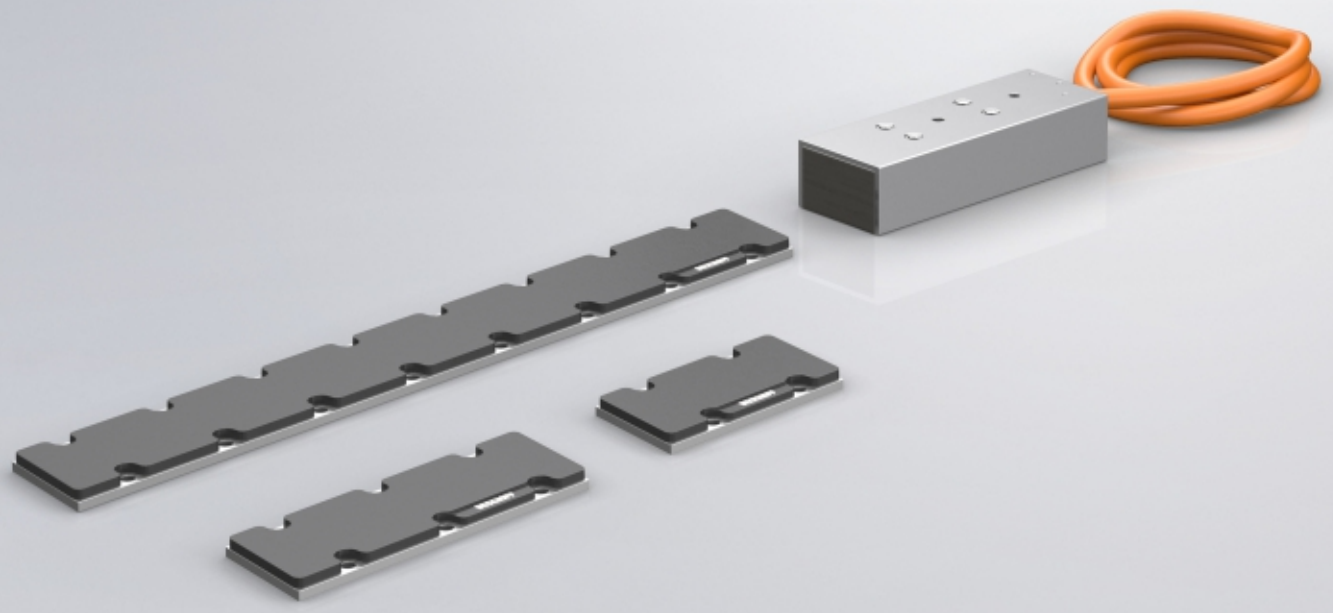
BECKHOFF New Automation Technology

Operating instructions | EN

AL8100

Linear servomotors for compact drive technology



2024-07-18 | Version 1.0.0

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1 Documentation notes

1.1 Disclaimer

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

1.1.1 Trademarks

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

1.1.2 Patents

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

- EP1590927
- EP1789857
- EP1456722
- EP2137893
- DE102015105702

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

1.1.3 Limitation of liability

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

The following is excluded from the liability:

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

1.1.4 Copyright

1.2 Version numbers

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

- Send your request to motion-documentation@beckhoff.com.

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

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

1.3 Scope of the documentation

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

1.4 Staff qualification

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

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

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

Instructed person

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

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

Trained person

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

- machine-specific or
- plant-specific

Trained specialists

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

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

Qualified electricians

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

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

1.5 Safety and instruction

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

1.5.1 Notes on information security

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

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

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

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

1.6 Explanation of symbols

Various symbols are used for a clear arrangement:

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

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

⚠ DANGER

Failure to comply will result in serious or fatal injuries.

⚠ WARNING

Failure to comply may result in serious or fatal injuries.

⚠ CAUTION

Failure to comply may result in minor or moderate injuries.

NOTICE

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

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

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

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

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

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

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

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.

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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 963-157
service@beckhoff.com
www.beckhoff.com/en-en/support/our-service-offerings/

1.7.4 Headquarters Germany

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info@beckhoff.com
www.beckhoff.com/en-en/

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

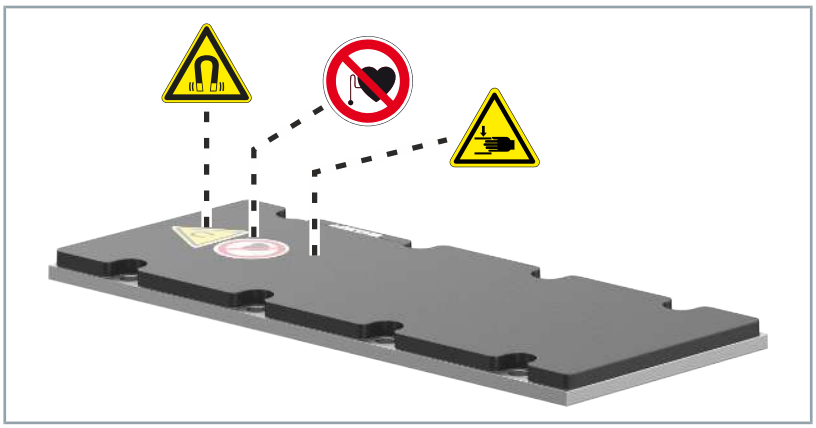
2 For your safety

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 symbols 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 force of magnetic 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.

Danger from magnetic fields

The magnetic fields of individual components of the AL8100 linear servomotors are dangerous to:

- people 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

Ensure a safe distance of at least 200 mm between the persons concerned and all magnetic parts.

Observe the requirements of DGUV Regulation 15 for electromagnetic fields (Germany) and applicable national regulations in other countries.

Danger due to magnetic attraction

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

Ensure a safety distance of at least 250 mm from the magnetic plate to other ferromagnetic parts, e.g. iron.

Observe the requirements of DGUV Regulation 15 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
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.

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 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
Activate and monitor the temperature contact 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

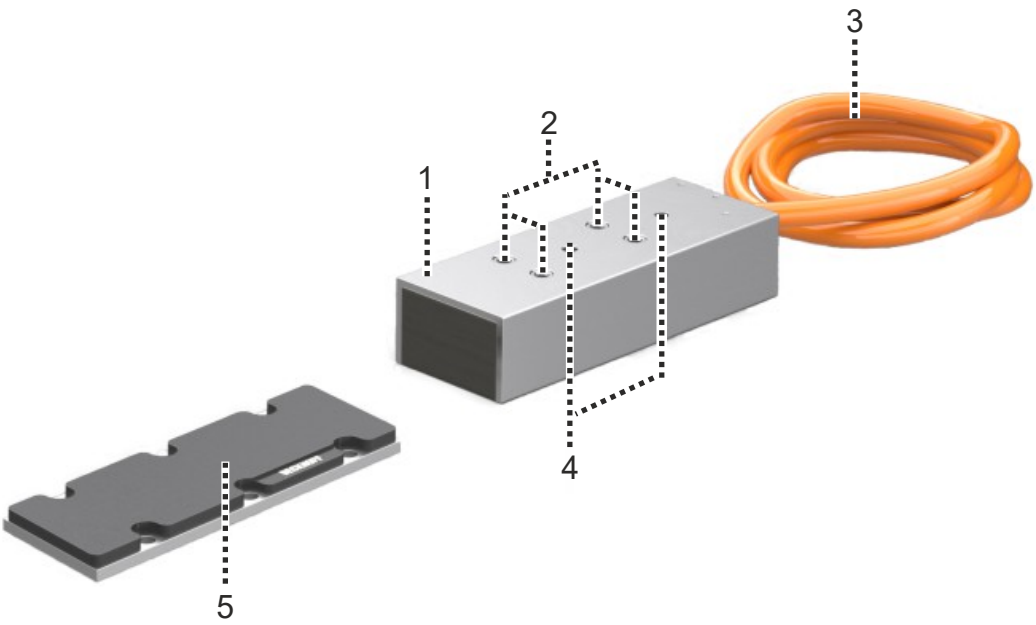
Check the functionality of all safety-relevant devices. Secure the working environment. Secure the machine or plant against being inadvertently started up. Observe and comply with the chapter: Decommissioning.

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.

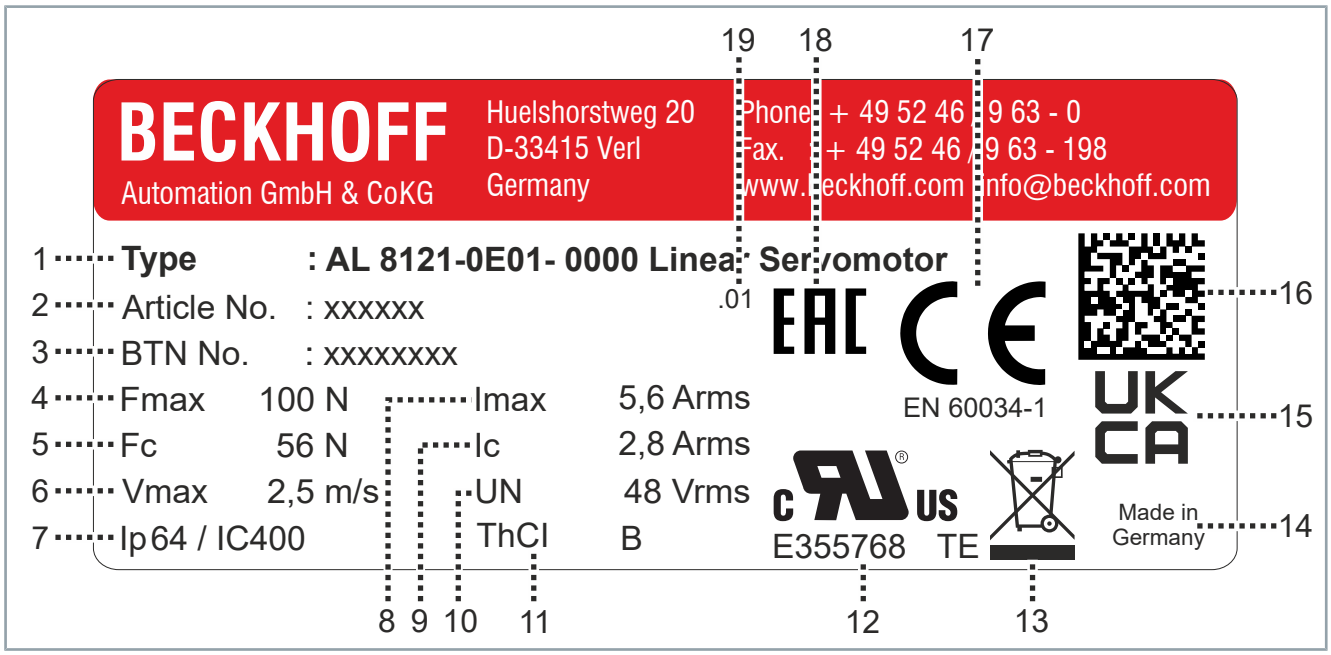
4 Product overview



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

4.1 Linear servomotor

4.1.1 Name plate



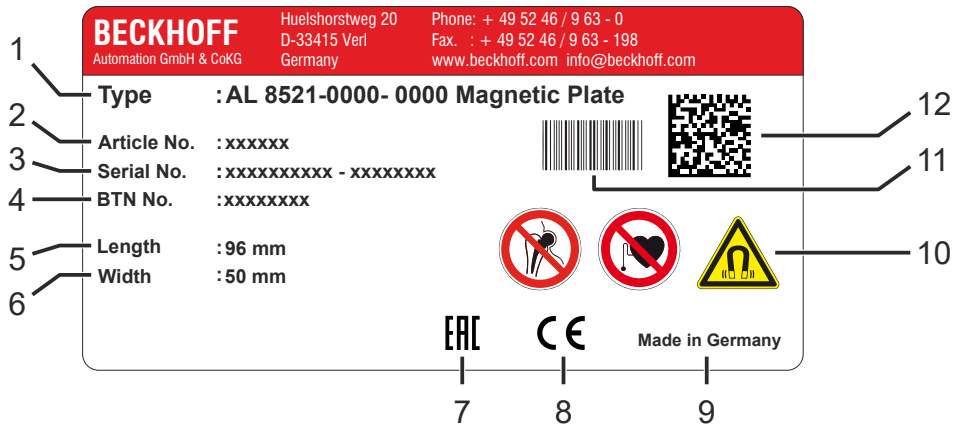
Item number	Explanation
1	Article name
2	Order number
3	Beckhoff Traceability Number (BTN)
4	Peak force
5	Continuous force
6	Maximum velocity
7	Protection class
8	Peak current
9	Continuous current
10	Nominal voltage
11	Insulation class
12	cURus approval
13	WEEE compliance
14	Country of manufacture
15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

4.1.2 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	Overall width 2 = W2; 50 mm
v	Overall length 1 = 3 2 = 6 4 = 12 6 = 18
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

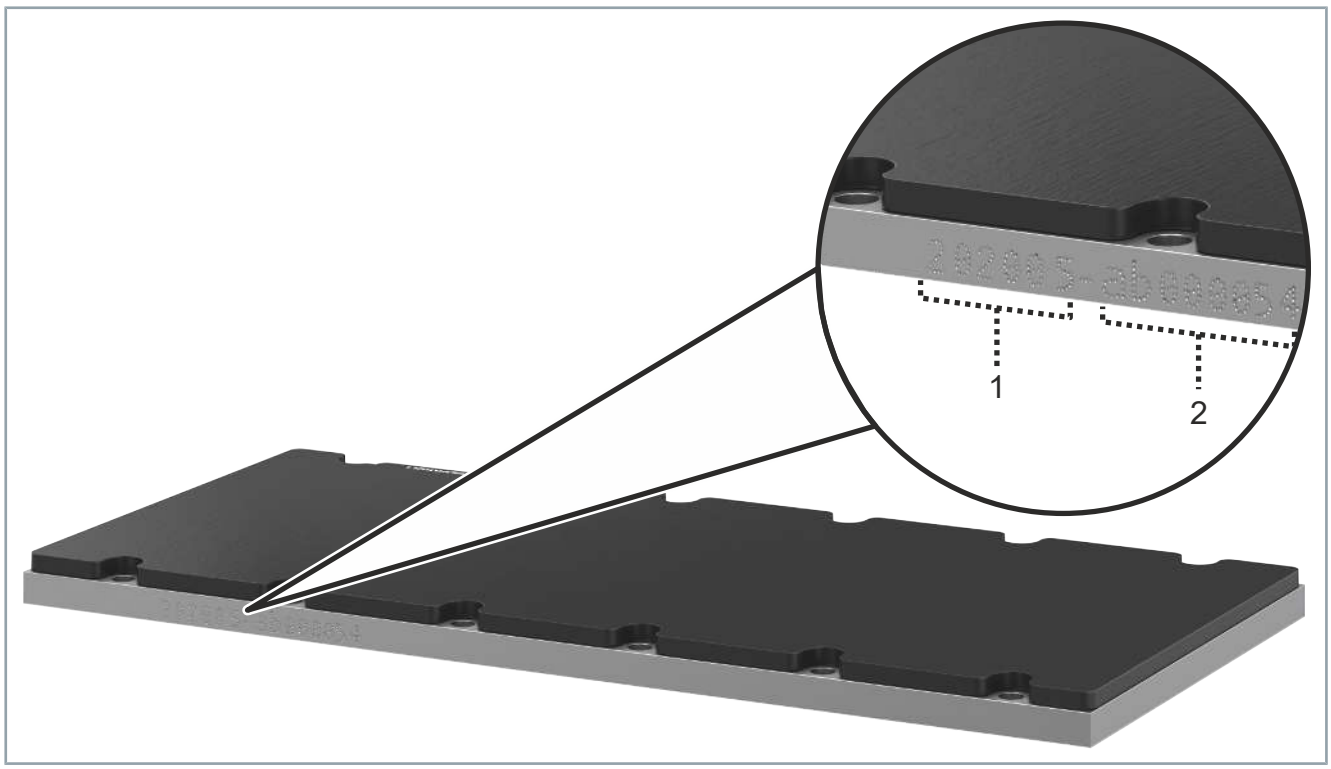
4.2 Magnetic plate

4.2.1 Name plate



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

4.2.2 Needle pattern marking



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

4.2.3 Type key

AL8 t u v - 0000 - 0000	Explanation
AL8	Product area Iron-core series 8 linear servomotors
t	Series 5 = magnetic plate
u	Overall width 2 = W2; 50 mm
v	Overall length 1 = short 2 = medium 3 = long

4.3 Product characteristics

Dust-protected IP64 housing

The coil parts are suitable for a wide range of environmental conditions. The coil parts 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.

Thermal contact

A thermal contact 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

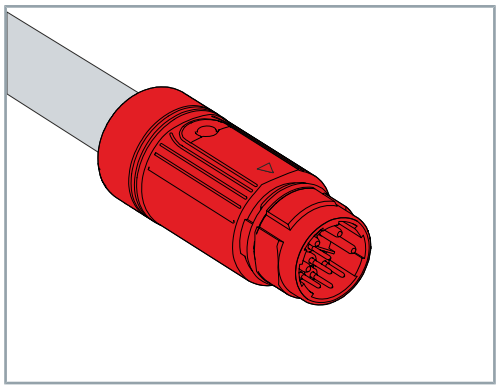
Within a width category, such as AL812x, the coil units have identical width and can therefore be operated together on one magnetic track and combined as desired.

4.4 Ordering options

4.4.1 Connection cables

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

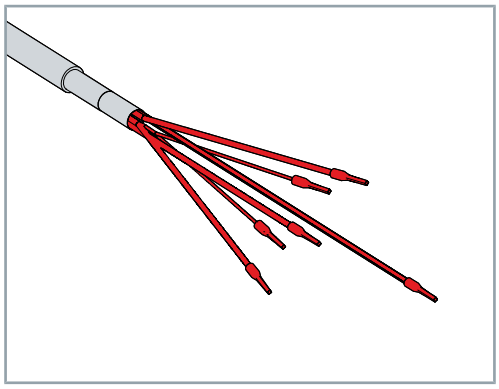
Plug



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.

4.5 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

4.5.1 Improper use

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

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

5 Technical data

5.1 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 5 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 design air gap.

Magnetic force of attraction F_a [N]

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

Continuous power loss P_L [W]

Maximum power dissipation 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.

5.2 Data for operation and environment

NOTICE

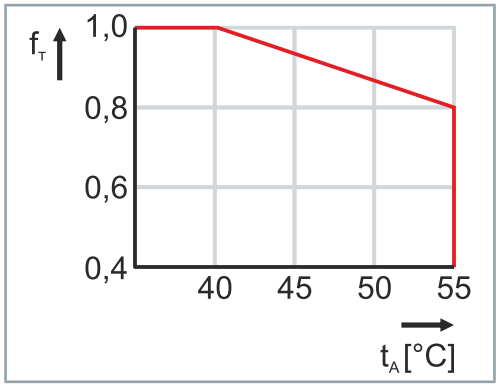
Operate linear motors only under the specified conditions
Operate the linear motors only under the conditions for operation and the environment listed in this chapter. This ensures a long service life and proper operation.
Short-term or long-term operation outside of the specifications listed here may reduce the service life of the coil units.

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	Convection 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	in accordance with EN 61800-3:2004 + A1:2012
Approvals	CE, cURus, EAC, UKCA

5.2.1 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.



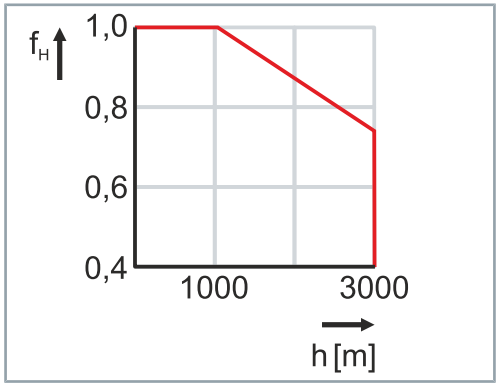
Ambient temperature

f_T = Temperature utilization factor

t_A = Ambient temperature in °C

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

$$F_{CA\_red} = F_C \times f_T$$



Installation altitude

f_H = Altitude utilization factor

h = Altitude in meters

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

$$F_{CA\_red} = F_C \times f_H$$

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:

$$F_{CA\_red} = F_C \times f_T \times f_H$$

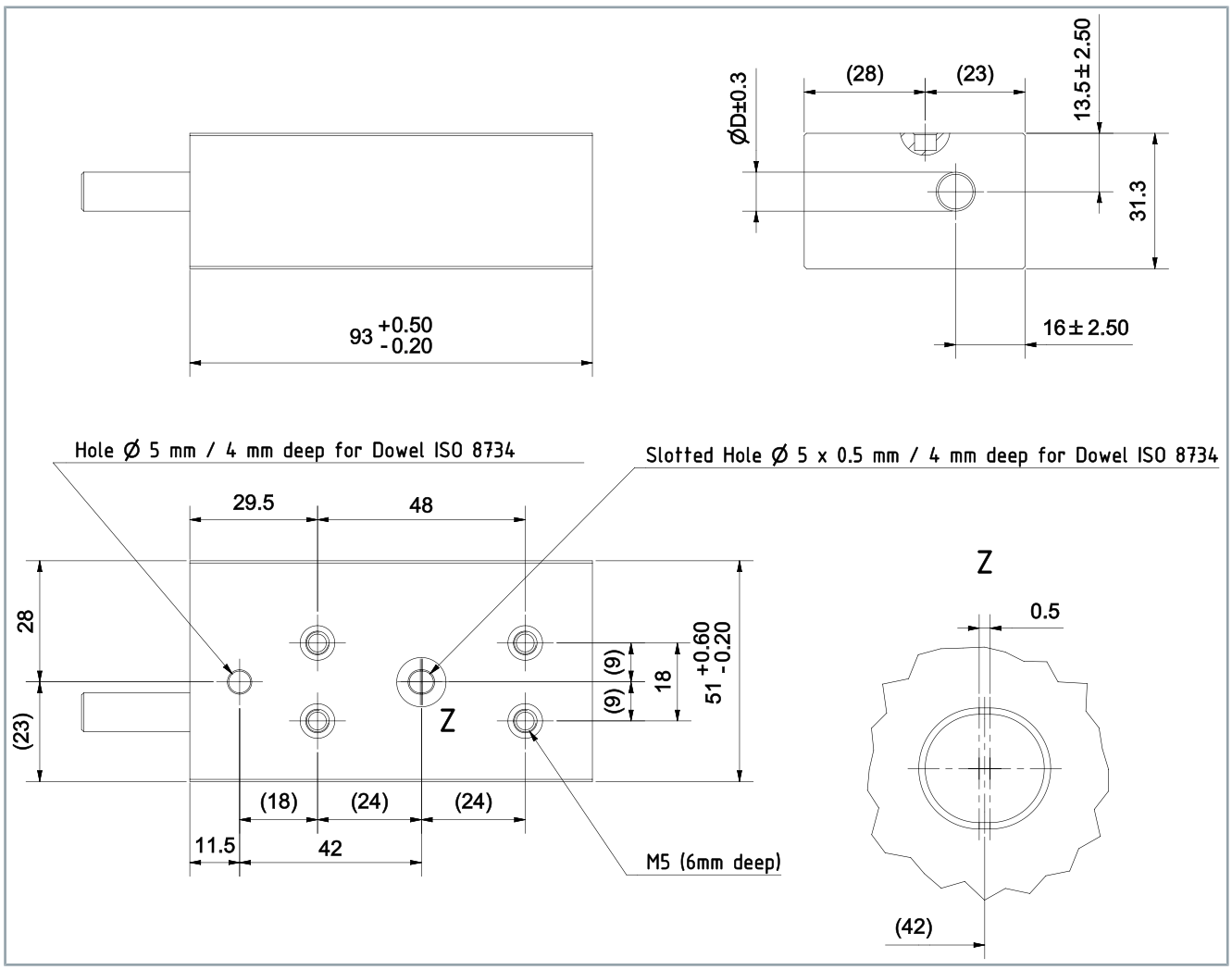
5.3 AL812x

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
Force of magnetic 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]	2.1								
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									

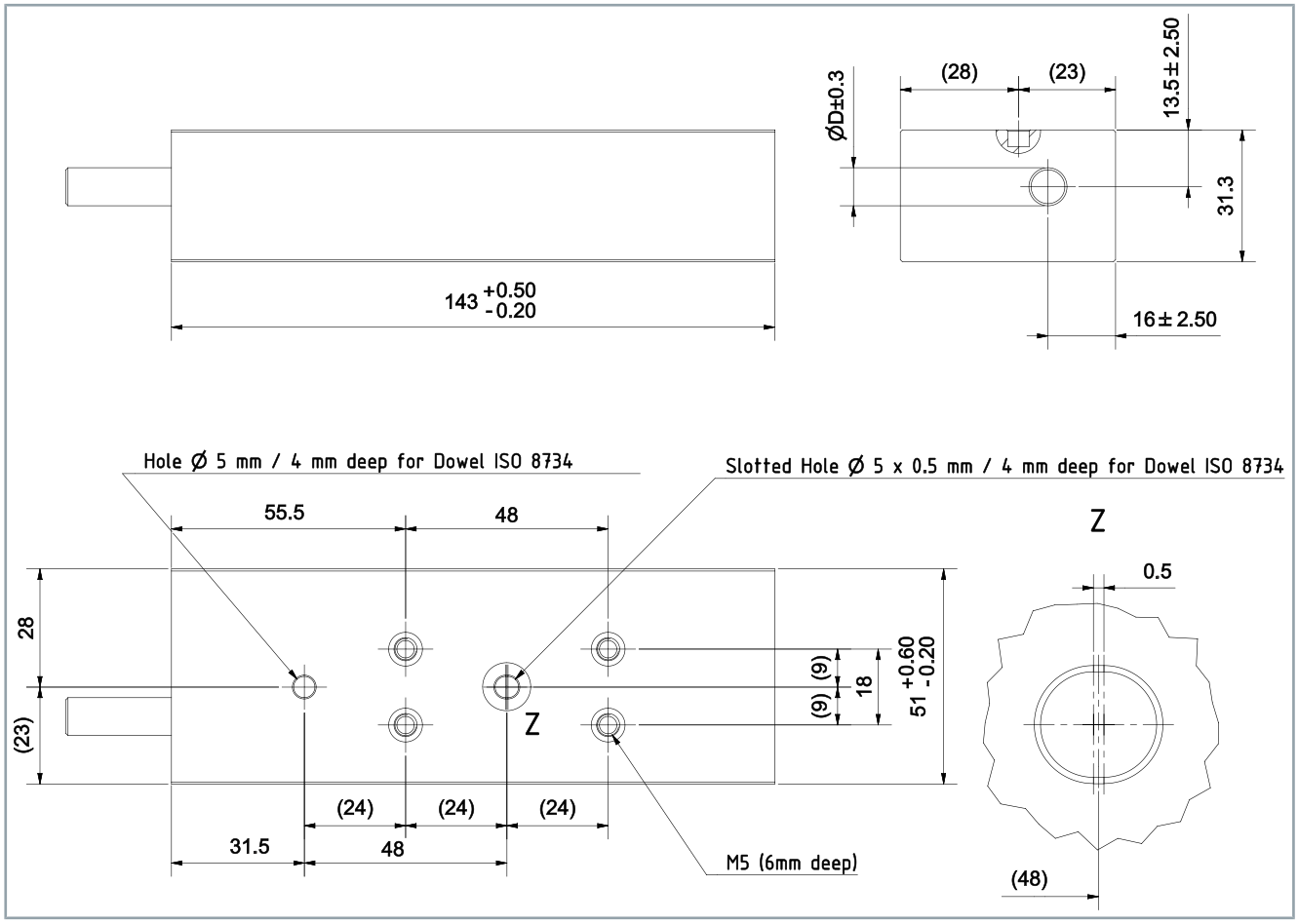
5.3.1 Dimensional drawings

- All figures in millimeters

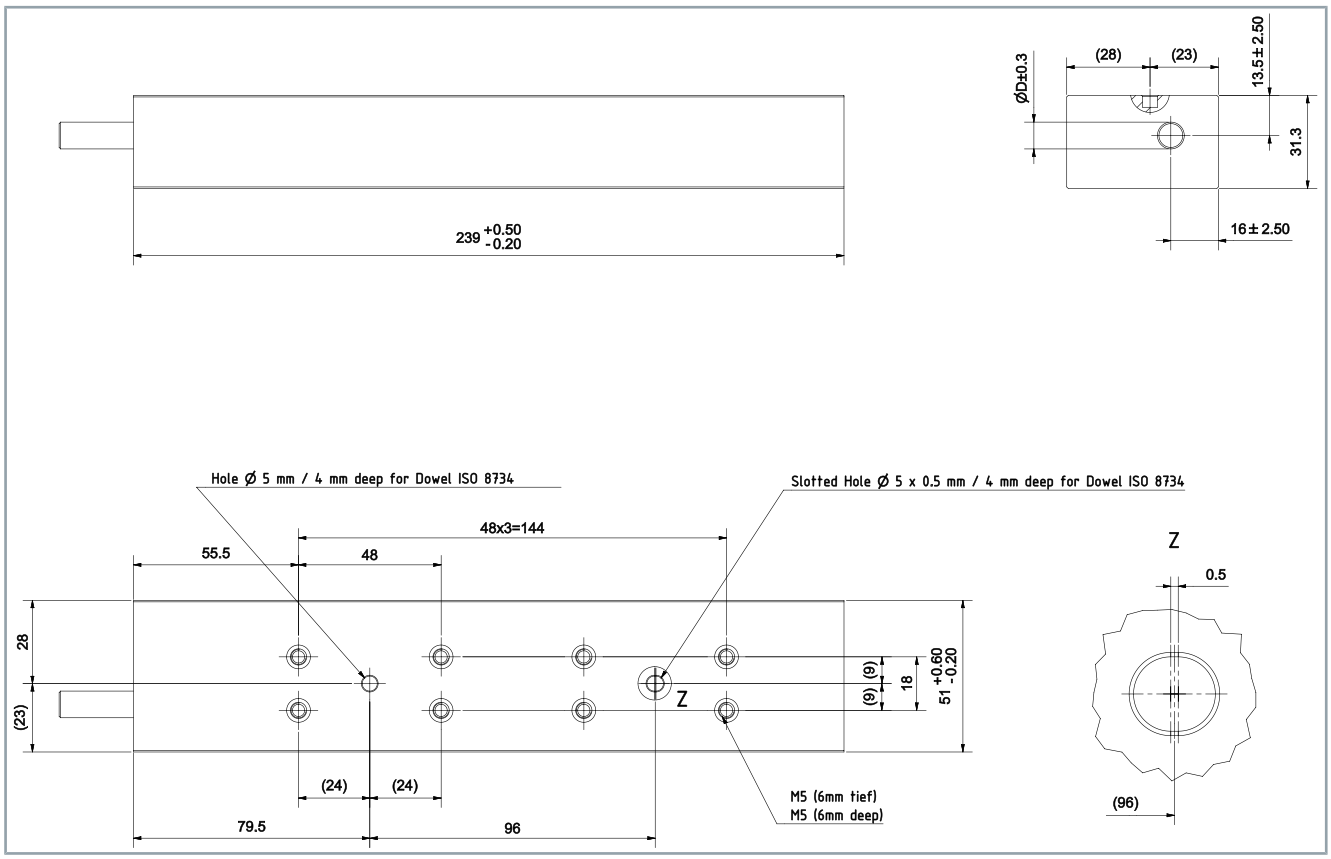
5.3.1.1 AL8121



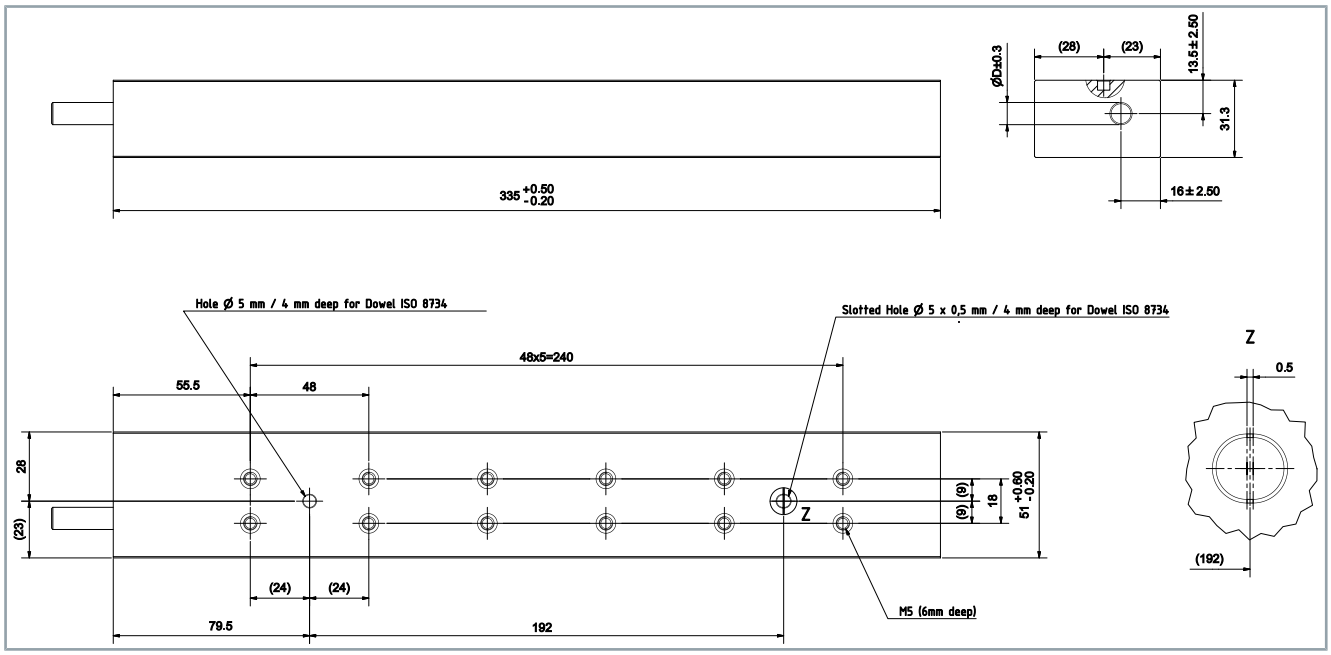
5.3.1.2 AL8122


ØD±0.3
(28)
(23)
13.5± 2.50
31.3
143 +0.50 -0.20
16± 2.50
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)

5.3.1.3 AL8124

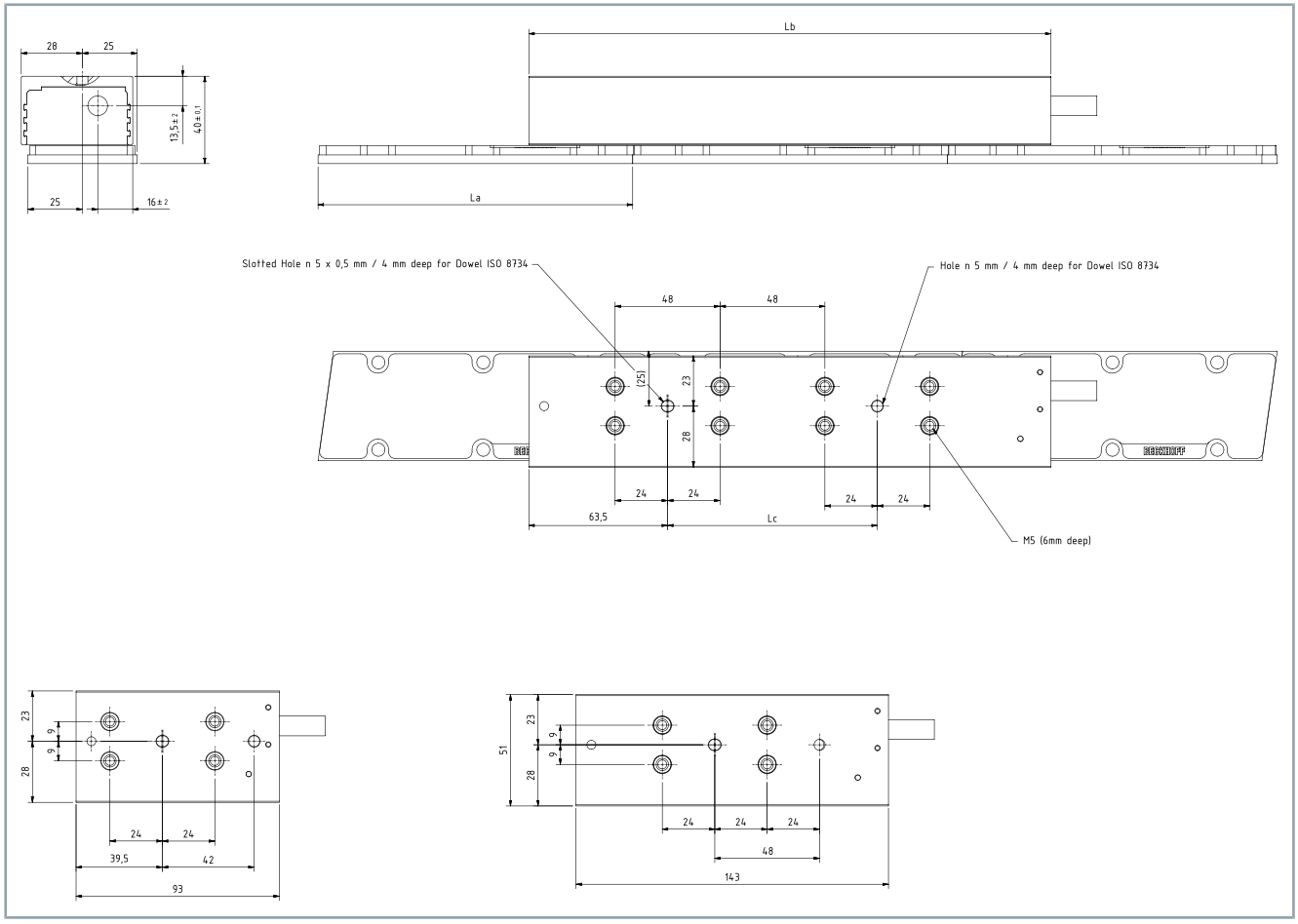


5.3.1.4 AL8126



5.3.2 AL812x alignment

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

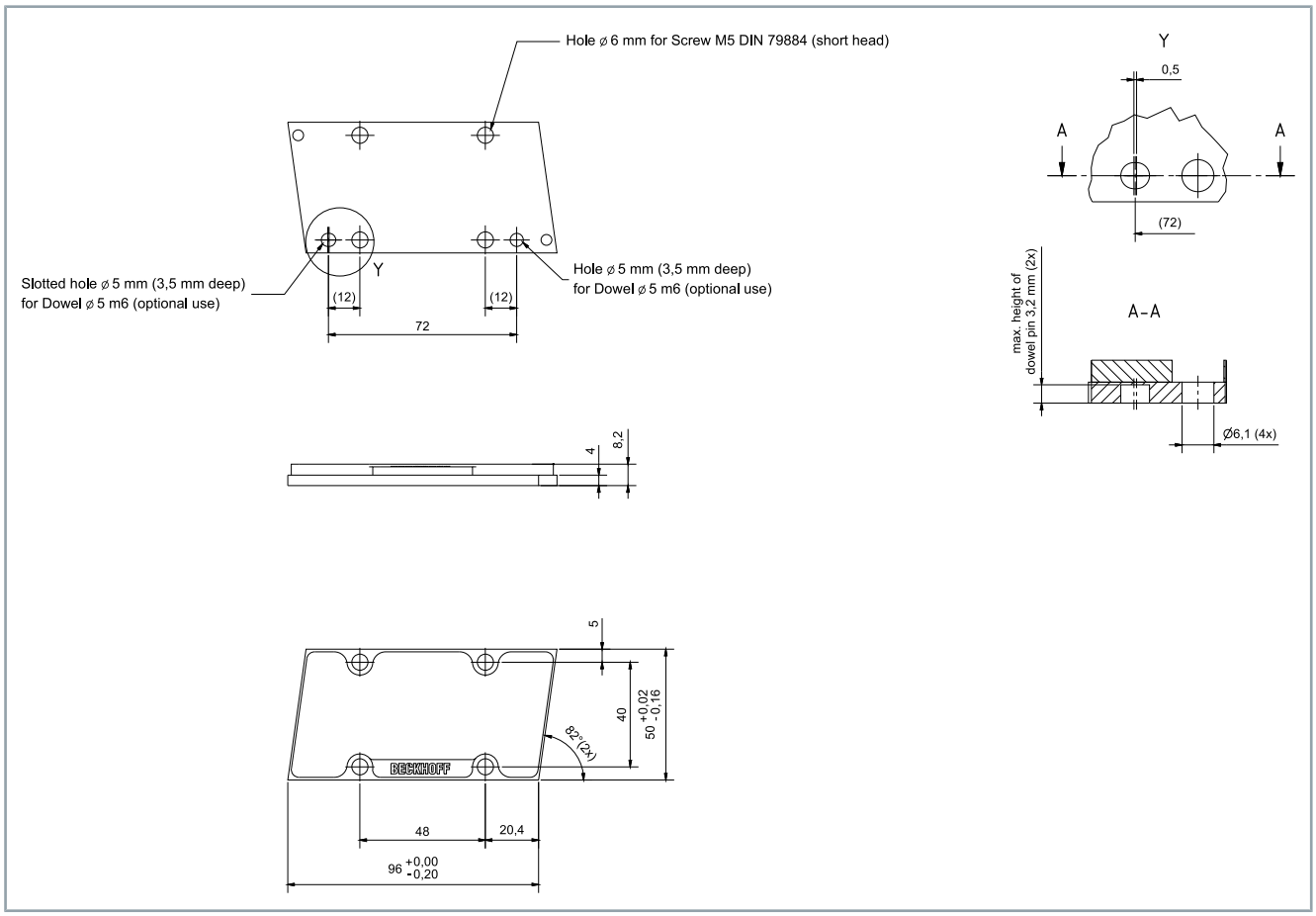


5.4 AL852x magnetic plates

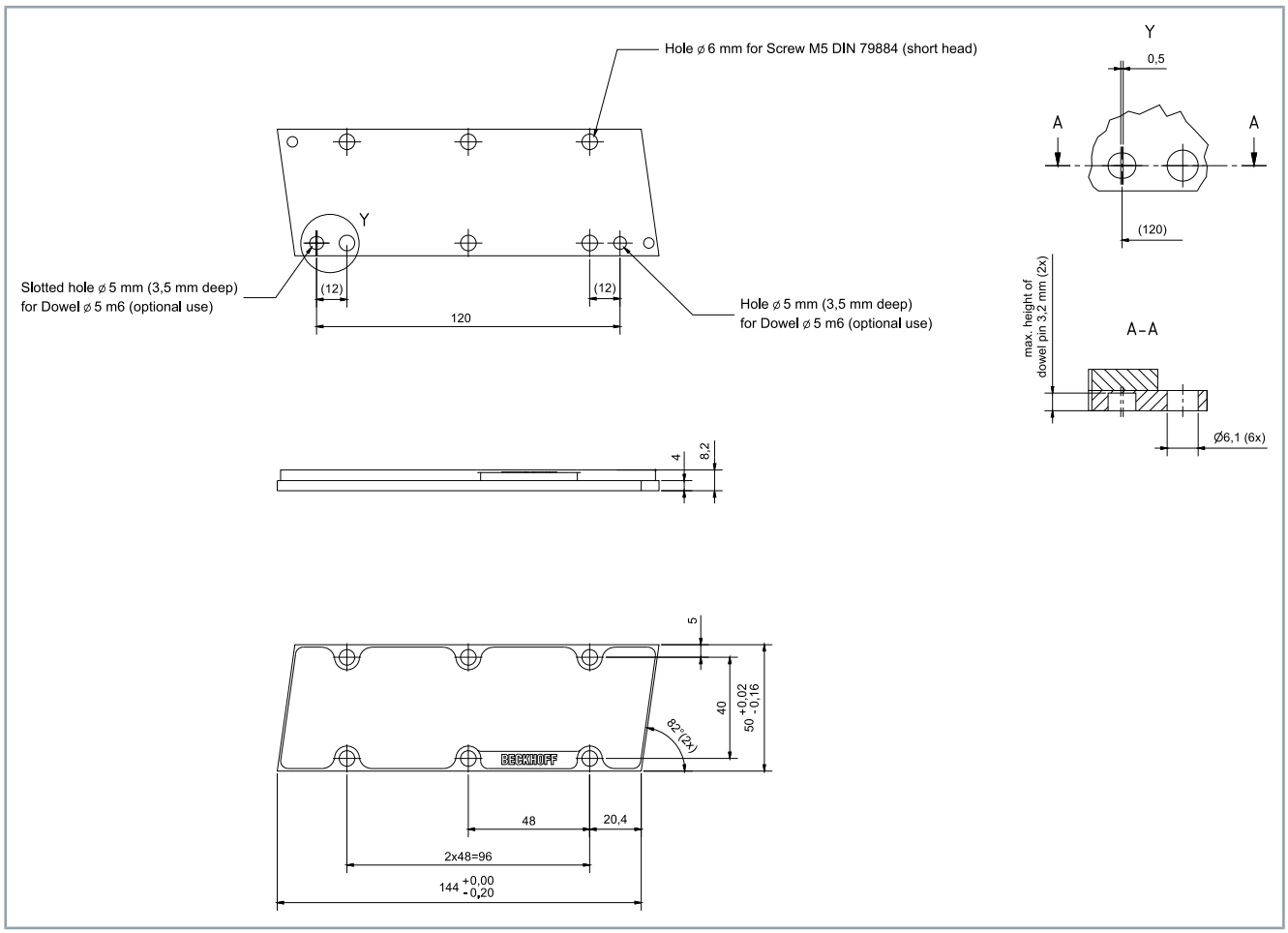
5.4.1 Dimensional drawings

- All figures in millimeters

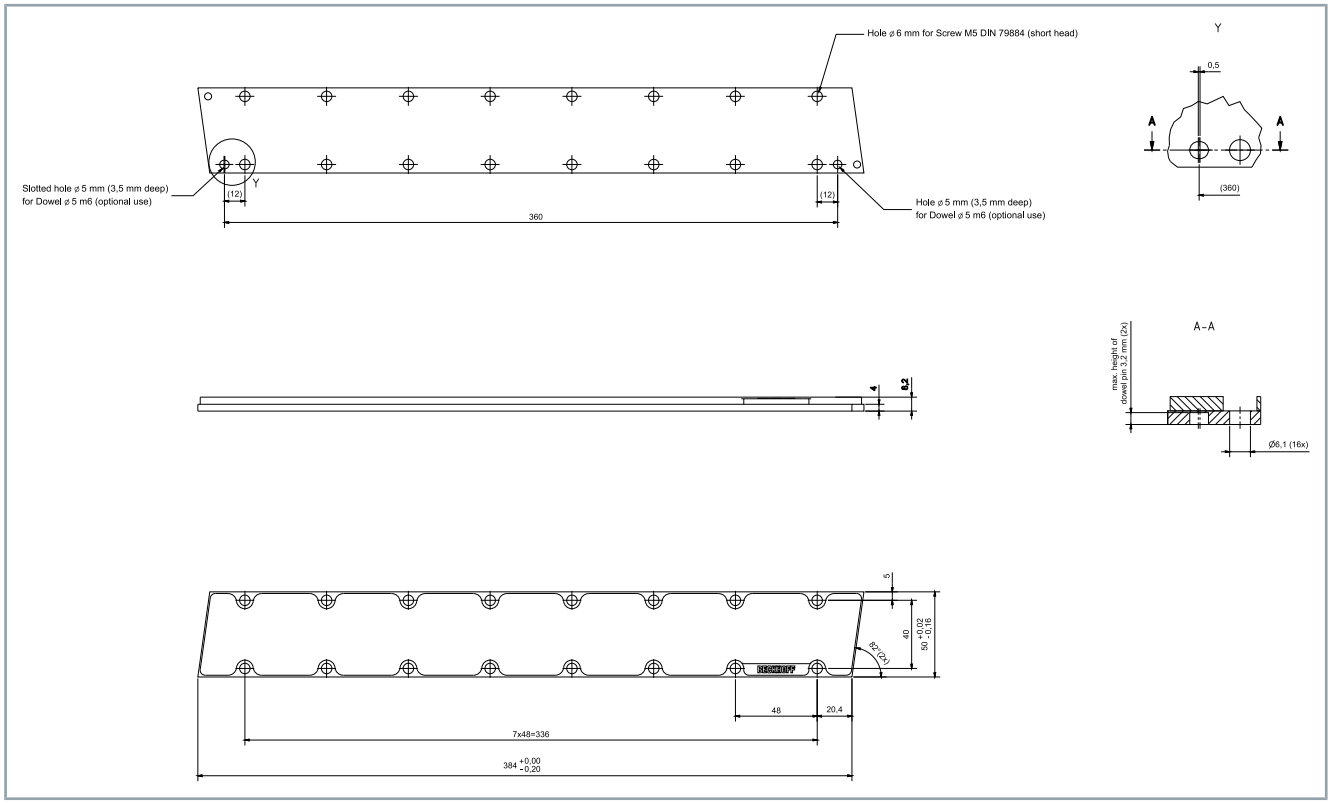
5.4.1.1 AL8521



5.4.1.2 AL8522


Hole ⌀ 6 mm for Screw M5 DIN 79884 (short head)
Slotted hole ⌀ 5 mm (3,5 mm deep)
for Dowel ⌀ 5 m6 (optional use)
Hole ⌀ 5 mm (3,5 mm deep)
for Dowel ⌀ 5 m6 (optional use)
Y
(12)
(12)
120
Y
0,5
A
A
(120)
max. height of
dowel pin 3,2 mm (2x)
A-A
Ø6,1 (6x)
4
8,2
5
40
50 +0,02 -0,16
82° (2x)
BECKHOFF
48
20,4
2x48=96
144 +0,00 -0,20

5.4.1.3 AL8523


Hole ⌀6 mm for Screw M5 DIN 79884 (short head)
Slotted hole ⌀5 mm (3,5 mm deep)
for Dowel ⌀5 m6 (optional use)
Hole ⌀5 mm (3,5 mm deep)
for Dowel ⌀5 m6 (optional use)
(12)
(12)
360
Y
0,5
A
A
(360)
A–A
max. height of
dowel pin 2,2 mm (2x)
Ø6,1 (16x)
4
8,2
5
40
50 +0,02
-0,16
60° (2x)
48
20,4
7x48=336
384 +0,00
-0,20

6 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:

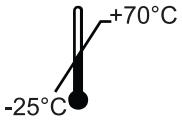
- AL85xx series magnetic plate with protective cover, without fixing material
- Short information

6.1 Packaging

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

Instructions for handling are printed on the packaging:

6.1.1 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.

6.1.2 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.

7 Transport and storage

NOTICE

Avoid damage to the coil parts and resulting loss of warranty
Observe the conditions and the following chapters on transport and storage.
Failure to observe the conditions may result in damage to the coil parts and void the warranty.

NOTICE

Do not remove silver protective cover
Do not remove the silver protective cover on the magnetic plates.
The protective cover protects against mechanical damage, magnetism and environmental influences. If you remove the protective cover, the magnetic plate may be damaged.

7.1 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

7.2 Transport

⚠ WARNING

Do not move under suspended loads
Use suitable means of transport. Secure coil parts and magnetic plates against falling.
Falling coil parts and magnetic plates can lead to serious or fatal accidents.

NOTICE

Do not touch connection points and plug contacts
Ensure a protected working environment. Avoid contact with ESD sensitive components without ESD protective clothing.
Electrostatic discharge can damage the circuitry in the coils and electrical components such as thermal contacts.

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

7.2.1 Linear servomotors

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.

7.2.2 Magnetic plates

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

7.3 Long-term storage

NOTICE

Observe storage conditions
Coil parts and magnetic plates can be stored for an unlimited period. Ensure that low air humidity is maintained when storing coil parts and magnetic plates.
Failure to observe this may result in changes in the properties of the cables or the sealing compound.

NOTICE

Perform recurring inspections
Check the coil part for proper condition every six months.
Damage to the coil part or maintenance work not carried out on the machine / system will affect the service life of the installed components and parts.

NOTICE

Prevent the formation of condensation
Keep the ambient temperature constant. Avoid solar radiation and high air humidity.
Condensation water can lead to damage during subsequent operation, calcification or rust formation.

The coil parts can be stored for shorter or longer periods. We always recommend storing components in the original packaging. Observe the conditions specified in chapter: "Transport and storage", [Page 42].

Ensure the storage space is vibration-free.

8 Technical description

8.1 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 path length corresponds to the travel range including the length of the coil part 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.

8.1.1 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

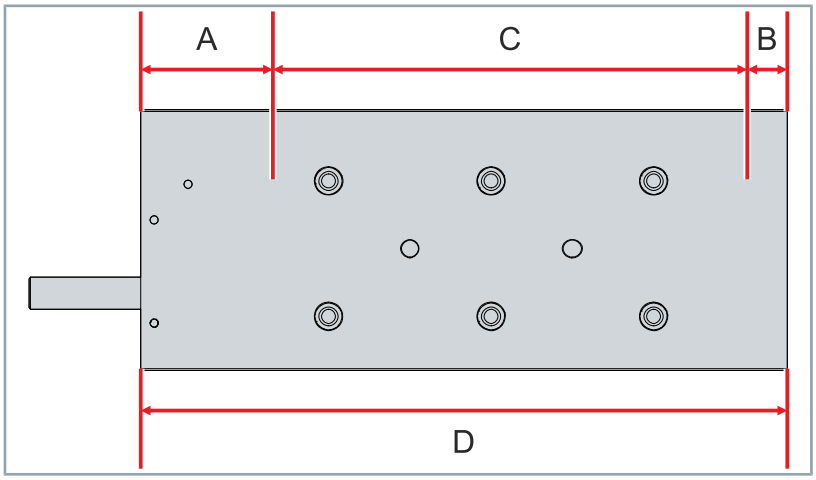
Required number of magnetic plates:
(490 mm + 93 mm)/384 = 1.52 magnetic plates < 2 magnetic plates are required.

8.1.2 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

8.2 Air gap

The air gap is created between the bottom of the coil part and the top of the magnetic plate.

8.2.1 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:

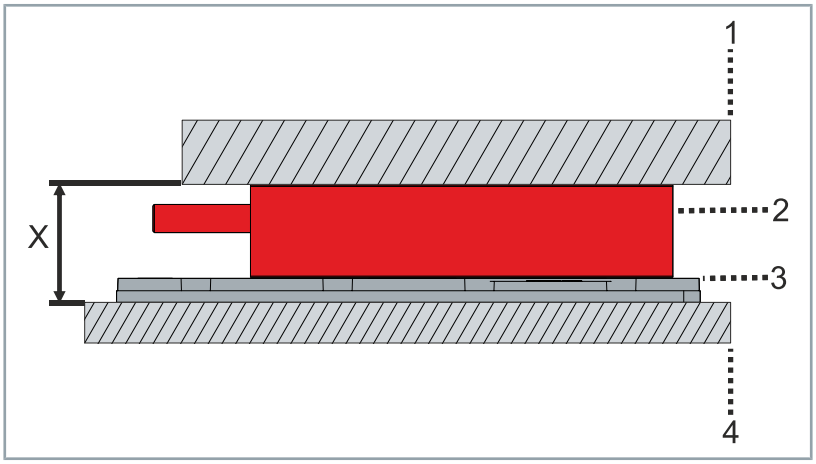
- deviations in parallelism or
- deviations in the evenness of the mounting surface

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 48].

Avoid reducing the air gap
Reducing the air gap increases the forces of magnetic 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

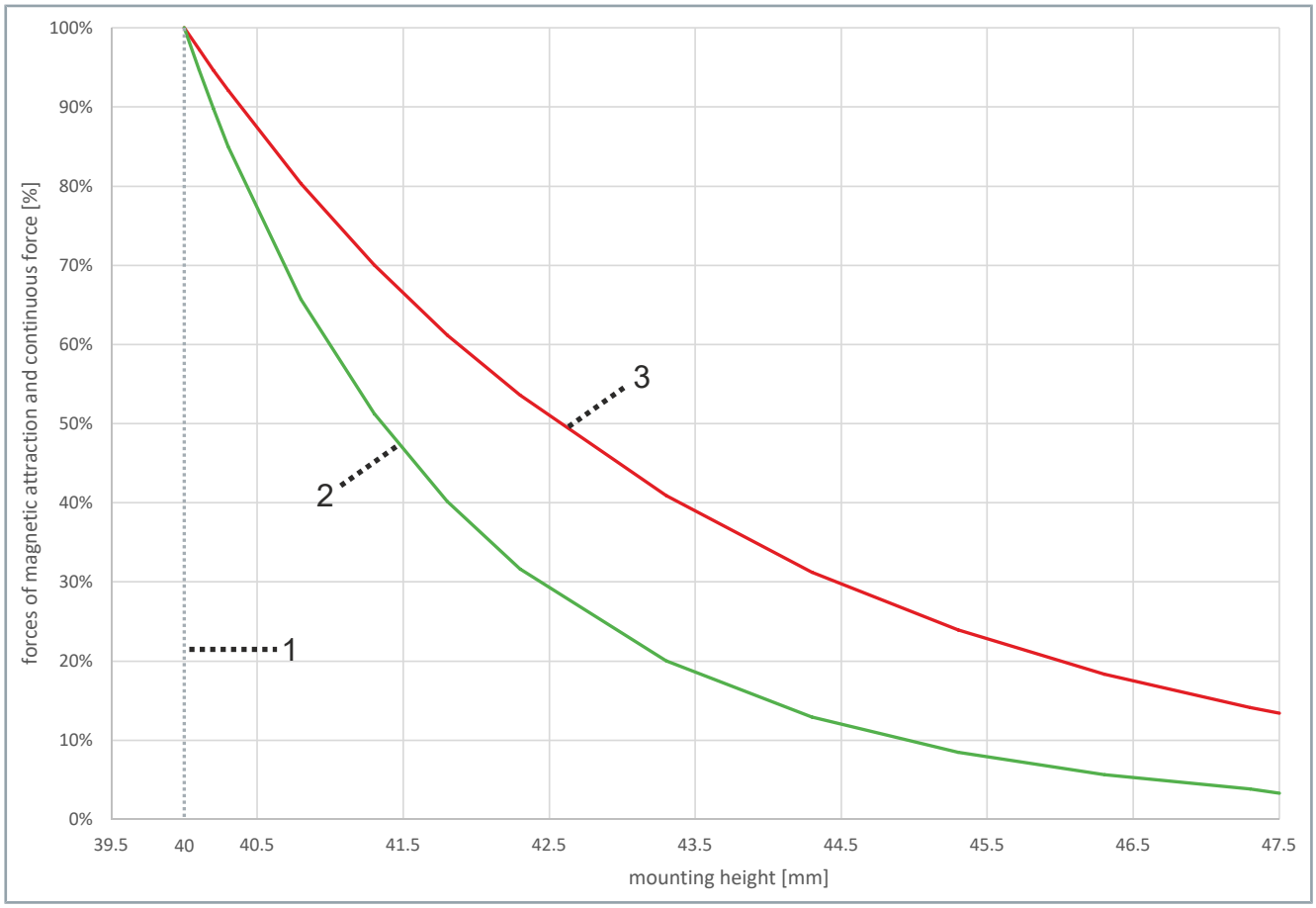


Position	Description
1	Machine slide
2	Coil part
3	Magnetic plate
4	Machine bed

8.2.2 Dependencies

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

AL812x



Position	Definition
Setpoint 1	Ideal air gap
Curve 2	Forces of magnetic attraction F_a
Curve 3	Continuous force F_c

8.3 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.

8.3.1 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

9 Coupling

NOTICE

Ensure synchronization of coupled coil parts
Ensure that the coupled coil parts move synchronously.
Rigidly coupled coil parts can cause non-synchronous movements which can lead to tension and damage to the mechanical system and the coil part.

NOTICE

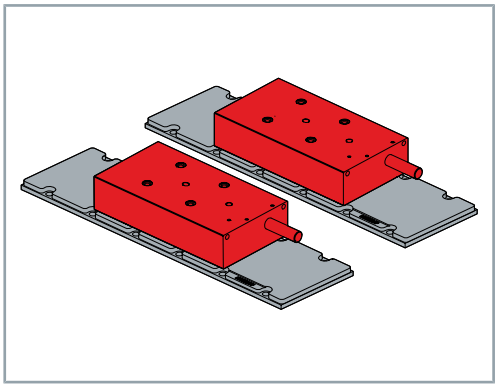
Only use parallel connection for coupling coil parts
Coil parts should only be coupled in a parallel connection. Series connection is not permitted.
Failure to observe this may cause a cable fire and result in damage to the coil part and connected components.

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

9.1 Structure

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

9.1.1 Gantry

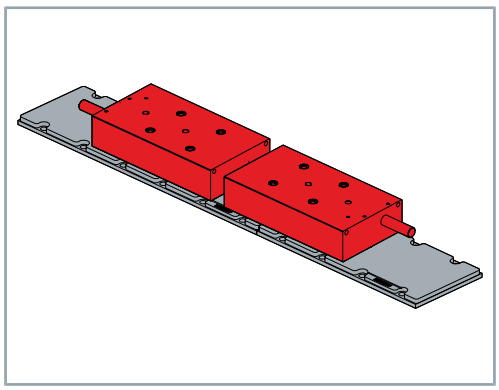


In a gantry structure, two parallel magnetic tracks each have a coil part. The coil parts are rigidly coupled and electrically connected in parallel. The movements are synchronized. Synchronization must be maintained at the best possible level even in the event of a drive error.

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.

9.1.2 Shared magnetic track



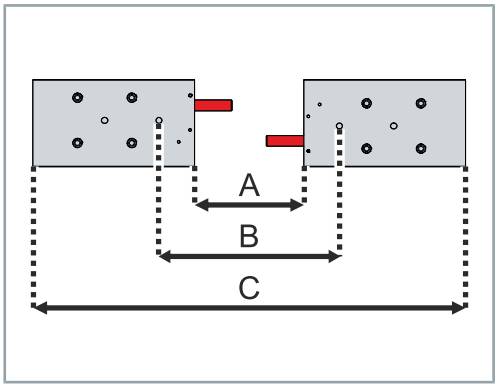
With this type of coupling, the coil parts are arranged one after the other on a common magnetic track. This type of coupling tends to be used for applications with long strokes, since a second magnetic track with associated costs is avoided.

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.

9.2 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.

9.2.1 Cables to each other



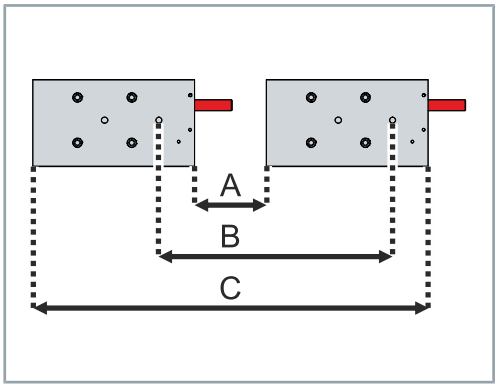
This illustration shows an example of two coil parts with cables facing each other.

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

9.2.2 Cables in the same direction



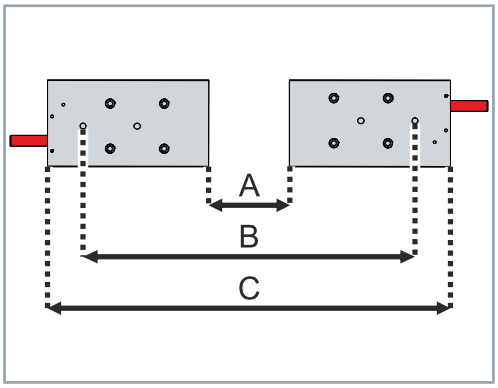
This illustration shows an example of an arrangement of two coil parts with cables in the same direction.

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

9.2.3 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

9.3 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.

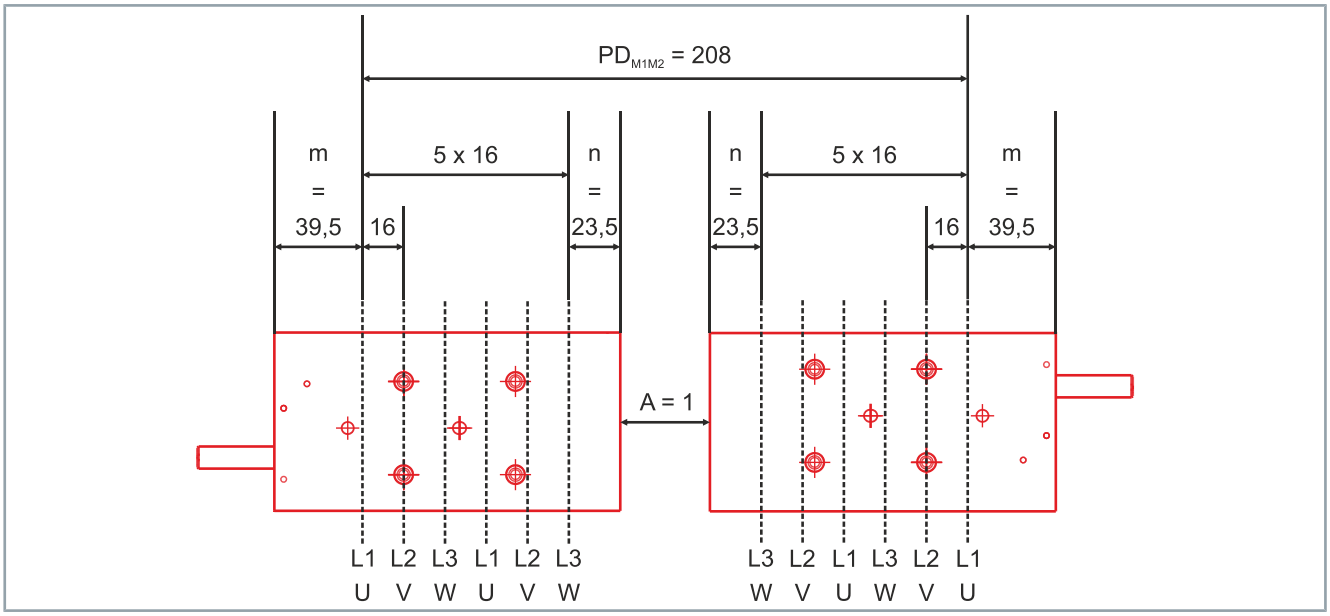
If the coil units are coupled to one another, there must also be a multiple of this winding distance between the windings of the connected coil units. The phase repetition is 48 mm and is made up of three times the winding distance.

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

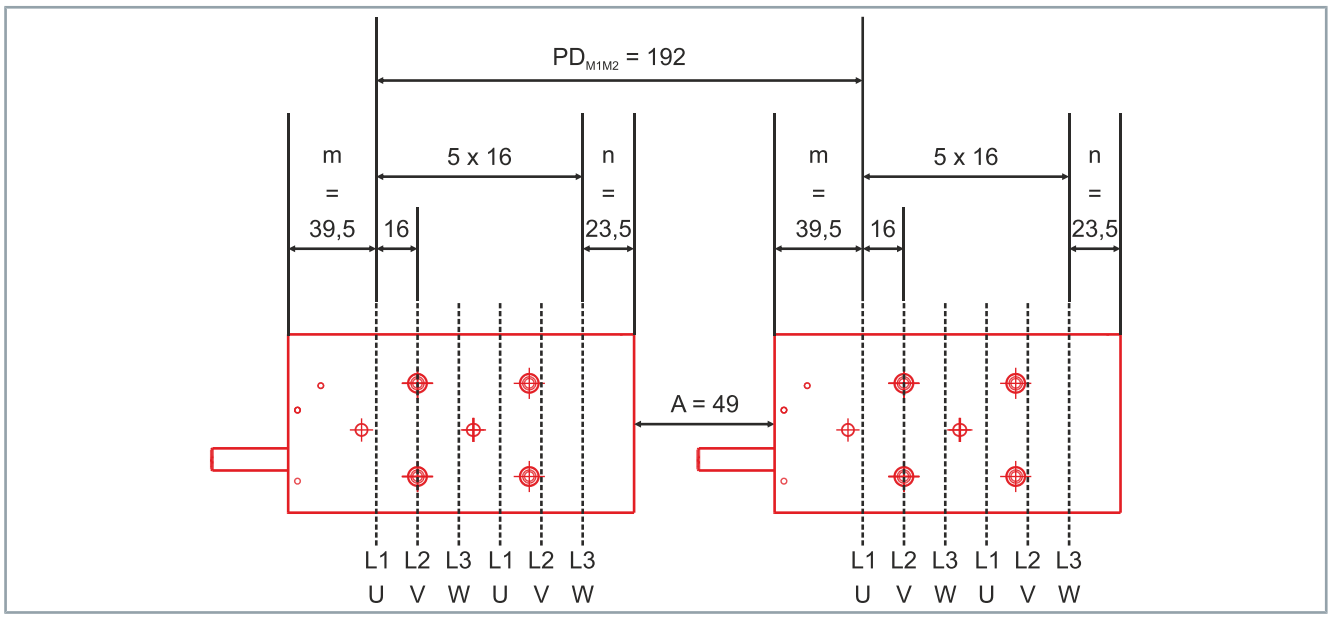
The following information is included in the figures:

- 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.



9.3.1 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

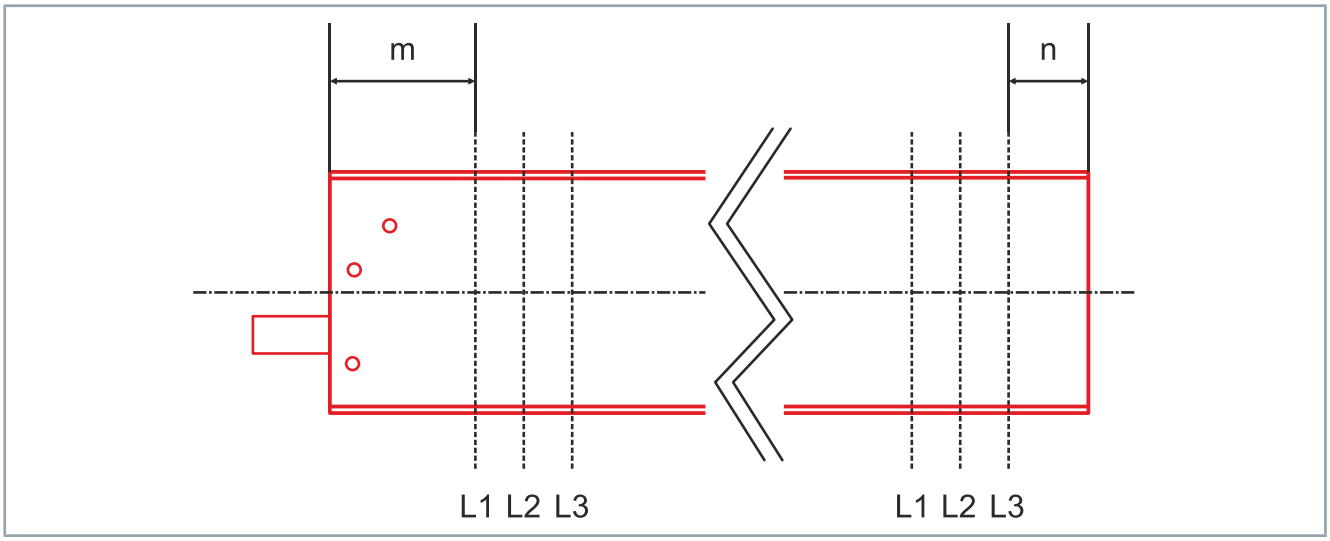
Information on PD_{M1M2} can be found in the chapter: "Electrical connection", [Page 54]

Information on wiring can be found in the chapter: "Power supply", [Page 57]

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

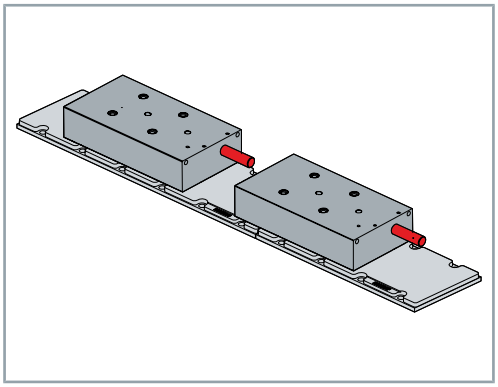
9.3.2 Phase lines



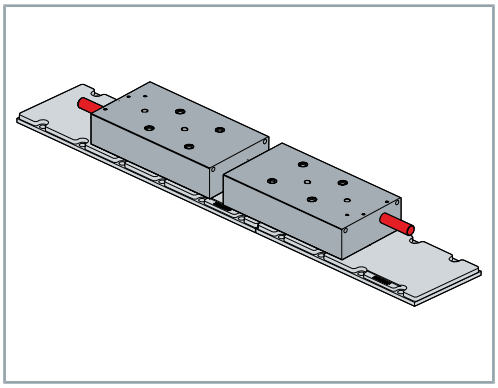
Motor	m	n
	[mm]	
AL8121	37.5	23.5
AL8122	39.5	23.5
AL8124	39.5	23.5
AL8126	39.5	23.5

9.3.3 Power supply

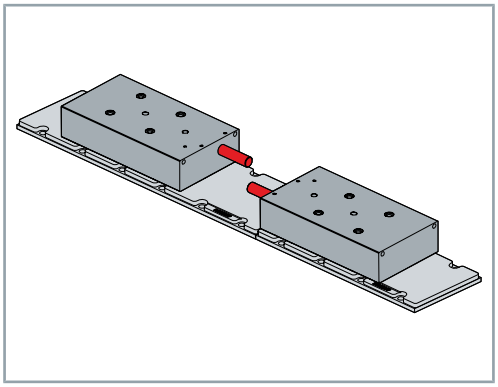
With the calculated offset and using the following tables, you can carry out the wiring of the coupled coil parts.



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



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



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

9.3.4 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.

10 Mechanical installation

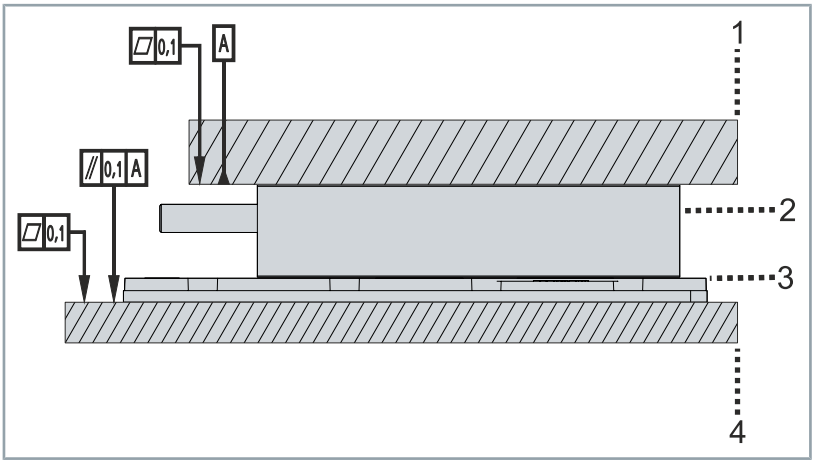
All work should be carried out with great care and without time pressure.

10.1 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.

10.1.1 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 47]

10.2 Assembly

⚠ WARNING

Warning of strong forces of magnetic attraction
Avoid standing within the travel range of the coil part even when the machine or system is switched off. The permanent magnets of the magnetic plates and coils of the coil part attract each other. The high forces of magnetic attraction cannot be controlled by hand.
Non-observance can result in serious or fatal injuries due to crushing.

NOTICE

Only use compatible magnetic plates
Only use original magnetic plates from the AL8xxx product series. Other magnetic plates are incompatible in the pole sequence.
Failure to observe this may result in serious injury and damage to the machine due to uncontrolled movements of the linear motor.

NOTICE

Use only the drill holes shown
Use only the drill holes shown for the assembly or for other activities described in these operating instructions. Drill holes not shown may be present, for example, for production purposes.
Non-compliance will result in damage to the motor.

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 part on the machine carriage. Then mount the machine carriage including the coil part 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.

10.2.1 Coil part

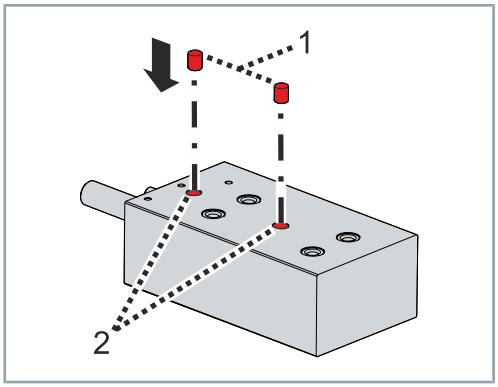
Loss of force due to asymmetry
Place the coil unit of the AL812x series with an offset to the magnetic plate.
Failure to observe this may result in loss of force at the linear motor and loss of performance in the machine or system.

Dimensional drawings for alignment
Please read the following chapters:

- "Technical data, paragraph AL812x, "alignment AL812x", [Page 36]"

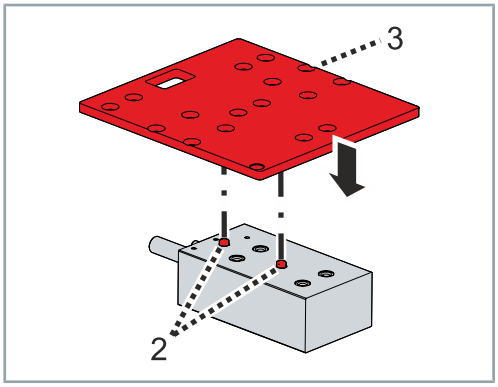
Mounting

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

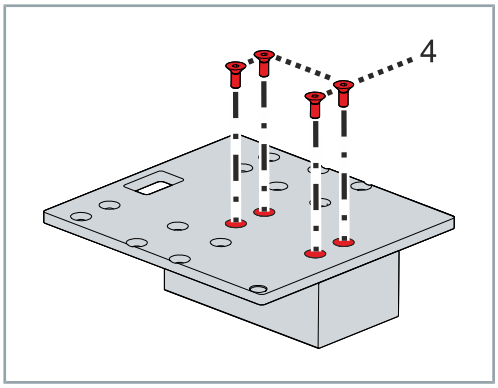


► Insert locating pins [1] into the holes of the coil unit [2]:

Locating pins	
Tolerance zone	M6
Maximum screw depth	4 mm



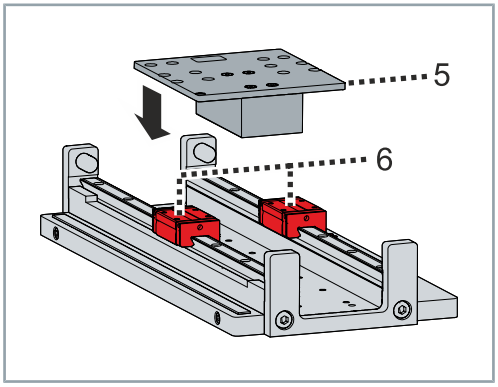
► Place the machine carriage [3] with the holes on the locating pins [2] of the coil unit
► Align the coil unit, making sure that all the holes are aligned



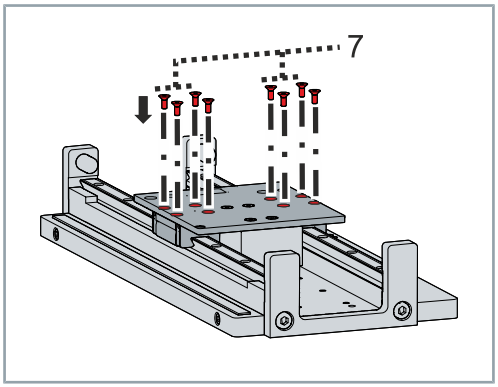
► Insert the screws [4] and tighten them crosswise from inside to outside

Observe tightening torques:

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



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



► Insert and tighten the screws [7]

10.2.2 Magnetic plates

⚠ WARNING

Do not remove the protective cover
The cover weakens the magnetic field and protects electrical components from magnetic influences.
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.

NOTICE

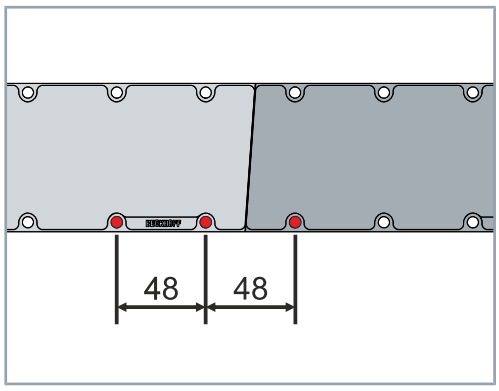
Observe the alignment
Align the magnetic plates identically. The Beckhoff logo must always be on the same side.
If this is not observed, the adjacent magnetic plates repel each other. As a result, the coil part cannot move without restriction. The system is not operational.

NOTICE

Observe minimum clearance
Keep the required minimum distance 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 part.
Failure to observe this can lead to complications during installation.

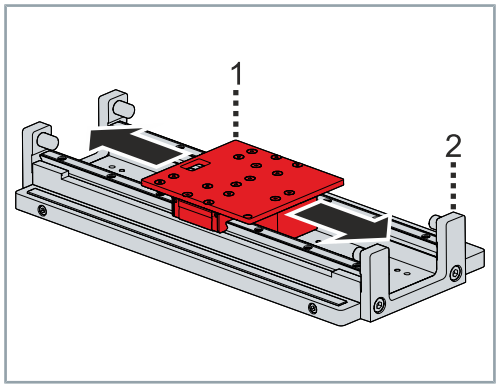
Minimum distance (example)
The diagram shows the minimum distance between two magnetic plates.

- Distance between hole centers: 48 mm



Mounting

- ► Clean the mounting surface on the machine bed and the magnetic plate

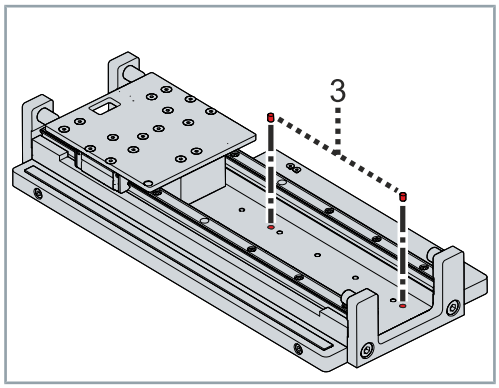


- ► Push the machine slide [1] to one end of the machine bed [2]

⚠ WARNING

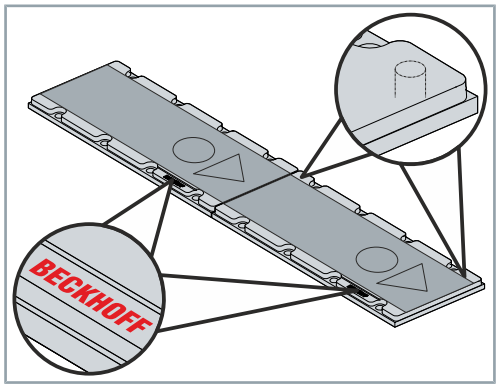
Secure the machine slide sufficiently
Secure the machine slide mechanically against uncontrolled movements. Do not reach under the machine slide or hold the machine slide by hand.
If the strong magnetic field of the permanent magnets in the magnetic plate unexpectedly attracts the components magnetically during assembly, it is not possible to hold the machine slide by hand. Severe injuries to limbs can be the result.

- ► Mechanically secure the machine slide against the forces of magnetic attraction and uncontrolled movements of the magnetic plate

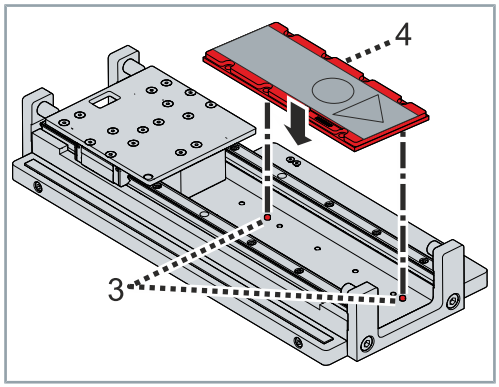


- ► Insert locating pins [3] into the machine bed
- ► Pay attention to the insertion depth of the locating pins [3]

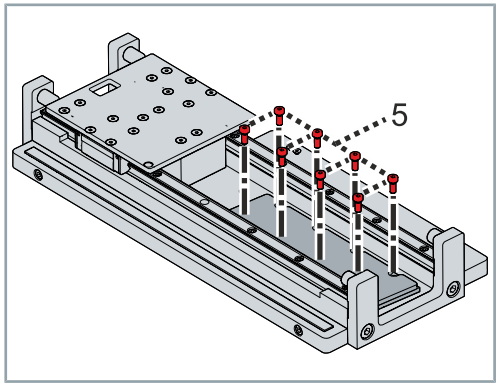
Locating pins	AL852x
Tolerance zone	M6
Maximum immersion in the magnetic plate	3.2 mm



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



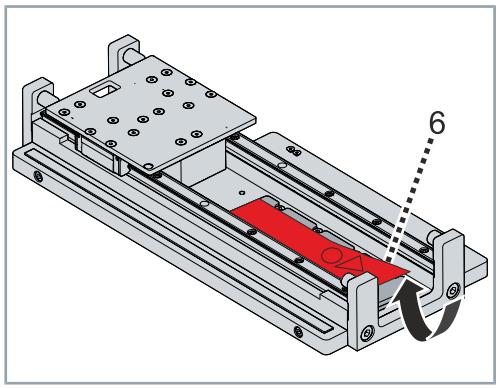
- ► Place the magnetic plate [4] on the locating pins [3]



- ► Insert screws [5] into the magnetic plate on the machine bed
- ► Tighten the screws crosswise and from inside to outside

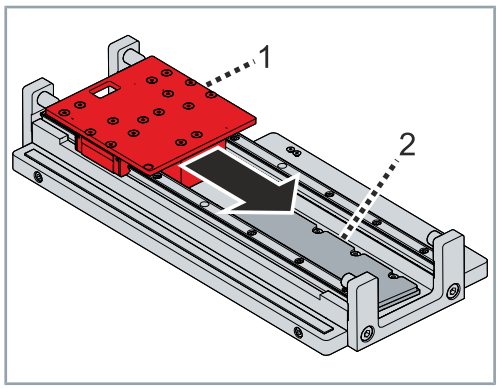
Observe tightening torque:

Quality of the screws = strength class 8.8	
Screw	M5
Tightening torque [Nm]	6

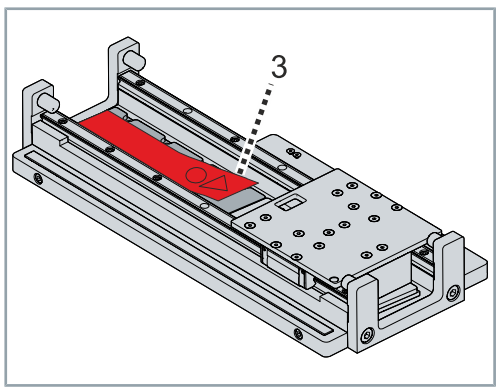


- ► Remove the protective cover [6] on the mounted magnetic plates onto which the machine slide is to be pushed. Do not dispose of the protective cover and keep it for subsequent transport of the machine or system.

Other magnetic plates



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



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

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

10.3 Verification

After assembly, check the installed components for smooth running and adequate "air gap", [Page 47].

10.3.1 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 58]

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

11 Electrical installation

11.1 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.

11.1.1 Cables

NOTICE

Do not lay cable in drag chains
The cable of the AL8100 is firmly encapsulated with the linear motor. It is part of the wear-free product. Do not lay the cable in a drag chain.
A limited service life or damage to the linear motor is the result. Non-compliance will void the warranty and other claims for damages.

NOTICE

Avoid soiling and damage
When connecting the coupling and the plug, make sure that the poles and the inside of the component are not soiled or damaged.
Failure to do so may adversely affect the function of the connections.

Hint for trouble-free application and assembly:

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

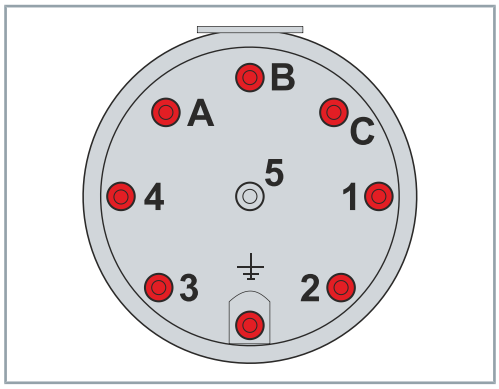
Beckhoff offers pre-assembled cables for faster and flawless installation of the motors. These cables are tested with regard to the material used, shielding and connection type. The use of other cables can cause unexpected malfunctions and result in exclusion of warranty.

11.2 Connector assignment

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

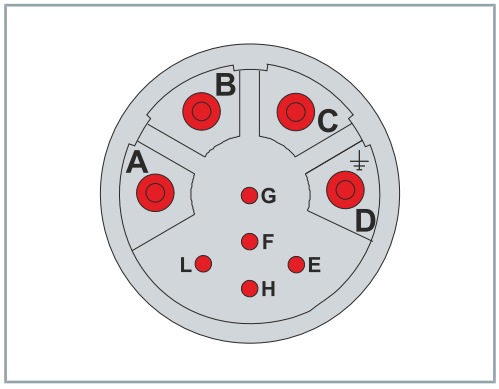
The following tables show the connector assignment:

11.2.1 iTec® plug



Pin assignment cable diameter 1.0 mm²			
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	Shield	Shield	---
PE	PE	Green/yellow	---

11.2.2 M23 Speedtec® plug



Pin assignment cable diameter 1.5 mm² and 2.5 mm²			
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	---	---	---

12 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.

12.1 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 motor and servo terminal

12.2 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 instructions in the operating manual 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

12.3 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

12.4 After operation

⚠ WARNING

Place the machine or plant in a safe state
Make sure that the motor comes to a complete stop.
Uncontrolled movements of the coil units can lead to serious injuries or damage to the system or machine.

13 Maintenance and cleaning

⚠ 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, bring the connected motors and the machine into a safe state.
Carrying cleaning work during operation can lead to serious or fatal injuries.

NOTICE

Do not submerge or spray the motor
Only wipe the motor with a cleaner and a cloth.
Cleaning by immersion may result in surface and motor damage and leakage problems as a result of impermissible solutions.

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.

13.1 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.

13.1.1 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

14 Decommissioning

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

Read the 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.

14.1 Disassembly

⚠ WARNING

Risk of injury during disassembly
Permanent magnets are installed in the AL85xx magnetic plates. Carefully remove the magnetic plates. Make sure that the magnetic plates and ferromagnetic objects are not magnetically attracted and that your hands are not between these components.
If you don't take care during the disassembly, opposite magnetic plates may attract each other without warning and injure your hands.

Removing the magnetic plates from the machine:

- Push the machine slide 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 slide to the other side and mechanically secure it against uncontrolled movements
- Remove the other magnetic plates in the same way

Removing the coil part from the machine:

- If present: Remove the water cooling
- Disconnect the electrical connector
- Remove the machine slide from guide rails
- Unscrew and remove the bolts
- Separate the coil part from the machine slide
- Remove the locating pins

14.2 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.

14.2.1 Returning to the vendor

In accordance with the WEEE-2012/19/EU directives, you can return used devices and accessories for professional disposal. The transport costs are borne by the sender.

Send the used devices with the note "For disposal" to:

Beckhoff Automation GmbH & Co. KG
"Service" Building
Stahlstrasse 31
D-33415 Verl

In addition, you have the option to contact a local certified specialist company for the disposal of used electrical and electronic appliances. Dispose of the old components in accordance with the regulations applicable in your country.

15 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.

15.1 Standards

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

RoHS: EN 50581:2012
"Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances"

15.2 Guidelines

2014/35/EU
Low Voltage Directive

2014/30/EU
EMC Directive

2011/65/EU
RoHS Directive

15.3 Test centers

CE	The motors do not fall within the scope of the Machinery Directive. However, Beckhoff products are designed and evaluated in full compliance with all relevant regulations for personal safety and use in a machine or system.
EAC	The motors meet all the requirements of the Eurasian Economic Union. These include Russian Federation, Belarus, Armenia, Kazakhstan and Kyrgyzstan. The EAC logo can be found on the name plate.
UKCA	The motors meet all the requirements of the UK economic area. These include England, Wales, and Scotland.
c UL us	The motors comply with UL requirements and are certified as cURus components 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.

15.4 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.

15.5 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.

More Information:
www.beckhoff.com/al8100

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