

Assembly instructions | EN

AX2090-BW65

External IP 65 braking resistors



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Disclaimer

Beckhoff products are subject to continuous further development. We reserve the right to revise the operating instructions at any time and without prior announcement. 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 these operating instructions.

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- EP1789857
- EP1456722
- EP2137893
- DE102015105702



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Limitation of liability

All components in this product as described in the operating instructions are delivered in a specific configuration of hardware and software, depending on the application regulations. 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:

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- Improper use
- Use of untrained personnel
- Use of unauthorized spare parts

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Version numbers



Provision of revision levels

On request, you can obtain a list of revision levels for changes in the operating instructions.

Send your request to: info@beckhoff.de

Origin of the document

These operating instructions were originally written in German. All other languages are derived from the German original.

Product properties

Only the product properties specified in the current operating instructions are valid. Further information given on the product pages of the Beckhoff homepage, in emails or in other publications is not authoritative.

Staff qualification

These operating instructions are intended for trained control and automation specialists with 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 operating instructions published at the respective time of each installation and commissioning is to be used. 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 manufacturer 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

Safety and instruction

Read the contents that refer to the activities you have to perform with the product. Always read the chapter For your safety in the operating instructions. Observe the warnings in the chapters so that you can handle and work with the product as intended and safely.

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 parentheses indicate cross-references to other text passages in the document
- [+] The plus sign in square brackets indicates ordering options and accessories

Pictograms

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

DANGER

Failure to observe will result in serious or fatal injuries.

WARNING

Failure to observe may result in serious or fatal injuries.

CAUTION

Failure to observe may result in minor or moderate injuries.



Notes

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

- Malfunctions of the product
- Damage to the product
- Damage to the environment



Information

This sign indicates information, tips and notes for dealing with the product or the software.



Examples

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



QR codes

This sign depicts a QR code, via which you can view videos, animations or other documents. Internet access is required in order to use it.

You can read the QR code, for example, with the camera of your Smartphone or Tablet PC. If your camera doesn't support this function you can download a free QR code reader app for your Smartphone. Use the Appstore for Apple operating systems or the Google Play Store for Android operating systems.

If you cannot read the QR code on paper, make sure that the lighting is adequate and reduce the distance between the reading device and the paper. In the case of documentation on a monitor screen, use the zoom function to enlarge the QR code and reduce the distance.

Beckhoff Services

Beckhoff and the worldwide partner companies offer comprehensive support and service.

Support

The Beckhoff Support offers technical advice on the use of individual Beckhoff products and system planning. The employees support you in the programming and commissioning of complex automation systems.

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E-mail: support@beckhoff.com
Web: www.beckhoff.de/support

Training

Training in Germany takes place in our training center at the Beckhoff headquarters in Verl, at branch offices or, by arrangement, at the customer's premises.

Hotline: +49(0)5246/963-5000
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E-mail: training@beckhoff.com
Web: www.beckhoff.de/training

Service

The Beckhoff Service Center supports you with after-sales services such as on-site service, repair service or spare parts service.

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E-mail: service@beckhoff.com
Web: www.beckhoff.de/service

Download area

In the download area you can obtain product information, software updates, the TwinCAT automation software, documentation and much more.

Web: www.beckhoff.de/download

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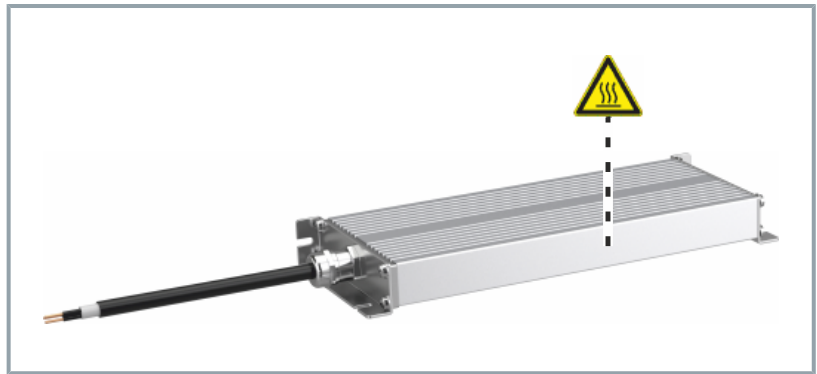
The addresses of the international Beckhoff branch offices can be found on the Beckhoff website: <http://www.beckhoff.de>

Read this chapter containing general safety information. The chapters in these operating instructions also 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.

Safety pictograms

Beckhoff products feature safety pictograms, either on stickers or printed, which vary depending on the product. They serve to protect people and to prevent damage to the products. Safety pictograms must not be removed and must be legible for the user.



Warning of hot surface

The surface of the housing can reach a temperature of 200 °C. Do not touch the hot surface. The housing must have cooled to below 40 °C before you touch the surface.

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.

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.

Shut down and secure the machine or plant

Shut down the machine or plant. Secure the machine or plant against being inadvertently started up.

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".

Keep the immediate environment clean

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

Check safety pictograms

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

Observe tightening torques

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

Use the original packaging only

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

During operation

Observe the discharge times of the capacitors

Observe the following delay times after disconnecting from the mains supply:

AX8620 and AX8640	30 minutes
AX8108, AX8118 and AX8206	30 minutes
AMP8620-2005-0x00	30 minutes
AMP8805-1000-0000	30 minutes
AX8831	30 minutes
AX8832	30 minutes
AX5101 to AX5125 and AX520x	5 minutes
AX5140, AX5160 and AX5172	15 minutes
AX5190 and AX5191	30 minutes
AX5192 and AX5193	45 minutes

Do not work on live electrical parts

Do not open the multi-axis servo system while it is live. Measure the voltage on the DC link test contacts DC+ und DC-. Only work on the multi-axis servo system when the voltage has dropped to < 50 V. Ensure that the protective conductor is connected properly. Never loosen electrical connections when live. Disconnect all components from the mains and secure them against being switched on again.

Do not touch hot surfaces

Check the cooling 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.

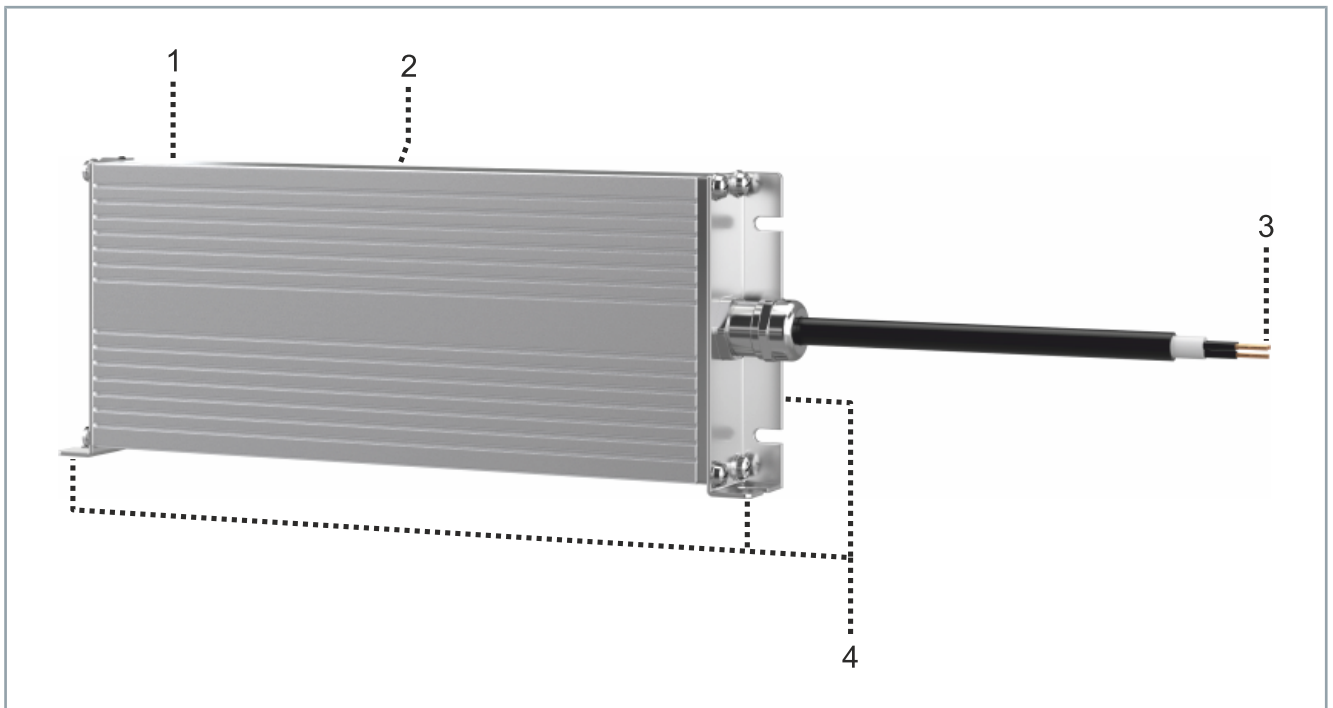
Avoid overheating

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

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. See chapter: "Decommissioning"



Number	Explanation
1	Housing
2	Name plate
3	Electrical connection
4	Fastening to the mounting surface

Name plate



Number	Explanation
1	Article description
2	Product type
3	Order number
4	Date of manufacture
5	Internal ID
6	Technical data: Resistance value, power rating, voltage
7	Protection class
8	Not relevant
9	Country of manufacture
10	CE approval
11	UR certification
12	E-number
13	Data-Matrix Code

Type key

AX2090 – BW65 – xxyy	Explanation
AX2090	Product area Drive Technology Accessories
BW	Brake energy management Brake resistor
65	Series IP65; all devices in the AMP8000, AX8000 and AX5000 series
xx	Power 04 = 400 W 15 = 1500 W
yy	Resistance 18 = 18 Ω 23 = 23 Ω 33 = 33 Ω 47 = 47 Ω Accessories 00 = protection from contact with hot surface

Product characteristics

External brake resistor

An optional external braking resistor can be connected to dissipate any braking energy that is generated. An external braking resistor is always required in cases where the braking resistor that is installed internally is insufficient.

Protection class IP65

The high protection class and corresponding complete contact protection means that the braking resistors are designed for protection from dust, dirt and moisture caused by water jets when mounted outside the control cabinet.

UL and CSA marking

The braking resistors of the AX2090-BW65-xxxx series are labeled as "UL Recognized Component" in accordance with the applicable safety requirements of UL and CSA and bear the test number E-217179. You may therefore use the brake resistors in products, plants or systems bearing the UL test mark.

Heat conversion

Regenerative energy is converted into heat via the external brake resistors from the AX2090-BW65 series when braking a servomotor.

Intended use

The braking resistors of the AX2090-BW65-xxxx series may only be operated at the connections provided for them on the AX8000 multi-axis servo system, the AMP8000 distributed servo drive system or the AX5000 servo drives.

Together with the Beckhoff products mentioned above, the braking resistors are to be installed in electrical systems or machines and are only to be commissioned as integrated components of the system or machine.



Read the entire drive system documentation:

- This translation of the original instructions
- Original operating instructions for the AX8000 multi-axis servo system or
- Original operating instructions for the distributed servo drive system AMP8000 or
- Original operating instructions for the AX5000 servo drive
- Complete machine documentation provided by the machine manufacturer

Improper use

Any use exceeding the permissible values specified in the Technical data is considered improper and therefore prohibited.

The brake resistors from the AX2090-BW65-xxxx series are 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. The brake resistors may only be installed in housings and control cabinets with appropriate shielding attenuation.

Data for operation and environment

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.



Operate the brake resistor only under the specified environmental conditions

Operate the brake resistor only in accordance with the specifications for operation and the environment listed in this chapter. This ensures a long service life and proper operation.

The lifetime of the brake resistor may be shortened at temperatures above +40 °C and with encapsulated installation.

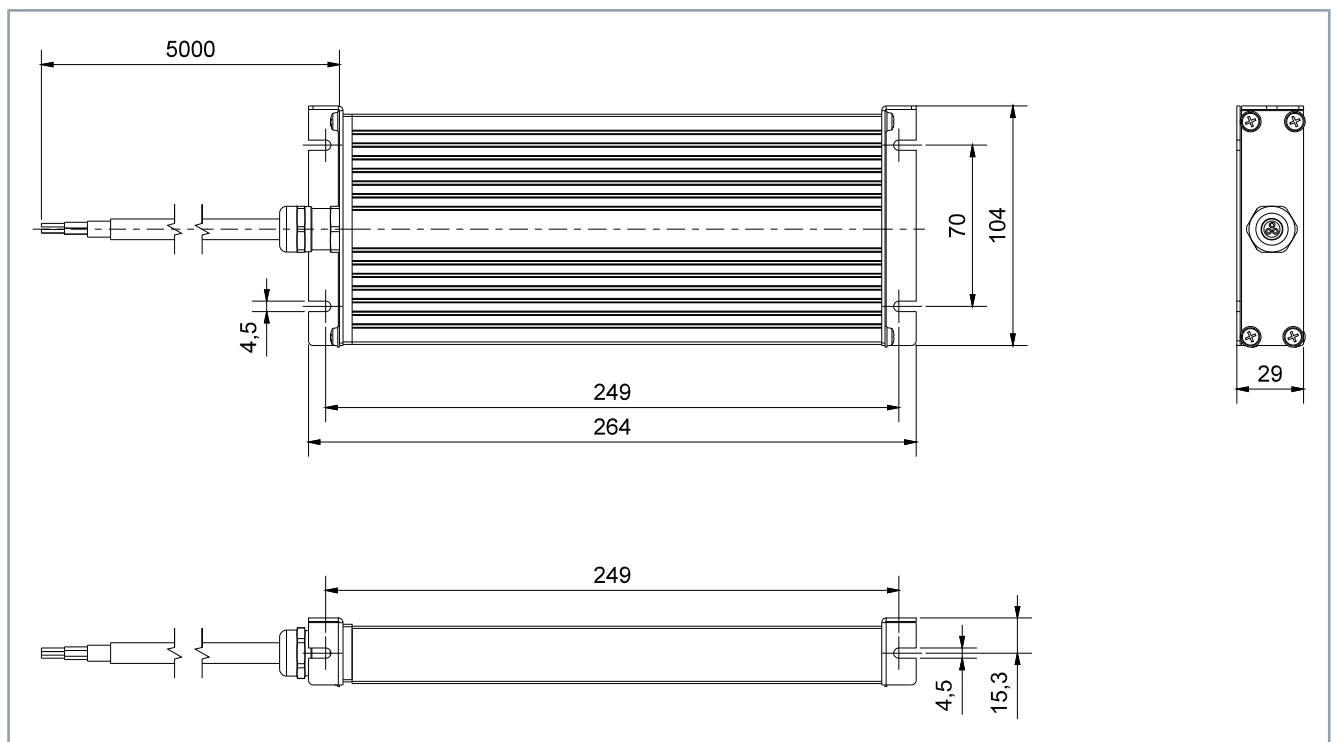
Environmental requirements	
Climate category - operation	3K3 according to EN 60721
Ambient temperature during operation	-15 °C to + 70 °C Above 40 °C the continuous output must be reduced by 5% per 10K
Ambient temperature during transport	-15 °C to +70 °C, maximum fluctuation 20 K/hour
Ambient temperature during storage	-15 °C to +70 °C, maximum fluctuation 20 K/hour
Power derating	No power derating up to 1000 m above sea level Power derating from 1000 m above sea level up to a maximum of 4000 m 5 % per 1000 m
Permissible humidity in operation	5 % to 85 % relative humidity, no condensation
Permissible humidity during transport and storage	5 % to 85 % relative humidity, no condensation
Corrosion protection	Strip-galvanized housing 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.
Degree of pollution	According to EN 50124 Exterior: PD4 Interior: PD2
Specifications for intended use	
Ventilation	Free convection
Insulation material class	N according to IEC 60085
Protection class	Devices IP 65
Installation position	Vertical or horizontal according to chapter "Installation position", [Page 26]
Vibration resistance	Category 1 Class B according to DIN EN 61373
Shock resistance	Category 1 Class B according to DIN EN 61373
Approvals	cURus See chapter: Guidelines and Standards

AX2090-BW65-04xx

Electrical data	AX2090-BW65-04xx			
	18	23	33	47
Type power at 40 °C [W] 4 % power derating per 10 K temperature difference	400	400	400	400
Resistance [Ω]	18	23	33	47

Mechanical data	AX2090-BW65-04xx			
Weight [kg]	2.2	2.2	2.2	2.2

Dimensional drawing

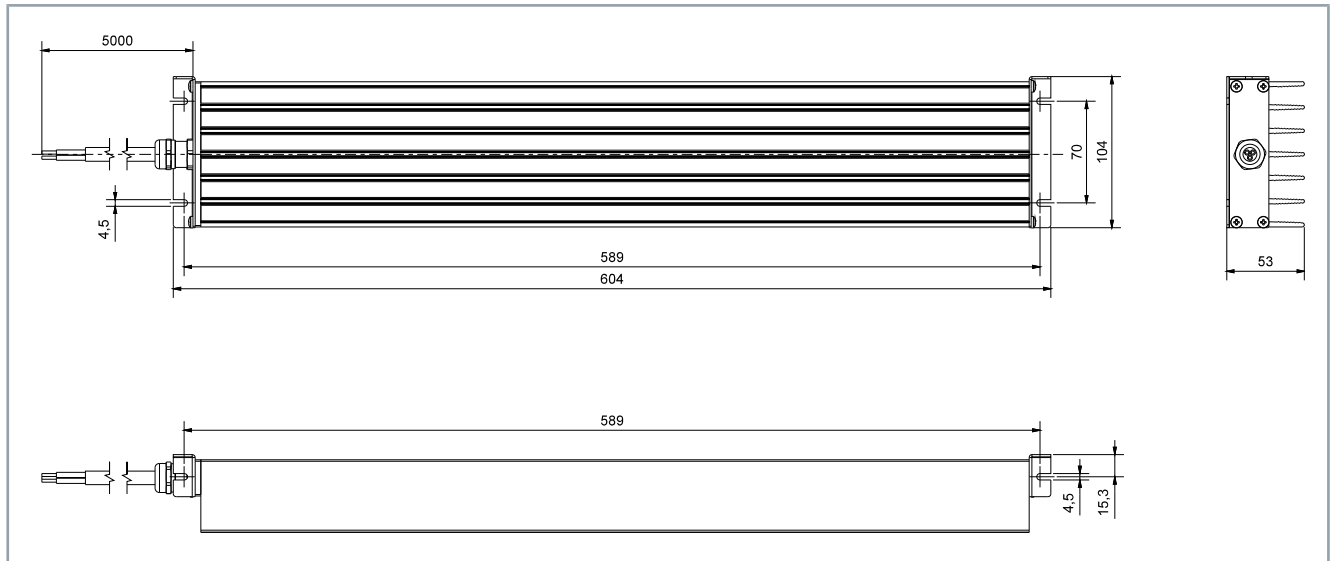


AX2090-BW65-15xx

Electrical data	AX2090-BW65-15xx			
	18	23	33	47
Type power at 40 °C [W] 4 % power derating per 10 K temperature difference	1500	1500	1500	1500
Resistance [Ω]	18	23	33	47

Mechanical data	AX2090-BW65-15xx			
Weight [kg]	4.8	4.8	4.8	4.8

Dimensional drawing



**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.

Please check that the delivery includes the following items:

- Braking resistor AX2090-BW65

⚠ WARNING

Protecting the brake resistor against damage

Protect the brake resistor against damage during transport and storage and adhere to the conditions.

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



Avoiding damage to the brake resistor and loss of the warranty

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

Disregarding the conditions can lead to damage to the brake resistor and invalidation of the warranty.

Avoid short-circuit due to moisture

Condensed water can form during transport in cold weather or in case of extreme temperature differences. Make sure that no moisture collects in the brake resistor. Slowly adjust the temperature to room temperature. Switch the brake resistor on only when it is dry.

If the brake resistor is not fully dry, condensed water can lead to a short-circuit and damage to the brake resistor when switching on.

Conditions

Care must be taken that the brake resistor and individual components are not damaged during transport and storage. Observe the specifications in the following chapters and comply with the following conditions:

- Avoid electrostatic charging
- Avoid contact with highly insulating materials
- Temperature: -15 °C to +70 °C, maximum fluctuation 20 K/hour
- Air humidity: Max. relative humidity 85 %, non-condensing
- Use of suitable means of transport
- Use of the vendor's original packaging

The table shows the maximum stacking height in which you may store and transport the brake resistors in their original packaging on a pallet:

Brake resistor type	Stacking height [pieces]
AX2090-BW65-04xx	8
AX2090-BW65-16xx	5

Transport



Avoid high mechanical stresses

Use a suitable means of transport and secure the brake resistor against high mechanical stress.

High mechanical stresses will damage the brake resistor and individual components.

All brake resistor models from the AX2090-BW65-xxxx series can be transported without any aids.

Long-term storage



Observe the maximum storage time

Do not exceed a maximum storage time of five years.

Exceeding the specified maximum storage time can lead to a change in the properties of the brake resistor used and may damage it in operation.

You have the option to store the brake resistor over a short or longer period. 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.

Installation position

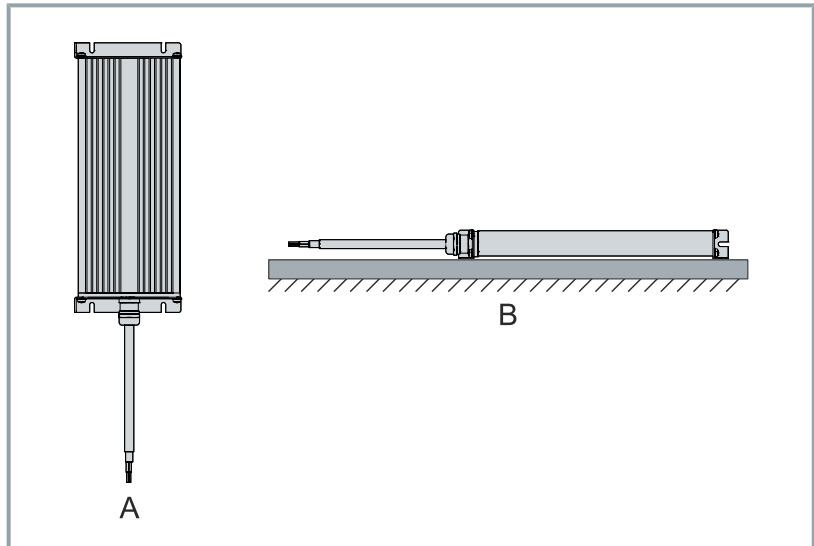
The approved installation position of the braking resistors is vertical (A) or horizontal (B). In the vertical installation position the electrical connection must point downwards.



Pay attention to the installation position

Due to heat generation the vertical installation position (A) is only permitted if the electrical connection points downwards.

Failure to comply may result in damage to the connecting cable and malfunctions.



Distances

You must maintain minimum distances, depending on the installation position.

In all installation positions:

- 25 mm to adjacent components or walls
- 200 mm upwards to components or roofs

In vertical installation position:

- 100 mm downwards to components or floor

⚠ WARNING

Observe the discharge times of the capacitors

Keep to the waiting times after disconnection from the supply network:

- 30 minutes for AX8620 and AX8640
- 30 minutes for AX8108, AX8118 and AX8206
- 30 minutes for AMP8620-2005-0x00
- 30 minutes for AMP8805-1000-0000
- 30 minutes for AX8831
- 30 minutes for AX8832
- 5 minutes for AX5101 to AX5125 and AX5172
- 15 minutes for AX5140, AX5160 and AX5172
- 30 minutes for AX5190 and AX5191
- 45 minutes for AX5192 and AX5193

There is still a life-threatening voltage of $> 848 V_{DC}$ on the capacitors after disconnection from the supply network. Serious or even fatal injuries may result if this is ignored.

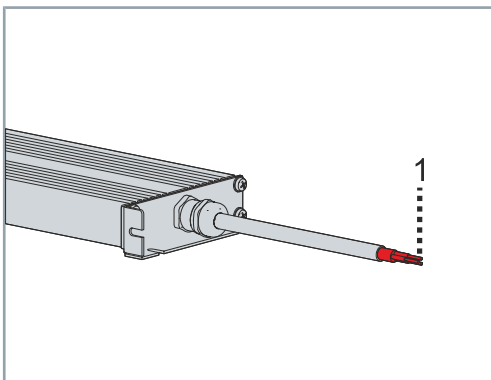


Electromagnetic compatibility

Connect all components and use only shielded cables. Ground the shields of the assembled cables via the mounting plate and place the star point centrally on the unpainted mounting plate.

In the case of larger applications, implement the potential equalization via PE rails.

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



► Electrical connections [1]:

Wire	Connection
Green/yellow	PE
Brown/gray	Brake resistor

Cables

Beckhoff offers pre-assembled cables for faster and flawless installation of the motors. These cables are tested with regard to the material used, shielding and connection type. Perfect functioning and compliance with legal regulations, such as EMC and UL, are guaranteed. The use of other cables can cause unexpected malfunctions and result in exclusion of warranty.

Cross-sections

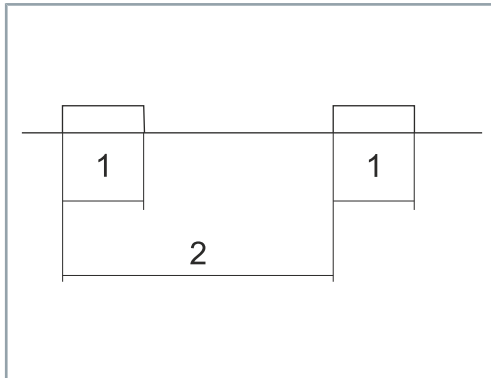
Model	Brake resistor
AX2090-BW65-04xx	3x AWG14
AX2090-BW65-15xx	3x AWG14

Short-term power

Brake resistors are usually not operated continuously, but only exposed to short-time duty. In the following chapter, the short-term power will be calculated from the following factors:

- Continuous power
- Overload factor
- Duty cycle

Duty cycle



Position	Explanation
1	Switch-on time t_{on}
2	Cycle time

The duty cycle is a relative value and depends on the switch-on time t_{on} and the cycle time. A cycle time of up to 120 seconds is incorporated directly into the calculation. If the cycle time exceeds 120 seconds, you must use the maximum relevant cycle time of 120 seconds.

Calculation equation

- Duty cycle = $t_{on} / \text{Cycle time} \times 100 \%$



Example

$T_{on} = 60 \text{ s}$

Cycle time = 120 s

$60 \text{ s} / 120 \text{ s} \times 100 \% = 50 \% \text{ duty cycle}$

$T_{on} = 40 \text{ s}$

Cycle time = 100 s

$40 \text{ s} / 100 \text{ s} \times 100 \% = 40 \% \text{ duty cycle}$

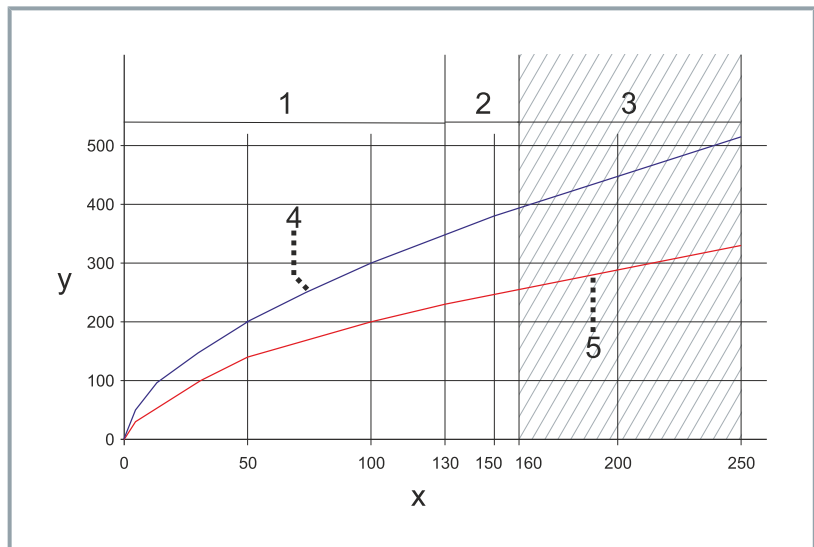
Overtemperature

⚠ WARNING

Do not touch hot surfaces

The housing surface may reach a temperature of over 200 °C. Do not touch the housing surface during operation and allow it to cool down after operation. For additional protection we recommend a "touch guard", [Page 33]. Always make sure that the brake resistor is adequately ventilated.

Failure to comply may result in severe skin burns and/or destruction of the braking resistor or adjacent components.



Position	Explanation
x	Continuous power in % of the type power
y	Overtemperature in K
1	Normal operating range
2	Permitted operating range
3	Inadmissible operating range
4	At resistor element
5	At the housing surface

An application may require a higher continuous power than the specified type power. You can implement this state if a higher temperature of the brake resistor is permissible.

Operating ranges

The following table provides information on the development of overtemperature with continuous power:

Operating range	Explanation
Normal: Maximum 130 %	Recommended operating range for maximum lifetime with error-free operation
Permissible: Maximum 160 %	Still permissible operation with short service life and high failure probability
Impermissible: Over 160%	Risk of destruction of the brake resistor due to overheating and endangerment of the surrounding components due to high temperature

Fuse protection



Line protection requirements

Line protection is implemented electronically internally. It requires activation of the thermal model for the selected resistor, and the correct braking resistor cable must be used.

The system may be damaged if this is ignored.

WARNING

Ensure safe condition for cleaning work

Basically, electronic devices are not fail-safe. The condition is always safe when the unit is switched off and not energized. For cleaning work, place the connected brake resistors and the machine in a safe state.

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

Do not touch hot surfaces

The surface of the housing can reach a temperature of 200 °C. Allow the brake resistor to cool to below 40 °C after switching off.

Ignoring this can lead to burns being sustained.



Do not immerse or hose down the brake resistor

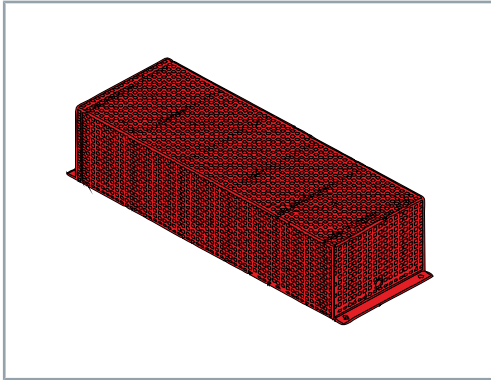
Only wipe the brake resistor with a cloth.

Cleaning by immersion will destroy the brake resistor. Impermissible solutions will damage the brake resistors and surfaces.

Contamination, dust or chips can have a negative effect on the function of the components. In the worst case, contamination can lead to failure. Beckhoff recommends regular cleaning and maintenance of the components in a system at regular and required intervals.

No special maintenance and cleaning measures are usually foreseen for brake resistors from the AX2090-BW65-xxxx series. A brake resistor must be replaced in the event of malfunctions or faults.

Touch protection



The touch guard provides protection from hot surface temperatures on the braking resistors.

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

For more information please 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.

Disassembly

WARNING

Observe the discharge times of the capacitors

Keep to the waiting times after disconnection from the supply network:

- 30 minutes for AX8620 and AX8640
- 30 minutes for AX8108, AX8118 and AX8206
- 30 minutes for AMP8620-2005-0x00
- 30 minutes for AMP8805-1000-0000
- 30 minutes for AX8831
- 30 minutes for AX8832
- 5 minutes for AX5101 to AX5125 and AX5172
- 15 minutes for AX5140, AX5160 and AX5172
- 30 minutes for AX5190 and AX5191
- 45 minutes for AX5192 and AX5193

There is still a life-threatening voltage of $> 848 V_{DC}$ on the capacitors after disconnection from the supply network. Serious or even fatal injuries may result if this is ignored.



Do not remove components from the products

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

Contact Beckhoff Service if you have any questions.

Removing the brake resistor from the machine

- Remove cables and electrical connections
- Loosen and remove the brake resistor fixing screws
- Transport the brake resistor to the workplace or put it into storage

Standards

EN 61000-6-2:2005

"Electromagnetic compatibility (EMC). Generic standards. Immunity for industrial environments"

EN 61000-6-4:2007+A1:2011

"Electromagnetic compatibility (EMC). Generic standards. Emission standard for industrial environments"

Product standard EN 61800-3:2004+A1:2012

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

Product standard EN 61800-5-1:2007+A1:2017

"Adjustable speed electrical power drive systems. Safety requirements"

RoHS: EN 50581:2012

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

IEC / EN 61800-5-2:2017

"Adjustable speed electrical power drive systems - Part 5-2: Safety requirements - Functional"

Guidelines

2014/35/EU

Low Voltage Directive



2011/65/EU

RoHS Directive

2014/30/EU

EMC Directive

Test centers

	<p>The AX2090-BW65-xxxx braking resistor is not covered by the Machinery Directive.</p> <p>However, Beckhoff products are designed and evaluated in full compliance with all relevant regulations for personal safety and use in a machine or system.</p>
	<p>The AX2090-BW65-xxxx braking resistor complies with UL requirements and is certified as cURus component for the US and Canadian markets in accordance with the standards applicable in the USA and Canada.</p> <p>The cURus logo can be found on the name plate.</p>

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

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