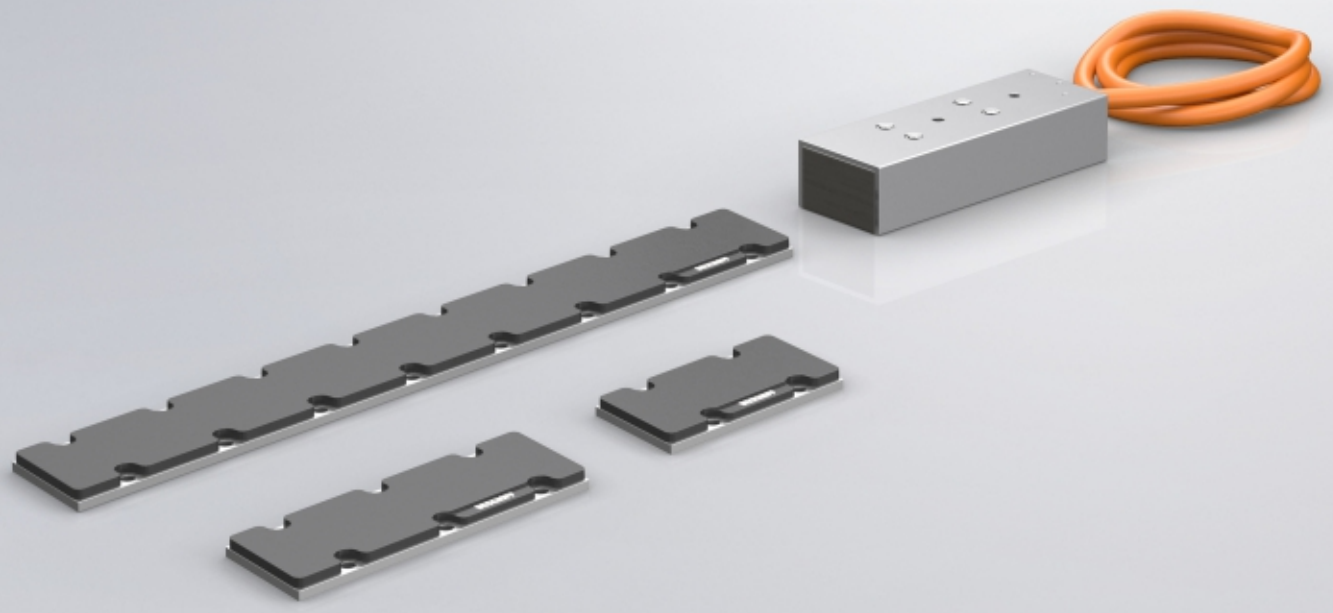
BECKHOFF New Automation Technology

Operating instructions | EN

AL8100

Linear servomotors for compact drive technology



2026-02-02 | Version 1.1.1

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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

Beckhoff®, ATRO® , EtherCAT®, EtherCAT G®, EtherCAT G10®, EtherCAT P®, MX-System®, Safety over EtherCAT®, TC/BSD®, TwinCAT®, TwinCAT/BSD®, TwinSAFE®, XFC®, XPlanar®, and XTS® are registered and licensed trademarks of Beckhoff Automation GmbH.

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.

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

1.1.2 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

1.1.3 Copyright

© Beckhoff Automation GmbH & Co. KG, Germany

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.

1.1.4 Third-party brands

Third-party trademarks and wordmarks are used in this documentation. The corresponding trademark endorsements can be found at

www.beckhoff.com/trademarks

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

Apart from these operating instructions, the following documents are part of the overall documentation:

AL8100	Definition
Short information: Motor	Accompanying document with general instructions for handling the motors. This is included with every 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 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.



Permitted cleaning agents
This symbol indicates the permitted cleaning agents that the components may be cleaned with. The permitted cleaning agents are 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
www.beckhoff.com/en-en/support/our-support-services/

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.

+49 5246 963-5000
training@beckhoff.com
www.beckhoff.com/en-en/support/training-offerings/

1.7.3 Service offerings

The Beckhoff service experts support you worldwide in all areas of after-sales service.

+49 5246 963-460
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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

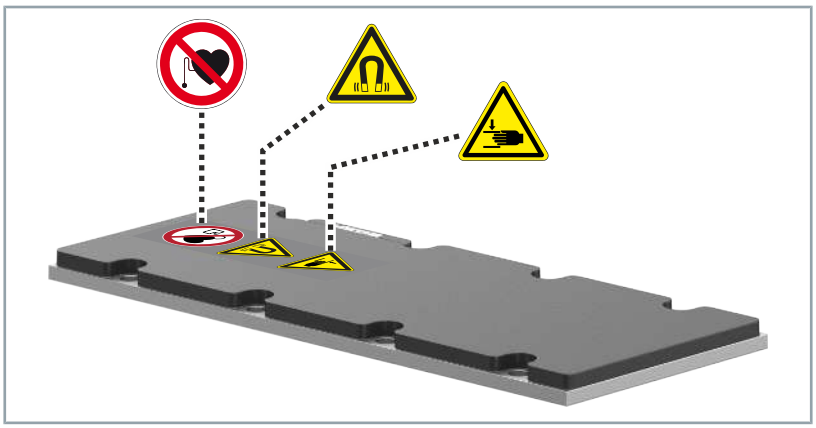
2 For your safety

Read this chapter containing general safety information. 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.

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.





Warning: magnetic field

Magnetic plates contain permanent magnets which constantly generate a strong magnetic field and attract other ferromagnetic objects, even in deenergized state. The high magnetic force of attraction cannot be controlled manually. Prevent direct contact between the magnetic plates and ferromagnetic objects such as assembly trolleys, tools, or machine beds.



Danger due to magnetic fields

Magnetic fields on the magnetic plate can be dangerous for people with cardiac pacemakers or magnetically conductive implants and defibrillators, for example.



Warning: hand injuries

The strong magnetic field of the magnetic plates can cause injuries and crushing of the hands when the magnetic plate is handled or transported. Always use the supplied protective cover outside the machine or system.

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.

Hazard due to magnetic fields

Magnetic fields on individual components of the AL8100 linear servomotors pose a risk to:

- persons with cardiac pacemakers or implanted or external defibrillators
- people with magnetically conducting implants
- magnetic data storage devices, chip cards with magnetic strips, and other electronic devices

Maintain a safe distance of at least 200 mm from all magnetic parts and prevent direct contact between magnetic parts and parts that are sensitive to interference.

Observe the requirements of DGUV [German Social Accident Insurance] Regulation 103-013 for electromagnetic fields (Germany) and applicable national regulations in other countries.

Hazard due to magnetic attraction

The magnetic plates contain permanent magnets and attract other ferromagnetic objects. The high magnetic forces of attraction cannot be controlled by hand.

Maintain a safe distance of at least 250 mm between the magnetic plate and other ferromagnetic parts such as iron.

Observe the requirements of DGUV [German Social Accident Insurance] Regulation 103-013 for electromagnetic fields (Germany) and applicable national regulations in other countries.

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

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.

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.

Avoid spalling of the sealing compound due to hard knocks
In case of improper use or due to hard knocks, the sealing compound can spall and the product can be damaged.

Use the original packaging only
Use the original packaging for dispatch, transportation, storage and packing.

2.2.2 During operation

Do not work on live electrical parts
Do not open any linear motors while they are live. Ensure that the protective conductor is properly connected. Never loosen electrical connections when live. Only work on linear motors when the device is switched off. Disconnect all components from the mains and protect them against unintentional reconnection.

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.

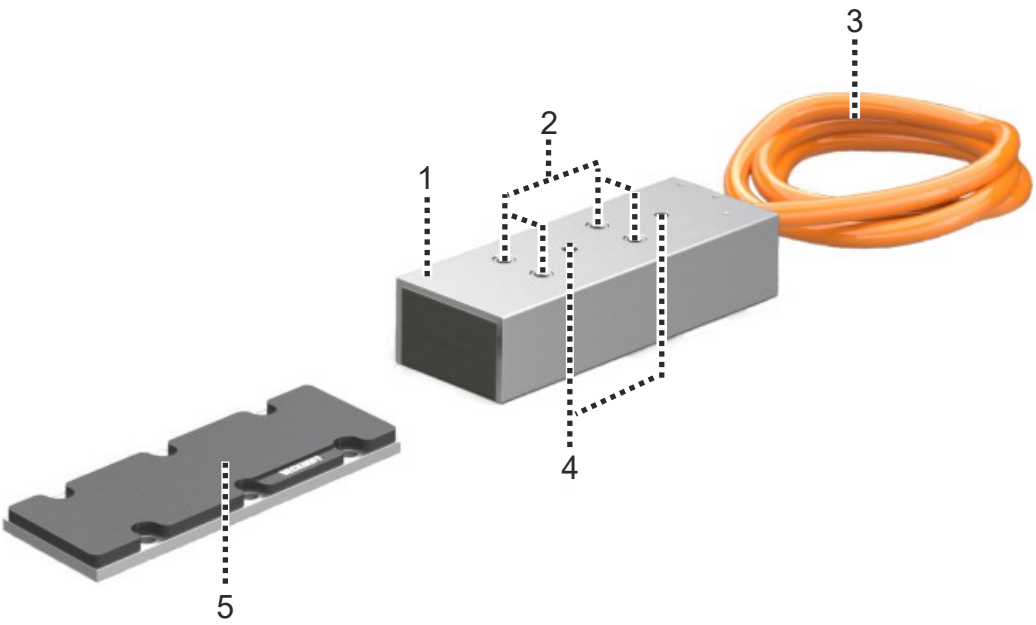
Avoid overheating
Activate and monitor the temperature sensor of the motor. Provide for sufficient cooling. Switch off the motor immediately if the temperature is too high.

Do not touch any moving or rotating components
Do not touch any moving or rotating components. Fasten all parts or components on the machine or plant.

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.

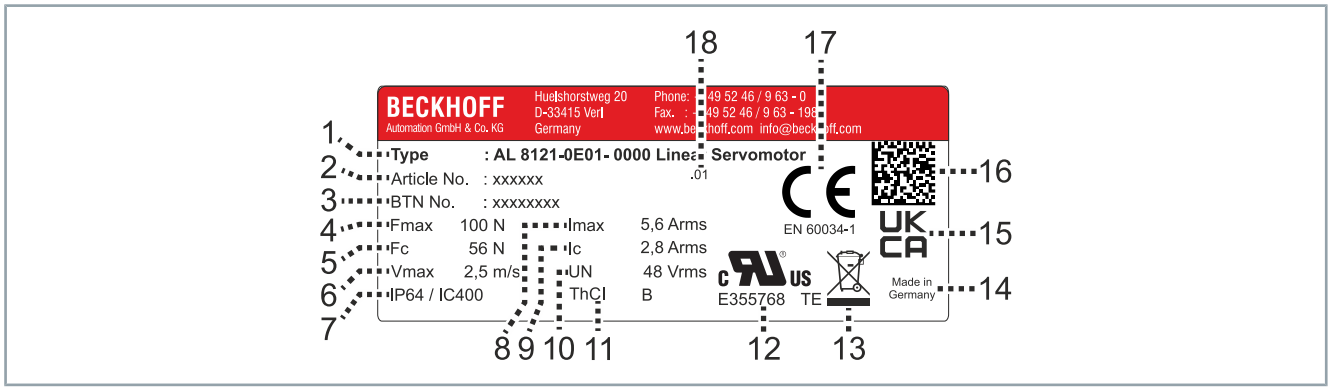
3 Product overview



Number	Explanation
1	Primary part: coil part of the linear servomotor
2	Thread for mounting on the machine slide
3	Cable: power and temperature sensor
4	Holes for locating pins
5	Secondary part: Magnetic plate

3.1 Linear servomotor

3.1.1 Name plate



Item number	Explanation
1	Product name
2	Order number
3	Beckhoff Traceability Number (BTN)
4	Peak force
5	Continuous force
6	Maximum velocity
7	Protection rating
8	Peak current
9	Continuous current
10	Nominal voltage
11	Insulation class
12	cURus approval
13	WEEE compliance
14	Country of manufacture
15	UKCA marking
16	DataMatrix code; Beckhoff Identification Code (BIC)
17	CE conformity
18	Hardware index

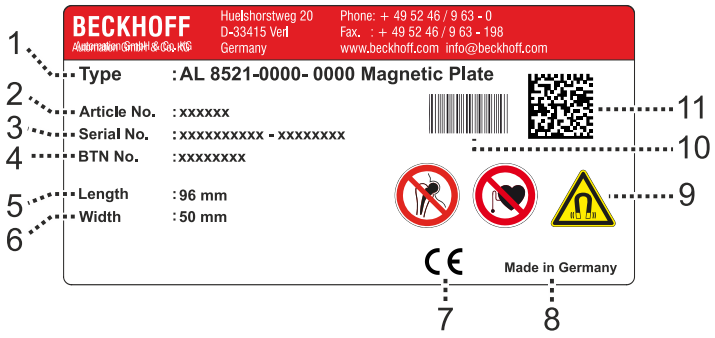
3.1.2 Type key

AL8 t u v - w x y z - 0000	Explanation
AL8	*Product area* • Iron-core series 8 linear servomotors
t	*Series* • 1 = 48 V DC
u	*Width* • 2 = W2; 50 mm
v	*Overall length* • 1 = 3 coils • 2 = 6 coils • 4 = 12 coils • 6 = 18 coils
w	*Cooling* • 0 = convection
x	*Winding letter* • A … Z • S = special winding
y	*Feedback system* • 0 = without feedback • 1 = OCT, inductive scanning head, absolute position, resolution 0.1 µm
z	*Connection technology* • 0 = Cable tail without plug • 1 = Cable tail with plug

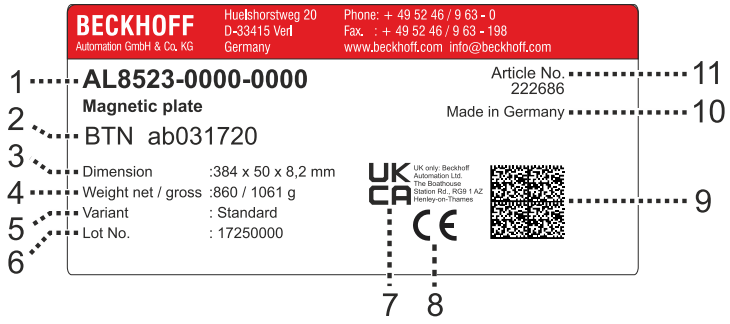
3.2 Magnetic plate

The following chapter shows examples of magnetic plate name plates.
Depending on the production line, the product is supplied with one of two name plate variants. The different nameplates only differ in terms of visual appearance and the markings displayed. There are no differences between the two variants in terms of functionality and quality.

3.2.1 Name plate

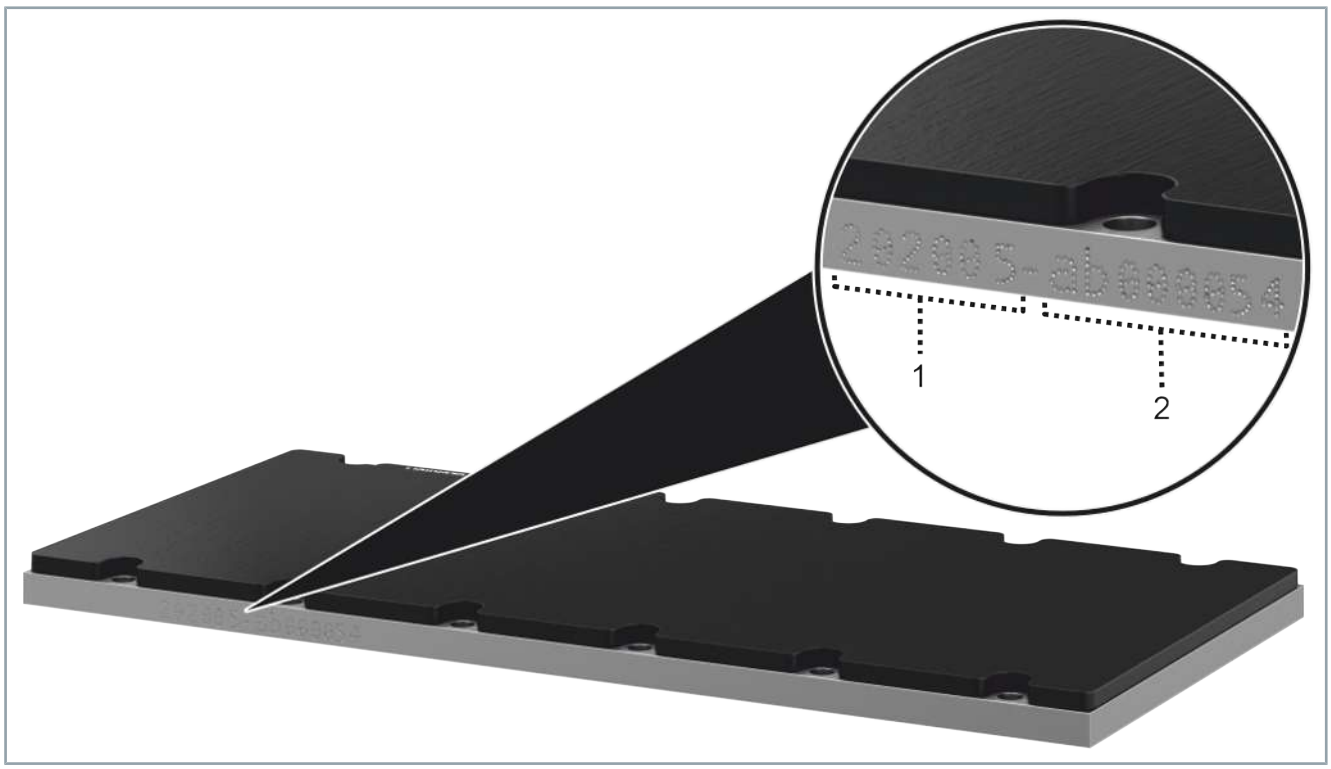


Item number	Explanation
1	Product name
2	Order number
3	Serial number
4	Beckhoff Traceability Number (BTN)
5	Length
6	Width
7	CE conformity
8	Country of manufacture
9	Safety pictograms
10	Barcode
11	DataMatrix code; Beckhoff Identification Code (BIC)



Item number	Explanation
1	Product name
2	Beckhoff Traceability Number (BTN)
3	Dimensions
4	Weight
5	Version
6	Lot number
7	UKCA conformity
8	CE conformity
9	Data Matrix code; Beckhoff Identification Code (BIC)
10	Country of manufacture
11	Order number

3.2.2 Needle pattern marking



Item number	Explanation
1	10-digit serial number / 6-digit order number
2	8-digit Beckhoff BTN

3.2.3 Type key

AL8 t u v - 0000 - 0000	Explanation
AL8	*Product area* • Iron-core series 8 linear servomotors
t	*Series* • 5 = magnetic plate
u	*Width* • 2 = W2; 50 mm
v	*Overall length* • 1 = Short • 2 = Medium • 3 = Long

3.3 Product characteristics

Dust-protected IP64 housing

The coil units are suitable for a wide range of environmental conditions. The coil units and magnetic plates are fully potted and IP64 protected, making the components dustproof and suitable for temporary immersion.

Neodymium permanent magnets

Neodymium permanent magnets are built into the magnetic plate. Neodymium is a hard magnetic material with strong magnetic fields that facilitate high forces.

Coupling to servo terminals

The coil parts are available with pre-assembled cables and connectors. This significantly reduces the cabling effort and prevents wiring faults. They can be coupled to servo terminals.

Electronic commutation in the servo terminal

The commutation of the motor is done electronically. The three coils are supplied from a bridge circuit.

Temperature sensor

A temperature sensor LPTC-600 is installed to monitor and measure the winding temperature and to protect the motor against overheating. This can be read out by the user.

Temperature warning and switch-off

- Motor warning temperature at 80 °C
- Motor switch-off temperature at 100 °C

Uniform linear motor width

Within a width category, such as AL812x, the coil units have identical width and can therefore be operated together on one magnetic track and combined as desired.

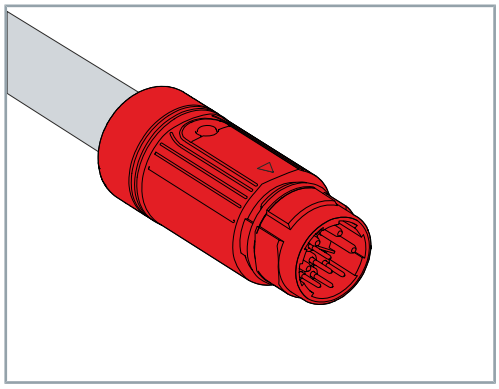
3.4 Ordering options

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 Connection cables

The coil parts can be ordered either with pre-assembled connection cables and plugs or with open wire end sleeves.

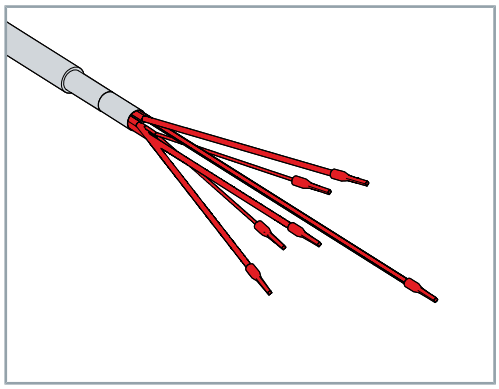
Plug



The following plug variants are used, depending on the cable diameter:

- itec® plug
- M23 SpeedTec® plug

Wire end sleeves



If you do not require a plug, you can order the connection cables with ferrules.

3.5 Intended use

The AL81xx linear servomotors may only be operated for the purposes as defined in this documentation and under the specified ambient conditions.

The components are installed in electrical plants or machines. Stand-alone operation of the components is not permitted.

The thermal protection contact installed in the motor windings must be regularly evaluated and monitored.



Read the entire drive system documentation:

- This translation of the original instructions
- Translation of the original instructions of the servo terminal used
- 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", [Page 26] is regarded as inappropriate and is thus prohibited.

Beckhoff AL81xx linear servomotors are not suitable for use in the following situations:

- Hazardous areas
- Areas with aggressive environments, for example aggressive gases or chemicals
- Areas with ionizing radiation and nuclear plants
- Aerospace industry
- Operation directly on the supply network without servo terminal

4 Technical data

4.1 Definition and technical terms

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



Consider validity framework
All data valid for 40 °C ambient temperature and 60 K overtemperature of the winding. The data can have a tolerance of +/- 10 %.

Peak force F_{max} [N]

Peak force at peak current I_{max}. The force that can be achieved depends on the peak output current of the servo terminal used. The peak force results in significant heating of the motor and may be delivered permanently for a maximum of 3 seconds; S5 operation.

Peak current I_{max} [A]

RMS value of the peak current at peak force F_{max}.

Continuous force F_c [N]

Available continuous force in S1 operation close to standstill at continuous current I_c.

Continuous current I_c [A]

RMS value of the continuous current at continuous force F_c.

Maximum velocity V_{max} [m/s]

Maximum velocity of the linear motor.

Force constant K_f [N/A]

Ratio of force to current while maintaining the ideal air gap.

Magnetic force of attraction F_a [N]

Magnetic force of attraction between magnetic plate and coil unit. Exists even when no current is flowing. Increases with the size of the coil unit and depends on the size of the air gap. See Chapter Air gap. Increases by up to 10% when the peak current is reached

Power loss P_L [W]

Maximum power loss of the linear motor. Can be used for the calculation of the cooling systems.

Pole pair distance [mm]

Distance across a pole pair, north pole and south pole, of the magnetic plate.

4.2 Data for operation and environment

NOTICE

Reduced service life due to improper operation
Short-term or long-term operation outside of the specifications listed here may reduce the service life of the coil units.

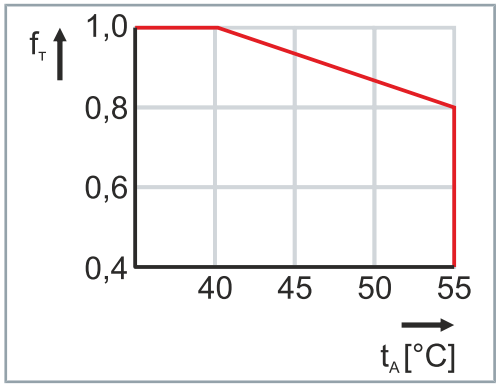
- Operate the linear motors only under the conditions for operation and the environment listed in this chapter

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	3K3 according to EN 60721
Ambient temperature during operation	+ 5 °C to + 40 °C
Ambient temperature during transportation	- 25 °C to + 70 °C, maximum fluctuation 20 K/hour
Ambient temperature during storage	- 25 °C to + 70 °C, maximum fluctuation 20 K/hour
Power derating	No power derating up to an installation altitude of 1000 m above sea level.
Installation altitude	At installation altitudes higher than 1000 m above sea level and 40 °C: 6 % at 2000 m above sea level 17 % at 3000 m above sea level 30 % at 4000 m above sea level 55 % at 5000 m above sea level
Permissible humidity during transport and storage	5 % to 95 % relative humidity, non-condensing
Specifications for intended use	
Ventilation	Air-cooled or water-cooled
Insulation material class	B
Protection rating	IP64
Vibration resistance	50 g, 10...2000 Hz in accordance with EN 60068-2-6
Shock resistance	100 g, 6 ms in accordance with EN 60068-2-27
EMC requirements	conforms to EN 61800-3:2004 + A1:2012
Approvals	CE, cURus, UKCA

4.2.1 Power derating

Derating may be necessary at high ambient temperature or when operating at a great height above sea level. Continuous forces are affected by the reduction.



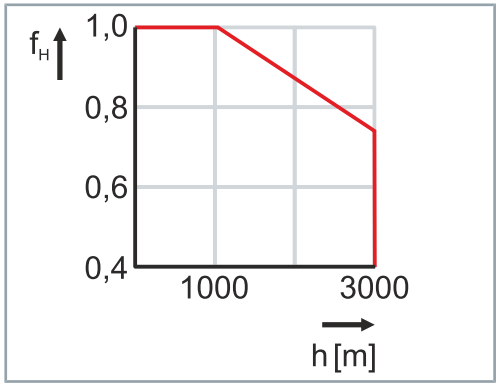
Ambient temperature

f_T = Temperature utilization factor

t_A = Ambient temperature in °C

Calculation of the power data when exceeding the specified temperature limit > 40°C:

$$\mathbf{F_{CA_red} = F_C \times f_T}$$



Installation altitude

f_H = Altitude utilization factor

h = Altitude in meters

Calculation of the performance data if the installation altitude exceeds 1000 m:

$$\mathbf{F_{CA_red} = F_C \times f_H}$$

Ambient temperature and installation altitude

Calculation of the power data when exceeding the specified limits:

Ambient temperature > 40°C and installation altitude > 1000 m above sea level:

$$\mathbf{F_{CA_red} = F_C \times f_T \times f_H}$$

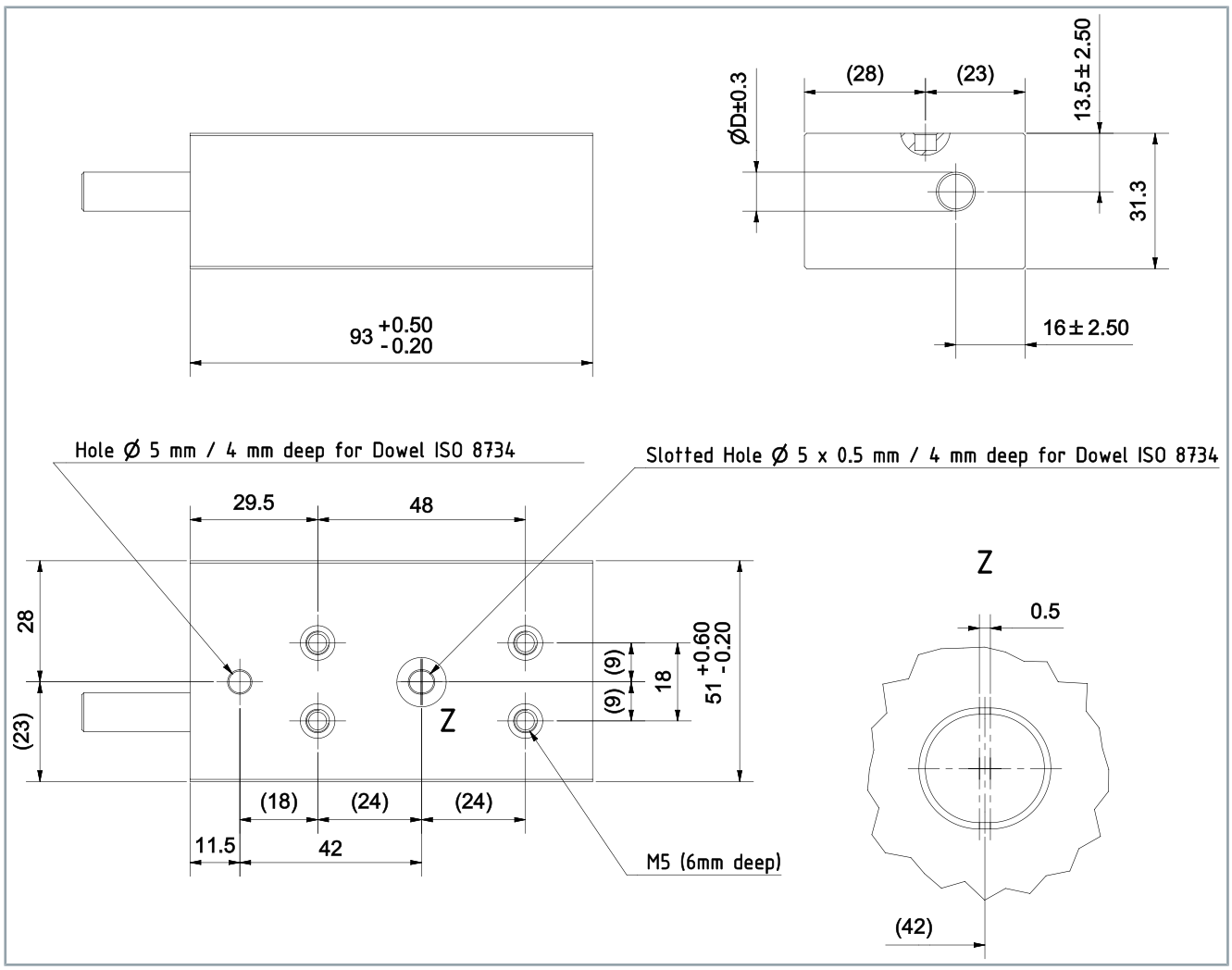
4.3 AL812x

Performance data	AL81xx								
	21-xE	21-xG	22-xE	22-xG	22-xJ	22-xN	24-xJ	24-xN	26-xN
Peak force F_{max} [N] ; 3 s	100	100	170	200	220	219	440	440	650
Peak current I_{max} [A]	5.6	9	5.6	9	16	32	16	32	32
Continuous force F_c [N] ; ΔT = 60 K	56	56	112	112	120	120	240	240	360
Continuous current I_c [A]	2.8	4.5	2.8	4.5	7.3	15	7.3	15	15
Maximum nominal output voltage U_n [V DC]	48	48	48	48	48	48	48	48	48
Maximum velocity v_{max} [m/s]	2.5	4.5	1.3	2.2	3.5	6	1.7	3.5	2.3
Force constant K_f [N/A]	20	13	40	25	16	8	33	16	24
Magnetic force of attraction F_a [N]	360	360	520	520	520	520	850	850	1250
Winding resistance ph-ph [Ω]	2.8	1	5.7	2.1	0.9	0.3	1.8	0.5	0.8
Winding inductance ph-ph [mH]	13	5.1	26	10	4.3	1	8.6	2.1	3.1
Counter EMF ph-ph [V/m/s]	11	7	23	14	9	5	19	9	14
Continuous power loss P_L [W]	50	46	101	93	98	115	195	231	346
Motor constant [N²/W]	71	78	143	155	148	125	295	250	375
Thermal resistance [K/W]	1.2	1.3	0.6	0.6	0.6	0.5	0.3	0.3	0.2
Pole pair distance [mm]	24								
Weight									
Coil unit [kg]	0.6	0.6	0.9	0.9	0.9	0.9	1.6	1.6	2.3
Magnetic plate [kg/m]	2.3								
Sensors									
Temperature sensor	LPTC-600								
Cable and motor data									
Motor cable, outer diameter [mm]	9	9	9	9	9.5	10.9	9.5	10.9	10.9
Motor cable, core cross-section	4x1.0 mm² + 2xAWG26	4x1.0 mm² + 2xAWG26	4x1.0 mm² + 2xAWG26	4x1.0 mm² + 2xAWG26	4x1.5 mm² + 2xAWG26	4x2.5 mm² + 2xAWG26	4x1.5 mm² + 2xAWG26	4x2.5 mm² + 2xAWG26	4x2.5 mm² + 2xAWG26
Minimum static bending radius	4 x outer diameter								
Cable length, assembled [m]	0.5								
Cable length unassembled [m]	1								
Connector	itec®	itec®	itec®	itec®	M23	M23	M23	M23	M23
Recommended servo terminal assignment									
Servo terminal ELMxxxx	7211/ 7212	7211/ 7212	7211/ 7212	7211	7221/ 7222	7231	7221/ 7222	7231	7231
The values are valid for a linear servomotor mounted on a metal surface that is equal to or larger than that of the motor, at a surface temperature of 20 °C									

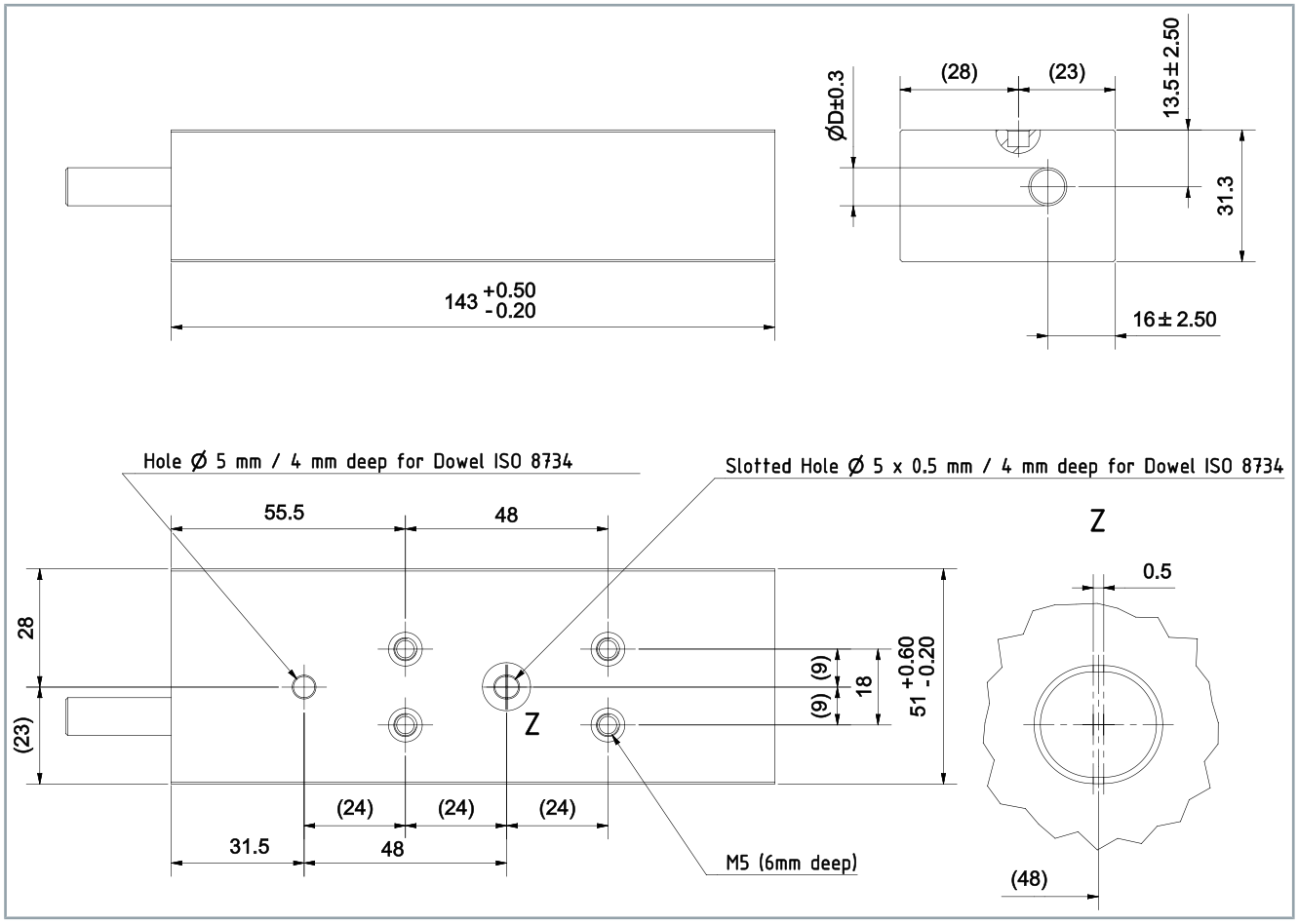
4.3.1 Dimensional drawings AL812x

- All figures in millimeters

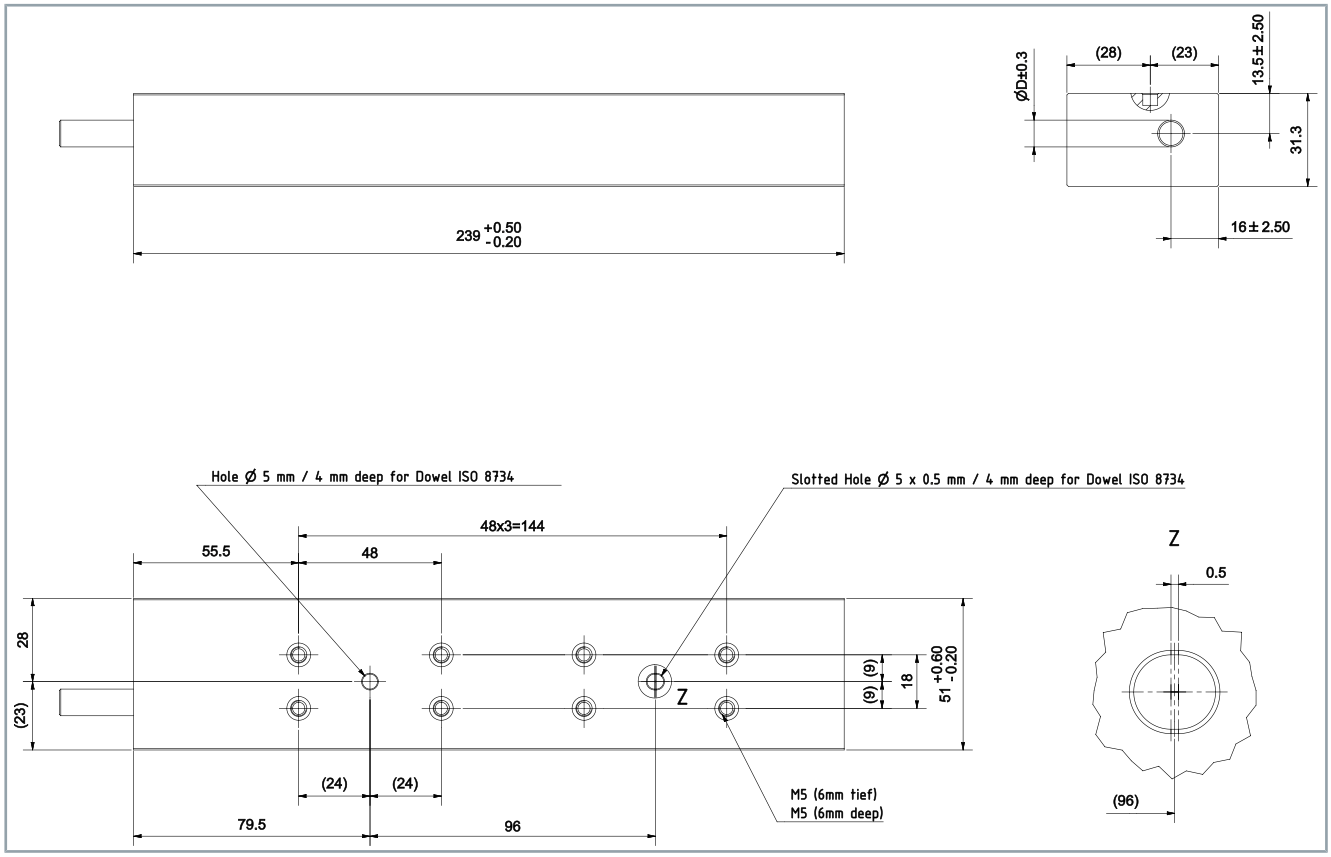
4.3.1.1 AL8121



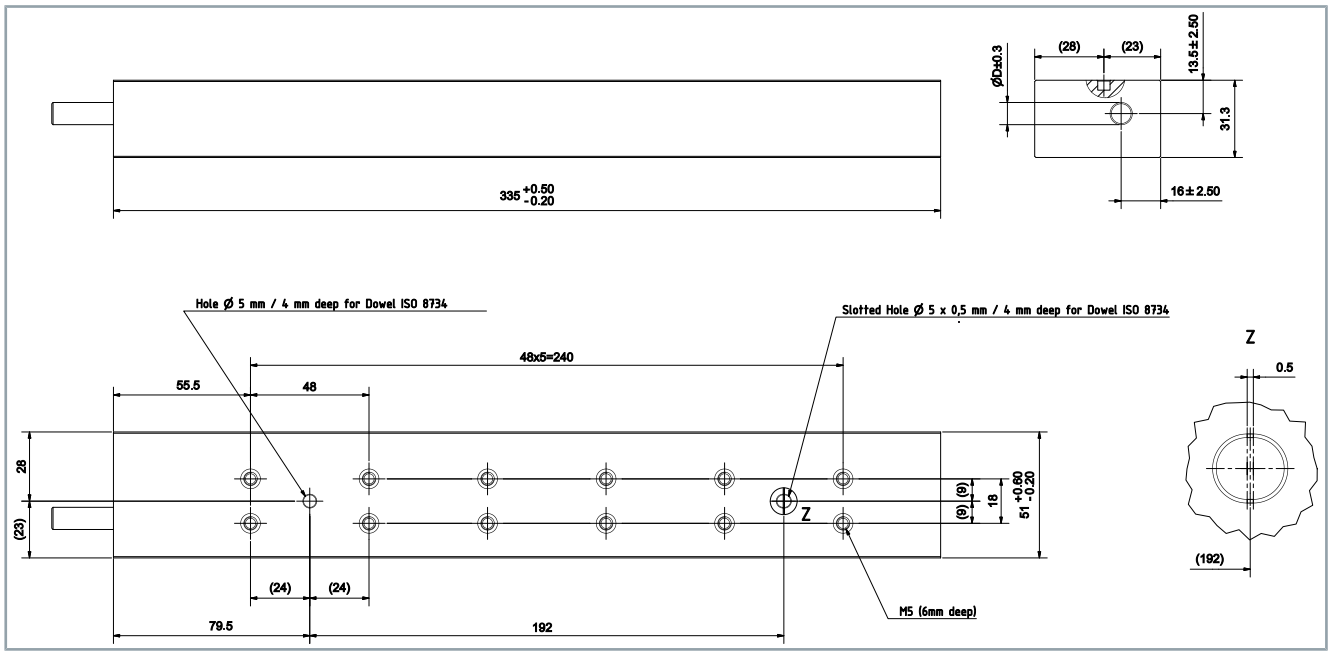
4.3.1.2 AL8122


ØD±0.3
(28)
(23)
13.5±2.50
31.3
16±2.50
143 +0.50 -0.20
Hole Ø 5 mm / 4 mm deep for Dowel ISO 8734
Slotted Hole Ø 5 x 0.5 mm / 4 mm deep for Dowel ISO 8734
55.5
48
Z
0.5
28
(23)
(9)
(9)
18
51 +0.60 -0.20
(24)
(24)
(24)
31.5
48
M5 (6mm deep)
(48)

4.3.1.3 AL8124

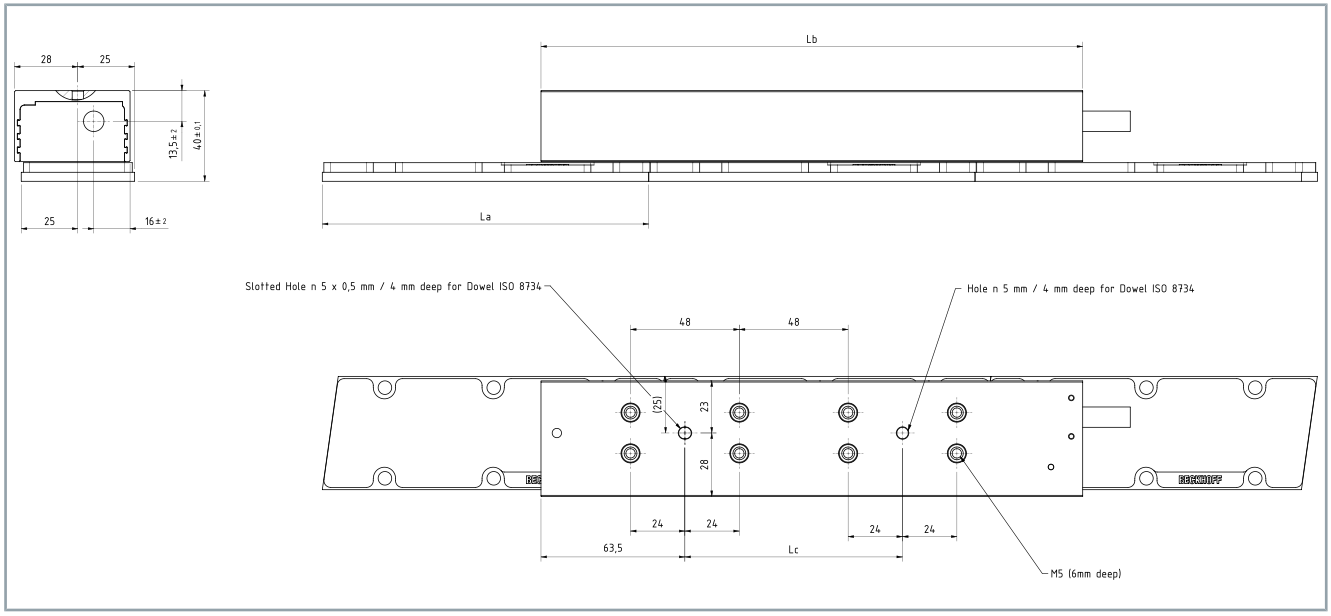


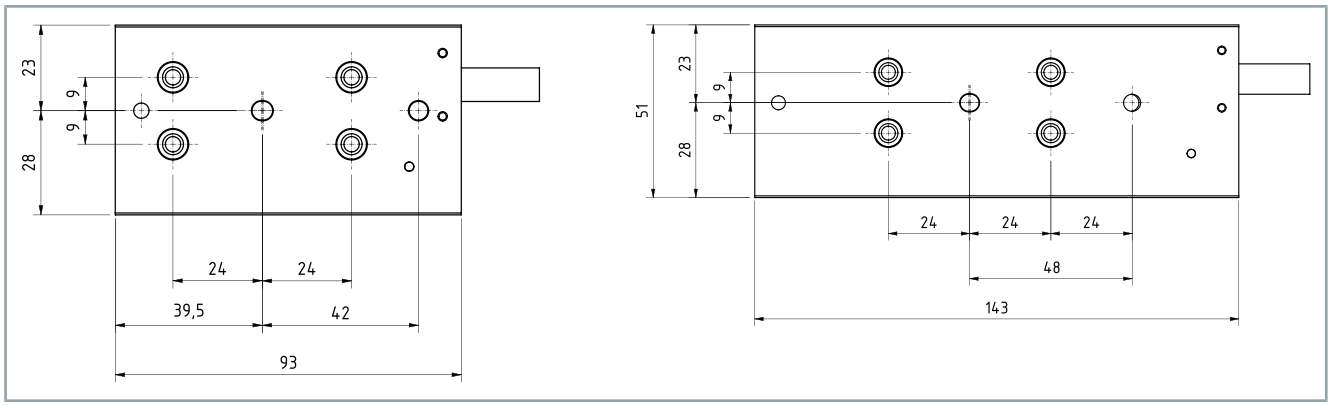
4.3.1.4 AL8126



4.3.2 AL812x alignment

Alignment based on AL812x as an example
The figure shows the positioning of a coil unit in relation to the magnetic track.



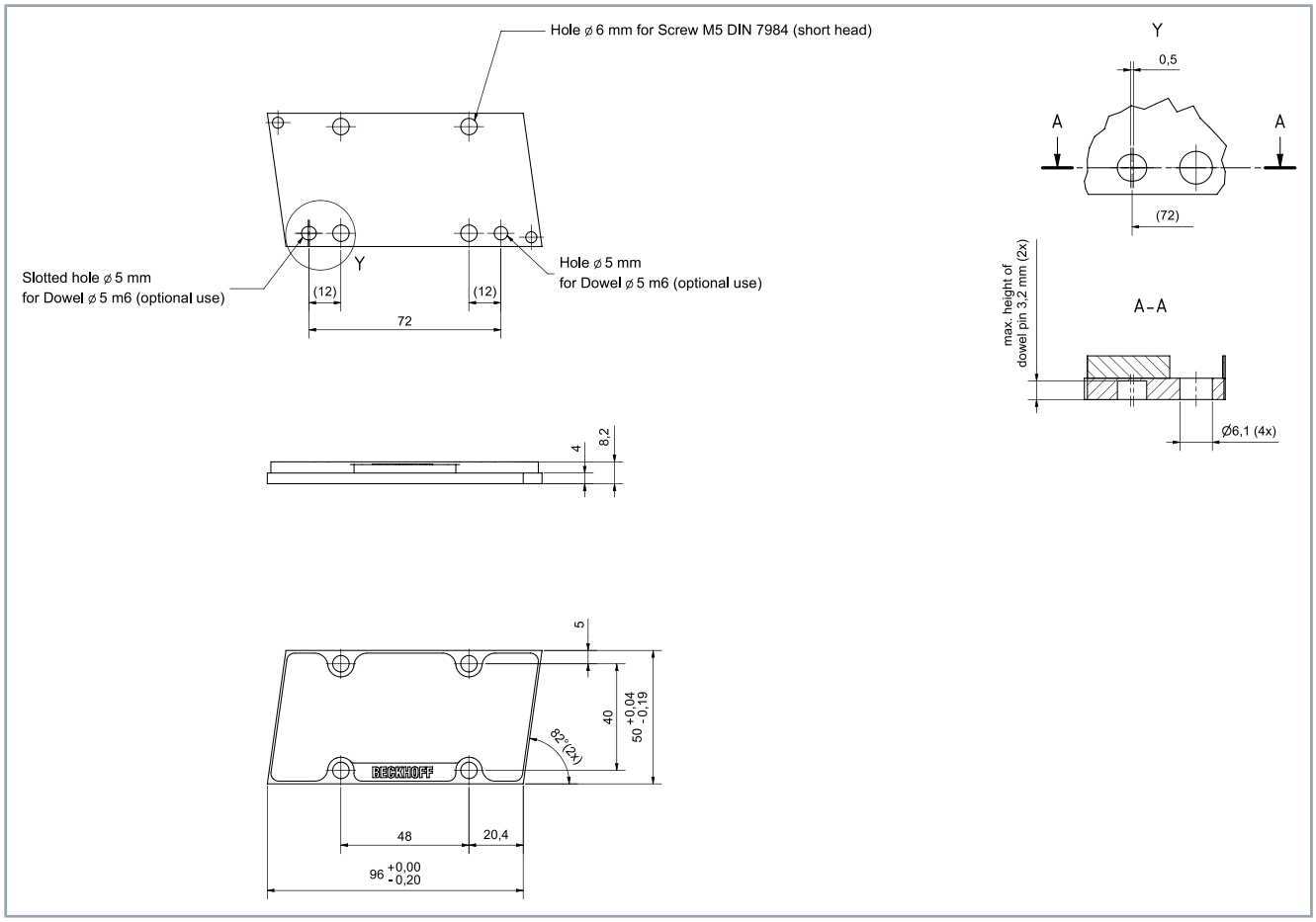


4.4 AL852x magnetic plates

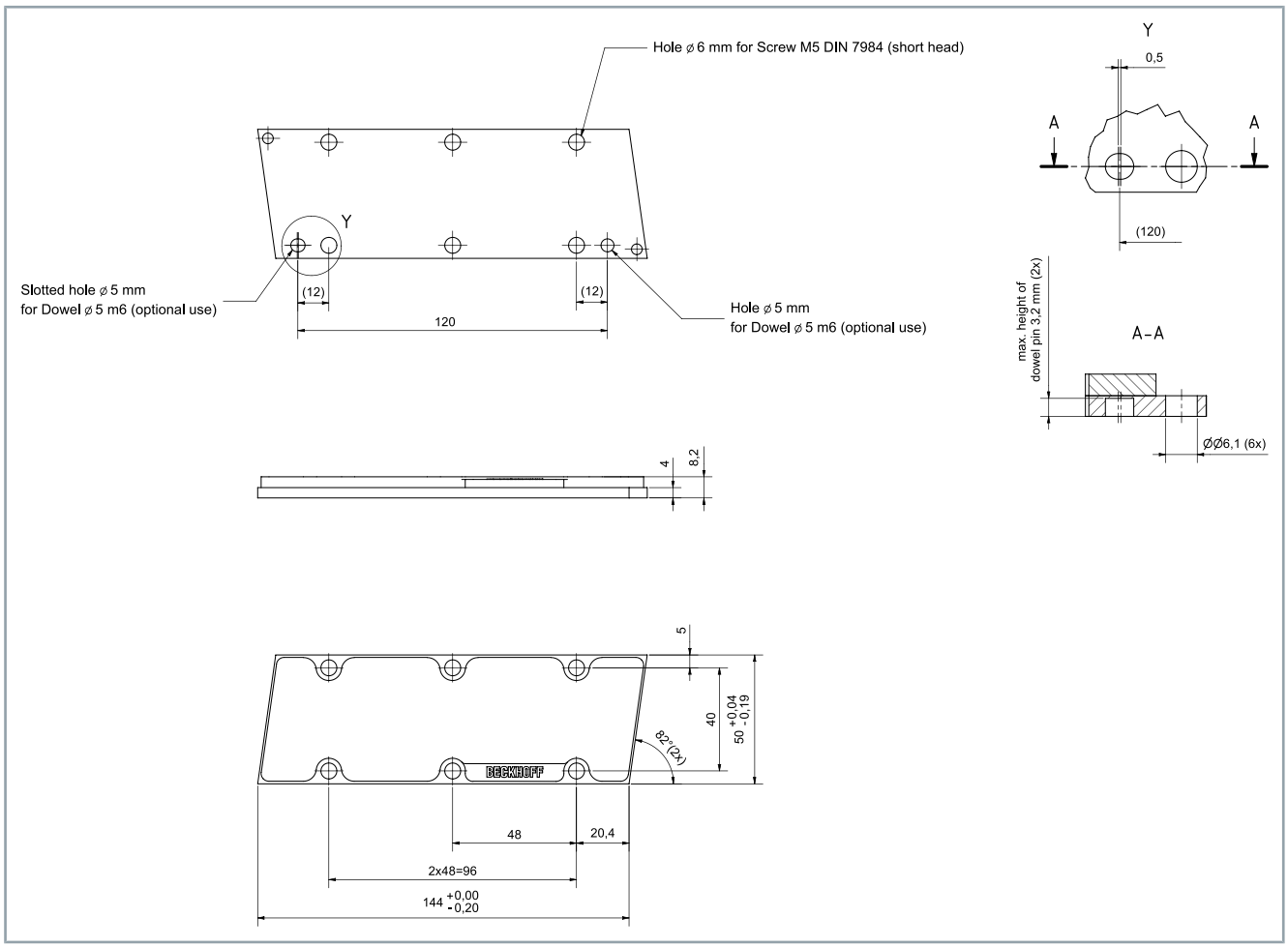
4.4.1 Dimensional drawings AL852x

- All figures in millimeters

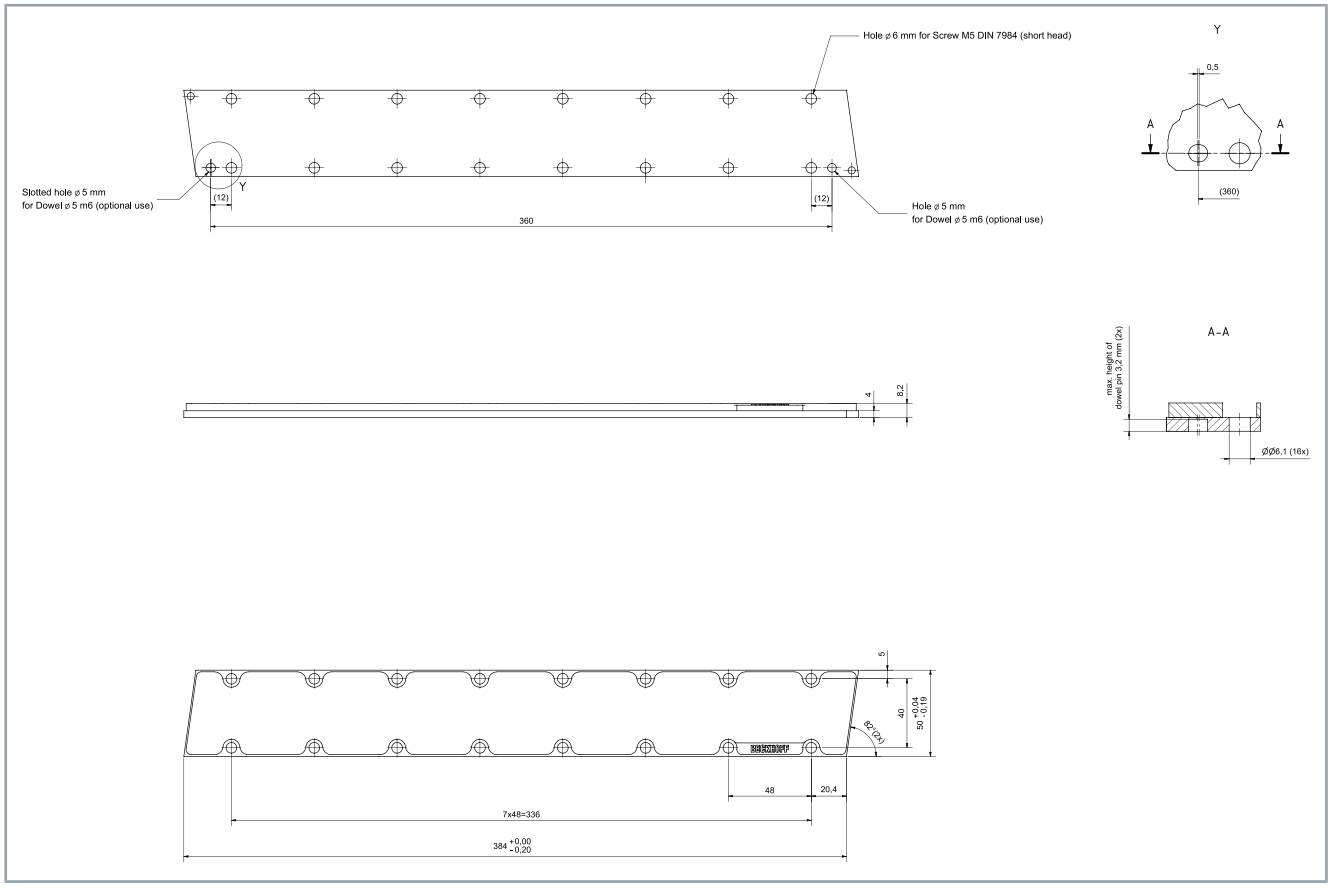
4.4.1.1 AL8521



4.4.1.2 AL8522


Hole ⌀ 6 mm for Screw M5 DIN 7984 (short head)
Slotted hole ⌀ 5 mm
for Dowel ⌀ 5 m6 (optional use)
Hole ⌀ 5 mm
for Dowel ⌀ 5 m6 (optional use)
Y
(12)
(12)
120
0,5
A
A
(120)
max. height of
dowel pin 3,2 mm (2x)
A–A
ØØ6,1 (6x)
4
8,2
5
40
50 +0,04 -0,19
82° (2x)
BECKHOFF
48
20,4
2x48=96
144 +0,00 -0,20

4.4.1.3 AL8523


Hole ø 6 mm for Screw M5 DIN 7984 (short head)
Slotted hole ø 5 mm
for Dowel ø 5 m6 (optional use)
Hole ø 5 mm
for Dowel ø 5 m6 (optional use)
(12)
(12)
360
Y
0,5
A
A
(360)
A – A
max. height of
dowel pin 3,2 mm (2x)
ØØ6,1 (16x)
4
8,2
5
40
50 +0,14 -0,19
82° (2x)
48
20,4
7x48=336
384 +0,00 -0,20

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.

Check the shipment for the following contents:

When ordering a coil unit:

- AL8100 series coil unit
- 2x adhesive name plates
- Short information

When ordering a magnetic plate:

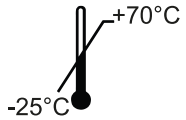
- AL85xx series magnetic plate with protective cover, without fixing material
- Short information

5.1 Packaging

The coil parts and magnetic plates are individually packed and delivered separately.

Instructions for handling are printed on the packaging:

5.1.1 Linear servomotor

Symbol	Explanation
	These are the permitted maximum and minimum temperatures at which the device may be stored and transported.
	This is the correct position for the packaging.
	Protect the packaging against wetness.
	The contents are fragile.

5.1.2 Magnetic plate

Symbol	Explanation
	Devices that are sensitive to magnetic fields must be moved out of range.
	Warning: hand injuries.
	Persons with cardiac pacemakers are particularly at risk from the magnetic field.
	Persons with implants are particularly at risk from the magnetic field.

6 Transport and storage

NOTICE

Damage due to disregard of transport and storage conditions
Failure to observe the conditions may result in damage to the coil units and void the warranty.

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

NOTICE

Damage to the magnetic plate due to removal of the protective cover
The protective cover protects against mechanical damage, magnetism and environmental influences. If you remove the protective cover, the magnetic plate may be damaged.

- Do not remove the silver protective cover on the magnetic plates

6.1 Conditions

During transport and storage avoid damage to the coil parts, magnetic plates and individual components. Observe the specifications in the following chapters and comply with the following conditions:

- Climate category: 3K3 according to EN 60721
- Temperature: -25 °C to +70 °C, maximum fluctuation 20 K/hour
- Humidity: relative humidity 5% to 95%, no condensation
- Use of suitable means of transport
- Transport and storage only in horizontal and vertical position
- Use of the vendor's original packaging

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

Motor type	Stacking height [pieces]
AL812x	6

6.2 Transport

⚠ WARNING

Risk of injury due to suspended loads
If the motor falls down, this can lead to serious or even fatal accidents.

- Use suitable means of transport
- Secure the motor against falling
- Do not move under suspended loads

NOTICE

Damage caused by electrostatic discharge
Electrostatic discharge can damage the circuitry in the coils and electrical components such as the temperature sensor.

- Ensure a protected working environment
- Avoid contact with ESD sensitive components without ESD protective clothing

Legal regulations for the lifting of loads
When transporting individual coil units or magnetic plates without lifting gear, comply with the legal regulations for lifting loads for employees.

6.2.1 Linear servomotors

NOTICE

Damage due to improper transport
Holding or transporting the motor by the cable tail can damage the connection cable or the connection points on the motor side. Damage to the cable and cable insulation can lead to short circuits, electric shocks or malfunctions.

- Hold and move the motor only by the designated points

The following options are available for transporting a single coil unit:

AL812x series

- Without aids, by hand in compliance with the legal requirements for the lifting of loads

Horizontal transportation recommended
We recommend that the coil unit is always lifted horizontally. Only lift and transport in a vertical position if absolutely necessary.

6.2.2 Magnetic plates

⚠ DANGER

Danger from strong magnetic fields
Strong permanent magnets generate intense magnetic fields that can interfere with or disable the function of pacemakers. This can cause serious health problems, including unconsciousness, heart attack or even death.

- Maintain a minimum distance of 200 mm between persons concerned and the magnetic plates
- Do not hold magnetic plates close to the chest area

The following options are available for transporting a single magnetic plate:

- Without aids, by hand in compliance with the legal requirements for the lifting of loads

6.3 Long-term storage

NOTICE

Change in component properties due to disregard of storage conditions
Failure to observe the storage conditions may result in changes in the properties of the cables or the sealing compound. Under proper storage conditions, coil units and magnetic plates can be stored indefinitely.

- Ensure that low air humidity is maintained when storing coil units and magnetic plates

NOTICE

Reduced service life due to lack of maintenance
Damage to the coil unit or maintenance work not carried out on the machine / system will affect the service life of the installed components and parts.

- Check the coil unit for proper condition every six months

NOTICE

Damage due to condensation
Condensation water can lead to damage during subsequent operation, calcification or rust formation.

- Keep the ambient temperature constant
- Avoid solar radiation and high air humidity

The coil units can be stored for shorter or longer periods. We recommend that you always store components in their original packaging. Adhere to the conditions specified in the chapter: "Transport and storage", [Page 39].

Ensure the storage space is vibration-free.

7 Technical description

7.1 Magnetic track length

This chapter contains information on determining the length of the magnetic track. The necessary travel range is determined by the application specifications.

The required magnetic track length corresponds to the length of the travel range plus the length of the coil unit used.

During the planning phase it is necessary to determine the number of magnetic plates required.

Two options are available for determining the number of magnetic plates required:

- conventional calculation and
- effective calculation.



Both approaches calculate a minimum requirement. In practice, the magnetic tracks are longer, since the space for limit switches and reserves is included in the calculation. In addition, whole magnetic plates are always used.

7.1.1 Conventional calculation

In a conventional calculation, the length of the coil unit is added to the travel path of the application and then divided by the length of the magnetic plate.



Example for conventional calculation:
Travel path = 490 mm
Length of coil unit AL8121 = 93 mm
Length of magnetic plate AL8523 = 384 mm

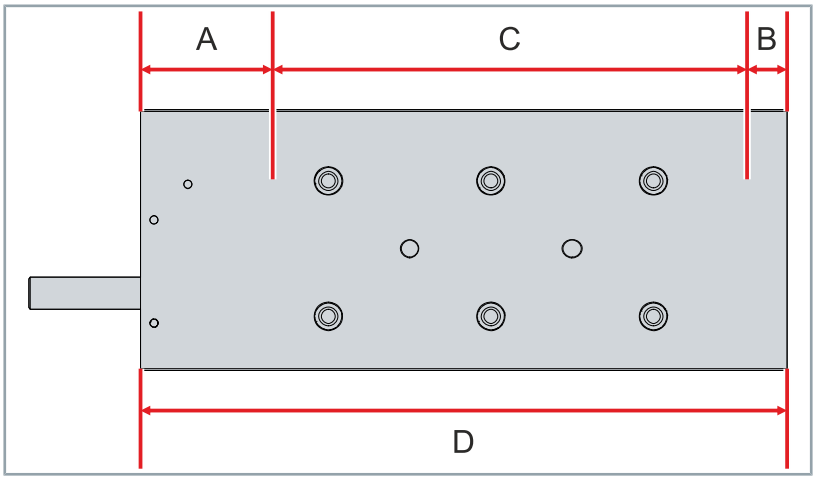
Required number of magnetic plates:
(490 mm + 93 mm)/384 = 1.52 magnetic plates < 2 magnetic plates are required.

7.1.2 Effective calculation

In an effective calculation, the travel path of the application is added to the length of the effective section of the coil unit and then divided by the length of the magnetic plate.

Effective section

The effective section contains are the coils of the coil unit. In this part the force is generated that drives the motor forward. The remaining installation space includes the wiring.



Position	Meaning
A	Passive part of the cable side
B	Passive part of the end side
C	Effective section
D	Housing length = sum of A + B + C

Example of effective calculation:
The values used here can be found in the following tables.
Travel path = 490 mm
Effective range of the coil unit AL8121 = 76 mm
Length of magnetic plate AL8523 = 384 mm

Required number of magnetic plates:
(490 mm + 76 mm)/384 mm = 1.47 magnetic plates < 2 magnetic plates are required.

AL812x

Designation	AL81			
	21	22	24	26
Passive part of the cable side A [mm]	15.5	17.5	17.5	17.5
Passive part of the end side B [mm]	1.5	1.5	1.5	1.5
Effective range C [mm]	76	124	220	316
Housing length D [mm]	93	143	239	335

7.2 Overall mounting height

You can increase the overall mounting height and the associated air gap in case of tolerance deviations. Tolerance deviations can result from:

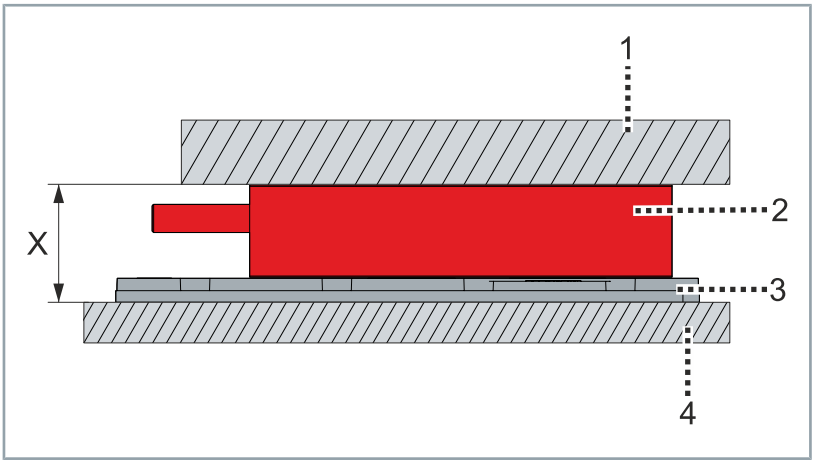
- deviations in parallelism or
- deviations in the evenness of the mounting surface

Be aware of performance losses with increased air gap
Increasing the overall mounting height or the air gap may have performance implications. These follow a non-linear function. Please refer to the diagram in Chapter: "Dependencies", [Page 45].

Avoid reducing the air gap
Reducing the air gap increases the magnetic forces of attraction between the coil part and the magnetic track. This requires larger guides and a stiffer design of the machine or system.

The following table and figure provide information about the overall mounting heights of the individual series:

Series	Mounting height "X" [mm]
AL812x	40 ± 0.1

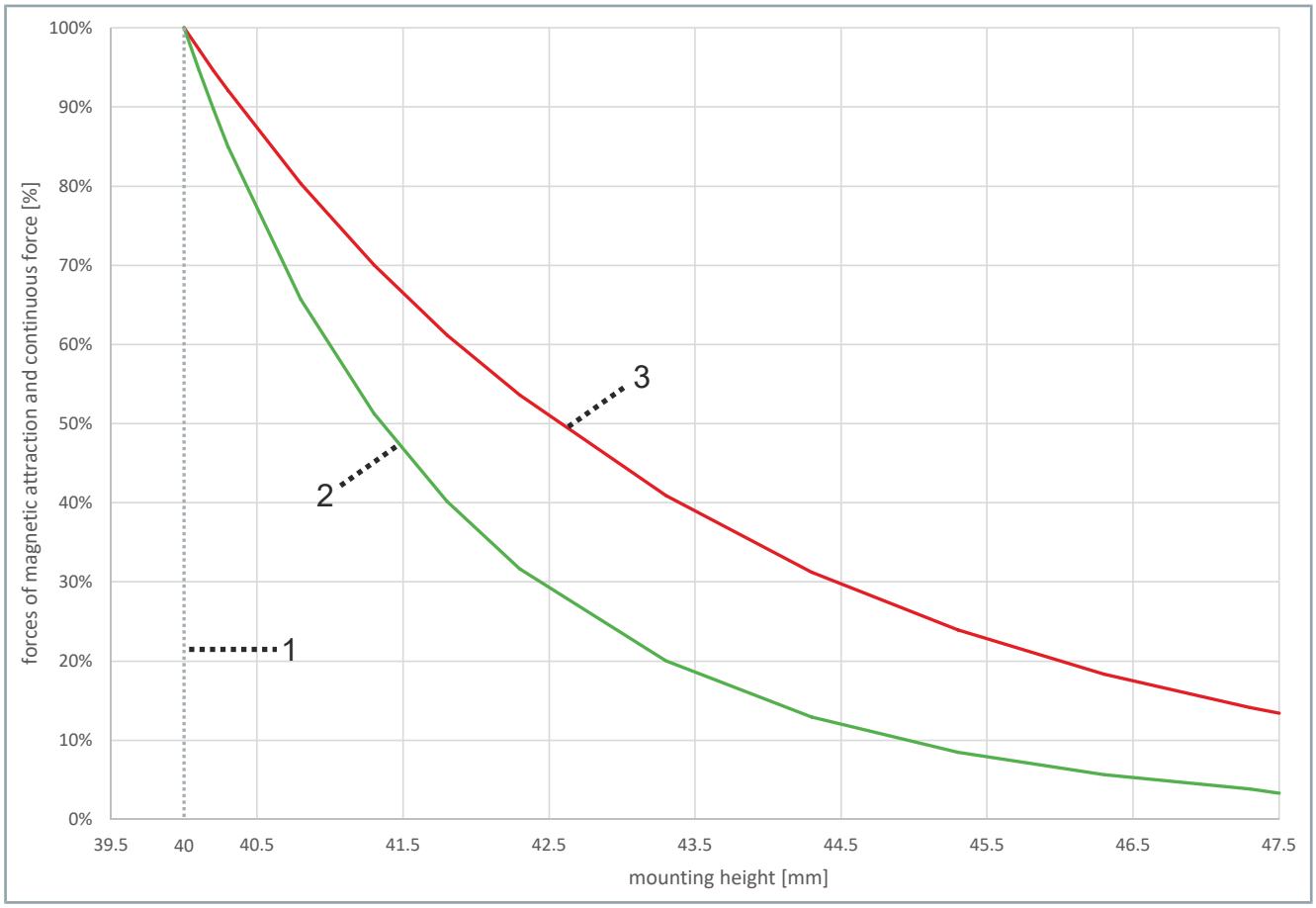


Position	Description
1	Machine slide
2	Coil part
3	Magnetic plate
4	Machine bed

7.2.1 Dependencies

The following diagram shows the continuous force in relation to the magnetic force of attraction as a function of the installation height:

AL812x



Position	Definition
Setpoint 1	Ideal installation height
Curve 2	Magnetic force of attraction F_a
Curve 3	Continuous force F_c

7.3 Protection equipment

A temperature sensor LPTC-600 is installed in all coil parts of the AL8100 series. The LPTC-600 is integrated into the monitoring system of the servo terminals for motors with preassembled plugs. Configure the servo terminal according to the motor temperature warning at 80 °C and the switch-off temperature at 100 °C.

7.3.1 LPTC-600 sensor

The following table shows the resistance values of the temperature sensor:

Temperature [°C]	LPTC-600 Resistance [Ω]			Temperature error [K]
	minimum	Nominal value	maximum	
-40	340	359	379	± 6.48
-30	370	391	411	± 6.36
-20	403	424	446	± 6.26
-10	437	460	483	± 6.16
0	474	498	522	± 6.07
10	514	538	563	± 5.98
20	555	581	607	± 5.89
25	577	603	629	± 5.84
30	599	626	652	± 5.79
40	645	672	700	± 5.69
50	694	722	750	± 5.59
60	744	773	801	± 5.47
70	797	826	855	± 5.34
80	852	882	912	± 5.21
90	910	940	970	± 5.06
100	970	1000	1030	± 4.90
110	1029	1062	1096	± 5.31
120	1089	1127	1164	± 5.73
130	1152	1194	1235	± 6.17
140	1216	1262	1309	± 6.63
150	1282	1334	1385	± 7.10
160	1350	1407	1463	± 7.59
170	1420	1482	1544	± 8.10
180	1492	1560	1628	± 8.62

8 Coupling

NOTICE

Damage caused by rigidly coupled coil units
Rigidly coupled coil units can cause non-synchronous movements which can lead to tension and damage to the mechanical system and the coil unit.

- Ensure that the coupled coil units move synchronously

NOTICE

Damage due to series connection of the coil units
Connecting the coil units in series can cause the cables to burn. This can damage the coil unit and connected components.

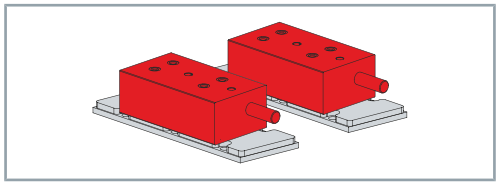
- Coil units should only be coupled in a parallel connection. Series connection is not permitted

You have the possibility to couple individual coil units with the same width and the same force constants. The total force is determined by adding the forces of the coupled coil units. The motors are connected in parallel to the servo terminal, which leads to a higher sum current. In coupled operation , maintain special distances between coil units and the dependent wiring.

8.1 Structure

You have the possibility to couple the linear motors in two different ways. These are described in the following chapter.

8.1.1 Gantry

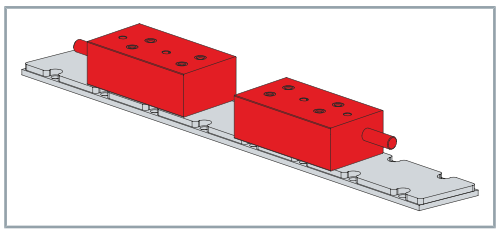


In a gantry structure, two parallel magnetic tracks each have a coil part. The coil parts are rigidly coupled and electrically connected in parallel. The movements are synchronized. Synchronization must be maintained at the best possible level even in the event of a drive error.

All coil parts in the gantry structure must respond almost instantaneously to any drive faults.

The existing communication time from the faulty drive to the NC or CNC and from there to all other coil parts is overridden by the electrically parallel switching.

8.1.2 Shared magnetic track



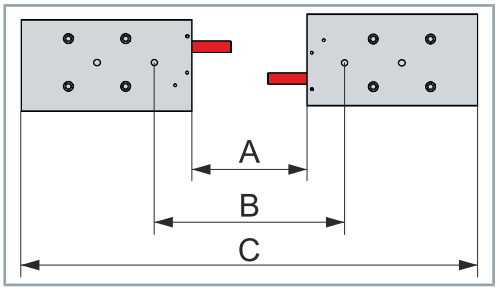
With this type of coupling, the coil parts are arranged one after the other on a common magnetic track. This type of coupling tends to be used for applications with long strokes, since a second magnetic track with associated costs is avoided.

By coupling two coil parts of the next smaller series, the force required for the application can be achieved and thus the width of the magnetic track can be reduced.

8.2 Arrangement of coil parts

The coil parts must be arranged such that the distances shown in this chapter are adhered to. They thus guarantee the generation of a symmetrical rotary field and adhere to the minimum bending radius of the cables.

8.2.1 Cables to each other



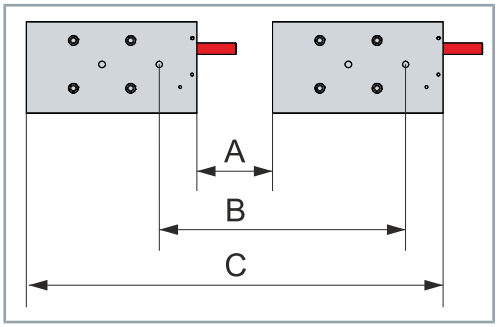
This illustration shows an example of two coil parts with cables facing each other.

The dimensions A - B - C are provided in the following tables.

- A = minimum distance
- B = center-to-center distance between locating pin holes
- C = total length

AL812x				
Motor 1	**Motor 2**	**A**	**B**	**C**
		[mm]		
AL8121-0Eyz	AL8121-0Eyz	53	76	239
AL8122-0Eyz	AL8122-0Eyz	49	112	335
AL8124-0Gyz	AL8124-0Gyz	49	208	527
AL8126-0Gyz	AL8126-0Gyz	49	208	719

8.2.2 Cables in the same direction



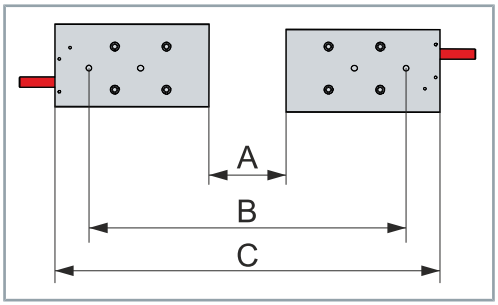
This illustration shows an example of an arrangement of two coil parts with cables in the same direction.

The dimensions A - B - C are provided in the following tables.

- A = minimum distance
- B = center-to-center distance between locating pin holes
- C = total length

AL812x				
Motor 1	**Motor 2**	**A**	**B**	**C**
		[mm]		
AL8121-0Eyz	AL8121-0Eyz	51	144	237
AL8122-0Eyz	AL8122-0Eyz	49	192	335
AL8124-0Gyz	AL8124-0Gyz	49	288	527
AL8126-0Gyz	AL8126-0Gyz	49	384	719

8.2.3 Cables opposite



This illustration shows an example of an arrangement of two coil parts with cables laid in opposite directions.

The dimensions A - B - C are provided in the following tables.

- A = minimum distance
- B = center-to-center distance between locating pin holes
- C = total length

AL812x				
Motor 1	**Motor 2**	**A**	**B**	**C**
		[mm]		
AL8121-0Eyz	AL8121-0Eyz	1	164	187
AL8122-0Eyz	AL8122-0Eyz	1	224	287
AL8124-0Gyz	AL8124-0Gyz	1	320	479
AL8126-0Gyz	AL8126-0Gyz	1	512	671

8.3 Electrical connection

Wire the coupled coil units according to the phase offset. The windings of the coil units always have the same winding distance to one another, which is dependent on the series. In the case of the AL8xxx series, the winding distance is 16 mm.

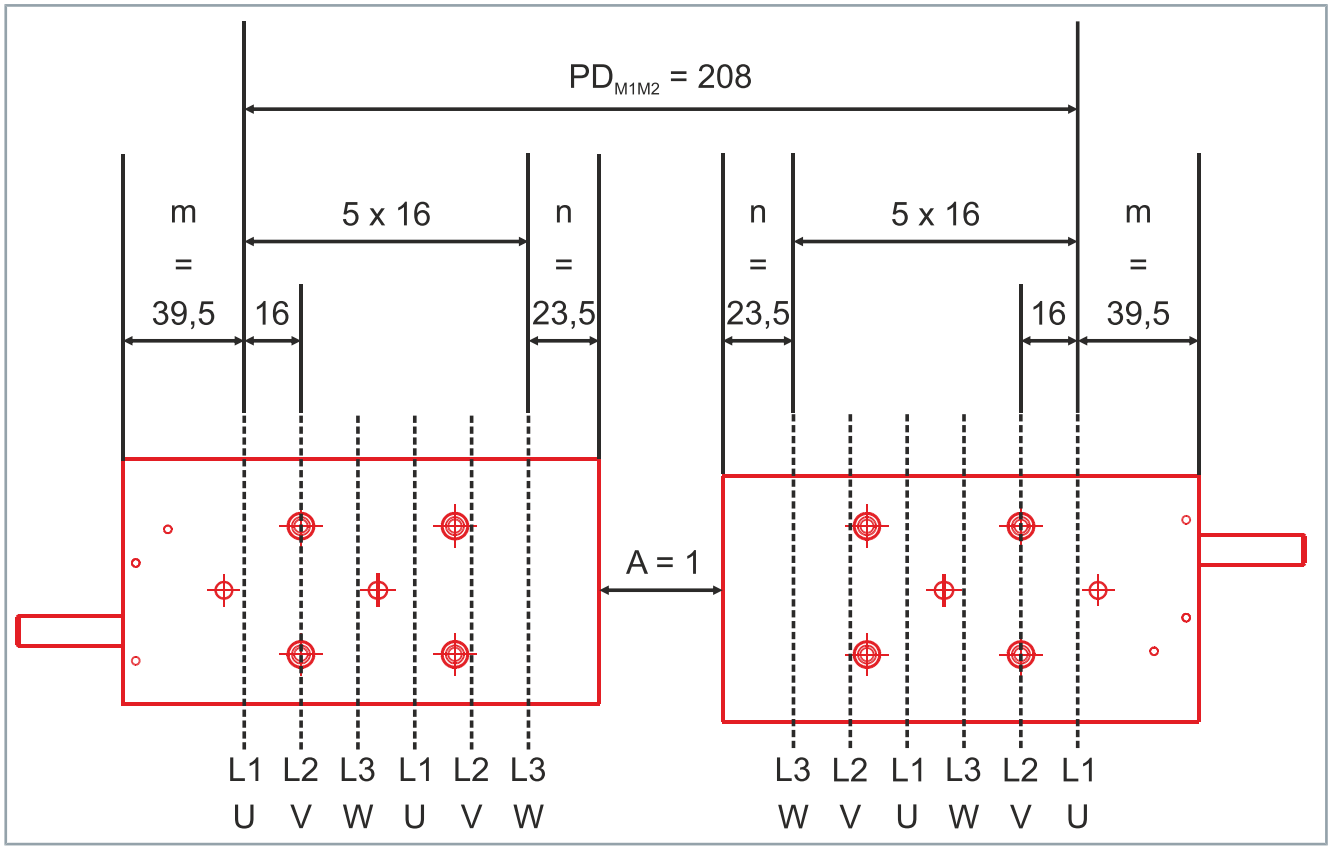
If the coil units are coupled to one another, there must also be a multiple of this winding distance between the windings of the connected coil units. The phase repetition is 48 mm and is made up of three times the winding distance.

In the following figures you can get information about the distance between the phase lines.

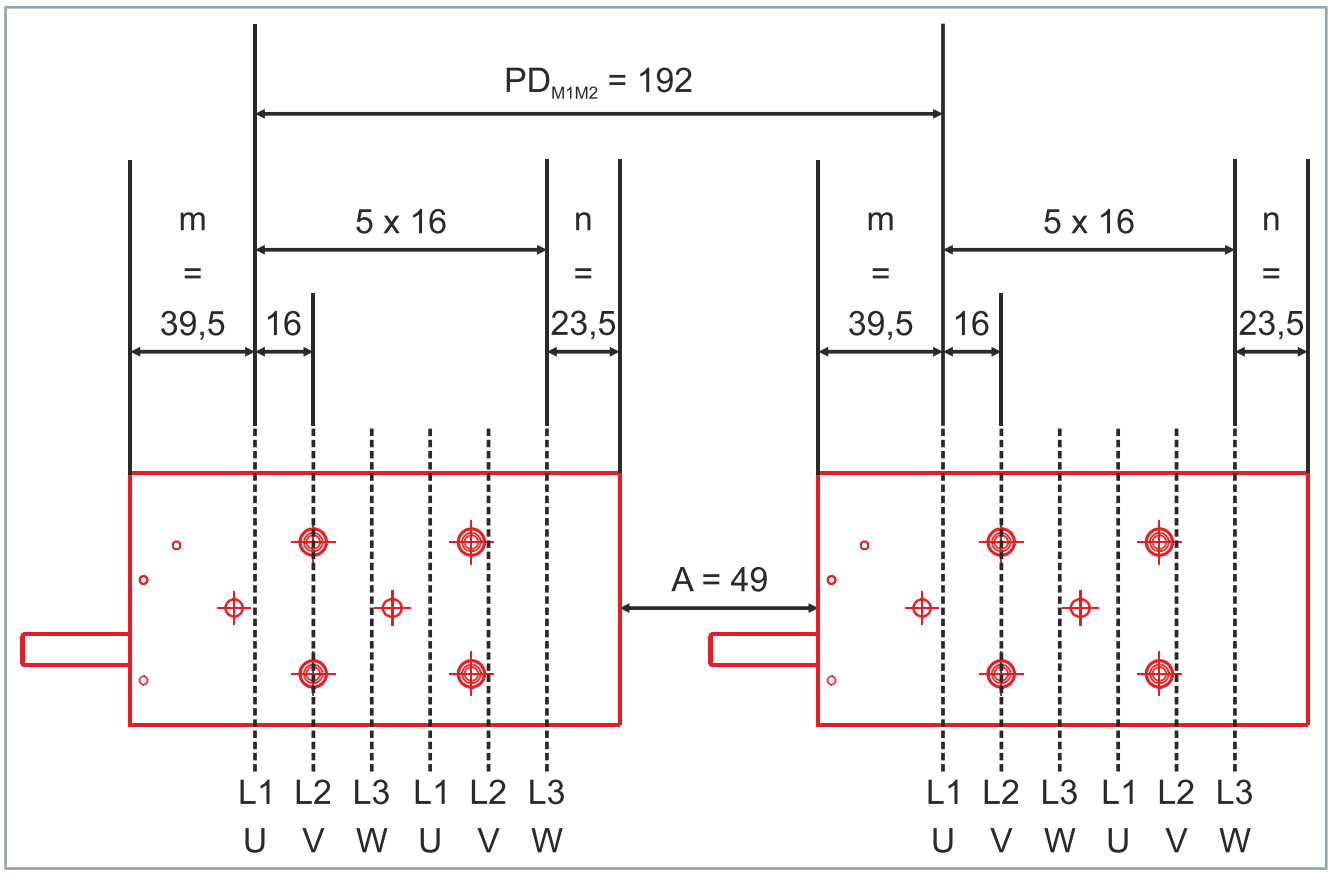
The following information is included in the figures:

- A = minimum distance
- m = distance from the stop on the cable side to the first phase center
- n = distance from the last phase center to the end side
- PD_{M1M2} = distance between the phase centers of the first phases at the stop on the cable side
- All figures in millimeters

Example 1: AL8122 and AL8122 with cables in opposite directions
This alignment of the coil units enables the minimum distance between the coil units.



Example 2: AL8122 and AL8122 with cables in the same direction
With this alignment, observe the minimum bending radius of the motor cables.



8.3.1 Offset calculation

Carry out the wiring according to the arrangement of the coil units. You have to calculate the offset for the wiring. The offset indicates the number of coils by which the rotary field is shifted in the second coil unit.

Calculate the offset using the following equation: (PD_{M1M2}/16) MOD 3

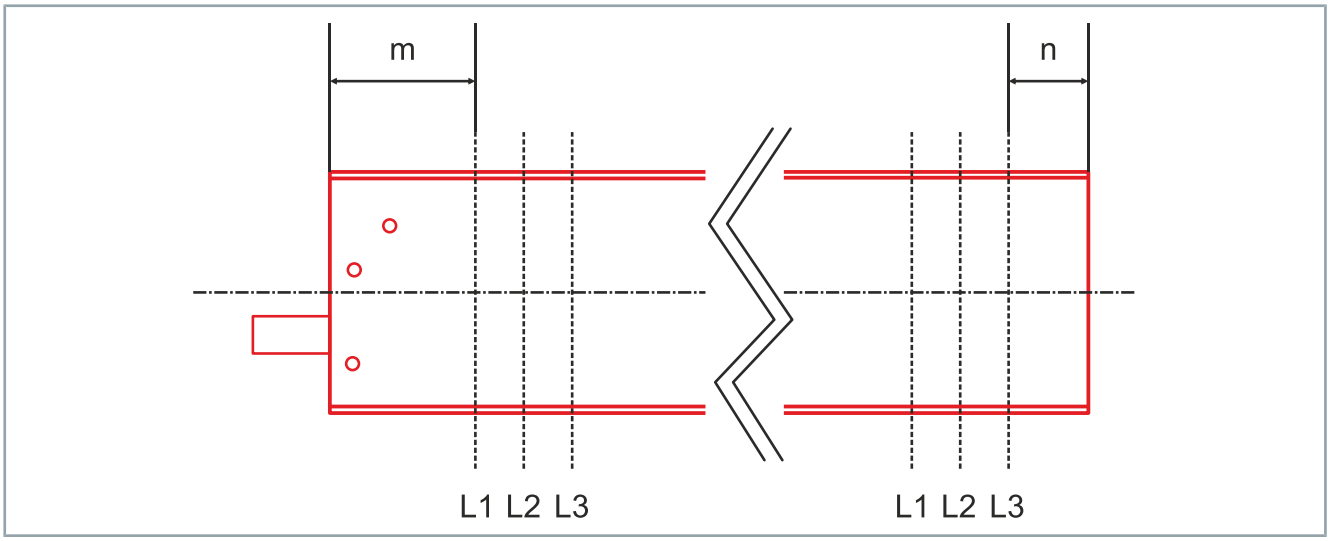
Information on PD_{M1M2} can be found in the chapter: "Electrical connection", [Page 50]

Information on wiring can be found in the chapter: "Power supply", [Page 53]

Example 1: AL8122 and AL8122 with cables in opposite directions
PD_{M1M2} = 208 mm
Offset = (208/16) MOD 3 = 1

Example 2: AL8122 and AL8122 with cables in opposite directions
PD_{M1M2} = 192 mm
Offset = (192/16) MOD 3 = 0

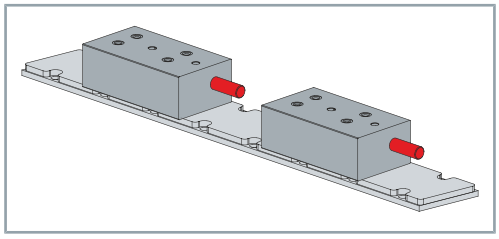
8.3.2 Phase lines



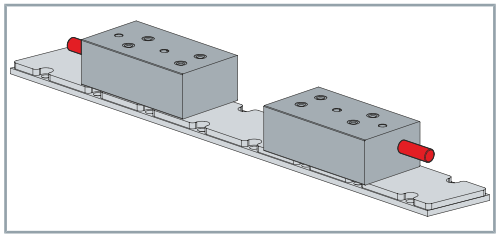
Motor	m	n
	[mm]	
AL8121	37.5	23.5
AL8122	39.5	23.5
AL8124	39.5	23.5
AL8126	39.5	23.5

8.3.3 Power supply

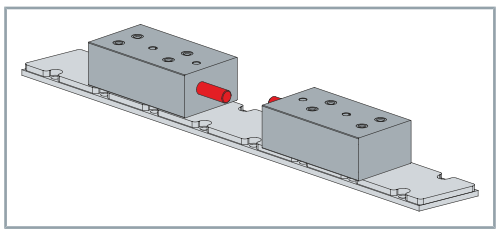
With the calculated offset and using the following tables, you can carry out the wiring of the coupled coil units.



Cables in the same direction			
Offset	**L1**	**L2**	**L3**
0	L1	L2	L3
1	L3	L1	L2
2	L2	L3	L1



Cables opposite			
Offset	**L1**	**L2**	**L3**
0	L3	L2	L1
1	L1	L3	L2
2	L2	L1	L3



Cables to each other			
Offset	**L1**	**L2**	**L3**
0	L3	L2	L1
1	L2	L1	L3
2	L1	L3	L2

8.3.4 Temperature sensor

By electrically connecting the coil parts in parallel to a servo terminal, only one temperature sensor can be connected. Always connect the temperature sensor of the coil part with the worst cooling connection and the highest temperature development. This will trigger the switch-off procedure in the servo terminal in case of a critical temperature rise in the poorly cooled coil part.

9 Mechanical installation

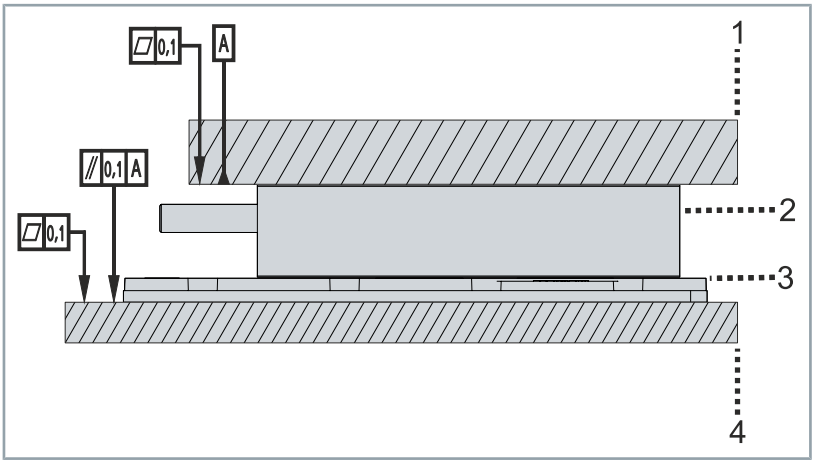
All work should be carried out with great care and without time pressure.

9.1 Requirements

When designing and dimensioning the machine or system, observe the basic requirements for the machine bed and the assembly of the coil part and magnetic plates.

9.1.1 Evenness

The specified mounting height is based on the specified evenness. The following figure shows the values for evenness and parallelism for the coil unit and the magnetic plate.



Position	Description
1	Machine slide
2	Coil part
3	Magnetic plate
4	Machine bed

Please refer to Chapter "Air gap, section Overall mounting height", [Page 44]

9.2 Assembly

⚠ WARNING

Serious injuries due to strong magnetic forces of attraction
The permanent magnets of the magnetic plates and coils of the coil unit attract each other. The high magnetic forces of attraction cannot be controlled by hand. Contact can result in serious or even fatal injuries due to crushing.

- Avoid standing within the travel range of the coil unit even when the machine or system is switched off

⚠ WARNING

Risk of injury due to incompatible magnetic plates
Non-approved magnetic plates are incompatible in the pole sequence and can cause serious injury and damage to the machine due to uncontrolled movements of the linear motor.

- Only use original magnetic plates from the AL8xxx product series

NOTICE

Damage due to improper installation
Holes that are not marked may be present for production purposes. Using the holes for other mounting purposes can damage the motor.

- Only use the illustrated holes for installation or other activities described in these operating instructions

During assembly, make sure that the magnetic track can be divided into two sections. The sections must be at least as large as the machine carriage.

Clean the mounting surfaces
Make sure that all mounting surfaces are oil-free, grease-free and unpainted. Remove any dirt or dust.

Observe the mounting sequence
First mount the coil unit on the machine carriage. Then mount the machine carriage including the coil unit on the guides. Finally, mount the magnetic plates.

Observe the screw requirements
Observe the minimum and maximum screw depths of the screws. Information on the screw depths can be found in the individual sections during mounting. Please observe the permissible torques and standards.

9.2.1 Coil part

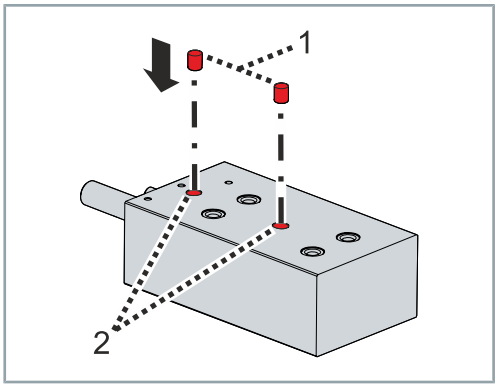
Loss of force due to asymmetry
Place the coil unit of the AL812x series with an offset to the magnetic plate.
Failure to observe this may result in loss of force at the linear motor and loss of performance in the machine or system.

Dimensional drawings for alignment
Please read the following chapters:

- "Technical data, paragraph AL812x, "alignment AL812x", [Page 33]"

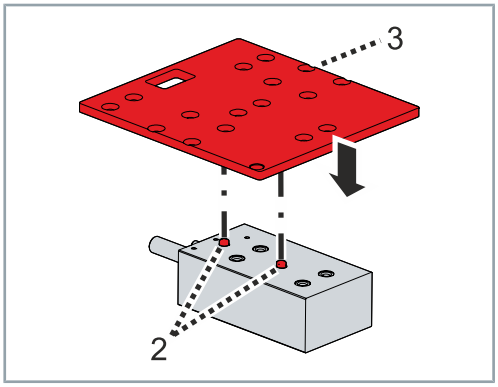
Mounting

► Clean the mounting surface on the coil unit and on the machine carriage

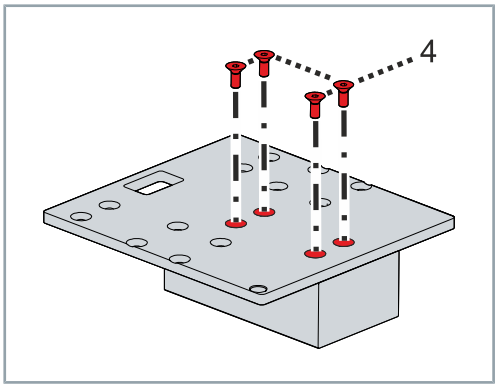


► Insert locating pins [1] into the holes of the coil unit [2]:

Locating pins	
Tolerance zone	M6
Maximum screw depth [mm]	4



► Place the machine carriage [3] with the holes on the locating pins [2] of the coil unit
► Align the coil unit, making sure that all the holes are aligned

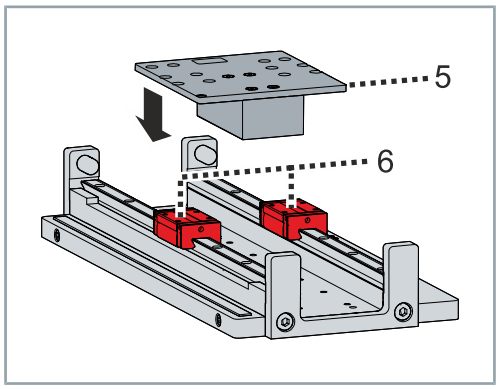


► Insert the screws [4] and tighten them crosswise from inside to outside

Observe tightening torques:

Screw quality = strength class 8.8	
Screw	M5 x 0.8
Recommended screw depth [mm]	5
Maximum screw depth [mm]	6
Tightening torque [Nm]	6

Before installing the pre-assembled machine carriage, the guide rails including the guide carriage must be attached to the machine bed.

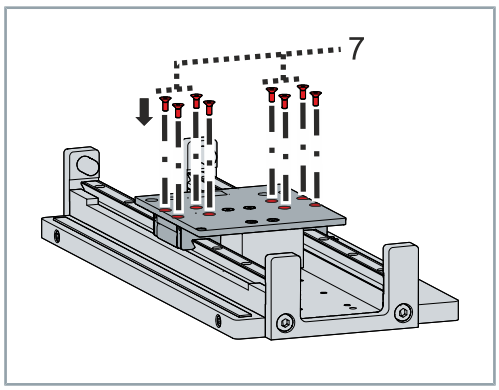


► Place the assembled coil unit including the machine carriage [5] on the guide carriage [6]

NOTICE

Damage due to incorrect alignment
Incorrect alignment of the individual machine components to each other can lead to tension in the entire system, resulting in damage to the components.

- When screwing on the machine carriage, ensure that the carriage is aligned with the machine bed and the guide rails.



► Insert and tighten the screws [7]

9.2.2 Magnetic plates

⚠ DANGER

Danger from strong magnetic fields
Strong permanent magnets generate intense magnetic fields that can interfere with or disable the function of pacemakers. This can cause serious health problems, including unconsciousness, heart attack or even death.

- Maintain a minimum distance of 200 mm between persons concerned and the magnetic plates
- Do not hold magnetic plates close to the chest area

⚠ WARNING

Serious injuries due to magnetic forces of attraction
Severe crushing injuries may result if the strong magnetic field of the permanent magnets in the magnetic plate unexpectedly attracts the components magnetically during assembly. The cover weakens the magnetic field and protects electrical components from magnetic influences.

- Do not remove the protective cover

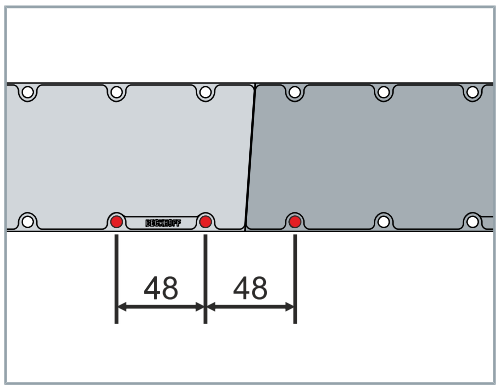
Defective smartphones and smartwatches due to strong magnetic fields
Strong magnetic fields emitted by magnetic plates can negatively affect devices such as smartwatches and smartphones.

- Keep smartphones and smartwatches away from magnetic plates without protective cover

Observe the alignment
Align the magnetic plates identically. The Beckhoff logo must always be on the same side.
If this is not observed, the adjacent magnetic plates repel each other. As a result, the coil unit cannot move without restriction. The system is not operational.

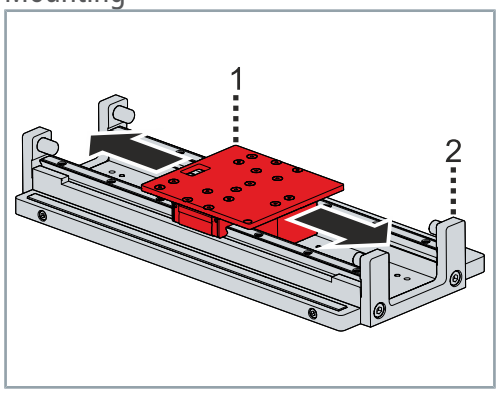
Observe minimum gap
Keep the required minimum gap when mounting additional magnetic plates. This is 48 mm between hole centers. During mounting, maintain a distance of at least 10 cm between the magnetic plate to be mounted and the mechanically protected coil unit.
Failure to observe this can lead to complications during installation.

Minimum gap (example)
The diagram shows the minimum gap between two magnetic plates.



- Distance between hole centers: 48 mm

Mounting



⚠ WARNING

Serious injuries due to uncontrolled movement of the machine carriage

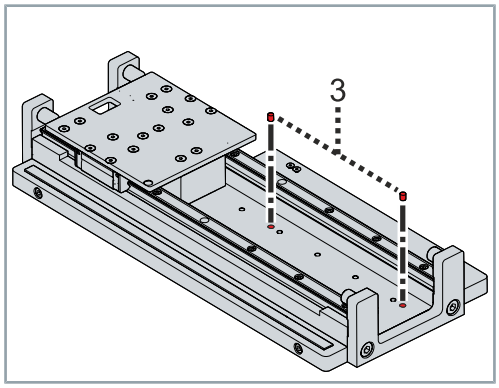
If the strong magnetic field of the permanent magnets in the magnetic plate unexpectedly attracts the components magnetically during assembly, it is not possible to hold the machine carriage by hand. Severe injuries to limbs can be the result.

- Secure the machine carriage mechanically against uncontrolled movements
- Do not reach under the machine carriage or hold the machine carriage by hand

▶ Clean the mounting surface on the machine bed and the magnetic plate

▶ Push the machine carriage [1] to one end of the machine bed [2]

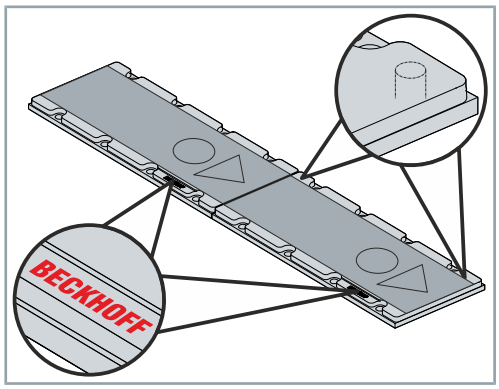
▶ Mechanically secure the machine carriage against the magnetic forces of attraction and uncontrolled movements of the magnetic plate



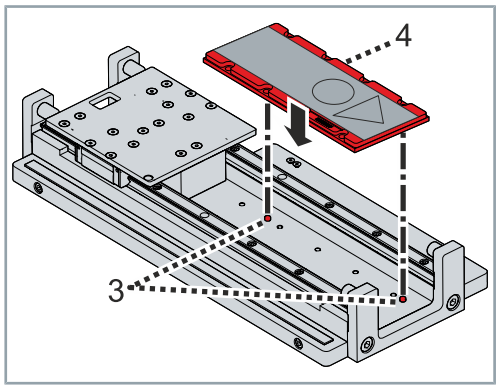
▶ Insert locating pins [3] into the machine bed

▶ Pay attention to the insertion depth of the locating pins [3]

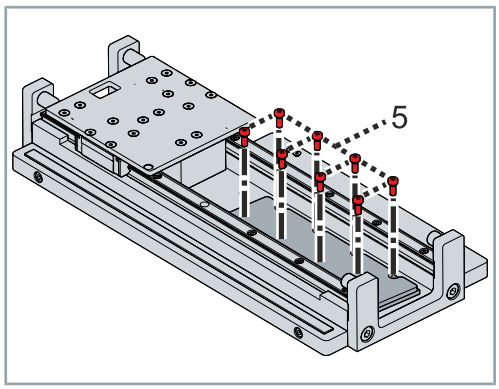
Locating pins	AL852x
Tolerance zone	M6
Maximum immersion in the magnetic plate [mm]	3.2



► Check the alignment of the magnetic plate. Make sure that the Beckhoff logos are on the same side.



► Place the magnetic plate [4] on the locating pins [3]



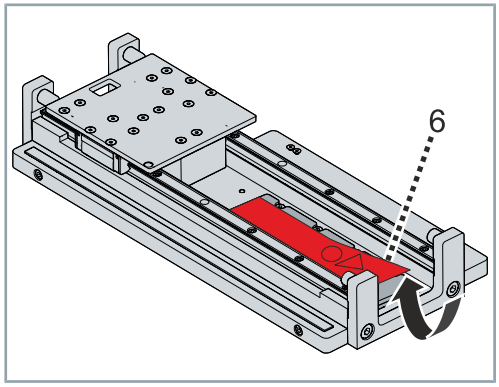
► Insert screws [5] into the magnetic plate on the machine bed

► Tighten the screws crosswise and from inside to outside

Observe tightening torque:

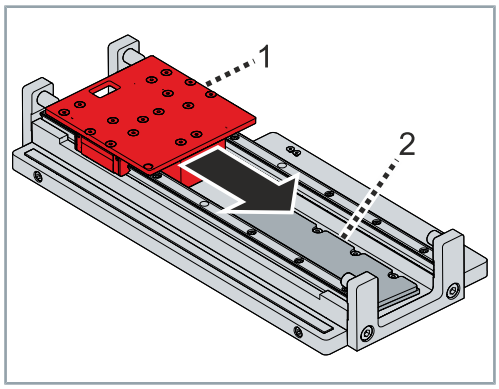
Screw quality = strength class 8.8	
Screw	M5
Tightening torque [Nm]	6

These steps must be repeated until half of the travel path has been fitted with magnetic plates.

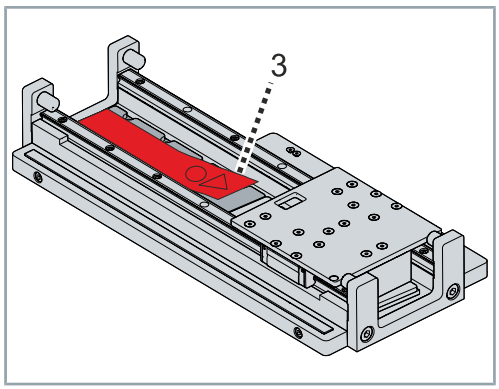


► Remove the protective cover [6] on the mounted magnetic plates onto which the machine carriage is to be pushed. Do not dispose of the protective cover and keep it for subsequent transport of the machine or system.

Other magnetic plates



- ► Push the machine carriage [1] onto the mounted magnetic plates [2]
- ► Secure the machine carriage mechanically against uncontrolled movements
- ► Mount the other magnetic plates in the same way



Once all components have been fitted and you start the machine or system:

- ► Remove all protective covers [3] on all magnetic plates

9.3 Verification

After assembly, check the installed components for smooth running and adequate air gap.

9.3.1 Smooth operation

Smooth running of the machine slide
The machine slide should move smoothly along the entire magnetic track. A permanent air gap must exist between the coil part and the magnetic track.
If you cannot move the coil part smoothly, check the assembly of your application. Observe all specifications from Chapter "Mechanical installation", [Page 54]

To check the smooth running of the machine slide, carry out the following steps:

- ► Remove all tools from the machine or system
- ► Clean the magnetic track
- ► Move the machine slide carefully by hand and guide it along the entire length of the magnetic track

10 Electrical installation

10.1 Connection technology

Beckhoff supplies pre-assembled power and feedback lines. For the selection of the cables required, refer to the Beckhoff documentation for the connecting cables. In the documentation you will find a complete overview of the available cables and information on the technical data.

Maximum number of mating cycles
The information on maximum mating cycles can be found in the respective data sheets at www.beckhoff.com.

10.1.1 Cables

NOTICE

Damage to the motor due to incorrect installation
The cable of the is firmly encapsulated with the linear motor. It is part of the wear-free product. Incorrect installation can lead to a limited service life or damage to the linear motors. Failure to comply with the provisions will void the warranty and other claims for damages.

- Do not lay the cable in a drag chain

NOTICE

Contact problems due to contamination
Dirt and impurities between the coupling and plug can impair the functions of the connection.

- When connecting the coupling and the plug, make sure that the poles and the inside of the component are not soiled or damaged

Hint for trouble-free application and assembly:

- Wiring in accordance with applicable regulations and standards
- Use of pre-assembled and shielded Beckhoff cables

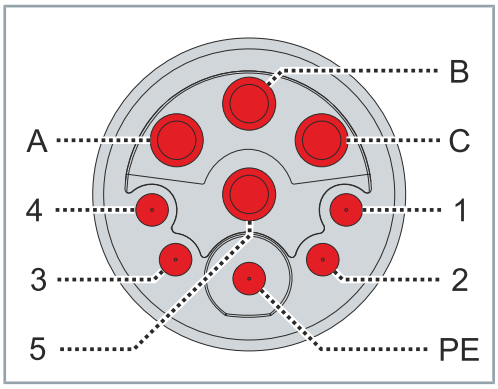
Beckhoff offers pre-assembled cables for faster and flawless installation of the motors. These cables are tested with regard to the material used, shielding and connection type. The use of other cables can cause unexpected faults and result in exclusion of warranty.

10.2 Connector assignment

Beckhoff offers various power connectors and feedback connectors. All plugs are IP65 rated.

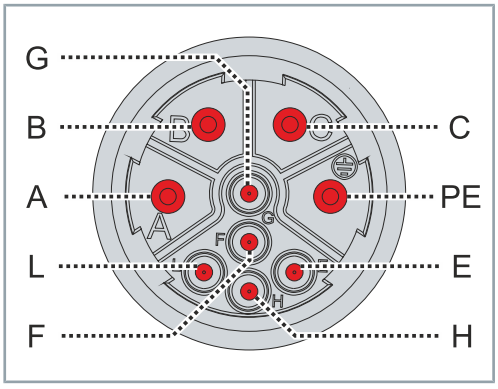
The following tables show the connector assignment:

10.2.1 itec® plug



Pin assignment			
Contact	**Function**	**Color**	**Core identification**
A	U	Black	1
B	W	Black	3
C	V	Black	2
1	---	---	---
2	---	---	---
3	Temperature+/ U_s	White	---
4	Temperature-/ GND	Blue	---
5	---	---	---
PE	PE	Green/yellow	---

10.2.2 M23 SpeedTec® plug



Pin assignment			
Contact	**Function**	**Color**	**Core identification**
A	U	Black	1
B	V	Black	2
C	W	Black	3
PE	PE	Green/yellow	---
E	Temperature-/ GND	Blue	---
F	Shield	Shield	---
G	---	---	---
H	Temperature+/ U_s	White	---
L	---	---	---

11 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.

11.1 Before commissioning

Pay attention to the following points before commissioning:

- ► In the case of multi-axis systems, commission each drive unit separately
- ► Read the operating instructions for the servo terminal
- ► Check drive for damage
- ► Check mounting and alignment
- ► Tighten screw connections correctly
- ► Installing mechanical, thermal and electrical protective devices
- ► Check the wiring, connection and proper grounding of the drive and servo terminal

11.2 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

Configuration
Beckhoff recommends using Beckhoff servo terminals and motors and configuration with Beckhoff TwinCAT 3 Drive Manager 2 | TE5950.

Carry out the operating procedures in the operating instructions for servo terminals:

- ► Build Project and Choose Target System
- ► Implement devices by scanning or manually
- ► Create axis configuration
- ► Set scaling factor and speeds
- ► Check status and activate control system

11.3 Prerequisites during operation

Pay attention to the following points during operation:

- ► Pay attention to unusual noise developments
- ► Always check drive surfaces and cables for dirt, leaks, moisture or dust
- ► Check temperature development
- ► Check for lubricant leakage
- ► Check function of safety devices

11.4 After operation

⚠ WARNING

Serious injuries due to uncontrolled movements of the coil unit

Uncontrolled movements of the coil units can lead to serious injuries or damage to the system or machine.

- Place the machine or plant in a safe state

12 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 the connected motors and the machine.
- Secure the connected motors and the machine against unauthorized restarting.

NOTICE

Damage to the motor due to liquid
Cleaning fluid entering the motor can cause damage to the motor.

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

Linear motors are essentially maintenance-free. Dirt, dust or chips along the guide rails can negatively affect the function of the linear motor. Extreme soiling can lead to failure.

12.1 Cleaning agents

Clean the components carefully with a damp cloth or a brush.

Use grease-dissolving and non-aggressive cleaning agents such as isopropanol for cleaning. You will also receive information about non-approved cleaning agents.

12.1.1 Not applicable

Cleaning agents	Chemical formula
Aniline hydrochloride	$C_6H_5NH_2HCl$
Bromine	Br_2
Sodium hypochlorite; bleaching solution	NaClO
Mercury (II) chloride	$HgCl_2$
Hydrochloric acid	HCl

13 Decommissioning

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

Refer to chapter "Documentation notes", [Page 6].

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", [Page 69].

13.1 Disassembly

⚠ WARNING

Risk of injury during disassembly of the magnetic plates
Permanent magnets are installed in the AL85xx magnetic plates. During disassembly, the opposing magnetic plates can attract each other unpredictably due to the strong magnetic forces and injure your hands.

- Carefully remove the magnetic plates
- Make sure that your hands are not between the magnetic plates and ferromagnetic objects during disassembly

Removing the magnetic plates from the machine:

► Push the machine carriage to one side and mechanically secure it against uncontrolled movements

► Attach protective covers to the magnetic plates. The protective cover is included with the magnetic plates.

► Unscrew and remove the bolts

► Remove the magnetic plate

► Remove the locating pin

► Push the machine carriage to the other side and mechanically secure it against uncontrolled movements

► Remove the other magnetic plates in the same way

Removing the coil unit from the machine:

► If present: remove water cooling

► Disconnect the electrical connectors

► Remove the machine carriage from guide rails

► Unscrew and remove the bolts

► Separate the coil unit from the machine carriage

► Remove the locating pins

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

Test procedures and certifications vary by product. Beckhoff linear servomotors of the AL8100 series are certified and tested according to the following directives and standards.

14.1 Standards

EN 60034-1:2010+Corr.:2010
"Rotating electrical machines – Rating and performance"

EN IEC 63000
"Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances"

14.2 Guidelines

2014/35/EU
Low Voltage Directive

2014/30/EU
EMC Directive

2011/65/EU
RoHS Directive

14.3 Test centers

The 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.

The product complies with UL requirements and is certified as a cURus component for the US and Canadian markets in accordance with the standards applicable in the USA and Canada. The cURus logo can be found on the name plate.

The product meets all the requirements of the British Economic Area. These include England, Wales, and Scotland.

14.4 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

14.5 CCC conformity

Export to Chinese Economic Area
Beckhoff linear motors of the AL8100 series are not subject to the **C**hina **C**ompulsory **C**ertificate; CCC. The products are exempt from this certification and can be exported to the Chinese economic area.

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