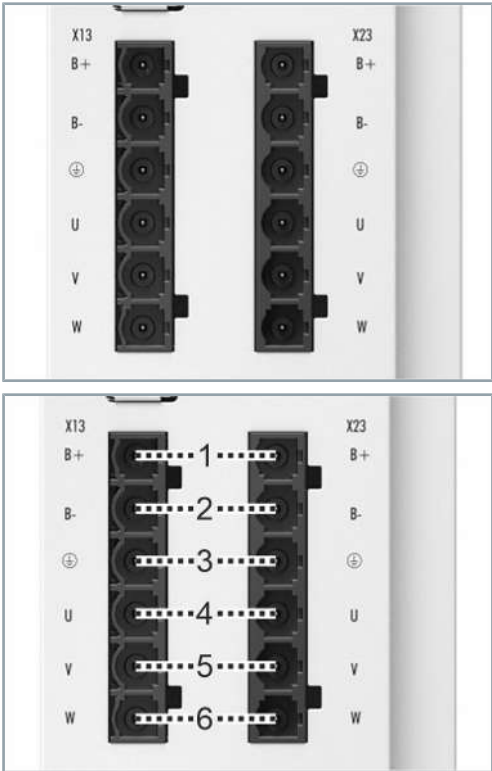
Position	Terminal point	Connection
1	B+	Motor brake +
2	B-	Motor brake GND
3	PE	Protective conductor
4	U	Phase U
5	V	Phase V
6	W	Phase W

9.6.9 Motor slot | X23

Valid for:

- All 2-channel devices in the AX1000 series
 - AX12xx-xxxx

Motor connection for channel 2 to connection X23



Feature	Implementation
Contact type	Connector
Number of contacts	6-pin
Connector	is part of the motor connection cable

Contact assignment at this connection

Position	Terminal point	Connection
1	B+	Motor brake +
2	B-	Motor brake GND
3	PE	Protective conductor
4	U	Phase U
5	V	Phase V
6	W	Phase W

10 Commissioning



Exemplary commissioning

The procedure for commissioning is described as an example. A different method may be appropriate or necessary, depending on the application of the components.

10.1 Before commissioning

Pay attention to the following points before commissioning:

- ▶ Make sure that an emergency stop switch complying with the valid regulations is fitted to the control station
- ▶ Check components for damage
- ▶ Check correct seating of the modules in the control cabinet and on the machine
- ▶ Tighten screw connections correctly
- ▶ Mount mechanical and electrical protective devices
- ▶ Check the wiring, connection and proper grounding

10.2 Prerequisites during operation

Pay attention to the following points during operation:

- ▶ Monitoring noise levels
- ▶ Control smoke development
- ▶ Always check drive surfaces and cables for dirt or dust
- ▶ Check temperature development
- ▶ Check function of safety devices

10.3 After operation

DANGER

Serious injuries due to electrical voltage!

Even after the mains voltage has been switched off, a life-threatening DC link voltage may remain present at the DC+ and DC- contacts of the economy servo drive AX1000 for up to 30 minutes. The following steps must be taken before removing the supply line:

- Wait until the DC link is discharged

WARNING

Risk of injury due to uncontrolled movement of components

The components of the drive system may perform uncontrolled movements after the power supply has been switched off and cause serious injury.

- Make sure that all moving parts on the machine come completely to a standstill

WARNING

Risk of injury through failure of the drive system

Electronic devices are not fail-safe; in the event of a failure, uncontrolled movements can result in serious injury.

- In the event of a failure, bring the connected motors and the machine to a safe state

CAUTION

Increased attention in the event of vertical axes

When commissioning vertical axes, the risk consideration described above is to be carried out with particular care. An uncontrolled movement can mean the sudden falling down of a load in this case.

11 Maintenance and cleaning

WARNING

Serious injuries due to cleaning work during operation

Carrying out cleaning work during operation can lead to serious or fatal injuries.

- Bring the connected motors and the machine into a safe state for cleaning work
- De-energize connected motors and the machine
- Secure connected motors and the machine to prevent unauthorized restarting

NOTICE

Damage to the economy servo drive due to liquid

Cleaning fluid entering the servo drive through immersion or spraying may cause damage to the product.

- Wipe the servo drive with cleaning agent and a cloth only
- Do not immerse servo drive

The components of the economy servo drive are maintenance-free. However, dirt, dust or swarf can negatively affect the function of the components. In the worst case, contamination can lead to failure. Therefore, clean the components regularly and carefully with a cloth or brush.

11.1 Intervals



All modules are maintenance-free

The modules of the economy servo drive AX1000 are subject to protection rating IP20 and may only be installed and operated in accordance with the data for operation and environment.

Operation beyond the permissible environmental conditions and operating states will shorten the service life of the components of the economy servo drive AX1000.

The service life of consumables may be shortened depending on the mechanical dynamics due to mounted devices and movements.

12 Accessories



Use accessories with UL approval

Accessories with UL approval are also required for the operation of the AX1000 in the USA or Canada.

12.1 AX2090-NF1x-xxxx | Mains filter

In the accessories

Mains filters are used to comply with the EMC requirements for variable speed drive systems. The requirements are defined in the product standard EN 61800-3.

The following products are available:

- Footprint filter for EMC-compliant noise suppression of individual devices with single-phase or three-phase mains connections
- Central mains filter for EMC-compliant noise suppression of multiple devices with single-phase or three-phase mains connections

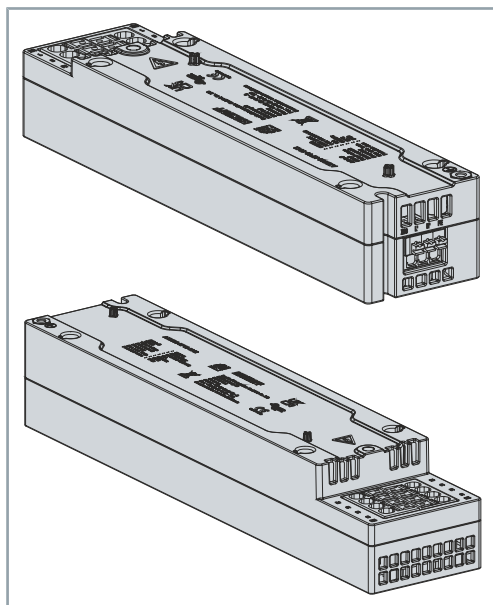
Supply 1 x 230 V AC for AX1xxx-1xxx

Mains filter, category C2	Rated current
AX2090-NF10-1012, footprint filter	12 A
AX2090-NF12-1020, central mains filter	20 A

Supply 3 x 400...480 V AC for AX1xxx-3xxx

Mains filter, category C2	Rated current
AX2090-NF10-3012, footprint filter	12 A
AX2090-NF12-3020, central mains filter	20 A

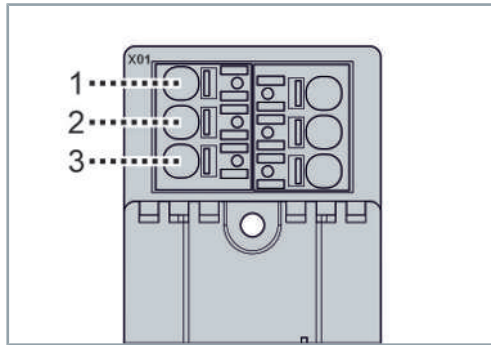
12.1.1 AX2090-NF10-x012 | footprint filter



The footprint filter is a compact mains filter that is mounted directly on the AX1000. It is designed for the operating current of the respective economy servo drive and reduces cable-related interference locally.

AX2090-NF10-1012 connection technology

Connection X01



X01 | Mains input for single-phase devices

Feature	Implementation
Connection type	Connection strip
Contact type	Direct plug-in technique
Number of contacts	3-pin

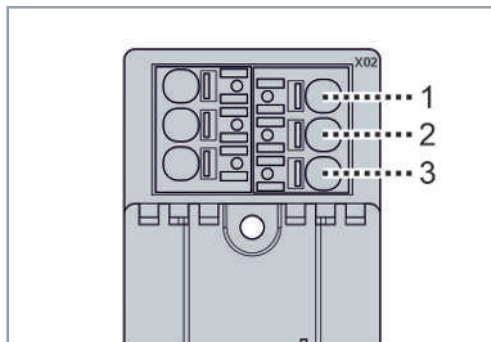
Connectable conductors at this connection

Technical parameter	Unit	min.	max.
Clamping range	mm ²	0.25	6
Conductor connection cross-section AWG	AWG	24	8
solid wire H05(07) V-U	mm ²	0.5	6
stranded wire H05(07) V-K	mm ²	0.5	6
with AEH with collar DIN46 228/4	mm ²	0.25	6
with wire end sleeve DIN46 228/1	mm ²	0.25	6
Strip length	mm	12	12

Contact assignment at this connection

Position	Terminal point	Connection
1	L	Phase L
2	N	Neutral conductor N
3	PE	Protective conductor, PE

Connection X02



X02 | Mains forwarding for single-phase devices

Feature	Implementation
Connection type	Connection strip
Contact type	Direct plug-in technique
Number of contacts	3-pin

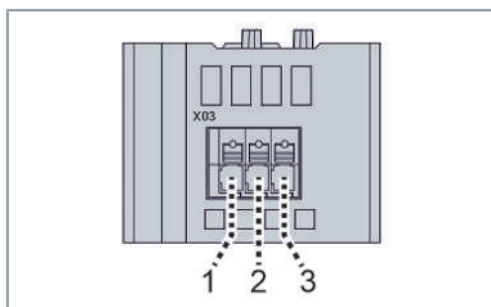
Connectable conductors at this connection

Technical parameter	Unit	min.	max.
Clamping range	mm ²	0.25	6
Conductor connection cross-section AWG	AWG	24	8
solid wire H05(07) V-U	mm ²	0.5	6
stranded wire H05(07) V-K	mm ²	0.5	6
with AEH with collar DIN46 228/4	mm ²	0.25	6
with wire end sleeve DIN46 228/1	mm ²	0.25	6
Strip length	mm	12	12

Contact assignment at this connection

Position	Terminal point	Connection
1	L	Phase L
2	N	Neutral conductor N
3	PE	Protective conductor, PE

Connection X03



X03 | Mains output for single-phase devices

Feature	Implementation
Connection type	Connection strip
Contact type	Direct plug-in technique
Number of contacts	3-pin

Connectable conductors at this connection

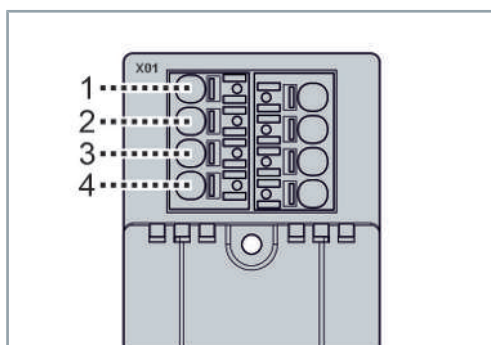
Technical parameter	Unit	min.	max.
Clamping range	mm ²	0.34	4
Conductor connection cross-section AWG	AWG	20	12
solid wire H05(07) V-U	mm ²	0.5	2.5
stranded wire H05(07) V-K	mm ²	0.5	4
with AEH with collar DIN46 228/4	mm ²	0.34	2.5
with wire end sleeve DIN46 228/1	mm ²	0.5	2.5
Strip length	mm	12	12

Contact assignment at this connection

Position	Terminal point	Connection
1	L'	Forwarding L
2	N'	Forwarding N
3	PE	Protective conductor, PE

AX2090-NF10-3012 connection technology

Connection X01



X01 | Mains input for three-phase devices

Feature	Implementation
Connection type	Connection strip
Contact type	Direct plug-in technique
Number of contacts	4-pin

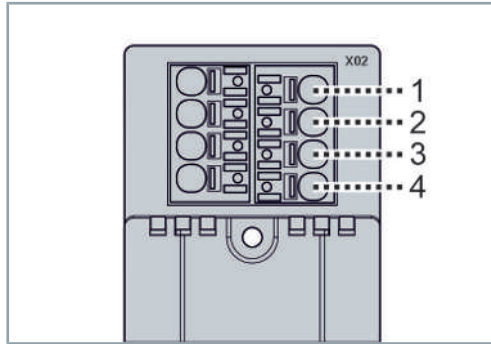
Connectable conductors at this connection

Technical parameter	Unit	min.	max.
Clamping range	mm ²	0.25	6
Conductor connection cross-section AWG	AWG	24	8
solid wire H05(07) V-U	mm ²	0.5	6
stranded wire H05(07) V-K	mm ²	0.5	6
with AEH with collar DIN46 228/4	mm ²	0.25	6
with wire end sleeve DIN46 228/1	mm ²	0.25	6
Strip length	mm	12	12

Contact assignment at this connection

Position	Terminal point	Connection
1	L1	Phase L1
2	L2	Phase L2
3	L3	Phase L3
4	PE	Protective conductor, PE

Connection X02



X02 | Mains forwarding for three-phase devices

Feature	Implementation
Connection type	Connection strip
Contact type	Direct plug-in technique
Number of contacts	4-pin

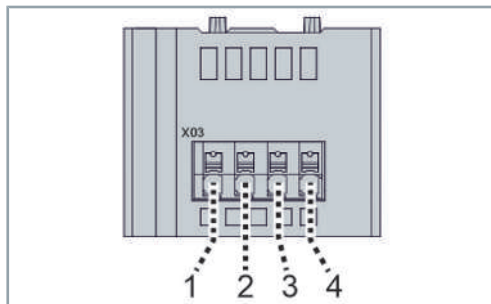
Connectable conductors at this connection

Technical parameter	Unit	min.	max.
Clamping range	mm ²	0.25	6
Conductor connection cross-section AWG	AWG	24	8
solid wire H05(07) V-U	mm ²	0.5	6
stranded wire H05(07) V-K	mm ²	0.5	6
with AEH with collar DIN46 228/4	mm ²	0.25	6
with wire end sleeve DIN46 228/1	mm ²	0.25	6
Strip length	mm	12	12

Contact assignment at this connection

Position	Terminal point	Connection
1	L1	Phase L1
2	L2	Phase L2
3	L3	Phase L3
4	PE	Protective conductor, PE

Connection X03



X03 | Mains output for three-phase devices

Feature	Implementation
Connection type	Connection strip
Contact type	Direct plug-in technique
Number of contacts	4-pin

Connectable conductors at this connection

Technical parameter	Unit	min.	max.
Clamping range	mm ²	0.34	4
Conductor connection cross-section AWG	AWG	20	12
solid wire H05(07) V-U	mm ²	0.5	2.5
stranded wire H05(07) V-K	mm ²	0.5	4
with AEH with collar DIN46 228/4	mm ²	0.34	2.5
with wire end sleeve DIN46 228/1	mm ²	0.5	2.5
Strip length	mm	12	12

Contact assignment at this connection

Position	Terminal point	Connection
1	L1'	Forwarding L1
2	L2'	Forwarding L2
3	L3'	Forwarding L3
4	PE	Protective conductor, PE

12.1.2 AX2090-NF12-x020 | Sum mains filter



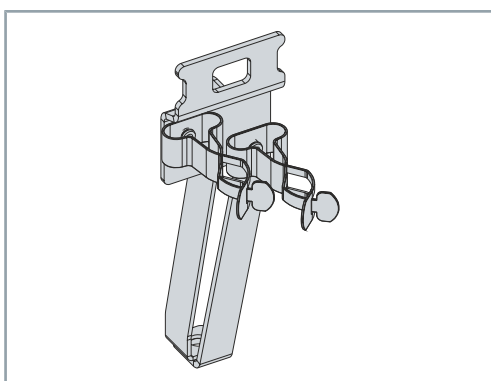
The mains filter is a central mains filter that is installed in the power supply upstream of several economy servo drives and is designed for the sum of the currents.

Economy servo drive	Mains filter, category C2
AX1xxx-1xxx, 1-phase	AX2090-NF12-1020, 20 A
AX1xxx-3xxx, 3-phase	AX2090-NF12-3020, 20 A

Prerequisites:

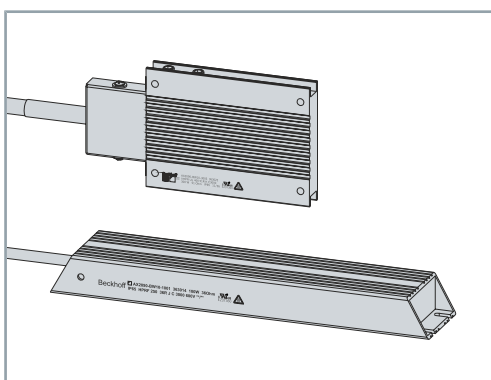
- Single-phase devices may only be connected to single-phase mains filters; three-phase devices may only be connected to three-phase devices.
- The total input current of the connected devices must be smaller than or equal to the permissible rated current of the mains filter.

12.2 AX2090-SB10-0001 | Shielding bracket



When using a shielded motor cable, the shield of the motor cable can be connected and safely contacted using the shielding bracket.

12.3 AX2090-BW10-xxxx | Braking resistor



When braking a servo drive, the regenerative energy is converted into heat by the braking resistors from the AX2090-BW10 series. As components with the protection rating IP65, the braking resistors feature full contact hazard protection and are protected against dust or water jets from any direction. For further information, read the operating instructions for the braking resistors from the AX2090-BW10 series.

13 Decommissioning

Disassembly may only be carried out by qualified and trained personnel.

When disposing of electronic waste, make sure that you dispose of it in accordance with the regulations applicable in your country. Read and follow the instructions for professional disposal.

13.1 Disassembly



Do not remove components from the products

Only

Beckhoff Automation GmbH & Co. KG is permitted to remove components.

Contact "Beckhoff Service", [Page 11] for further information.

Removing the economy servo drive from the machine

- ▶ Shut down the system
- ▶ Secure system against restarting
- ▶ Wait for "the discharge times", [Page 95]
- ▶ Spannungsfreiheit prüfenCheck for absence of voltage
- ▶ Remove cables and electrical connections
- ▶ Loosen and remove the fixing screws of the economy servo drive

13.2 Disposal

Depending on your application and the products used, ensure the professional disposal of the respective components:

Cast iron and metal

Dispose of cast and metal parts as scrap metal for recycling.

Cardboard, wood and foam polystyrene

Dispose of packaging materials made of cardboard, wood or foam polystyrene in accordance with the regulations.

Plastics and hard plastics

You can recycle parts made of plastic and hard plastic via the recycling depot or re-use them depending on the component designations and markings.

Oils and lubricants

Dispose of oils and lubricants in separate containers. Hand over the containers at the used oil collection station.

Batteries and rechargeable batteries

Batteries and rechargeable batteries may also be marked with the crossed-out trash can symbol. You must separate these components from the waste and are legally obliged to return used batteries and rechargeable batteries within the EU. Observe the relevant provisions outside the area of validity of the EU Directive 2006/66/EC.



Electronic components

Products marked with a crossed-out waste bin must not be disposed of with general waste. Electronic components and devices are considered as waste electrical and electronic equipment for disposal. Observe the national regulations for the disposal of old electrical and electronic equipment.

14 Guidelines and Standards

14.1 Standards

Generic standards EN IEC 61000-6-2

"Immunity standard for industrial environments"

EN IEC 61800-5-1

"Adjustable speed electrical power drive systems"

Part 5-1: Safety requirements - Electrical, thermal and energy

Generic standards EN IEC 61000-6-4

"Emission standard for industrial environments"

Product standard EN IEC 61800-3

"Adjustable speed electrical power drive systems. EMC requirements and specific test methods"

EN IEC 63000

"Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances"

IEC 61800-5-3

"Adjustable speed electrical power drive systems"

Part 5-3: Safety requirements - Functional, electrical and environmental requirements for encoders

14.2 Guidelines

2014/35/EU

Low Voltage Directive

2011/65/EU

RoHS Directive

2014/30/EU

EMC Directive



Installation with protective conductor connection

When installing electrical systems and components, the protective conductors must be connected first. They must be disconnected last when uninstalling.

Depending on the magnitude of the leakage currents, observe the following regulations for the implementation of the protective conductor connection:

- Minimum requirement for protective conductor: KU value of 4.5
- The minimum requirement for leakage currents: $I_L < 10 \text{ mA}$; $KU = 6$ for $I_L > 10 \text{ mA}$

Value	Explanation
KU	Variable for the classification of safety-related types of failure for protection against dangerous shock current and excessive heating

Value	Explanation
KU = 4.5	Achieved in relation to interruption: With permanently connected protective conductor connection $\geq 1.5 \text{ mm}^2$ With protective conductor connections $\geq 2.5 \text{ mm}^2$ via connector for industrial plants according to IEC 60309-2
KU = 6	Achieved in relation to interruption: With permanently connected conductors $\geq 10 \text{ mm}^2$; the type of connection and routing must comply with the standards applicable to PE conductors

14.2.1 Electrical isolation

The power section, consisting of motor connection, DC link connection and mains connection, as well as the control unit are to be double-insulated against each other. This guarantees secure shock protection on all terminals in the control unit, even without further measures. The air gaps and creepage distances conform to EN 50178 / VDE 0160.

14.3 Regulations

Regulation (EU) 2021/821

Regulation of the European Parliament and of the Council of 20 May 2021 setting up a Union regime for the control of exports, brokering, technical assistance, transit and transfer of dual-use items (recast).

14.4 Notified bodies



The product does not fall within the scope of the Machinery Directive. However, Beckhoff products are designed and evaluated in full compliance with all relevant regulations for personnel safety and use in a machine or system.

14.5 EU conformity



Provision

Beckhoff Automation GmbH & Co KG will be pleased to provide you with EU declarations of conformity and manufacturer's declarations for all products on request.

Send your request to:

✉ info@beckhoff.com

14.6 UL certification

The servo drive may be used as components in a system with an UL-Listing test mark.

Further information can be found in the chapter Fuse protection under "UL-compliant", [Page 76].

14.6.1 USA and Canada



The English translation is binding

Note that all statements made in this chapter on UL certification are binding only in the English version. The German version of this chapter is purely informative.

A UL certification is necessary for the operation of the Economy servo drive AX1000 in the economic area of the USA or Canada. The devices have been certified according to the standards of the UL test laboratory and are permitted to bear the cULus logo on the name plate. The test number is: E195162.

The following specifications apply for UL-certified use:

- Components of the economy servo drive AX1000 may be used in an environment with non-conductive contamination. This corresponds to a pollution degree of 2. Note that occasionally, depending on the environmental conditions, temporary conductivity can be expected due to condensation.
- The wiring must be done using copper wires with a temperature resistance of at least 75°C.

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