

BECKHOFF New Automation Technology

Operating instructions | EN

AX8820

Universal regenerative unit

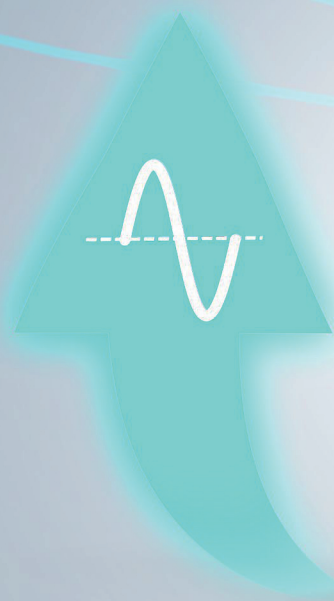


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1 Documentation notes

1.1 Disclaimer

Beckhoff products are subject to continuous further development. We reserve the right to revise the documentation at any time and without notice. No claims for the modification of products that have already been supplied may be made on the basis of the data, diagrams, and descriptions in this documentation.

1.1.1 Trademarks

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The use by third parties of other brand names or trademarks contained in this documentation may lead to an infringement of the rights of the respective trademark owner.

1.1.2 Patents

The EtherCAT technology is protected by patent rights through the following registrations and patents with the relevant applications and registrations in various other countries:

- EP1590927
- EP1789857
- EP1456722
- EP2137893
- DE102015105702



EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH.

1.1.3 Limitation of liability

All components of this product described in the original operating instructions are delivered in a hardware and software configuration, depending on the application requirements. Modifications and changes to the hardware or software configuration that go beyond the documented options are prohibited and nullify the liability of Beckhoff Automation GmbH & Co. KG.

The following is excluded from the liability:

- Failure to comply with this documentation
- Improper use
- Use of untrained personnel
- Use of unauthorized spare parts

1.1.4 Copyright

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The copying, distribution and utilization of this document as well as the communication of its contents to others without express authorization is prohibited. Offenders will be held liable for the payment of damages.

We reserve all rights in the event of registration of patents, utility models and designs.

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:

✉ motion-documentation@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	Accompanying document with general notes on handling the 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

Qualified electricians

Qualified electricians have comprehensive technical knowledge gained from a course of study, an apprenticeship or technical training. They have an understanding of control technology and automation. They are familiar with relevant standards and directives. Qualified 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 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

The Beckhoff Support offers technical advice on the use of individual Beckhoff products and system planning. The support engineers offer you competent assistance, for comprehension questions as well as for commissioning.


 +49 5246 963-157

 support@beckhoff.com

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1.7.2 Training offerings

Training in Germany takes place at the Beckhoff branches or, after consultation, at the customer's premises. Beckhoff offers both face-to-face and online training courses.


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1.7.3 Service offerings

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1.7.4 Headquarters Germany

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A detailed overview of the Beckhoff locations worldwide can be found at:

 www.beckhoff.com/en-en/company/global-presence/

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

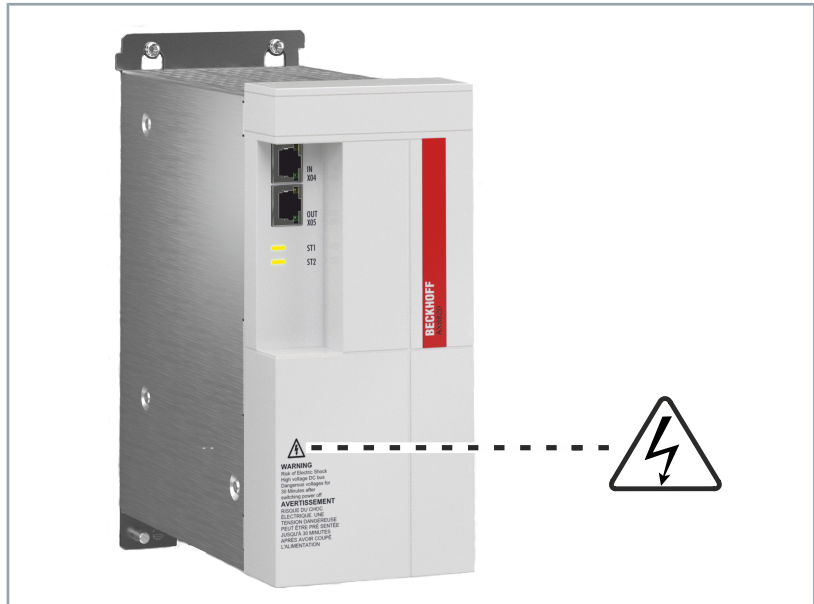
Read this chapter containing general safety information. Furthermore, the chapters in this documentation contain warning notices. Always observe the safety instructions for your own safety, the safety of other persons and the safety of the product.

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 Safety pictograms



Warning of high voltage!

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

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

Protective equipment

Do not remove or bypass any protective devices. Check all protective devices before operation. Make sure that all emergency switches are present at all times and can be reached by you and other people. People could be seriously or fatally injured by unprotected machine parts.

Observe tightening torques

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

Correctly ground electrical components or modules

Avoid electric shocks due to improper grounding of electrical components or modules. Ground all conductive components according to the specifications in the chapters "Electrical Installation" and "Mechanical Installation".

Do not use damaged components

Adhere to the specifications from the technical data for storage, transport and operation. Do not use damaged components.

Use the original packaging only

When shipping, transporting, storing and packing, use the original packaging or non-conductive materials.

Check safety pictograms

Check whether the designated pictograms are on the product. Replace missing or illegible stickers.

Keep the immediate environment clean

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

2.2.2 During operation

Avoid overheating

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

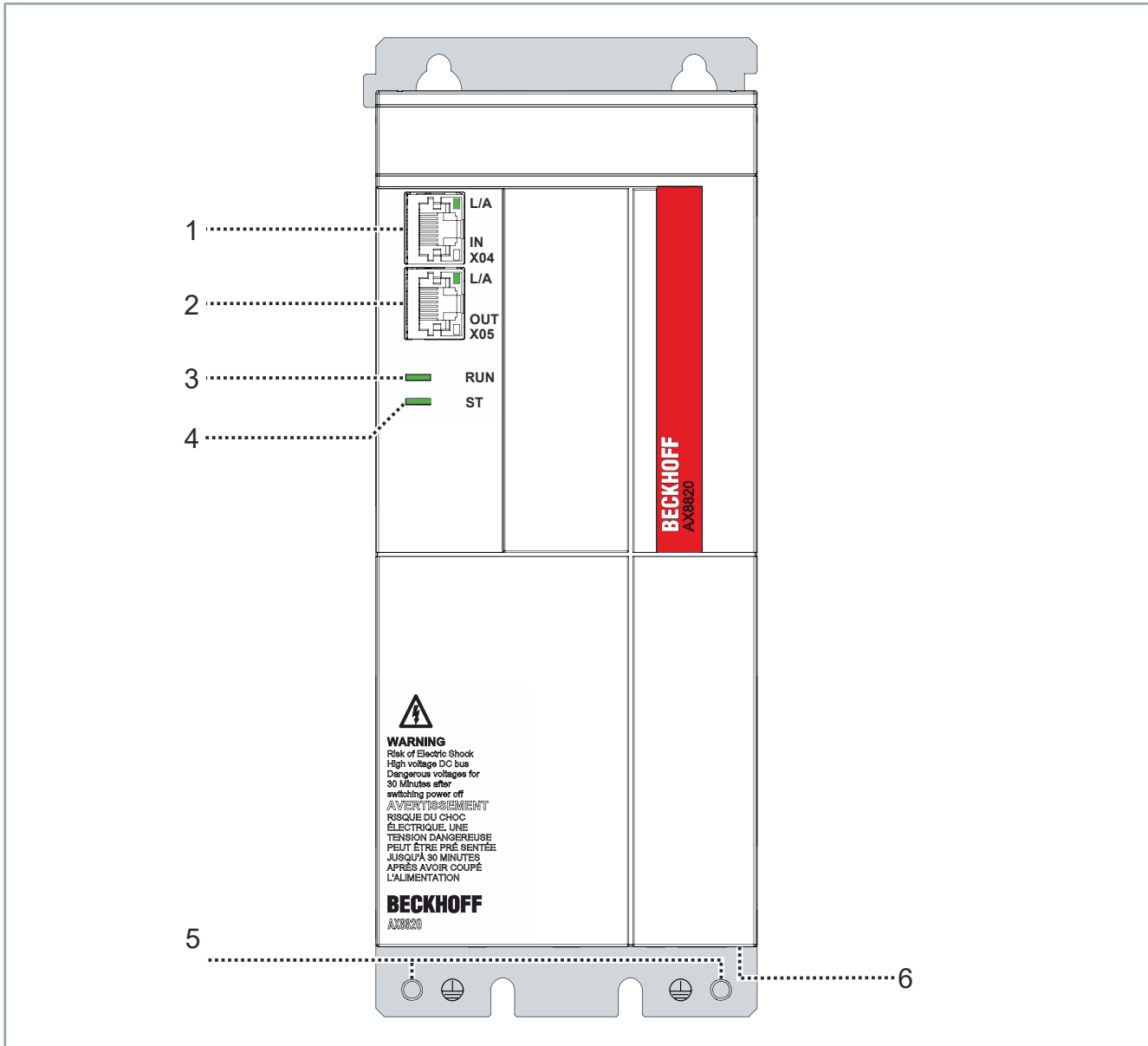
2.2.3 After operation

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 and comply with the chapter: De-commissioning.

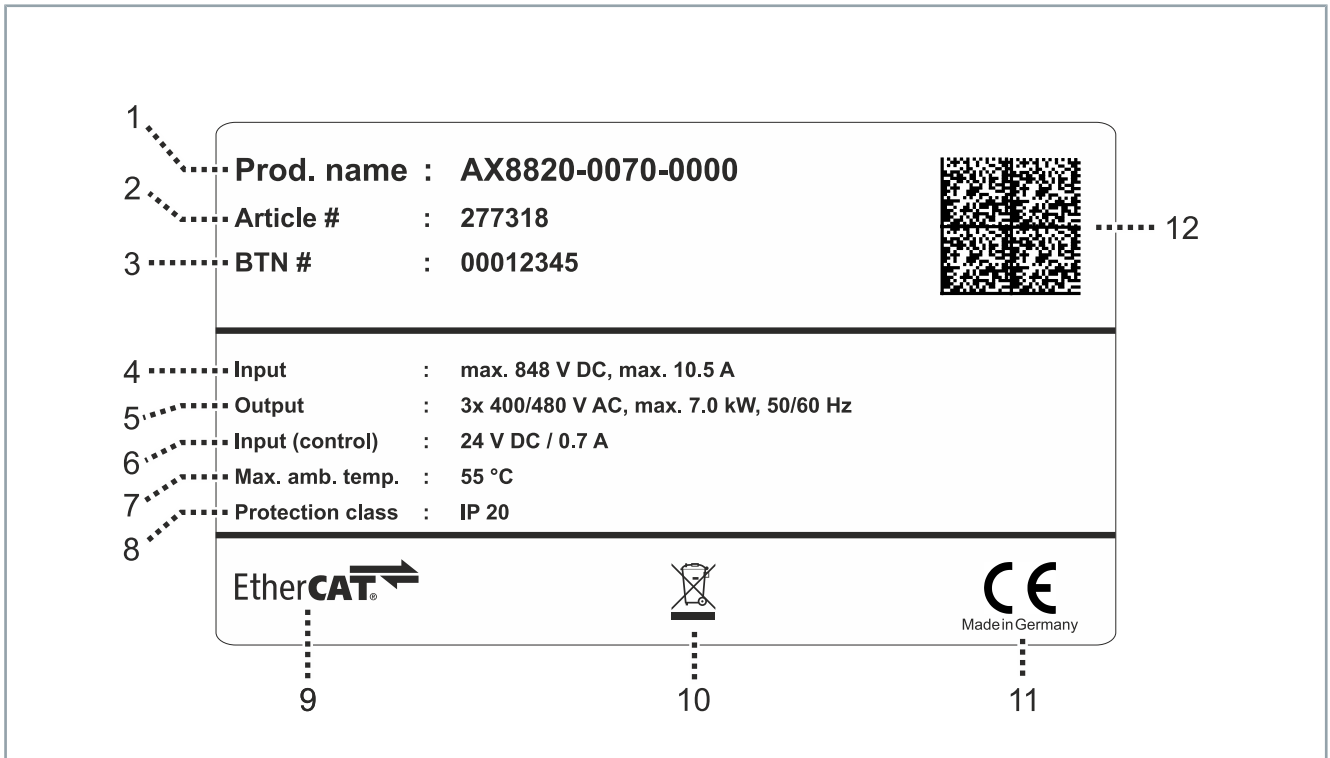
3 Product overview

3.1 Universal regenerative unit



Item number	Explanation
1	Fieldbus EtherCAT input X04
2	Fieldbus EtherCAT output X05
3	Status LED RUN
4	Status LED ST
5	Grounding bolt
6	Input terminal X01

3.1.1 Name plate



Item number	Explanation
1	Product number
2	Order number
3	Beckhoff Traceability Number
4	Input voltage
5	Output voltage
6	Input control voltage
7	Maximum ambient temperature
8	Protection rating
9	EtherCAT conformity
10	WEEE compliance
11	CE conformity
12	DataMatrix code

3.1.2 Type key

AX8820-aaab-0000	Explanation
AX8820	<i>Product area</i> <ul style="list-style-type: none">• Drive technology - Regeneration
aaa	<i>Output power</i> <ul style="list-style-type: none">• aaa = 007 = 7 kW
b	<i>Mains voltage</i> <ul style="list-style-type: none">• 0 = 3 x 360 ... 520 V AC

3.2 Product characteristics

The AX8820 universal regenerative unit is used to feed regenerative energy back into the mains. It is compatible with the AX8000 multi-axis servo system, AX5000 digital compact servo drives, and third-party devices.

No mains distortions

Sinusoidal energy regeneration prevents the typical mains distortions seen with block-shaped recovery.

Operation of several regenerative units in a group

In order to achieve optimum adaptation of the regenerative power to the requirements of the machine, several regenerative units can be operated in parallel.

Analysis of regenerative energy

With the help of the extended diagnostics via EtherCAT, the current regenerative energy can also be analyzed. With the online data, it is possible to record the chronological sequence of the machine processes and to analyze whether the efficiency of the machine can be increased by offsetting the machine processes.

3.3 Intended use

The AX8820 universal regenerative unit may only be used for the intended activities defined in this documentation under the specified environmental conditions.

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



Read the entire drive system documentation

- This operating instructions
- The machine manufacturer's complete documentation for the machine

3.4 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 AX8820 universal regenerative unit is not suitable for use in the following areas:

- ATEX zones without suitable housing
- Areas with aggressive environments, for example aggressive gases or chemicals. The relevant standards and directives for EMC interference emissions must be complied with in residential areas.

4 Technical data

4.1 Data for operation and environment

NOTICE

Reduced service life due to temperature influence

Temperatures above +45 °C and encapsulated installation can shorten the service life of the regenerative unit.

- Operate the regenerative unit only under the conditions for operation and the environment listed in this chapter

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	
Climate category – operation	2K3 according to EN 60721
Ambient temperature during operation	-0 °C ... +45 °C Extended temperature range up to +55 °C with power derating of 2 % / K
Ambient temperature during transportation	-25 °C ... +70 °C, maximum fluctuation 20 K per hour
Ambient temperature during storage	-25 °C ... +55 °C, maximum fluctuation 20 K per hour
Power derating	No power derating up to 1000 m above sea level From 1000 m up to a maximum of 3000 m above sea level with a power derating of 1 % / 100 m
Installation altitude	A reduction of the overvoltage category is necessary from an installation altitude of 2000 m up to maximally 3000 m above sea level. Observe derating.
Permissible humidity in 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
Specifications for intended use	
Ventilation	Integrated fan
Protection rating	Devices IP20
Installation position	vertical
Vibration resistance	1 G, 150 Hz according to EN 61800-5-1
Shock resistance	5 G, 30 ms according to EN 60068-2-27
EMC requirements	conforms to EN 61800-3
Approvals	CE See chapter: Guidelines and Standards

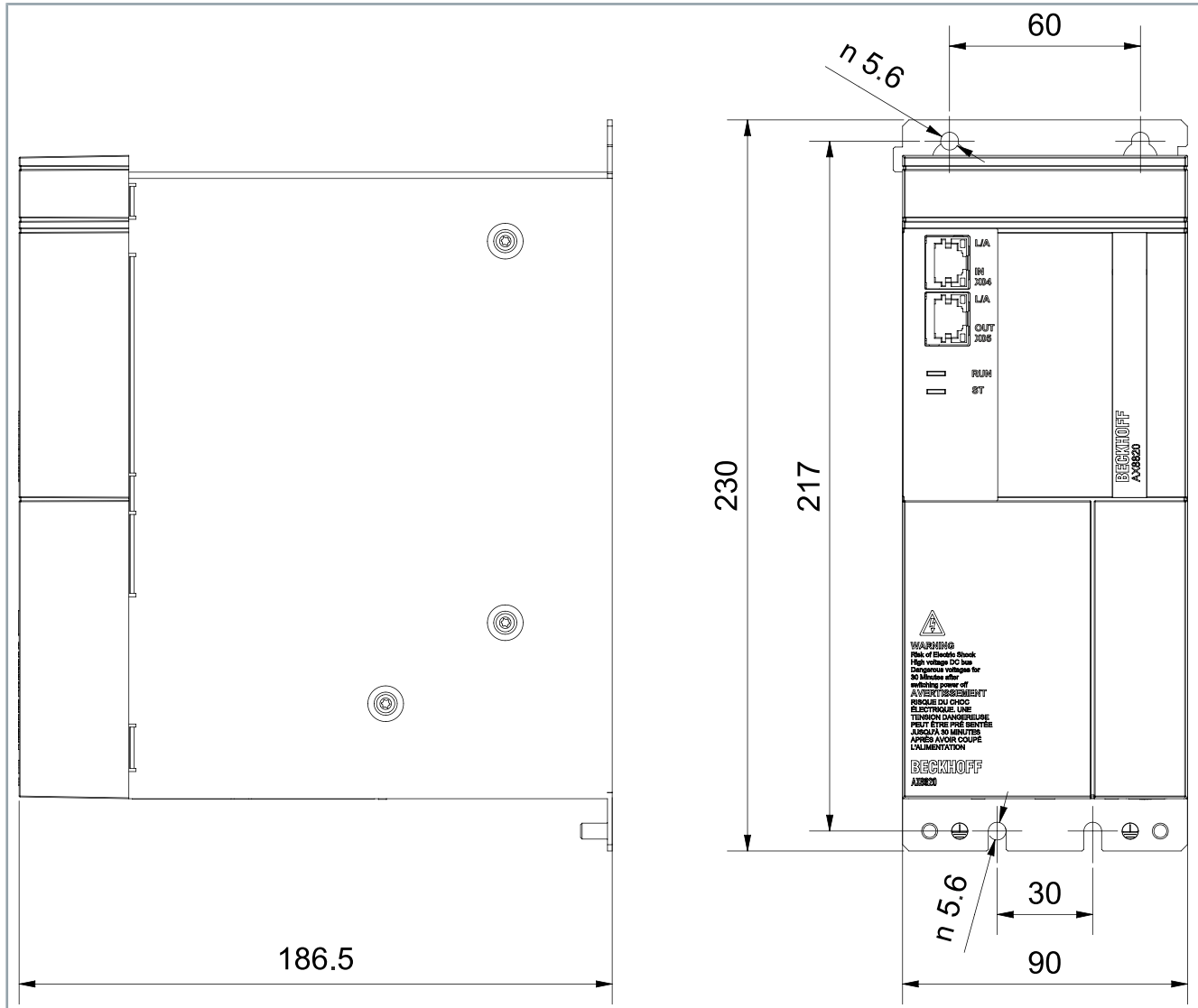
4.2 AX8820 universal regenerative unit

Technical data	AX8820-0070-0000
Function	Regenerative unit
Nominal mains voltage	3 x 360 ... 520Y/300 V
Nominal mains current	10.1 A AC
Peak output current for 60 seconds	15.2 A AC
Frequency	50/60 Hz
Mains filter	Integrated, category C2
SCCR value	5 kA
Minimum DC link capacitance of the connected devices	235 µF
Nominal output	7 kW
DC link voltage	max. 848 V DC
24 V control voltage	18 ... 30 V DC
24 V current consumption	0.7 A DC
System bus	EtherCAT
Drive profile	CiA402 according to IEC 61800-7-201 (CoE)
Ambient temperature (operation)	0...+40 °C, up to +55 °C with power derating (see documentation)
Approvals/markings	CE
Mechanical data	AX8820
Width	90 mm
Height without connectors	230 mm
Depth without connectors / accessories	186.5 mm
Weight	3.2 kg

4.3 Dimensional drawings

- Dimensions without connectors and cables
- All figures in millimeters

4.3.1 AX8820



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.

The scope of delivery always includes the following documents:

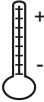



Operating Instructions
AX8820 universal regenerative unit

Depending on the application, the scope of delivery may consist of different components. Please check the delivery:

Components	Connector
AX8820 universal regenerative unit	Mating connector X01

5.1 Packaging

Instructions for handling are printed on the packaging:

Symbol	Explanation
	That is the highest and lowest temperature at which you may store.
	This is the correct position for the packaging.
	The packaging must be protected from moisture.
	The contents are fragile.

The table below shows the dimensions of the packages:

Dimension	AX8820
Height [mm]	395
Width [mm]	275
Depth [mm]	170

6 Transport and storage

⚠ WARNING

Serious injuries due to damage to the housing

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

- Protect the universal regenerative unit from damage during transport and storage
- Comply with the prescribed transportation conditions

NOTICE

Short circuit due to moisture

Condensed water can form during transport in cold weather or in case of extreme temperature differences. If the regenerative unit is not completely dry, condensed water can lead to a short circuit when switching on and damage the AX8820.

- Make sure that there is no moisture in the universal regenerative unit
- Equalize room temperatures slowly
- Only switch on AX8820 when dry

NOTICE

Loss of warranty due to improper use

Failure to comply with the conditions may result in damage to the regenerative unit and invalidate the warranty.

- Observe the conditions and the following chapters on transport and storage

6.1 Conditions

During transport and storage avoid damage to the universal regenerative unit and individual components. Observe the specifications in the following chapters and comply with the following conditions:

- Avoid electrostatic charging
- Avoid contact with highly insulating materials
- Temperature: -25 °C to +55 °C, maximum fluctuation 20 K per hour
- Air humidity: relative humidity max. 95 %, non-condensing
- Use of suitable means of transport
- Use the vendor's original packaging

The table shows the maximum stacking height at which you may store and transport the universal regenerative units on a pallet in the original packaging:

Product	Stacking height [pieces]
AX8820 universal regenerative unit	8

6.2 Transport

NOTICE

Damage due to high mechanical load

High mechanical loads can damage the universal regenerative unit and individual components.

- Use suitable means of transport
- Protect the universal regenerative unit from high mechanical loads

All modules can be transported without aids.

6.3 Long-term storage

NOTICE

Damage due to excessive storage times

Exceeding the specified maximum storage time can change the properties of the universal regenerative unit and damage it in operation.

- Do not exceed a maximum storage time of five years

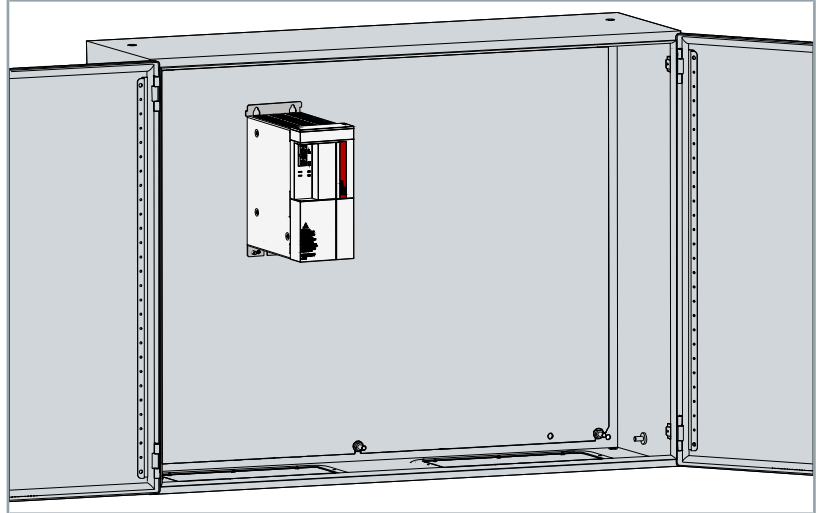
You have the option of storing the universal regenerative unit for a short or longer period of time. For storage we always recommend the original packaging. Adhere to the conditions specified in the chapter: "Transport and storage", [Page 24].

Ensure the storage space is vibration-free.

7 Technical description

7.1 Installation position

The standard installation position of the universal regenerative unit in the control cabinet is the vertical installation position.



7.2 Dimensioning

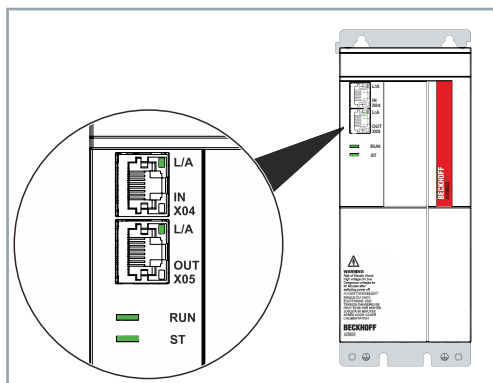
The dimensioning of drive axes, combined with the optimum selection of motor, gear unit, drive controllers, power supply modules, universal regenerative units and accessories, is the basis for an efficient machine design. The free TwinCAT 3 Motion Designer tool is available for this purpose.

7.3 Cable lengths

Different cable lengths apply to the AX8820 universal regenerative unit.

Cable	Maximum cable length [m]
DC link connection cable	1.5

7.4 Status LEDs



The status LEDs on the AX8820 universal regenerative unit provide you with information about its state. The following chapter explains the different status displays:

If the LEDs do not light up, the regenerative unit is switched off.

7.4.1 L/A (Link/Act)

LED status	Meaning
Off	No connection to the connected EtherCAT device
Lit	LINK: connection to the connected EtherCAT device
Flashes	ACT: communication with the connected EtherCAT device

7.4.2 RUN

LED status	Meaning
Off	AX8820 is in "Init" state
Flashes uniformly	AX8820 is in "Pre-Operational" state
Flashes sporadically	AX8820 is in "Safe-Operational" state
Lit	AX8820 is in "Operational" state

7.4.3 ST

LED status	Meaning
Green	Ready for operation and mains OK
Red	Mains missing / mains phase missing
Flashing red	Overvoltage DC link / overtemperature / overcurrent
Blue	Regeneration active

8 Mechanical installation

8.1 Preparation

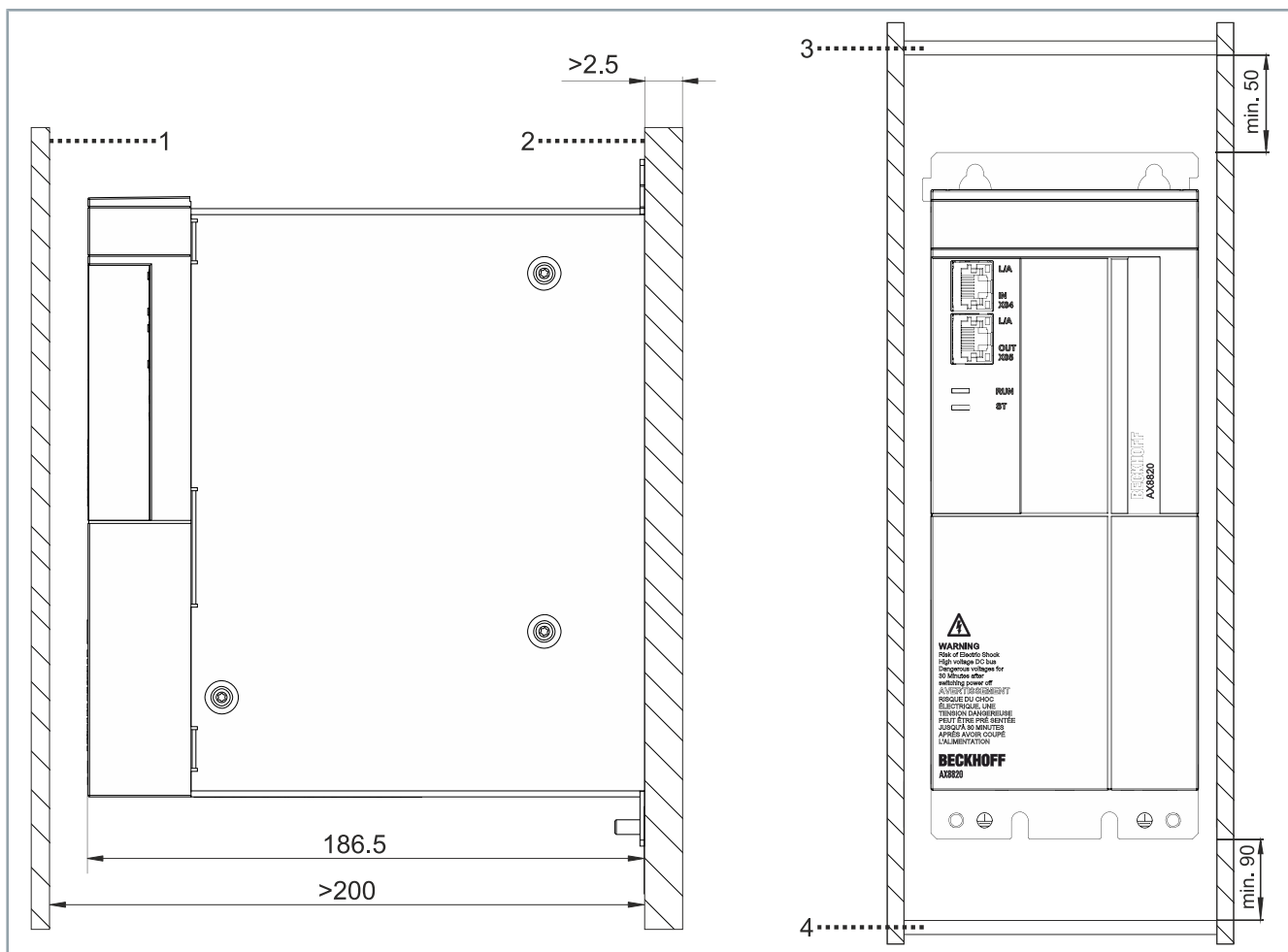
NOTICE

Damage due to improper installation

Inadequate ventilation and incorrect installation can lead to damage to the AX8820 and its components due to heat development.

- Observe the permissible data for operation and environment as well as the notes in this chapter

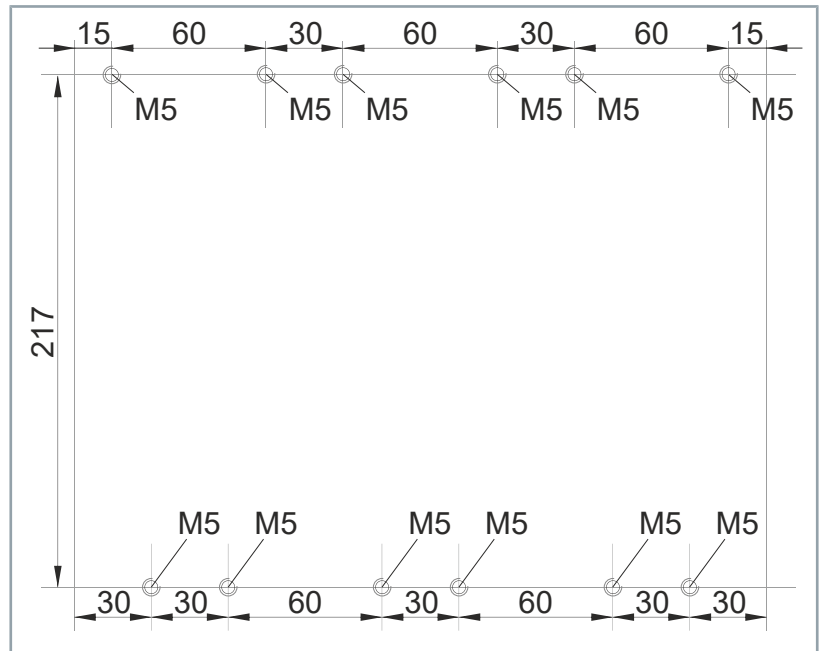
The following figure shows the recommended dimensions that you should observe when installing the regenerative unit in the control cabinet:



Item number	Explanation
1	Control cabinet door
2	Conductive and galvanized mounting plate
3	Control cabinet roof, cable channel or anything that disturbs the convection
4	Control cabinet floor, cable channel or anything that disturbs the convection

8.1.1 Drilling pattern

The following exemplary illustration provides information on how to create the threaded holes according to the drilling pattern in the mounting plate.



8.2 Module assembly

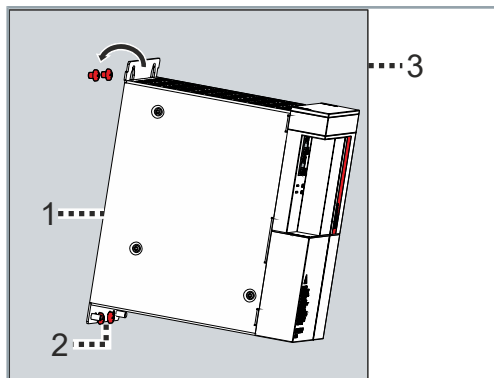


Mounting example

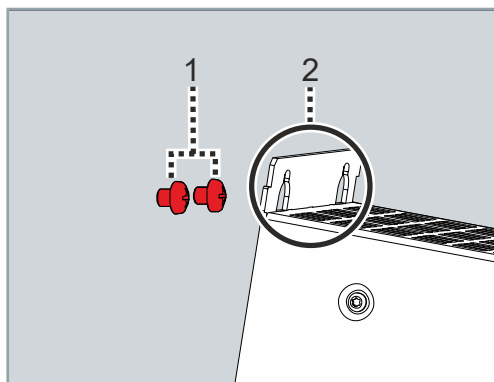
This chapter provides information on mounting the universal regenerative unit. A universal regenerative unit is installed as an example.

8.2.1 Universal regenerative unit

- ▶ Screw the screws into the control cabinet mounting plate in accordance with the drilling pattern



- ▶ Place the universal regenerative unit [1] on the screw [2] and press carefully against the mounting plate [3]



- ▶ Insert the screws [1] through the recesses on the housing [2]
- ▶ Screw all the screws tight in the elongated holes in the housing
- ▶ Observe tightening torques:

Components	Tightening torque [Nm]
Screws M5 x 5 Strength class 8.8	6

9 Electrical installation

NOTICE

Damage due to improper connection

Improper grounding or faulty contacting can lead to damage to the universal regenerative unit or to EMC interference emissions. The minimum cross-sections of separate protective conductors can be found in EN 61439-1.

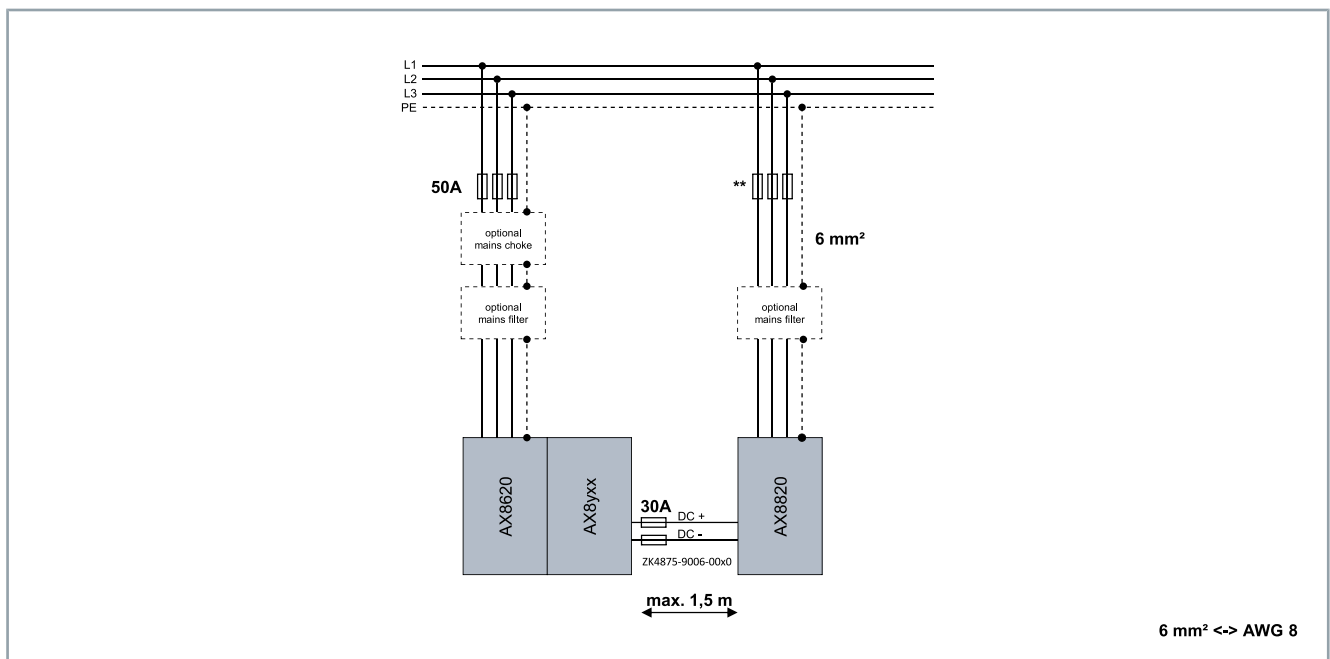
- Connect all components and use only shielded cables
- Ground the shields of the ready-made cables via the mounting plate and place the star point centrally on the unpainted mounting plate
- For larger applications, implement the potential equalization via PE rails

9.1 Block diagrams

Below you will find examples of connection scenarios using schematic connection diagrams for the universal regenerative unit.

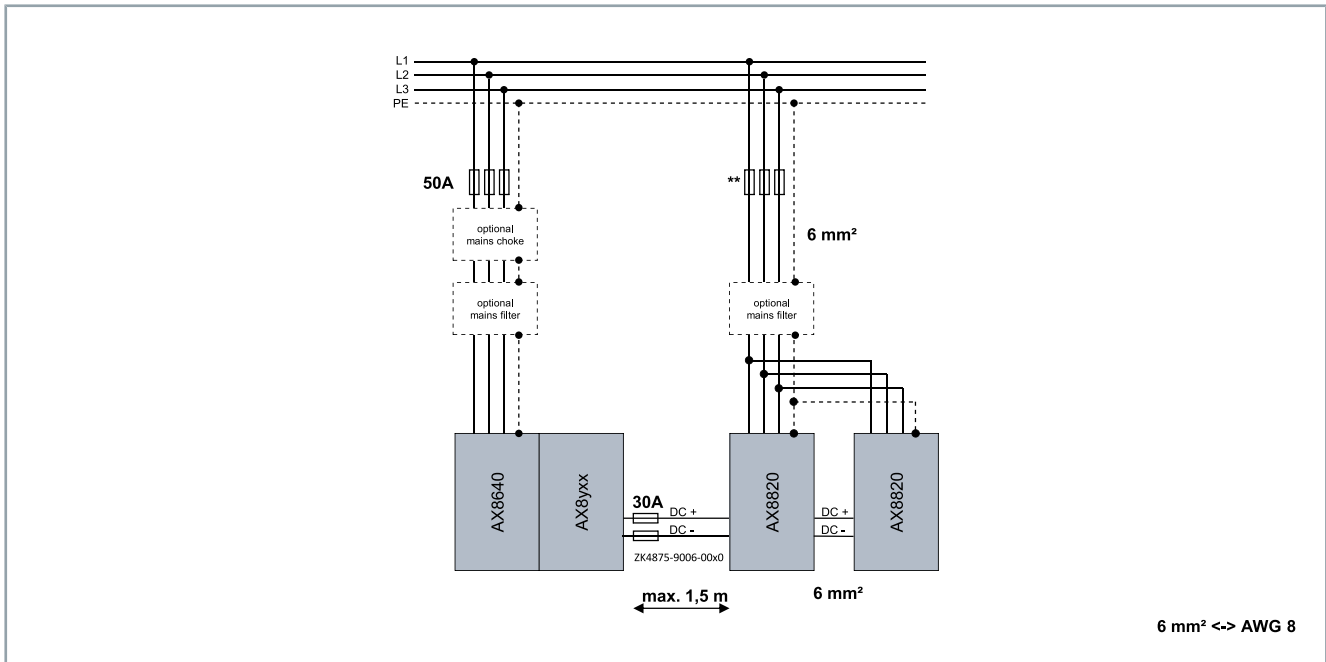
Further information on the permitted fuses can be found in the chapter "Fuse protection", [Page 40].

9.1.1 AX8820 with AX8620



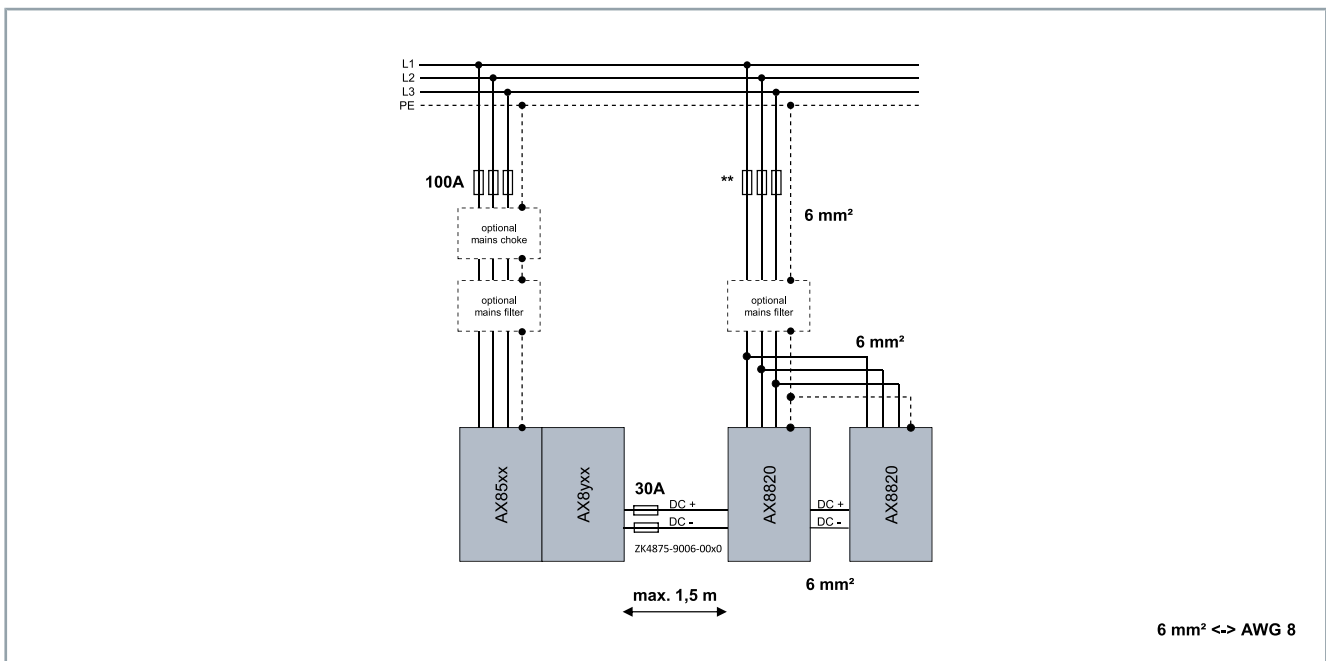
**) Further information can be found in chapter "Fuse protection", [Page 40]

9.1.2 AX8820 with AX8640



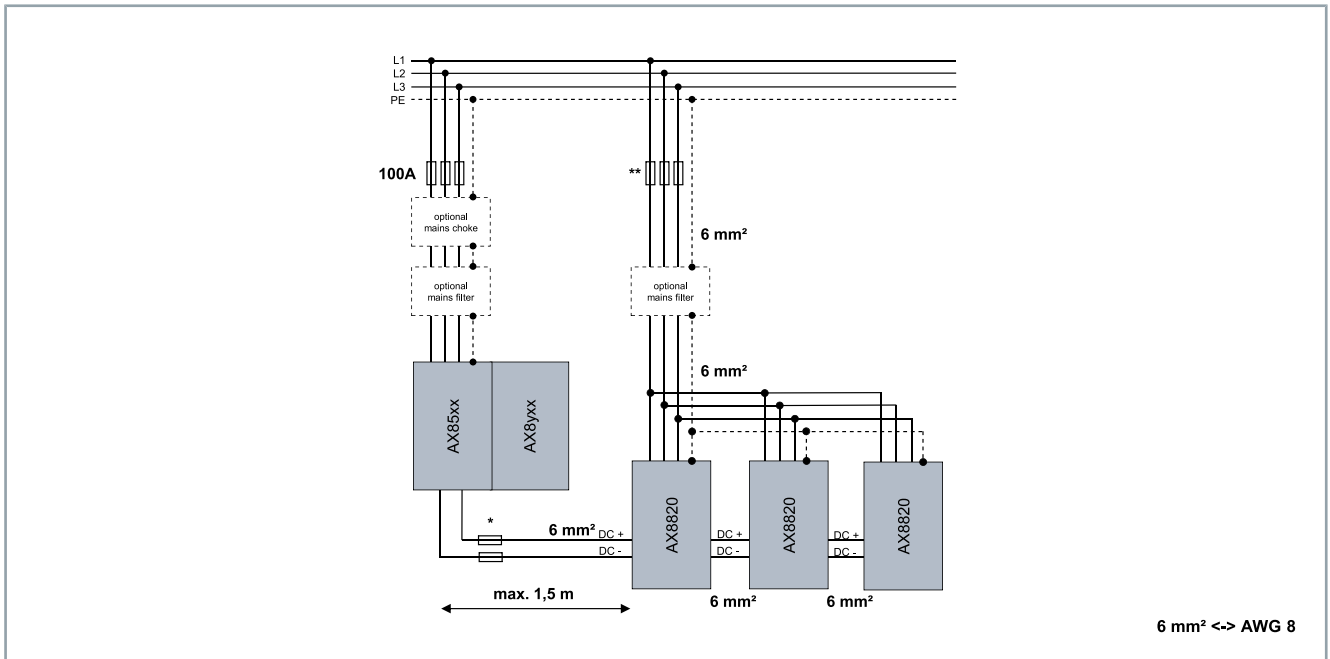
**) Further information can be found in chapter "Fuse protection", [Page 40]

9.1.3 AX8820 with AX85xx and ZK4875-9006-00x0



**) Further information can be found in chapter "Fuse protection", [Page 40]

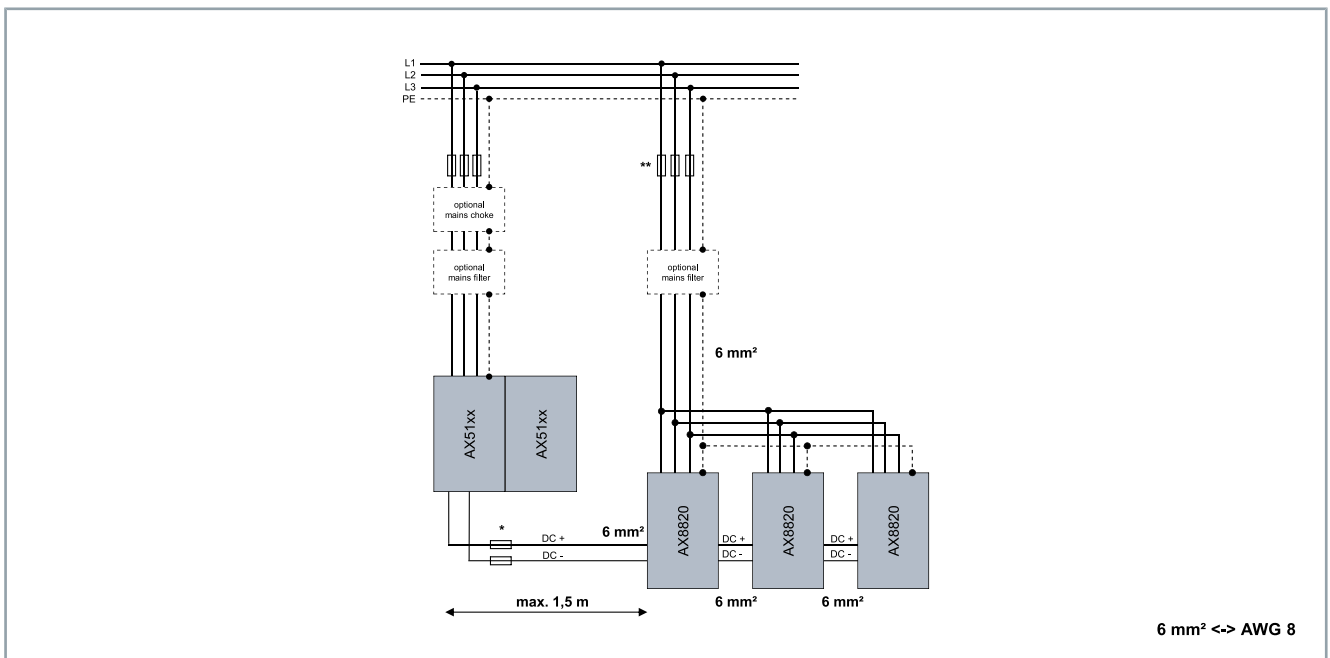
9.1.4 AX8820 with AX85x0



*) Further information can be found in chapter "Fuse protection", [Page 40]

***) Further information can be found in chapter "Fuse protection", [Page 40]

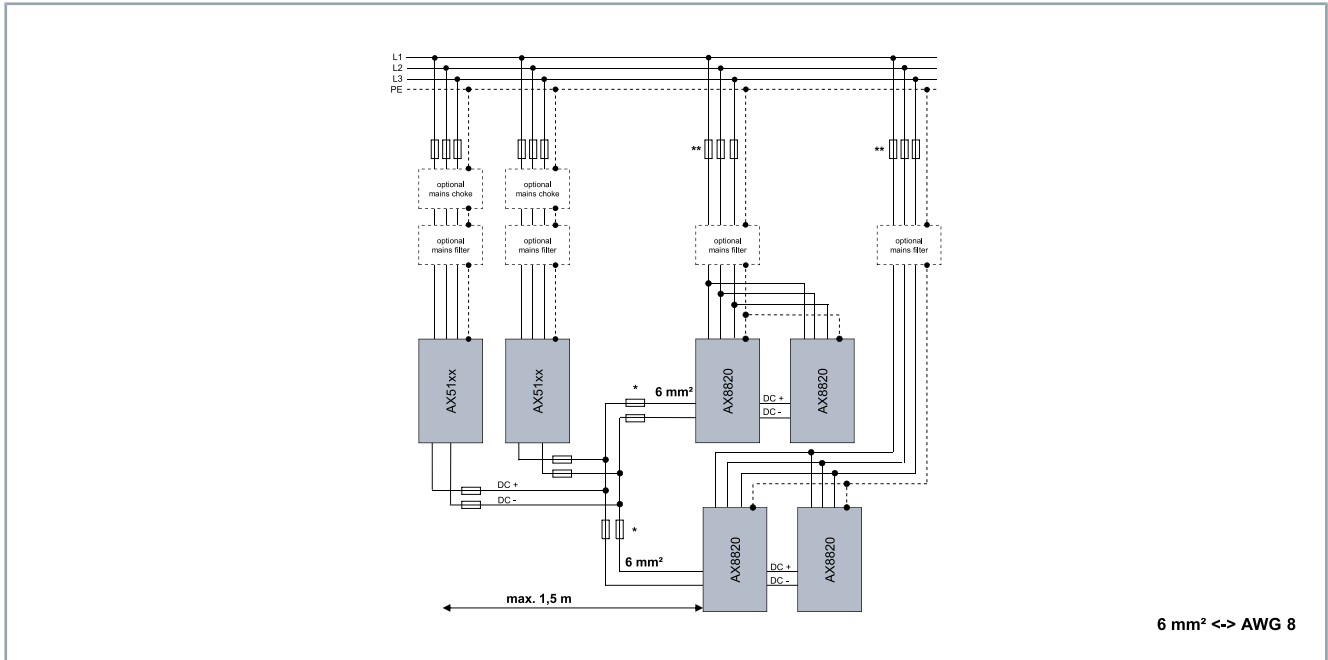
9.1.5 AX8820 with AX51xx/AX52xx



*) Further information can be found in chapter "Fuse protection", [Page 40]

***) Further information can be found in chapter "Fuse protection", [Page 40]

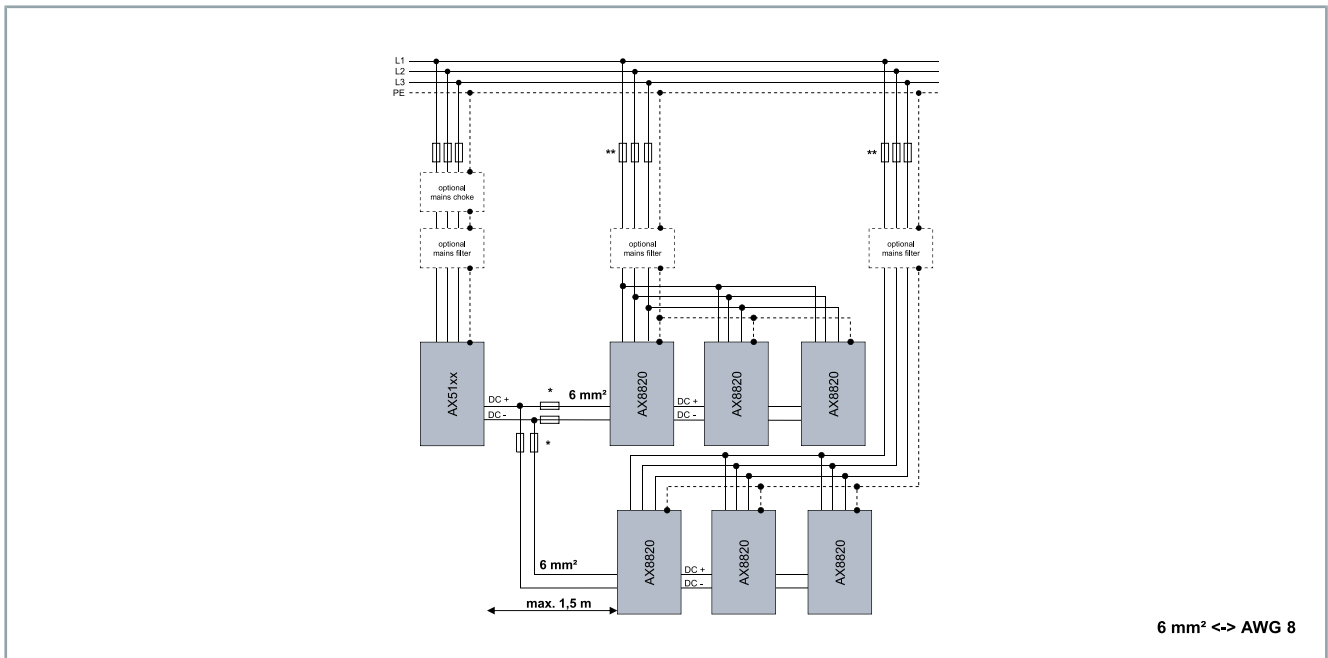
9.1.6 AX8820 with AX51xx/AX52xx - UL



*) Further information can be found in chapter "Fuse protection", [Page 40]

***) Further information can be found in chapter "Fuse protection", [Page 40]

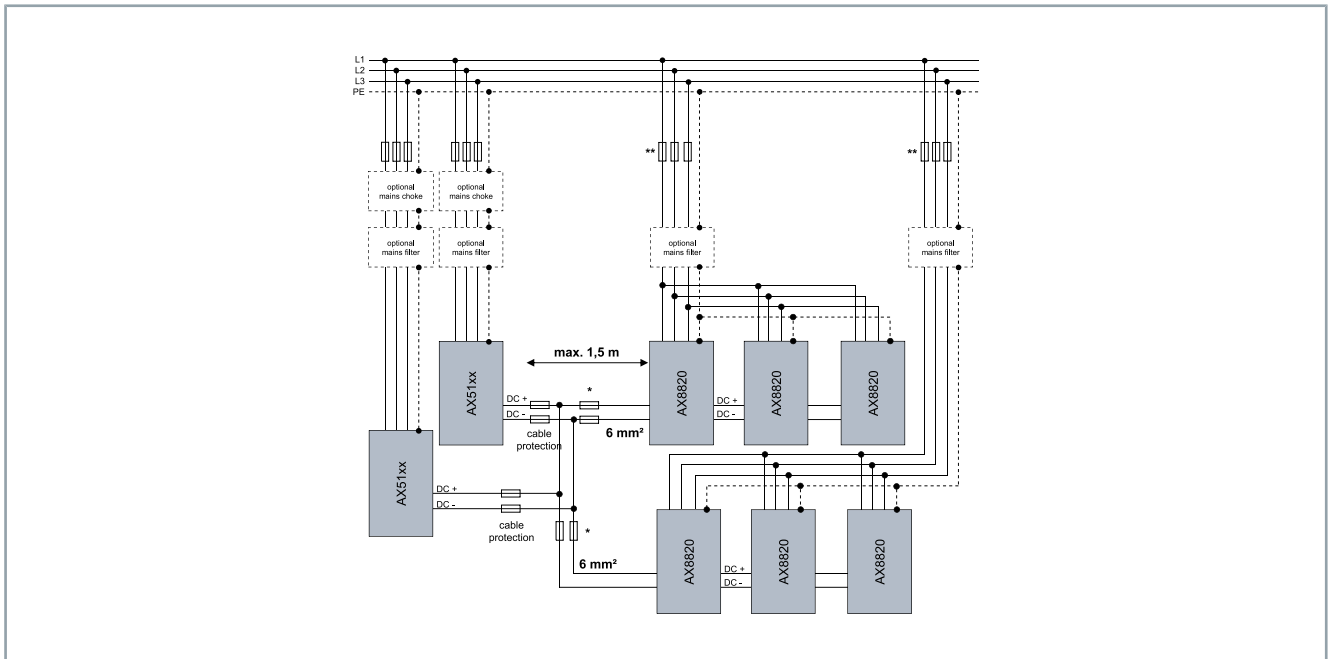
9.1.7 AX8820 with an AX51xx



*) Further information can be found in chapter "Fuse protection", [Page 40]

***) Further information can be found in chapter "Fuse protection", [Page 40]

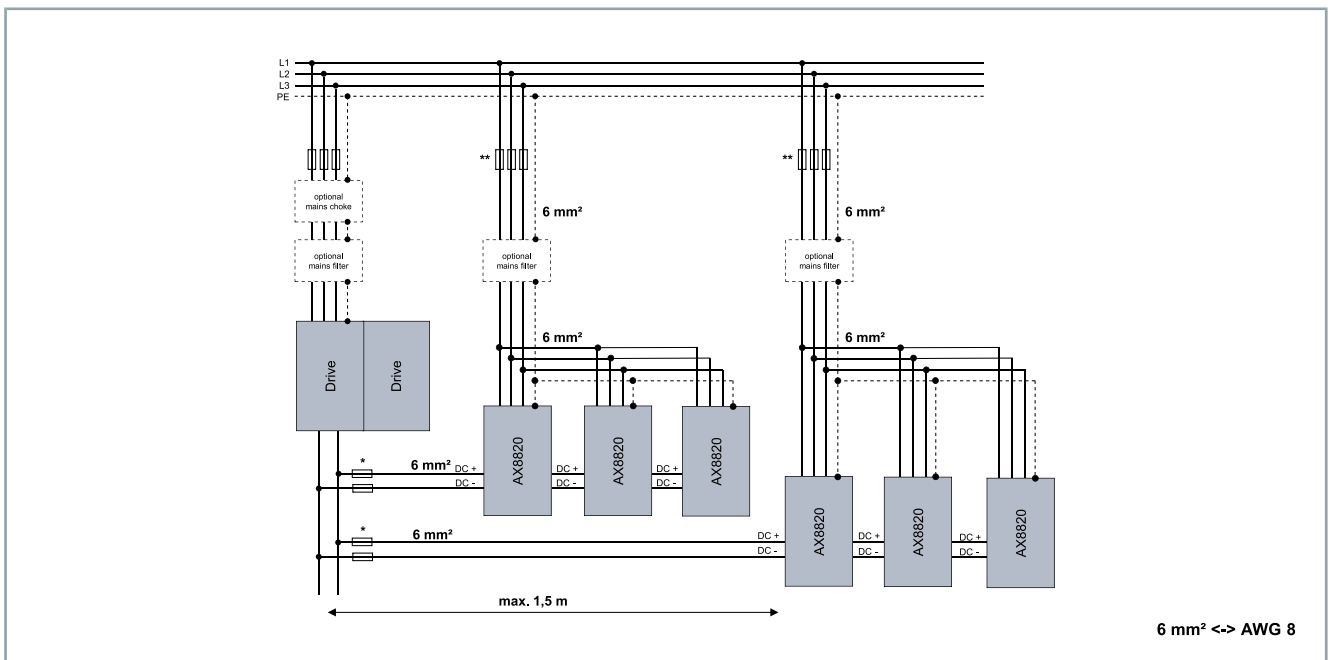
9.1.8 AX8820 with DC link AX51xx



*) Further information can be found in chapter "Fuse protection", [Page 40]

**) Further information can be found in chapter "Fuse protection", [Page 40]

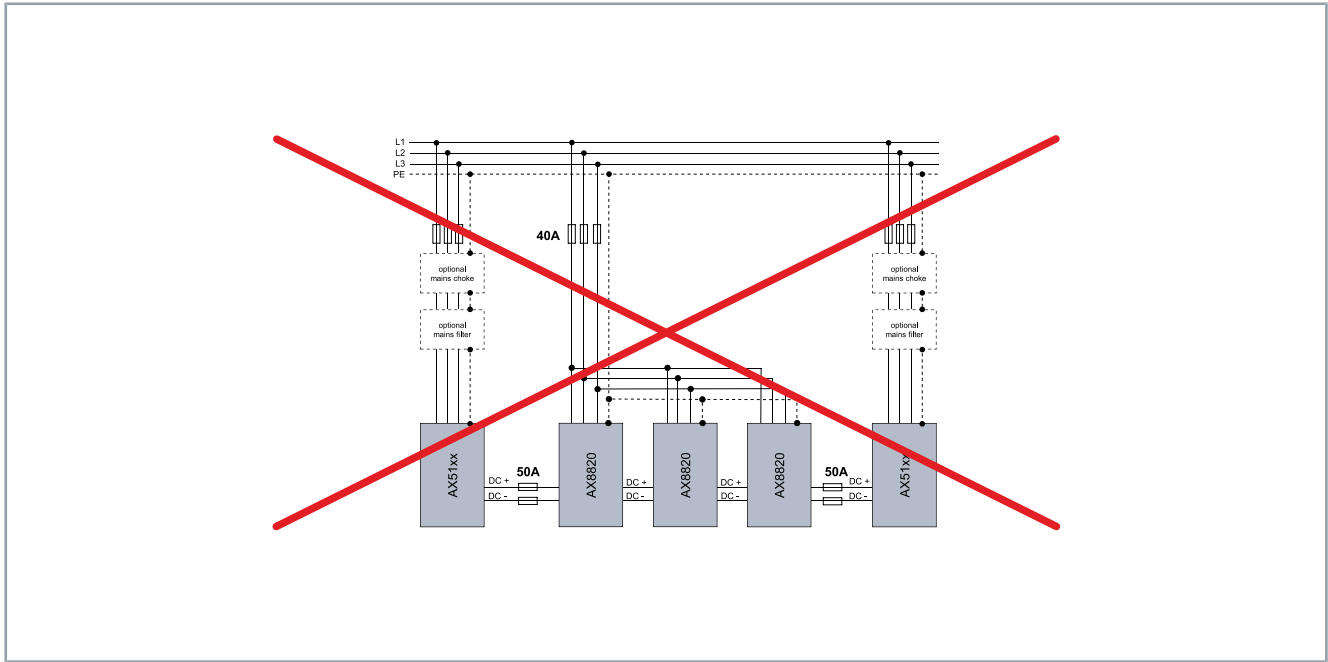
9.1.9 AX8820 | System extension



*) Further information can be found in chapter "Fuse protection", [Page 40]

**) Further information can be found in chapter "Fuse protection", [Page 40]

9.1.10 Not supported



9.2 Grounding

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.

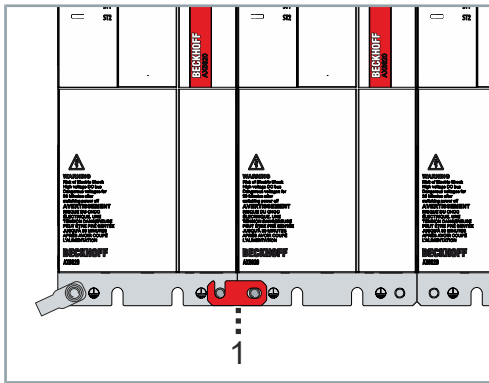
The ground connection for the regenerative unit is made via the grounding hangers and hexagon nuts similar to DIN 6923 with flange and serrations class 8 with the galvanized surface. These components are included in the scope of delivery of the accessories set for parallel connection of AX8820 universal regenerative units.



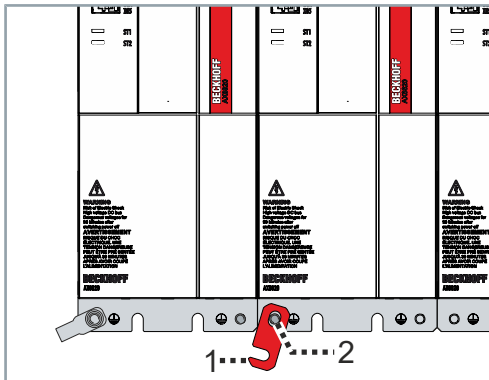
Example group of regenerative units

This chapter describes the device connection using the example of a group consisting of several AX8820 universal regenerative units.

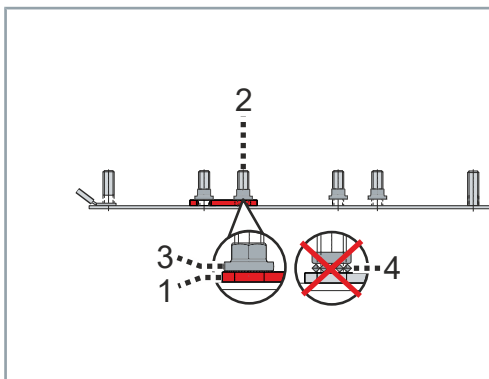
9.2.1 Module connection



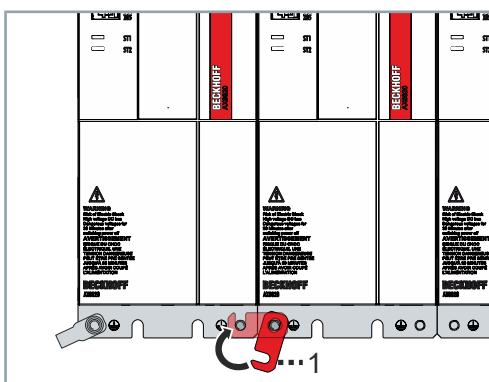
The individual AX8820s are connected to a group via the grounding hangers [1]. These are mechanically locked to the right-hand grounding bolt of the individual devices and attached to the left-hand grounding bolt of the adjacent regenerative unit, where they are mechanically locked by the nuts and serrations.



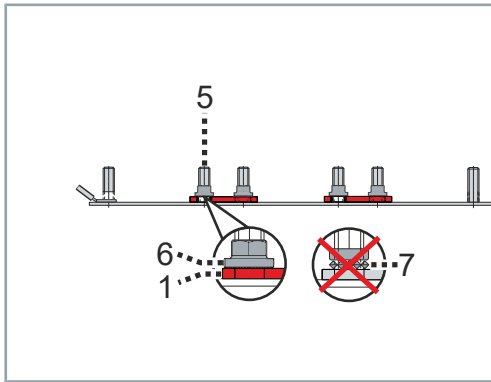
- ▶ Push the grounding hanger [1] onto the grounding bolt [2] of the right-hand regenerative unit
- ▶ Make sure that the opening in the grounding hanger [1] is facing upwards



- ▶ Screw the nut [3] on the grounding bolt [2] onto the grounding hanger [1]
- ▶ Do not use a spring washer [4]

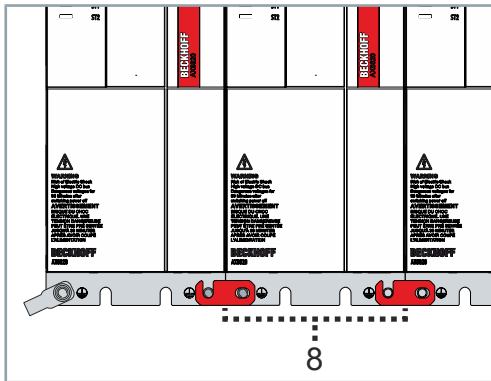


- ▶ Turn the grounding hanger [1] onto the right-hand grounding bolt [5] of the left-hand AX8820



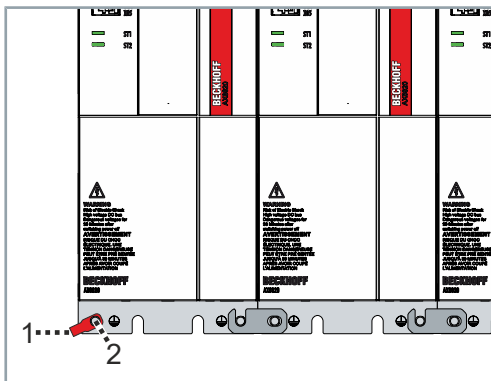
- ▶ Screw the nut [6] on the grounding bolt [5] onto the grounding hanger [1]
- ▶ Do not use a spring washer [7]
- ▶ Tighten both nuts firmly
- ▶ Observe tightening torques:

Components	Tightening torque [Nm]
Serrated hexagonal nut M5, strength class A2-50	2.7



- ▶ Mount further grounding hangers [8]

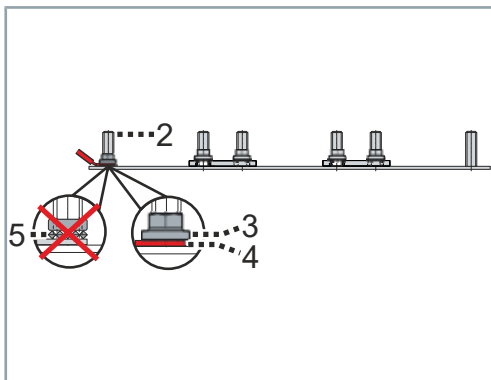
9.2.2 Protective earth



The protective earth is established via the left-hand grounding bolt on the regenerative unit and the mounting plate on the control cabinet. The connection is made via a cable with a ring-shaped cable lug [1]. Use a cable with a cross-section of at least 10 mm² for a protective conductor.

Optionally, an additional protective earth can be attached via the right-hand grounding bolt of the last regenerative unit.

- ▶ Make up a cable with a ring-shaped cable lug and a cross-section of at least 10 mm²
- ▶ Plug the cable with the cable lug [1] onto the left-hand grounding bolt [2] of the first module in the group

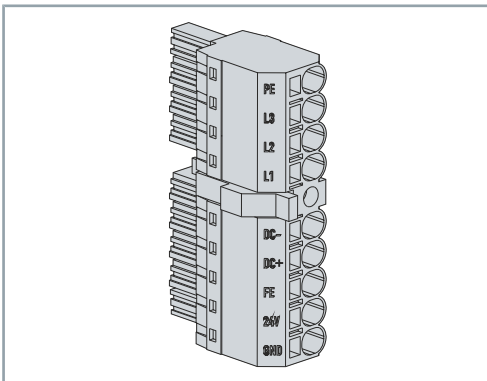


- ▶ Place nut [3] on the grounding bolt [2] on top of the cable lug [4] and screw it tight
- ▶ Do not use a spring washer [5]
- ▶ Observe tightening torques:

Components	Tightening torque [Nm]
Serrated hexagonal nut M5, strength class A2-50	2.7

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

9.3 Voltage input



- X01 slot for the AX8820 universal regenerative unit

Terminal point	Connection
PE	Protective conductor
L3	Phase L3
L2	Phase L2
L1	Phase L1
DC -	DC link -
DC +	DC link +
FE	Functional Earth
24 V DC	18...30 V DC
GND	GND
Wire cross-section	
Maximum 6 mm ² AWG 8	
Mounting	
PUSH-IN connection Solid cores and cores with ferrules simply have to be plugged in and are securely connected	



24 V DC supply voltage connection

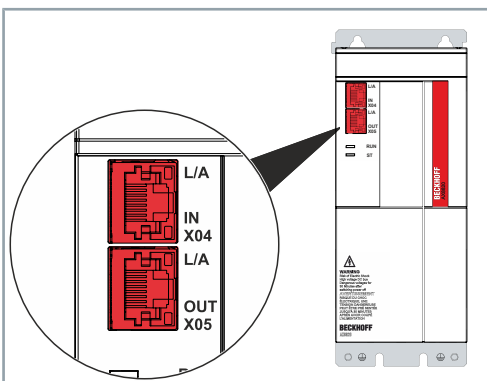
Wire the AX8820 universal regenerative unit in accordance with standard EN 60204-1:2006 Protective Extra Low Voltage; PELV:

- The PE and 0 V conductors of the 24 V voltage source must be on the same potential and connected in the control cabinet
- Standard EN 60204-1:2006, section 6.4.1:b stipulates that one side of the circuit, or a point of the energy source for this circuit must be connected to the protective conductor system

9.4 Fieldbus system

In the AX8820 universal regenerative unit, the real-time Ethernet EtherCAT fieldbus is available.

9.4.1 EtherCAT



- X04 slot and X05 slot for AX8820 universal regenerative units

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

9.5 Fuse protection

NOTICE

Damage due to improper dimensioning

The universal regenerative unit is equipped with integrated self-protection. The recommended fuses are used for line protection. The system may be damaged if this is ignored.

- Adhere to the dimensioning according to the prescribed data for operation and environment

9.5.1 Mains fuse

- Valid for all fuses marked with ** in the chapter "Block diagrams", [Page 31]

Fuses	Tested circuit breakers	Protection rating	Protection Interrupt Rating
IEC fuse Tripping characteristic "C"		500 V / max. 40 A	500 V / 120 kA
UL: Class J fuse		600 V / max. 40 A	600 V / 300 kA
UL listed circuit breaker	Siemens 3VA5140-6ED31-0AA0	480 V / 40 A	480 V / 65 kA

9.5.2 DC link fuse

⚠ WARNING

Safety risks due to the use of untested fuses

The use of untested fuses in the DC link can lead to malfunctions and safety risks.

- Only use the fuses approved by the manufacturer

- Valid for all fuses marked with * in the chapter "Block diagrams", [Page 31]

Connection scenario	DC link fuse
AX8820 with AX85x0	<ul style="list-style-type: none"> • Bussmann DWP-80A22F • Bussmann DWP-50A22F • Mersen DCT30-2
AX8820 with AX51xx/AX52xx	
AX8820 with AX51xx/AX52xx UL	
AX8820 with an AX51xx	
AX8820 with DC link connection AX51xx	
AX8820 system extension	

9.6 Supply networks

The AX8820 distributed servo drive system is suitable for operation three-phase networks. The respective network configurations differ by 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

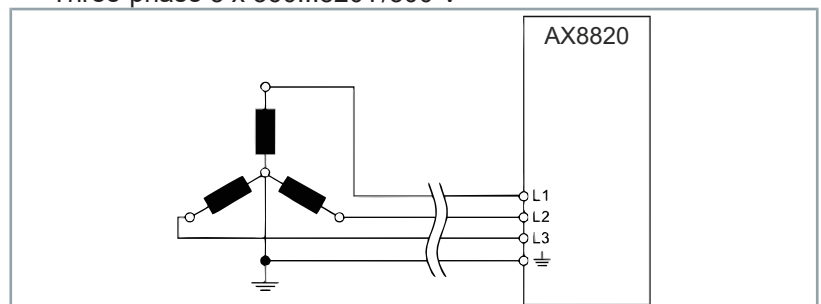
Connection to TN or TT networks is possible without further measures.

For all other networks, operation is only possible on isolating transformers. An isolating transformer is a mains transformer that transfers the mains voltage to the secondary winding via an electrical isolation. A star point grounded network is made available with the help of this protective isolation.

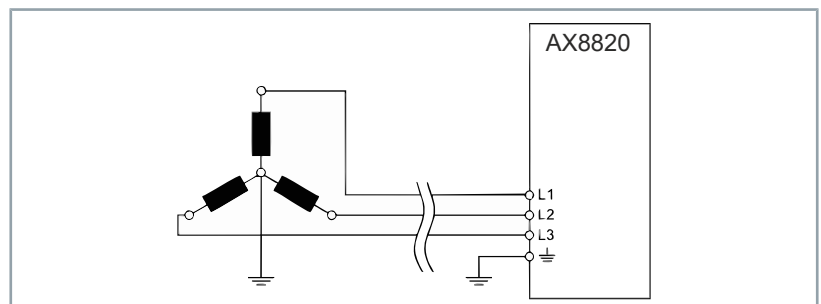
The AX8820 universal regenerative unit is equipped with a wide-range voltage input and can be connected to the following voltage systems:

- Three-phase 3 x 360...520Y/300 V

TN network



TT network



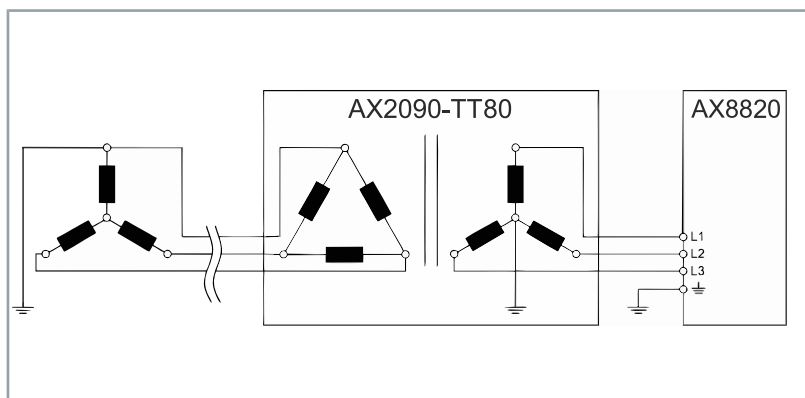
NOTICE

Damage due to disconnected isolating transformer

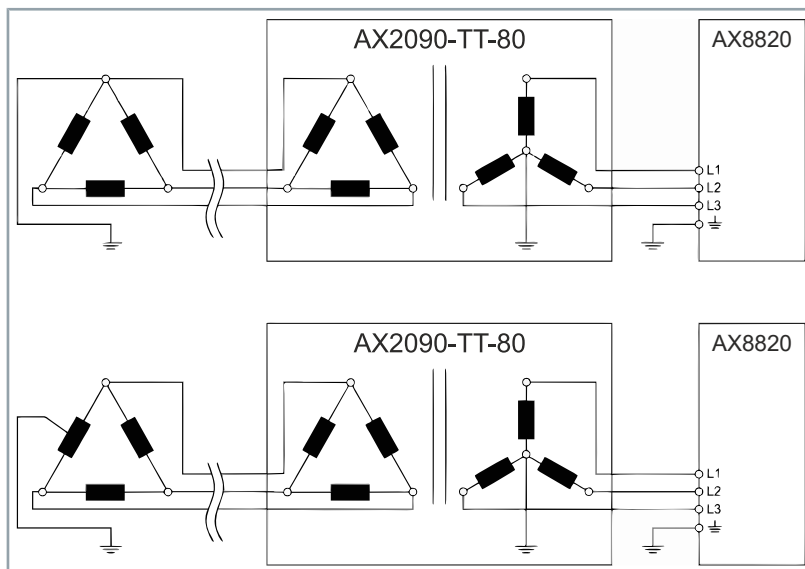
The following networks require an isolating transformer to be connected upstream. Failure to do so may damage the universal regenerative unit.

- Connection only with upstream isolating transformer
- The converter and the universal regenerative unit must be connected to the isolating transformer. The converter must also be connected to the universal regenerative unit

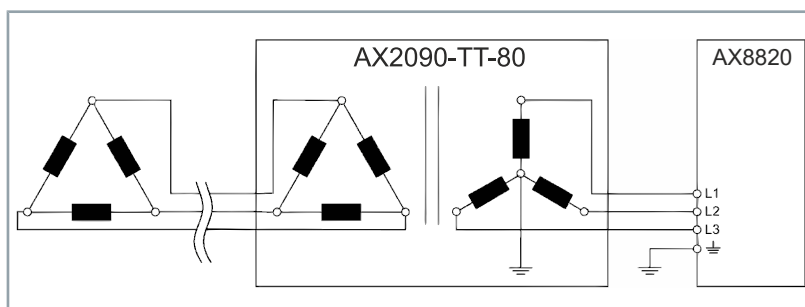
Asymmetrically grounded network with star point



Asymmetrically grounded delta network



IT delta network



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 mounting and alignment
- 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 During commissioning

Pay attention to the following points during commissioning:

- Check function and adjustment of attachments
- Observe information for environment and operation
- Check protective measures against moving and live parts

10.2.1 Commissioning the AX8820

The AX8820 universal regenerative unit can be integrated into both an AX5000 system and an AX8000 system. It cannot be integrated into several DC links.

Like other Beckhoff products, it is configured in the TwinCAT 3 XAE development environment and requires an EtherCAT connection. The AX8820 is fully functional if the EtherCAT connection is interrupted. The parameter settings are also saved in the EEPROM of the AX8820 by activating a configuration.

The AX8820 can also be operated as a stand-alone device with the default settings without further configuration.

Default settings

Address	Parameter Name	Value
0x2C2E	PSM Backup parameters	
0x2C2E:00	SubIndex 000	10
0x2C2E:01	Mains type	AC 3 phases (0)
0x2C2E:03	Mains voltage	400 V
0x2C2E:04	Mains voltage max tolerance	10 %
0x2C2E:05	Mains voltage min tolerance	10 %
0x2C2E:06	DC link max voltage	848 V
0x2C2E:07	Device temperature warning threshold	90 %
0x2C2E:08	Voltage threshold switch on	750 V
0x2C2E:09	Voltage threshold max power	800 V
0x2C2E:0A	Power derating	0 %

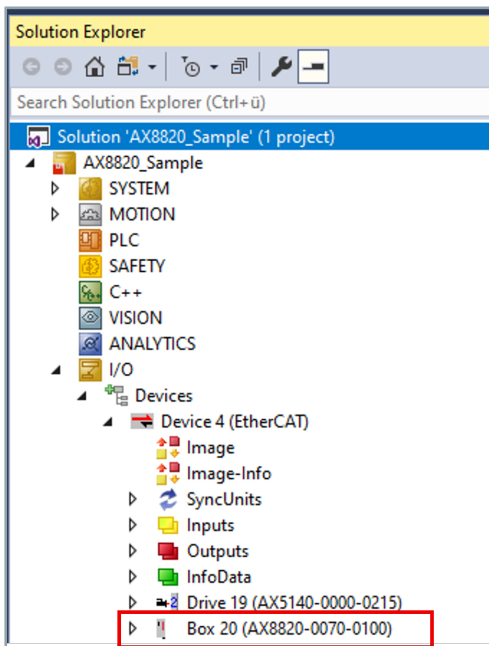
The default settings can be found in the *PSM Backup parameters* object and are stored in the device's EEPROM. They are used in stand-alone operation. These parameters can only be changed in PreOp mode.

Configuration in TwinCAT

The following instructions describe the configuration in TwinCAT for commissioning the AX8820 with an AX5000. Proceed as follows:

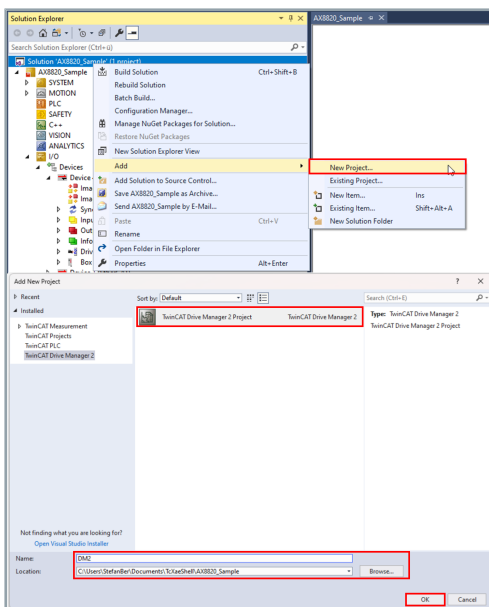
- ▶ Establish an EtherCAT connection to the AX8820
- ▶ Create a project in the Solution Explorer or open an existing project

Commissioning



A scan automatically finds the AX8820 when EtherCAT communication is established and adds it to the project. Alternatively, you can add the AX8820 manually when EtherCAT communication is established.

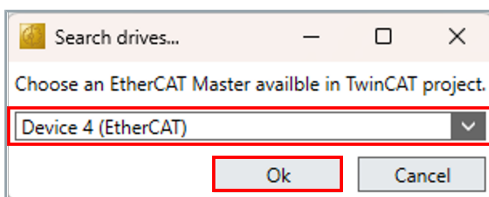
- ▶ Perform a scan
- or
- ▶ Manually add the AX8820 to the I/O configuration



A TwinCAT Drive Manager 2 project is required for further configuration of the AX8820.

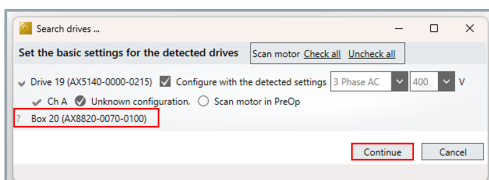
- ▶ Add a TwinCAT Drive Manager 2 project to the TwinCAT Solution

Quick initial configuration



The *Search drives...* window opens automatically and starts a dialog for a quick initial configuration of the drive components.

- ▶ In the drop-down menu, select the EtherCAT master to which the AX8820 is connected
- ▶ Click **Ok**



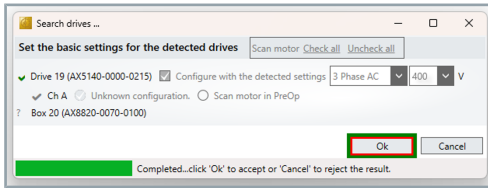
The drive components connected to the EtherCAT segment are listed.

- ▶ In the *Search drives...* dialog box, select the *Scan motor in PreOP* checkbox to automatically scan connected motors with an electronic nameplate.
- ▶ Confirm the *Search drives...* dialog box with the **Continue** button to execute the scan

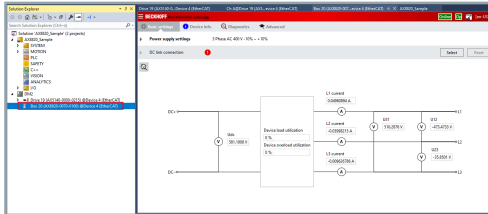


Scan of the connected motors

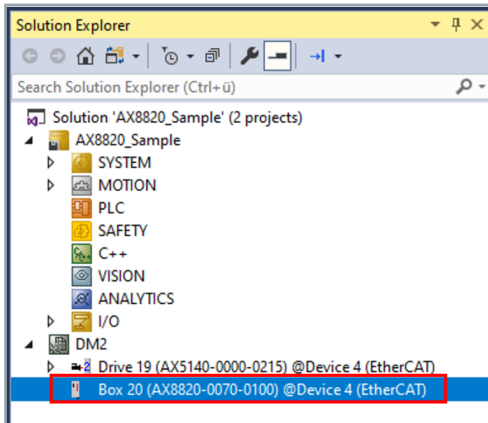
If servo drives are found, the electronic nameplate of the connected motors can be scanned. The read motor parameters are automatically transferred to the configuration. The scanned motors are displayed in green.



- In the *Search drives...* dialog box, confirm the transfer of the drive components found to the TwinCAT Drive Manager 2 project with **Ok**

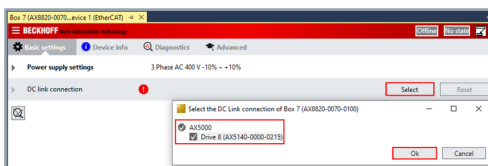


The view jumps back to the TwinCAT Solution.



After the scan, all drive components found are listed under the TwinCAT Drive Manager 2 project node.

- Double-click on the AX8820 in the list to display the *Basic settings* tab



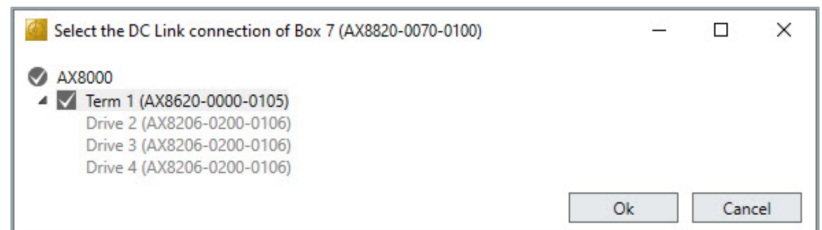
The standard view of the AX8820 universal regenerative unit is the *Basic settings* tab, which is used for further configuration.

- Click the **Select** button in the *DC link connection* section to specify the DC link connection
- In the *Select the DC Link connection of Box ...* dialog box, select the corresponding DC link connection to the connected servo drive
- Click **Ok**.



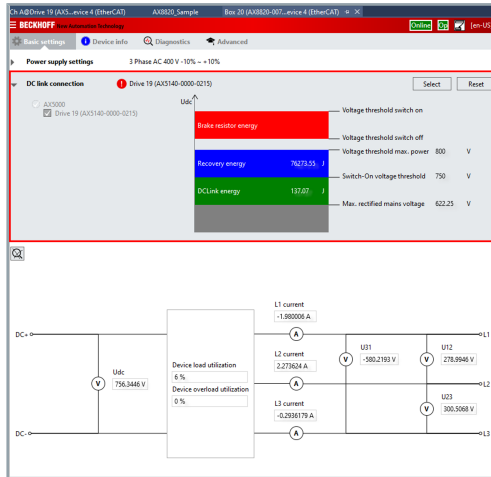
DC link connection to another system

It is possible to select an DC link connection to an AX8000 system, provided the system is in the same EtherCAT network. However, only one connection to an AX5000 or AX8000 can be established.



Commissioning

Graphical illustration



After selecting the Basic Settings, the DC link connection to the selected device and the energy management are displayed graphically in the section:

- The switch-on thresholds and switch-off thresholds are displayed
- The energy stored in the DC link is displayed in the *DCLink energy* area (green)
- If the AX8820 feeds energy back into the mains, the corresponding value is displayed in the *Recovery energy* area (blue)

Advanced Settings

Index	Name	Actual value	Set value	Export all
0x2C23	PSM Actual current	114	114	Copy to clipboard
0x2C24	PSM Actual data			Copy to clipboard
0x2C25	PSM Actual diagnostics			Add to switch
0x2C27	PSM Standard parameters			Add to startup
0x2C28	PSM Advanced parameters			Export list
0x2C29	PSM Calculated parameters			
0x2C2A	PSM Device info			
0x2C2B	Rated output power	3.590 W	7.000 W	
0x2C2C	Peak output power	1.131 W	10.000 W	
0x2C2D	DC link max. voltage	848 V	848 V	
0x2C2E	Device max. temperature	81 °C	93 °C	
0x2C2F	Operating time	1.510 s	1 s	
0x2C30	Total recovery energy	0 J	1 J	
0x2C31	Stopwatch task time	4.858-06 s	1 s	
0x2C32	Stopwatch task	3.386-06 s	1 s	
0x2C33	Stopwatch cycle	3.968-05 s	1 s	
0x2C38	PSM Error handling			
0x2C39	PSM Factory settings			
0x2C3D	PSM HW id			
0x2C41	PSM Serial parameters			
0x2C40	Subindex 05	10	10	
0x2C35	Main type	AC(3) phase (B)	AC(3) phase (B)	
0x2C36	Main voltage	400 V	400 V	
0x2C34	Main voltage min. tolerance	10 %	10 %	
0x2C37	Main voltage max. tolerance	10 %	10 %	
0x2C3E	DC link max. voltage	848 V	848 V	
0x2C2D	Device temperature warning threshold	80 %	80 %	
0x2C38	Voltage threshold switch on	750 V	750 V	
0x2C39	Voltage threshold max. power	800 V	800 V	
0x2C3A	Power derating	50 %	50 %	
0x2C31	PSM Command parameters			
0x2C30	Modular Device Profile			
0x2C32	Coil used	0	0	

Further settings can be made in four sections in the *Advanced* tab.

The *Parameter list* section is used to set advanced parameters such as the switch-on thresholds, the power factor and the compensation mode.

- ▶ Setting the advanced parameters if necessary

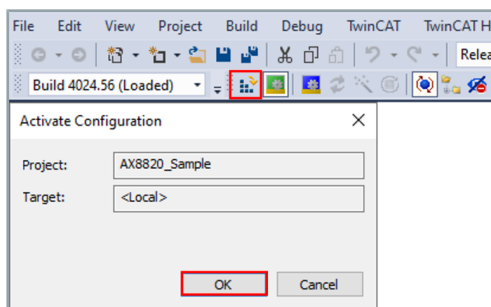
Additional process data

Parameter list	Device commands
<input type="checkbox"/> Stationward (0x2C30); UNVT; 16b4 <input type="checkbox"/> Actual mains voltage (0x2C21); REAL; 32b4 <input type="checkbox"/> Actual mains L1-L2 voltage (0x2C22); REAL; 32b4 <input type="checkbox"/> Actual mains L2-L3 voltage (0x2C23); REAL; 32b4 <input type="checkbox"/> Actual mains L3-L1 voltage (0x2C24); REAL; 32b4 <input checked="" type="checkbox"/> Actual DC link voltage (0x2C25); REAL; 32b4 <input type="checkbox"/> Actual mains L1 current (0x2C26); REAL; 32b4 <input type="checkbox"/> Actual mains L2 current (0x2C27); REAL; 32b4 <input type="checkbox"/> Actual mains L3 current (0x2C28); REAL; 32b4 <input type="checkbox"/> Actual mains rms current (0x2C29); REAL; 32b4 <input type="checkbox"/> Actual active current (0x2C2A); REAL; 32b4 <input checked="" type="checkbox"/> Actual reactive current (0x2C2B); REAL; 32b4 <input type="checkbox"/> Actual mains supply frequency (0x2C2C); BYTE; 8b4 <input type="checkbox"/> Actual mains supply type (0x2C2D); BYTE; 8b4 <input type="checkbox"/> Actual active power (0x2C2E); UNVT; 16b4 <input checked="" type="checkbox"/> Actual reactive power (0x2C2F); UNVT; 16b4 <input type="checkbox"/> Actual device load utilization (0x2C33); UNVT; 16b4	

The current performance data of the AX8820 can be recorded for diagnostic purposes, e.g. with the TwinCAT Scope View, or analyzed in the PLC. The corresponding process data to be provided for this purpose is selected in the *Process data* section.

- ▶ Select the process data to be displayed via the checkbox

Activation of the configuration



The selected settings take effect when the configuration is activated. The parameter settings are also saved in the EEPROM of the AX8820 by activating the configuration. The AX8820 is fully functional if the EtherCAT connection is interrupted.

- ▶ Activating the configuration

10.3 Prerequisites during operation

Pay attention to the following points during operation:

- Atypical noise development
- Unusual smoke development
- Always check cables for dirt or dust
- Check temperature development
- Observe recommended maintenance intervals
- Check function of safety devices

11 Maintenance and cleaning

⚠ WARNING

Serious injuries due to cleaning during operation

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

- For cleaning work, bring the connected regenerative unit and the machine into a safe state

NOTICE

Damage due to moisture ingress

Cleaning by immersion destroys the universal regenerative unit. Impermissible solutions will damage the regenerative unit and surfaces.

- Do not immerse or spray universal regenerative unit
- Only clean the universal regenerative unit carefully with a cloth

The components of the AX8820 universal regenerative unit 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 AX8820 universal regenerative unit has an IP20 protection rating and may only be installed and operated in accordance with the "specifications for operation and environment", [Page 20].

Operation beyond the permissible environmental conditions and operating states will shorten the service life of the components of the AX8820 universal regenerative unit.

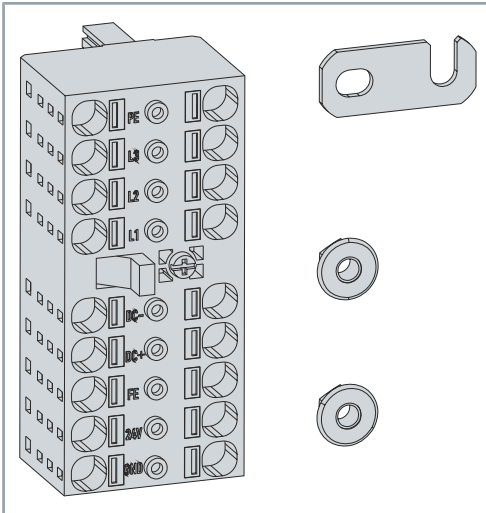
12 Accessories



Use accessories with UL approval

Accessories with UL approval are also required for the operation of the AX8820 in the USA or Canada.

12.1 Set for parallel connection of AX8820 universal regenerative units



- Double-row mating connector
- Grounding hanger
- Two hexagonal nuts similar to DIN 6923 with flange and serrations class 8 with the galvanized surface

13 Decommissioning

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

Refer to chapter Documentation notes.

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 proper 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 for further information.

Removing the universal regenerative unit from the machine

- Remove cables and electrical connections
- Loosen and remove the fastening screws of the universal regenerative unit

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 device 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"

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"

14.2 Guidelines

2014/35/EU

Low Voltage Directive

2011/65/EU

RoHS Directive

2014/30/EU

EMC Directive

2006/42/EC

Machinery Directive

14.3 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.

14.4 Notified bodies

CE The regenerative unit AX8820 product does not fall within the scope of the Machinery Directive. However, Beckhoff products are designed and evaluated for personal safety and use in a machine or system in full compliance with all relevant regulations.

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