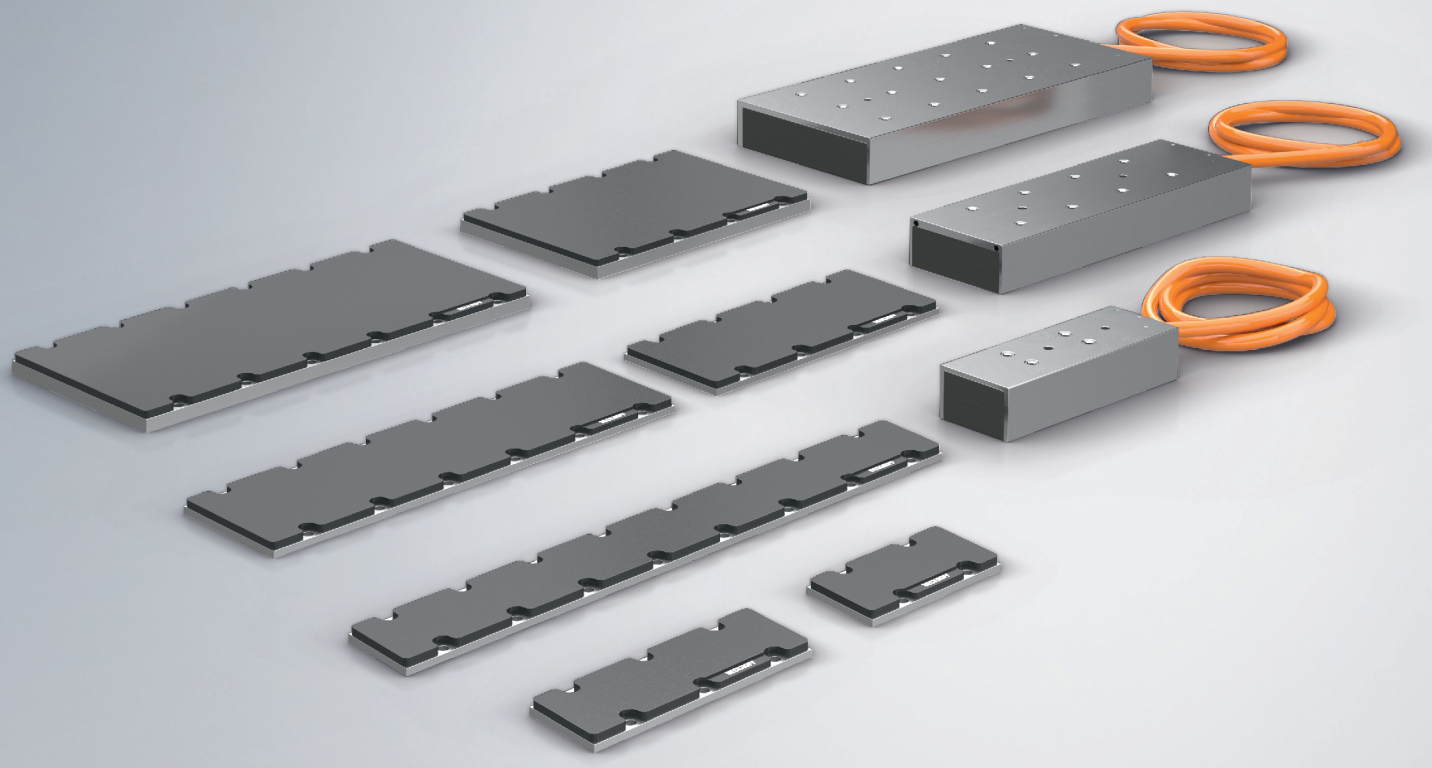
BECKHOFF New Automation Technology

Operating instructions | EN

AL8000

Linear servo motors



2025-01-14 | Version 1.8.0

Table of contents

Table of contents

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®, TwinCAT®, TwinCAT/BSD®, TC/BSD®, EtherCAT®, EtherCAT G®, EtherCAT G10®, EtherCAT P®, Safety over EtherCAT®, TwinSAFE®, XFC®, XTS® and XPlanar® 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.

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

1.1.5 Third-party brands

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

AL8000	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

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.

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

1.7.4 Headquarters Germany

Beckhoff Automation GmbH & Co. KG
Hülshorstweg 20
33415 Verl, Germany

+49 5246 963-0
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

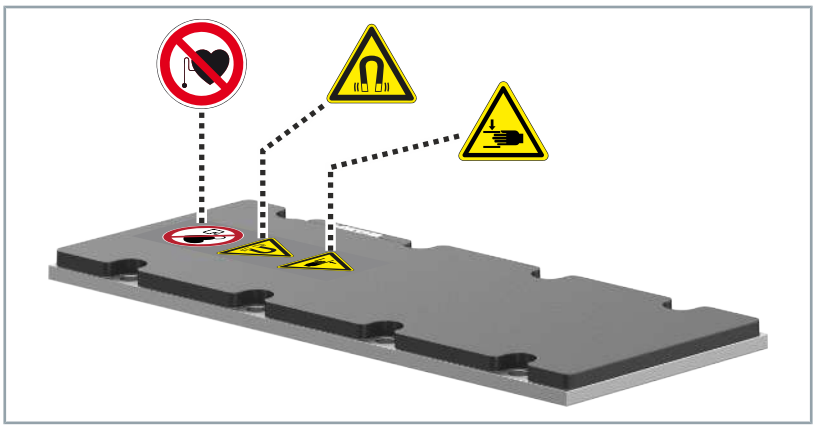
2 For your safety

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

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

2.1 Safety pictograms

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



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.

Magnetic field warning
Magnetic plates contain permanent magnets. Even in a de-energized state, these always generate a strong magnetic field and attract other magnetic objects. The high forces of attraction cannot be controlled by hand. Prevent the permanent magnets of the magnetic plates from coming into direct contact with ferromagnetic objects such as assembly trolleys, tools or machine beds.

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

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 resulting from magnetic fields

Magnetic fields on individual components of the AL8000 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

Ensure a safety distance of at least 200 mm between the persons concerned and all magnetic parts.
Observe the requirements of DGUV regulation 15 for electromagnetic fields 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
Ensure that the protective conductor is connected properly. Measure the voltage on the DC link test contacts DC+ und DC-. Do not work on the linear motor until the voltage has dropped below 50 V DC. Never loosen electrical connections when live. Disconnect all components from the mains and secure them against being switched on again.

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

Avoid overheating

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

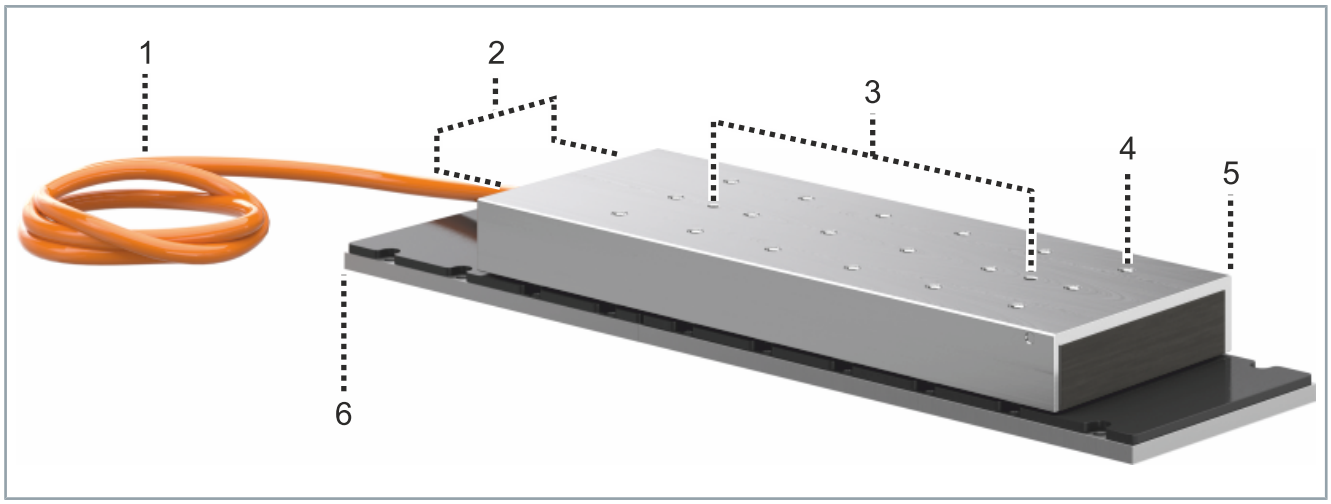
Do not touch any moving or rotating components. Fasten all parts or components on the machine or plant.

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 and comply with the chapter: Decommissioning.

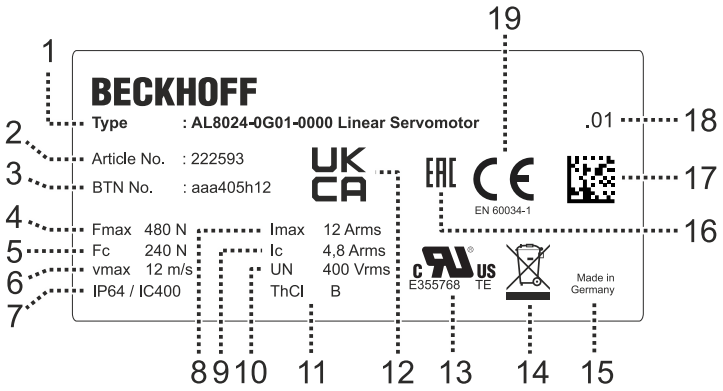
3 Product overview



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

3.1 Linear servomotor

3.1.1 Name plate



Item number	Explanation
1	Article name
2	Order number
3	BTN = **B**eckhoff-**T**raceability-**N**umber
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	UKCA marking
13	cURus approval
14	WEEE compliance
15	Country of manufacture
16	EAC approval
17	Data-Matrix Code
18	Hardware index
19	CE conformity

3.1.2 Type key

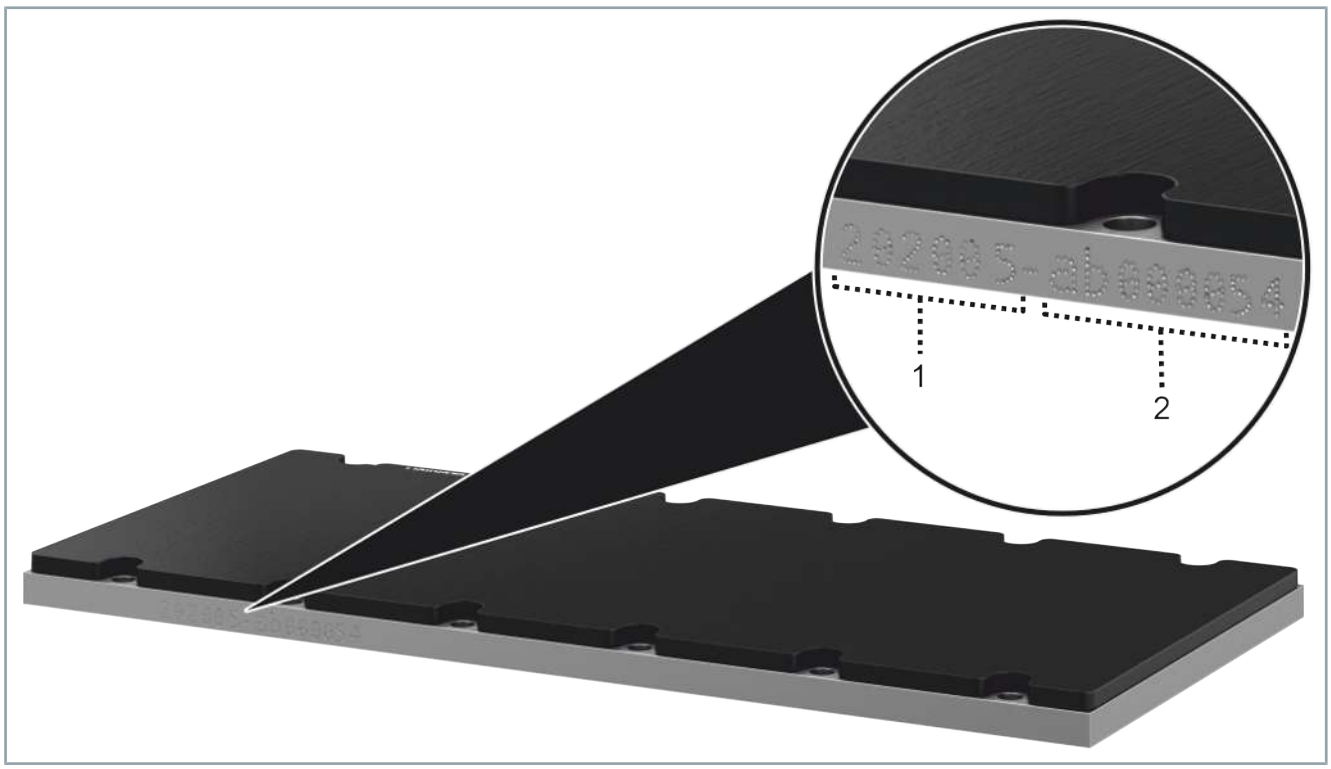
AL8 t u v - w x y z - 0000	Explanation
AL8	*Product area* • Iron-core series 8 linear servomotors
t	*Series* • 0 = 400 V AC
u	*Width* • 2 = W2; 50 mm • 4 = W4; 80 mm • 6 = W6; 130 mm
v	*Length* • 1 = 3 coils • 2 = 6 coils • 3 = 9 coils • 4 = 12 coils • 5 = 15 coils • 6 = 18 coils • 8 = 24 coils • A = 30 coils • B = 33 coils • F = 45 coils
w	*Cooling* • 0 = convection • 1 = water cooling
x	*Winding letter* • A…Z
y	*Feedback system* • 0 = without feedback
z	*Connection technology* • 0 = 1.00 m connection cable with ferrules • 1 = 0.50 m connection cable with connector

3.2 Magnetic plate

3.2.1 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	Data Matrix code; Beckhoff Identification Code (BIC)

3.2.2 Needle pattern marking



Item number	Explanation
1	10-digit serial number / 6-digit article 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 • 4 = W4; 80 mm • 6 = W6; 130 mm
v	*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 drives

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

Electronic commutation in the servo drive

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

Temperature sensor

A temperature sensor "LPTC-600", [Page 70] 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

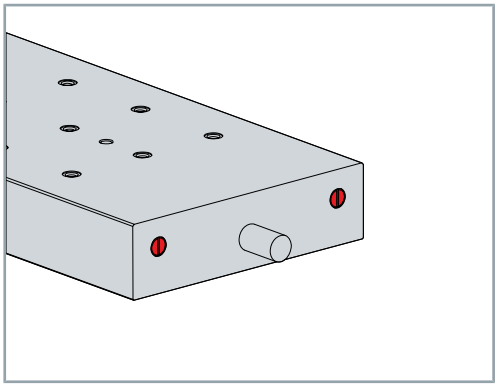
Uniform linear motor width

Within a width category, such as AL802x, 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 Water cooling



The coil units of the AL8000 series are available with convection cooling or water cooling. The connection of a water cooling system enables a higher continuous force of the linear motor.

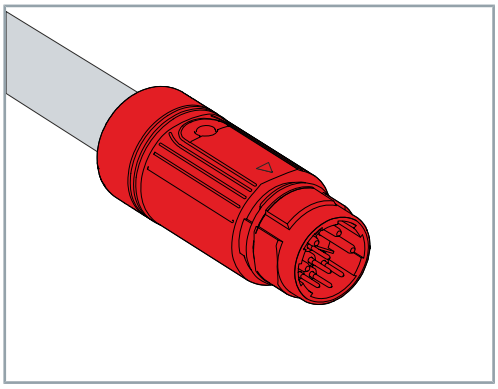
This ordering option is available for coil units of the following series:

- AL804x
- AL806x

3.4.2 Connection cables

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

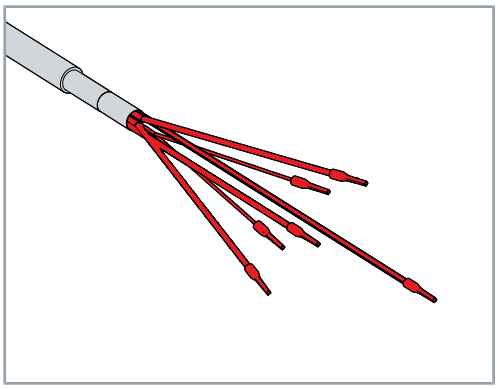
3.4.2.1 Plug



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

- itec® connector
- M23-SpeedTec® connector
- M40-SpeedTec® connector

3.4.2.2 Wire end sleeves



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

3.5 Intended use

The AL8000 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 temperature sensor installed in the motor windings must be regularly analyzed and monitored.

Read the entire drive system documentation:

- This operating instructions
- Operating instructions for the servo drive 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 28] is regarded as inappropriate and is thus prohibited.

Beckhoff AL8000 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 in the supply network without servo drive

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 to be achieved depends on the peak output current of the servo drive used. The peak force 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]

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

Pole pair distance [mm]

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

Mounting height [mm]

Distance between machine bed and machine carriage. Correct mounting height ensures that the motor works smoothly and efficiently, without mechanical obstructions or excessive wear.

Power loss P_L [W]

Power loss occurring during nominal operation or continuous operation that must be dissipated by the cooling system. The cooling unit can be dimensioned based on the sum of the power losses of all components in the cooling circuit. This information is contained in the documentation of the respective product.

Pressure drop Δp [bar]

Necessary pressure difference of the coolant between the coolant inlet and coolant outlet in order to achieve the minimum flow rate in the component to be cooled. This information is contained in the documentation of the respective product.

Flow rate Q_{min} [l/min]

Coolant flow rate required for nominal operation or continuous operation of the component to be cooled. This information is contained in the documentation of the respective product.

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.

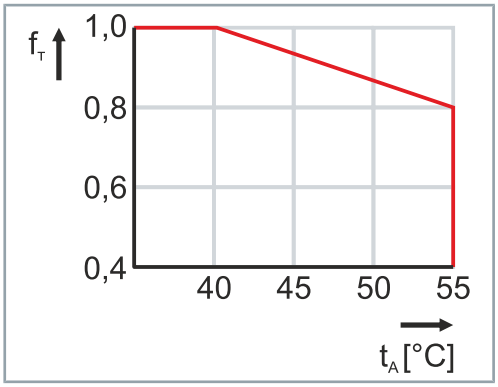
- Operate the linear motors only under the conditions for operation and the environment listed in this chapter

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	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

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.



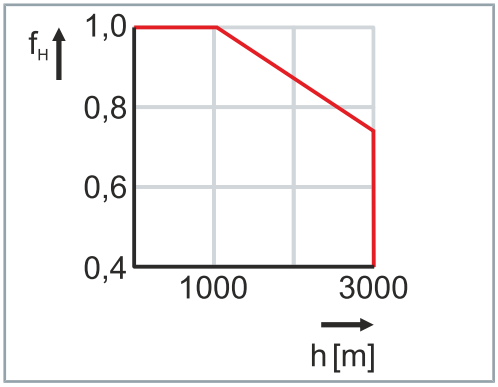
Ambient temperature

f_T = Temperature utilization factor

t_A = Ambient temperature in °C

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

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



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:

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

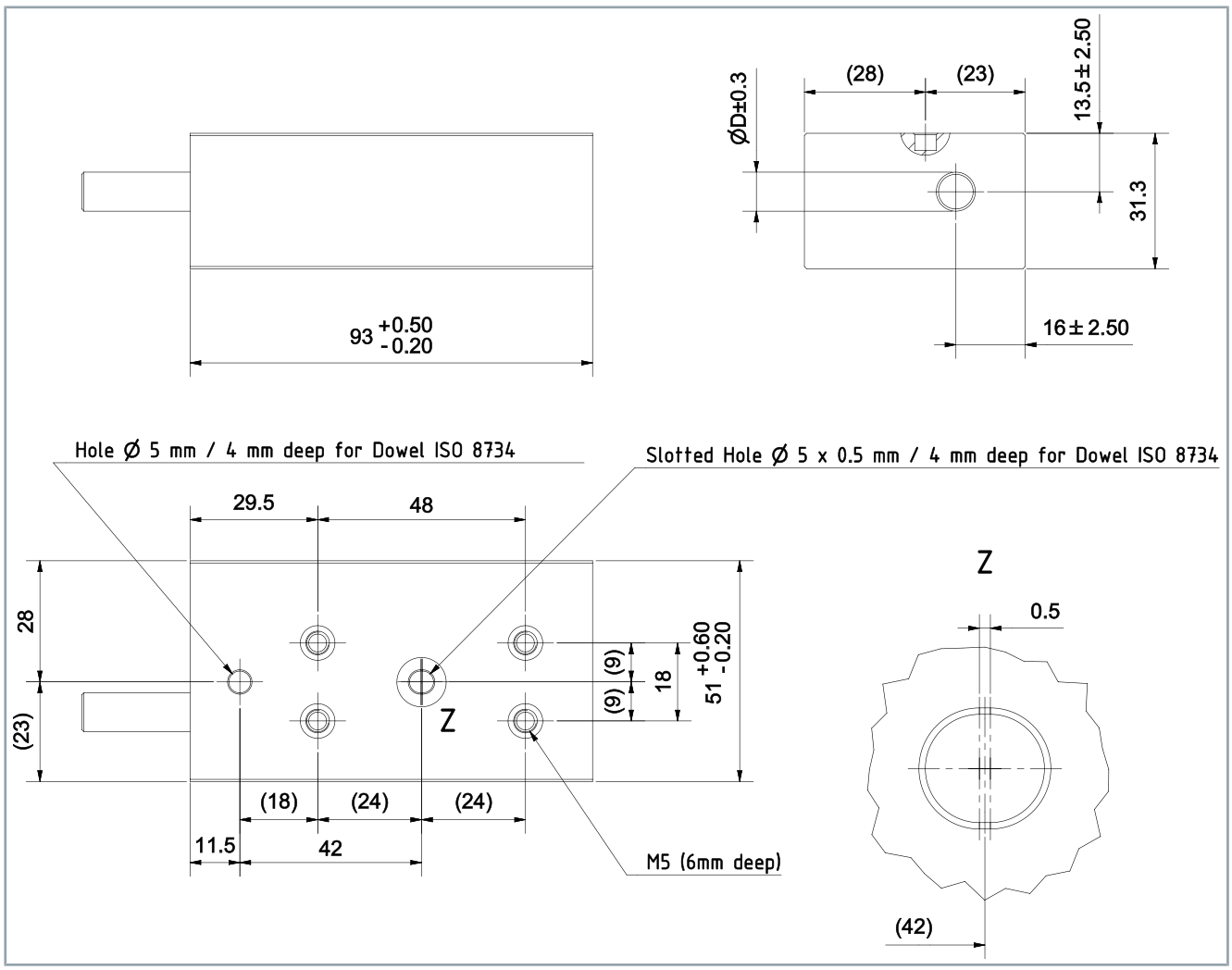
4.3 AL802x

Performance data	AL80			
	21-0E	22-0E	24-0G	26-0G
Peak force F_{max} [N]	120	240	480	720
Peak current I_{max} [A]	7.3	7.3	12	12
Continuous force F_c [N]	60	120	240	360
Continuous current I_c [A]	3	3	4.8	4.8
Maximum velocity v_{max} [m/s]	12	12	12	10
Force constant K_f [N/A]	20	40	50	75
Magnetic force of attraction F_a [N]	360	520	850	1250
Winding resistance ph-ph [Ω]	2.8	5.7	4.1	6.1
Winding inductance ph-ph [mH]	13	26	20	30
Counter EMF ph-ph [V/m/s]	11	23	29	43
Power loss P_L [W]	57	114	202	303
Motor constant [N²/W]	63	126	285	428
Thermal resistance [K/W]	1.1	0.5	0.3	0.2
Pole pair distance [mm]	24	24	24	24
Weight				
Coil unit [kg]	0.6	0.9	1.6	2.3
Magnetic plate [kg/m]	2.1			
Sensors				
Temperature sensor	LPTC-600; compatible with KTY 84-130			
Cable and motor data				
Outer diameter [mm]	9			
Wire cross-section	4 x 1.0 mm² + 2 x AWG26			
Minimum static bending radius	4 x outer diameter			
Cable length, assembled [m]	0.5			
Cable length unassembled [m]	1			
Connector	itec®			
Recommended servo drive assignment				
AX5000	AX5x03	AX5x03	AX5x06	AX5x06
AX8000	AX8108/AX8206			
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				

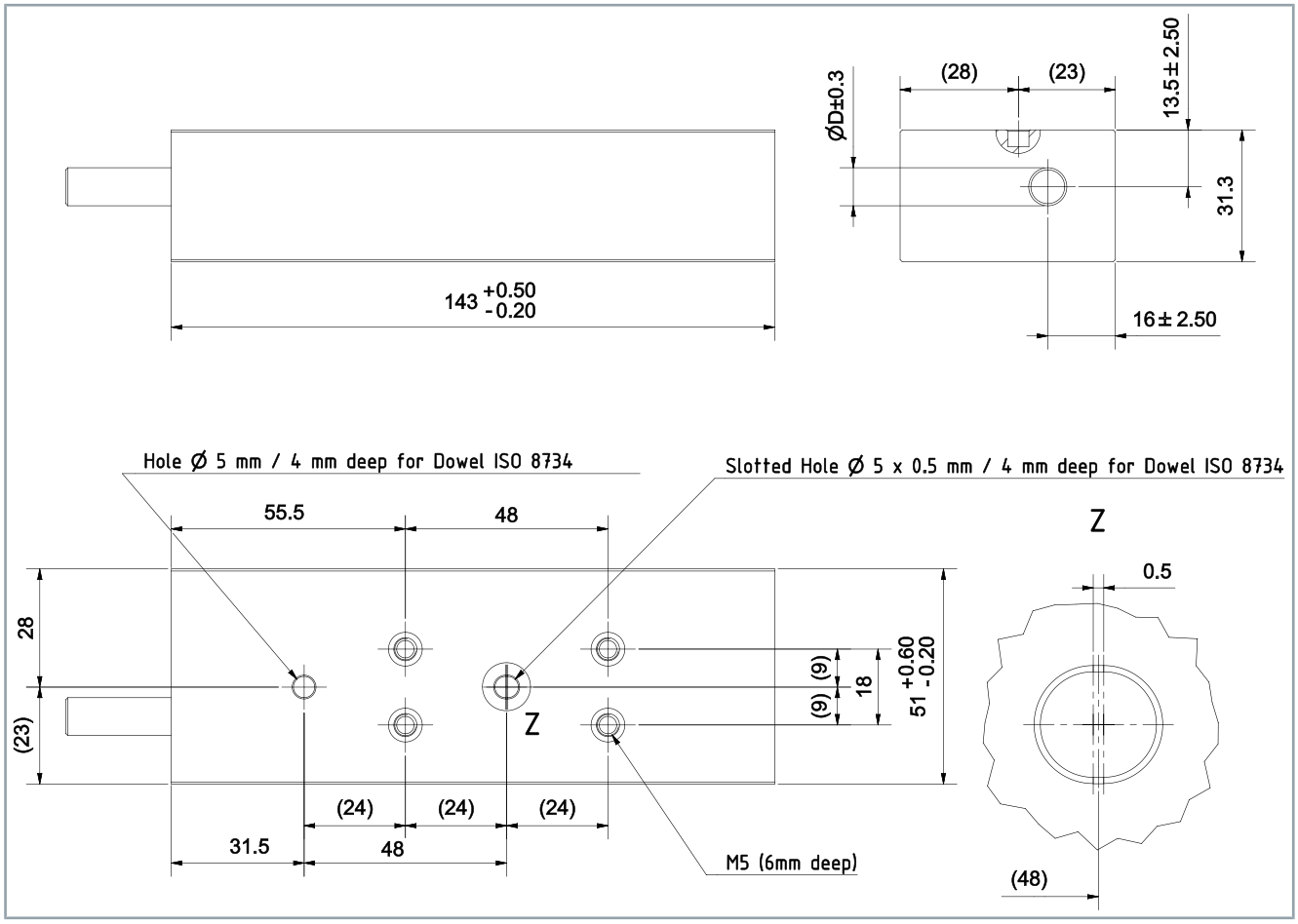
4.3.1 Dimensional drawings AL802x

- All figures in millimeters

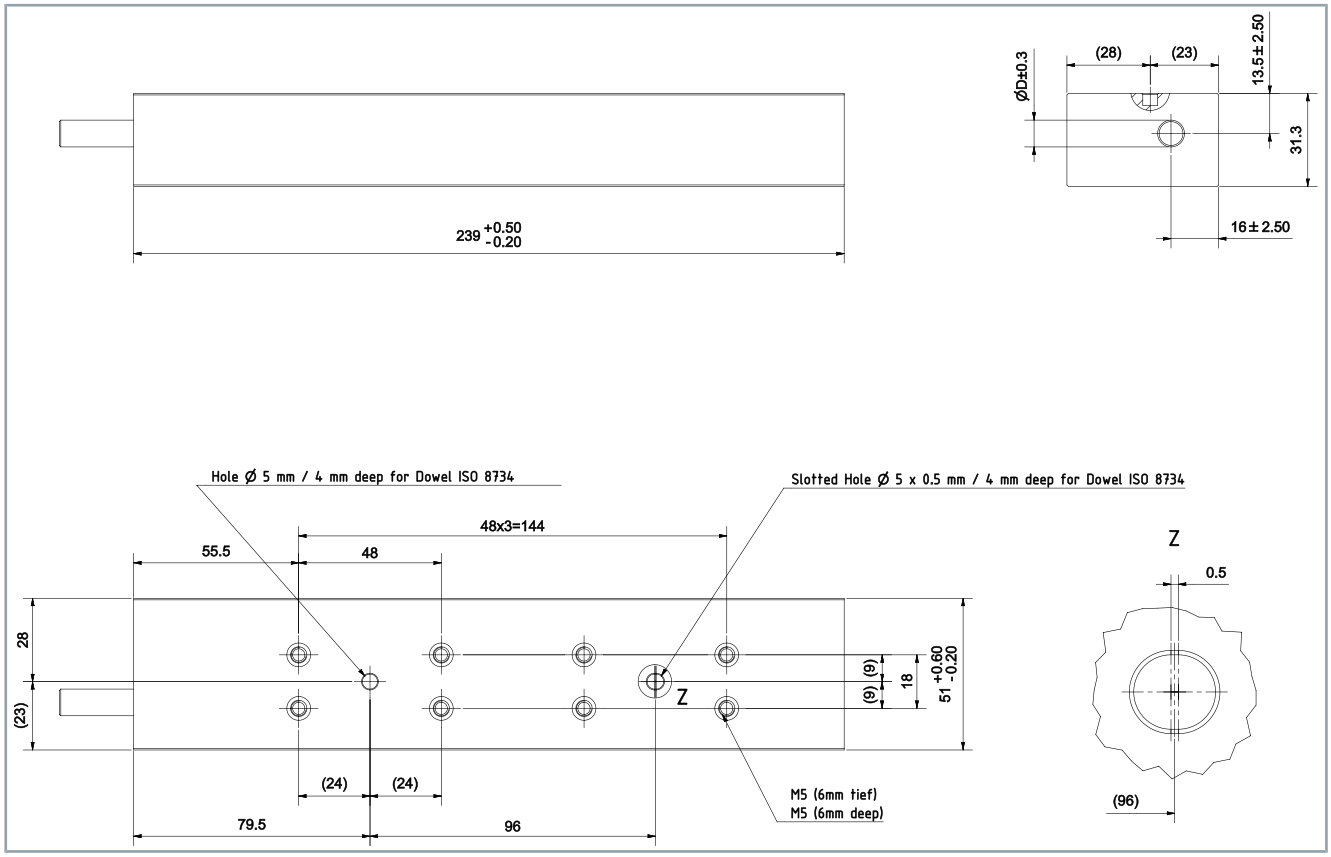
4.3.1.1 AL8021



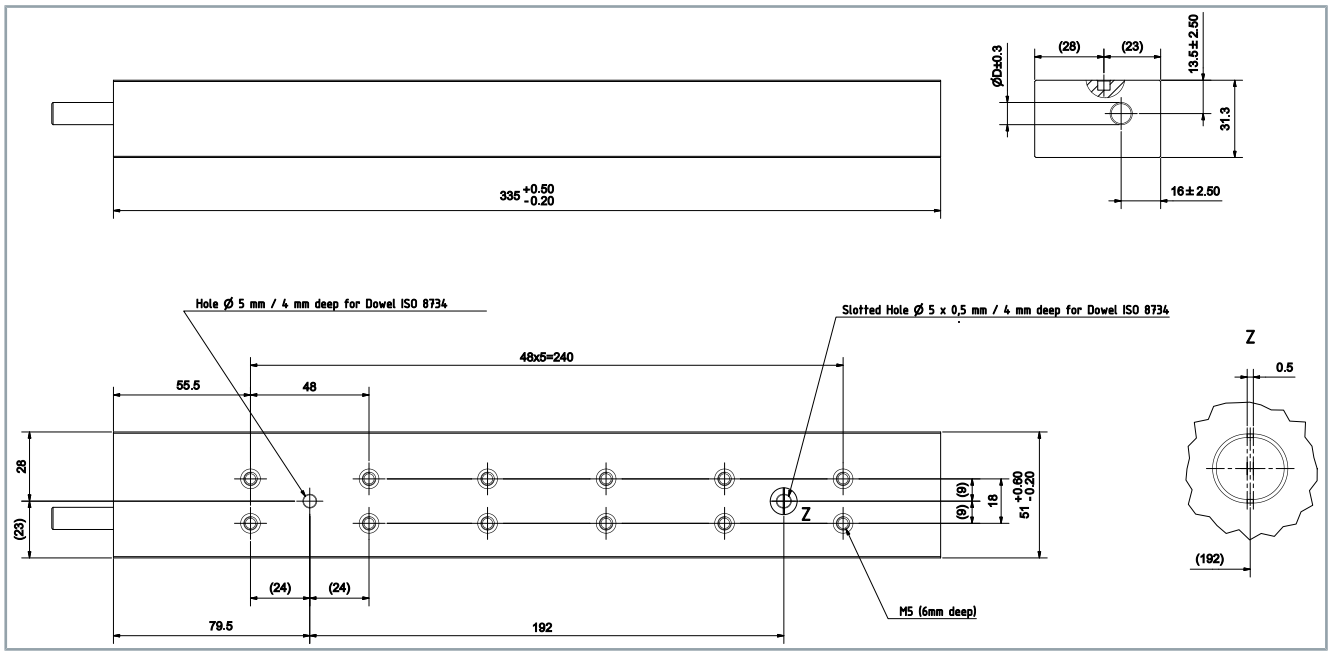
4.3.1.2 AL8022


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 AL8024



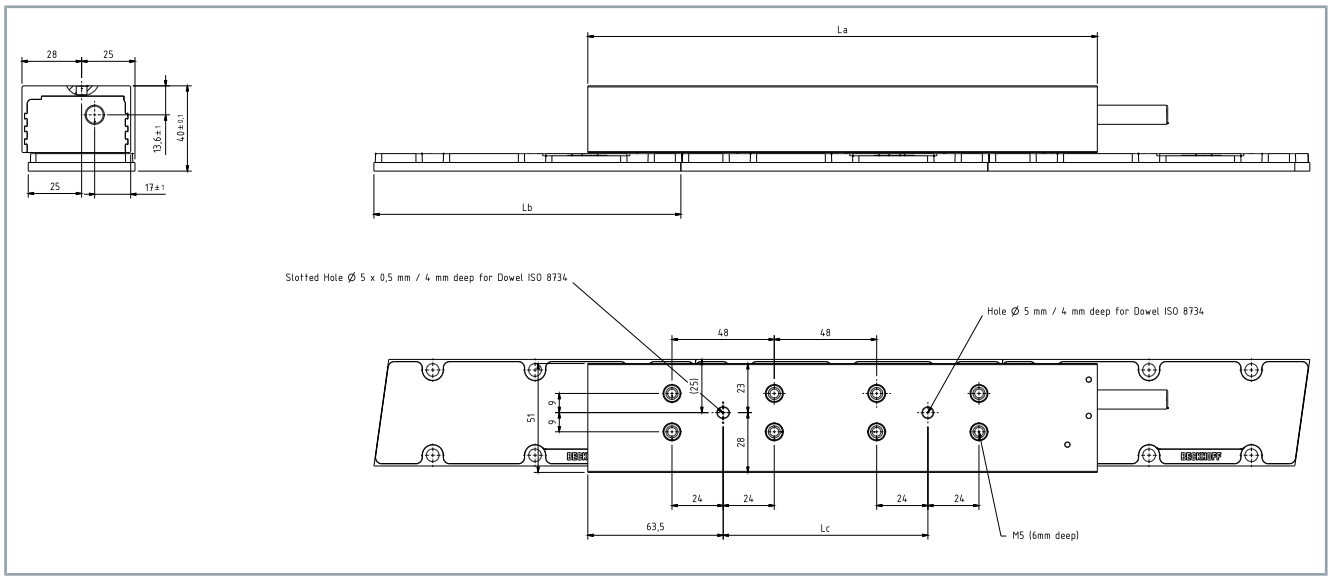
4.3.1.4 AL8026

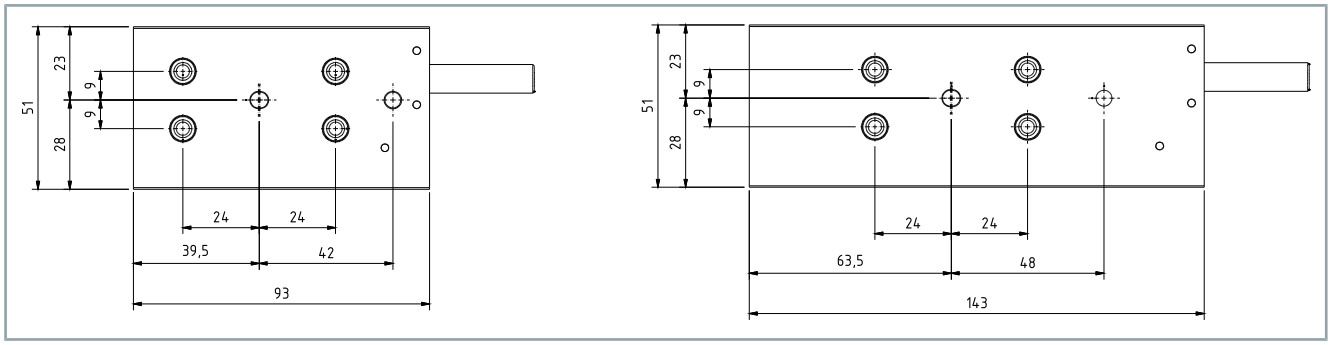


4.3.2 AL802x alignment

Alignment based on AL802x as an example
The figure shows the positioning of a coil unit in relation to the magnetic track.

- All figures in millimeters



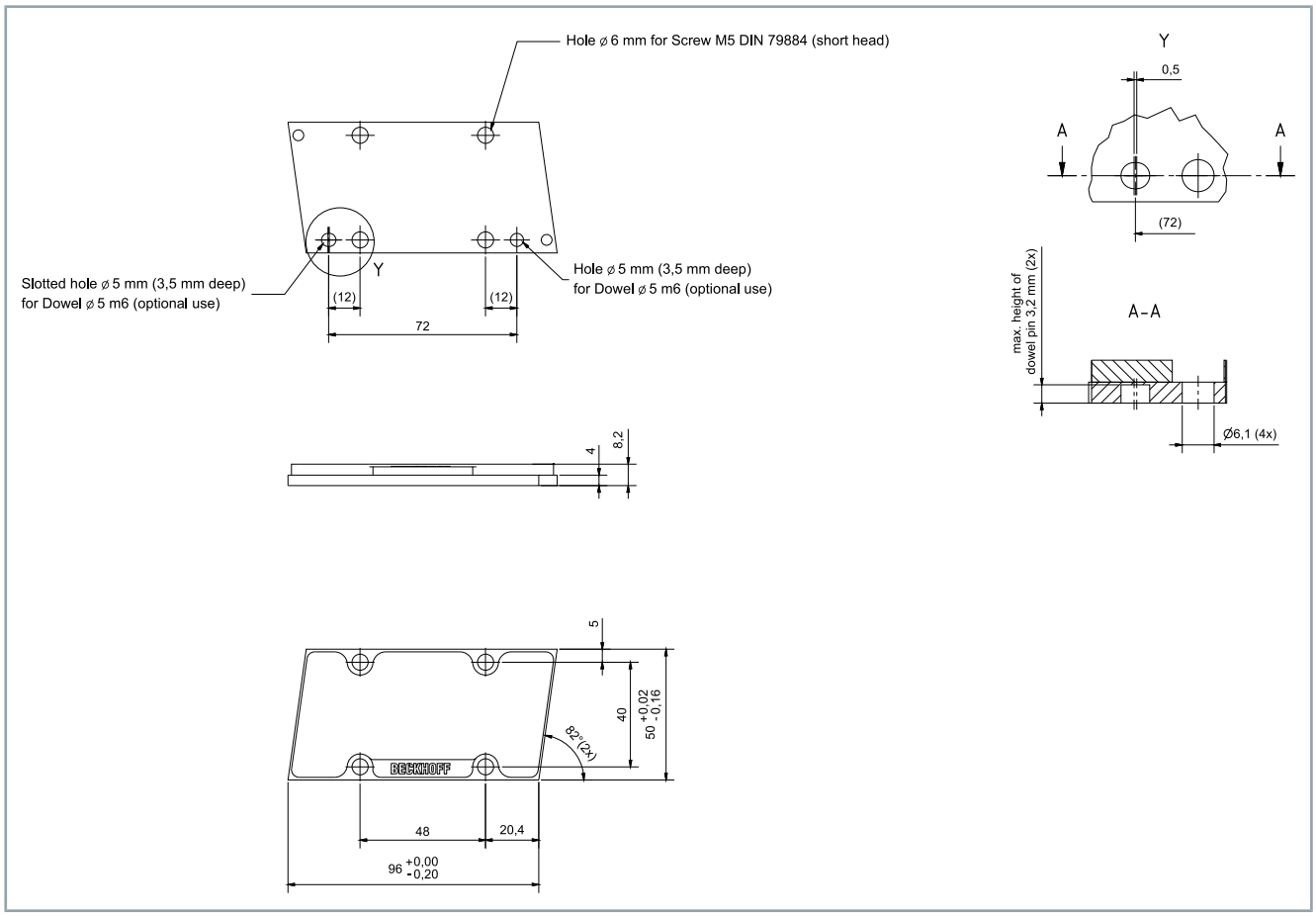


4.4 AL852x magnetic plates

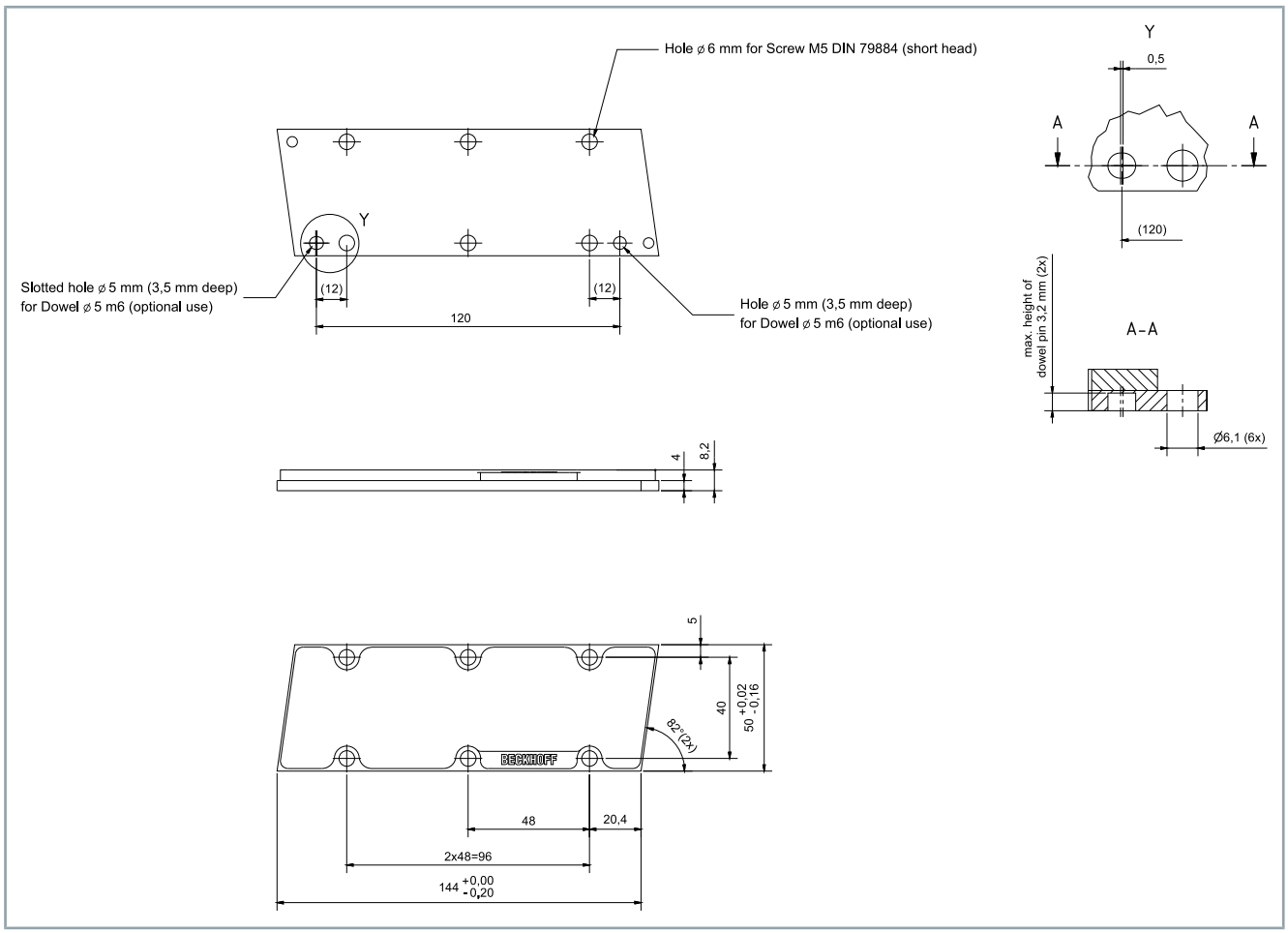
4.4.1 Dimensional drawings AL852x

- All figures in millimeters

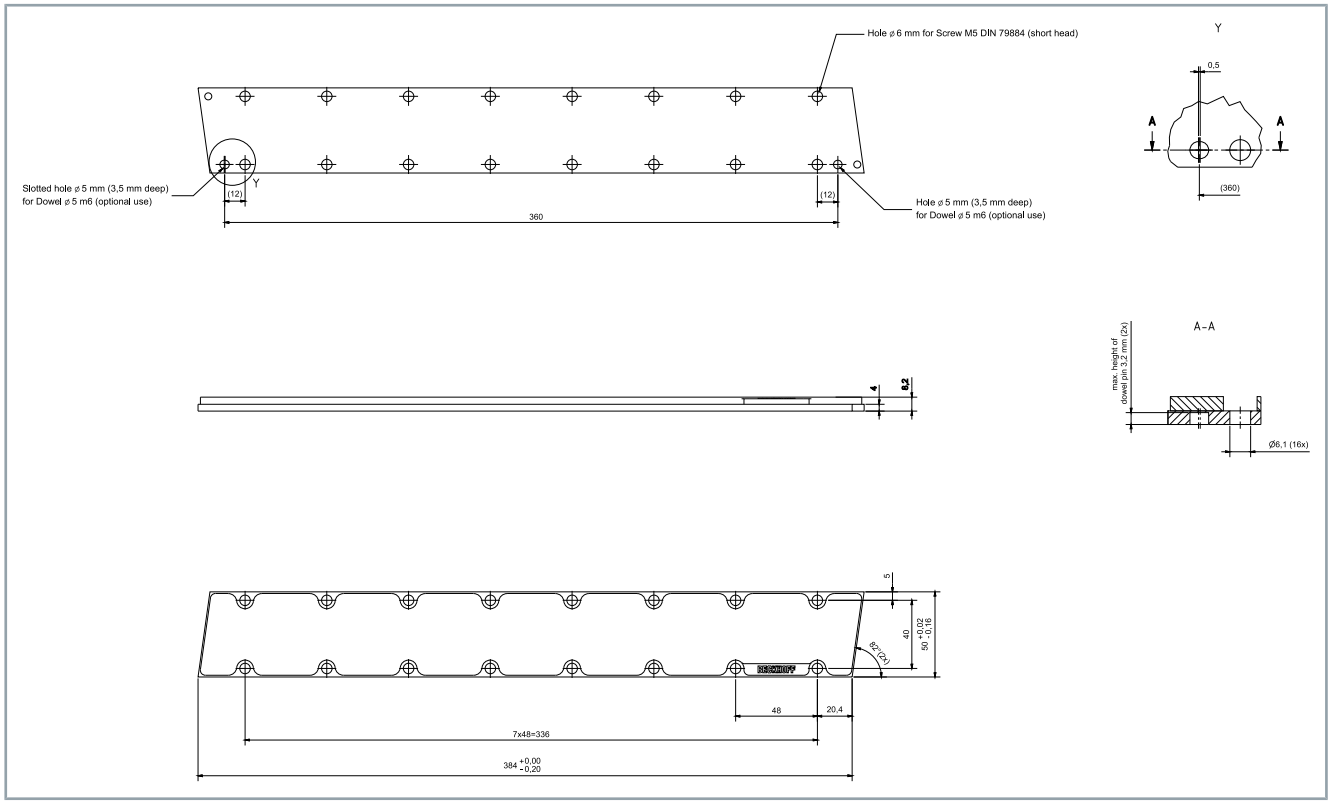
4.4.1.1 AL8521



4.4.1.2 AL8522


Hole ⌀ 6 mm for Screw M5 DIN 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

4.4.1.3 AL8523


Hole ø 6 mm for Screw M5 DIN 79884 (short head)
Slotted hole ø 5 mm (3,5 mm deep)
for Dowel ø 5 m6 (optional use)
Hole ø 5 mm (3,5 mm deep)
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)
Ø6,1 (16x)
4
8,2
5
40
±0,02
±0,16
45° (2x)
48
20,4
7x48=336
384 +0,00 -0,20

4.5 AL804x

Performance data	AL80					
	41-0E	42-0E	43-0E	43-0G	44-0E	44-0H
Peak force F_{max} [N]	230	460	690	690	920	920
Peak current I_{max} [A]	7.2	7.2	7.2	12	7.2	15
Continuous force F_c [N]	100	200	300	300	400	400
Continuous current I_c [A]	2.5	2.5	2.5	4.1	2.5	5.4
Maximum velocity v_{max} [m/s]	7	7	3.5	7.0	3.5	7
Force constant K_f [N/A]	39	79	118	74	157	74
Magnetic force of attraction F_a [N]	700	1000	1350	1350	1650	1650
Winding resistance ph-ph [Ω]	4.6	9.1	14	4.9	18.2	3.8
Winding inductance ph-ph [mH]	25	50	75	29	100	22
Counter EMF ph-ph [V/m/s]	22	44	66	42	89	41
Power loss P_L [W]	63	126	189	169	252	238
Motor constant [N²/W]	158	317	475	531	634	673
Thermal resistance [K/W]	0.95	0.48	0.32	0.35	0.24	0.25
Pole pair distance [mm]	24	24	24	24	24	24
Weight						
Coil unit [kg]	1.0	1.5	2	2	2.6	2.6
Magnetic plate [kg/m]	3.8					
Sensors						
Temperature sensor	LPTC-600; compatible with KTY 84-130					
Cable and motor data						
Outer diameter [mm]	9					
Wire cross-section	4 x 1 mm² + 2 x AWG26					
Minimum static bending radius	4 x outer diameter					
Cable length, assembled [m]	0.5					
Cable length unassembled [m]	1					
Connector	itec®					
Recommended servo drive assignment						
AX5000	AX5x03	AX5x03	AX5x03	AX5x06	AX5x03	AX5x06
AX8000	AX8108/AX8206					

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

Performance data	AL80					
	45-0G	45-0K	46-0G	46-0K	48-0H	48-0K
Peak force F_{max} [N]	1150	1150	1380	1380	1840	1840
Peak current I_{max} [A]	12	24	12	24	15	29
Continuous force F_c [N]	500	500	600	600	800	800
Continuous current I_c [A]	4.1	8.5	4.1	8.5	5.4	10
Maximum velocity v_{max} [m/s]	3.5	7	3.5	7	3.5	7
Force constant K_f [N/A]	123	59	148	71	147	79
Magnetic force of attraction F_a [N]	2050	2050	2400	2400	3200	3200
Winding resistance ph-ph [Ω]	8.1	2	9.7	2.4	7.6	2.2
Winding inductance ph-ph [mH]	49	11	59	13	44	12
Counter EMF ph-ph [V/m/s]	69	33	83	40	83	44
Power loss P_L [W]	282	298	339	358	476	458

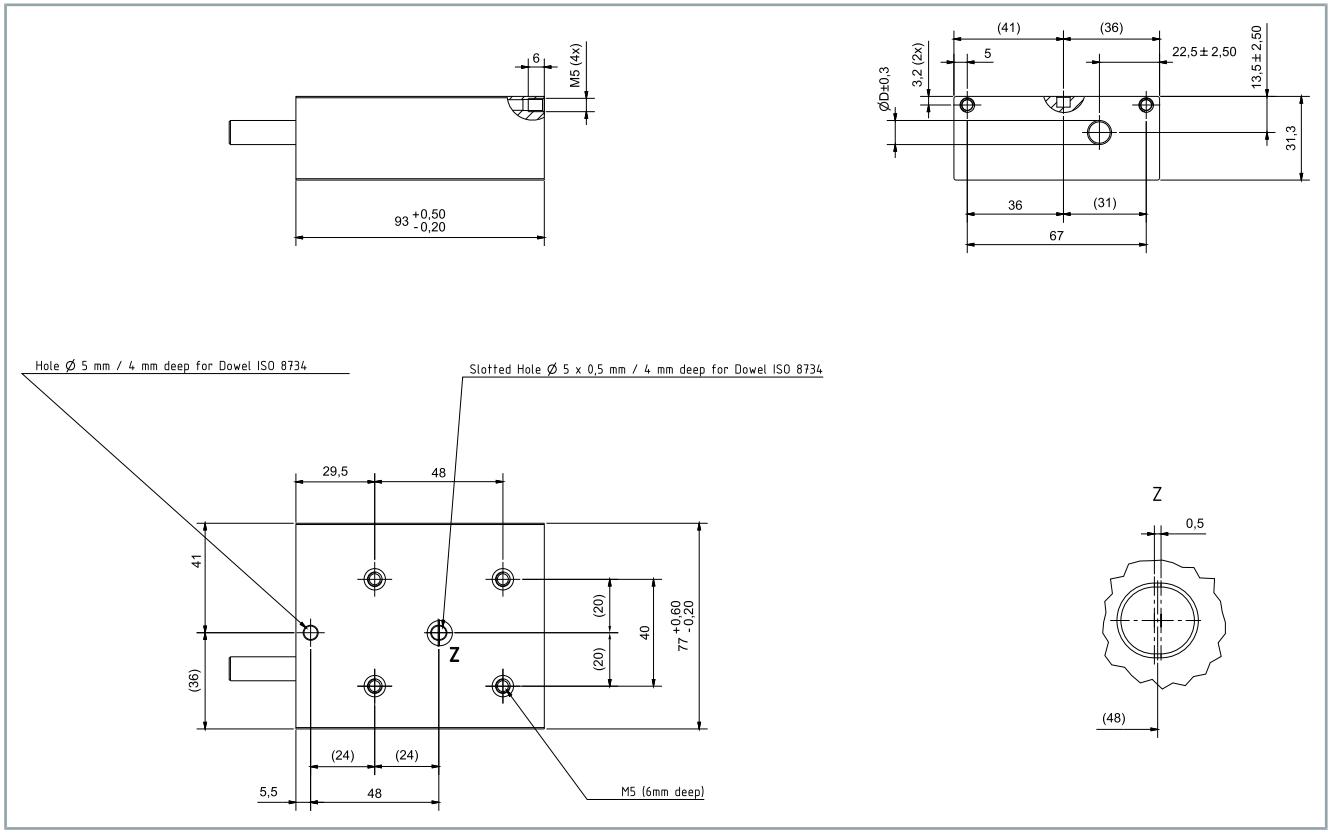
Performance data	AL80					
	41-0E	42-0E	43-0E	43-0G	44-0E	44-0H
Motor constant [N²/W]	885	839	1062	1006	1346	1398
Thermal resistance [K/W]	0.21	0.20	0.18	0.17	0.13	0.13
Pole pair distance [mm]	24	24	24	24	24	24
Weight						
Coil unit [kg]	3.2	3.2	3.8	3.8	4.9	4.9
Magnetic plate [kg/m]	3.8					
Sensors						
Temperature sensor	LPTC-600; compatible with KTY 84-130					
Cable and motor data						
Outer diameter [mm]	9	9.5	9	9.5	9	9.5
Wire cross-section	4 x 1 mm² + 2 x AWG26	4 x 1.5 mm² + 2 x AWG26	4 x 1 mm² + 2 x AWG26	4 x 1.5 mm² + 2 x AWG26	4 x 1 mm² + 2 x AWG26	4 x 1.5 mm² + 2 x AWG26
Minimum static bending radius	4 x outer diameter					
Cable length, assembled [m]	0.5					
Cable length unassembled [m]	1					
Connector	itec®	M23-SpeedTec®	itec®	M23-SpeedTec®	itec®	M23-SpeedTec®
Recommended servo drive assignment						
AX5000	AX5x06	AX5112	AX5x06	AX5112	AX5x06	AX5112
AX8000	AX8108 AX8206	AX8108	AX8108 AX8206	AX8108	AX8108 AX8206	AX8108

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

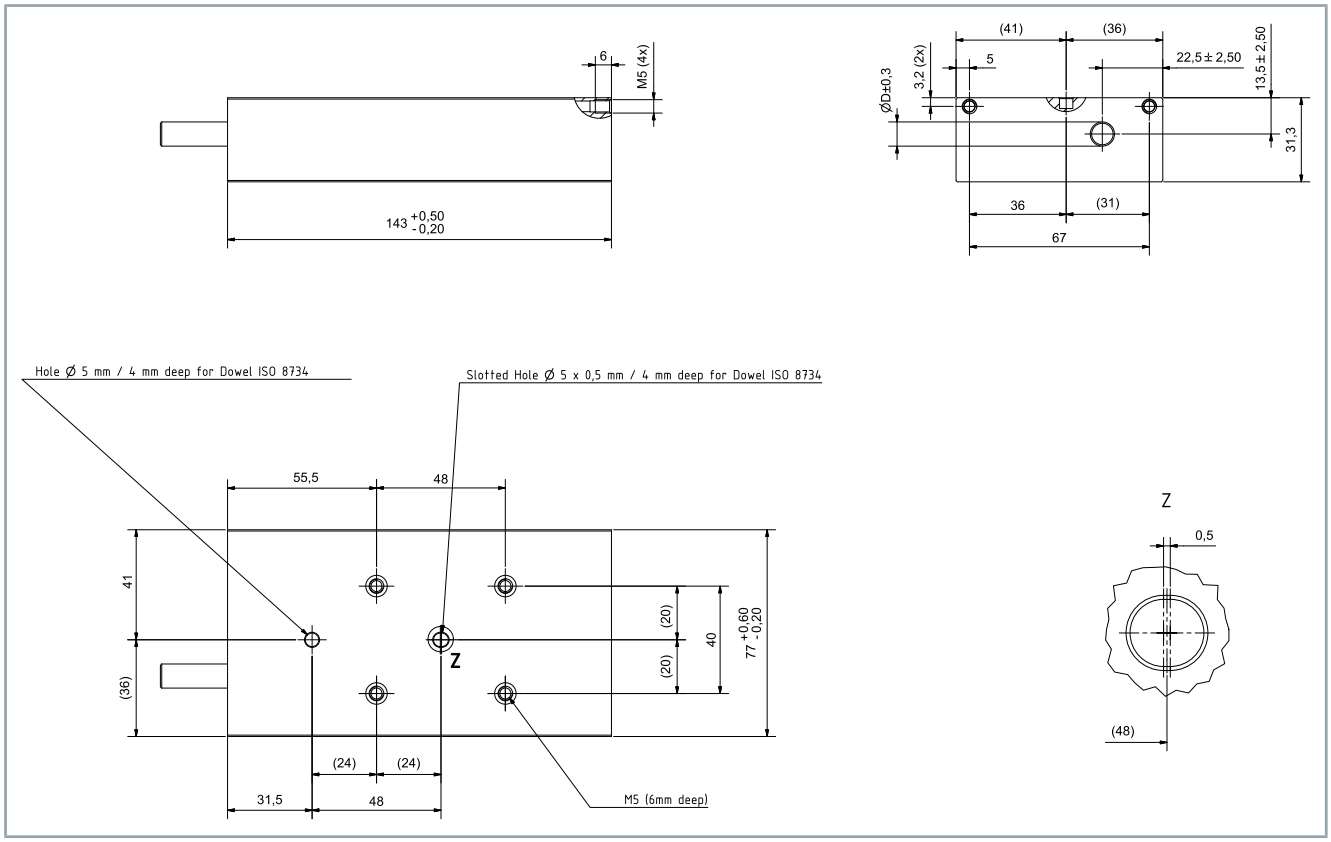
4.5.1 Dimensional drawings AL804x

- All figures in millimeters

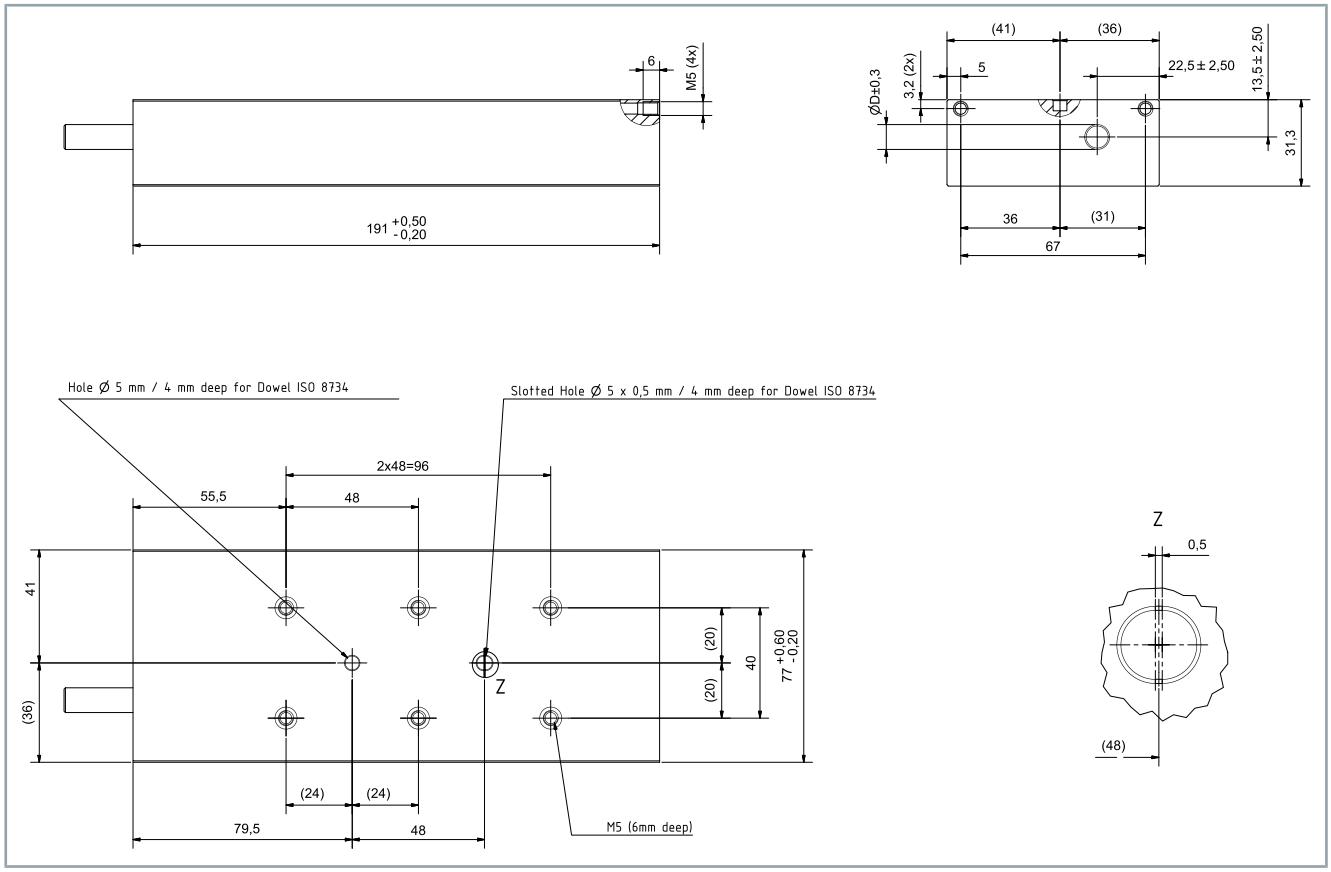
4.5.1.1 AL8041



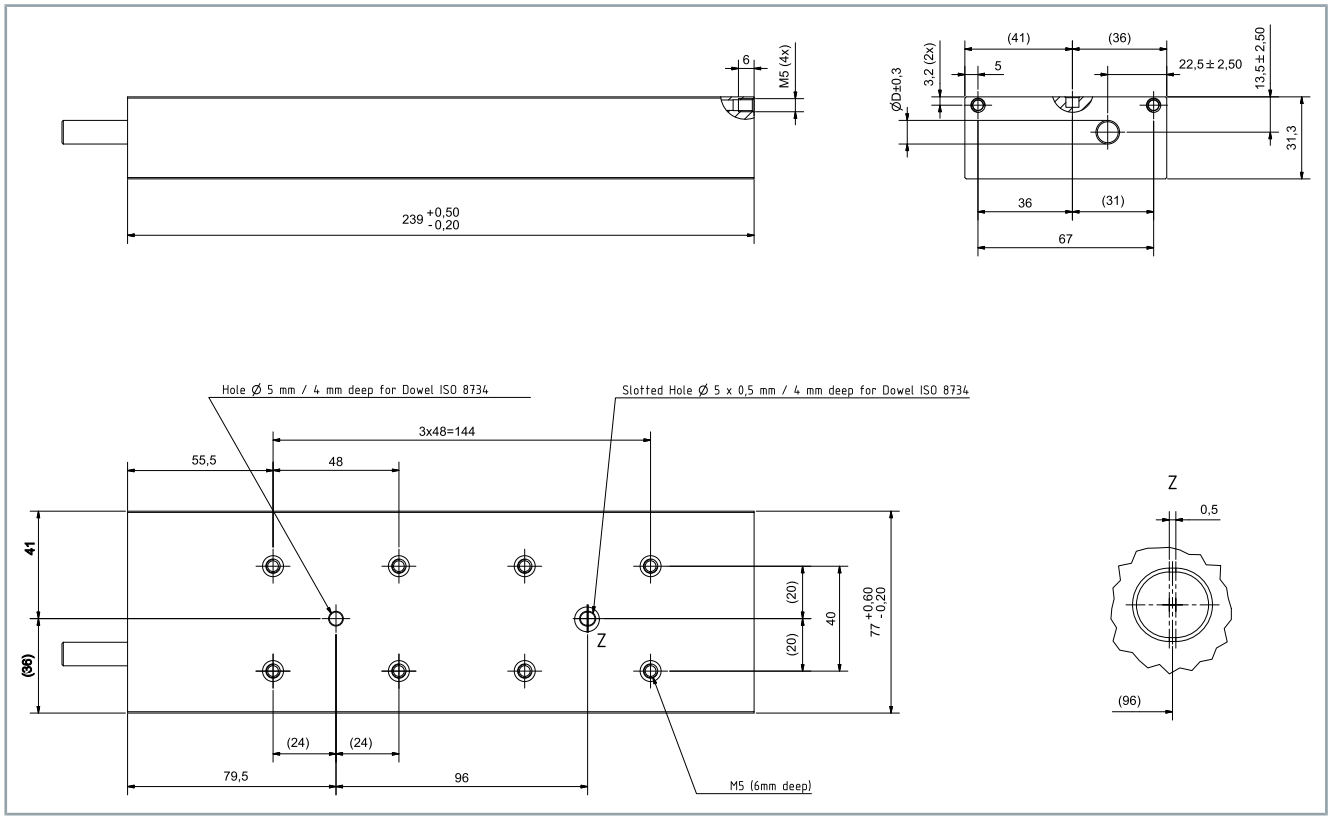
4.5.1.2 AL8042



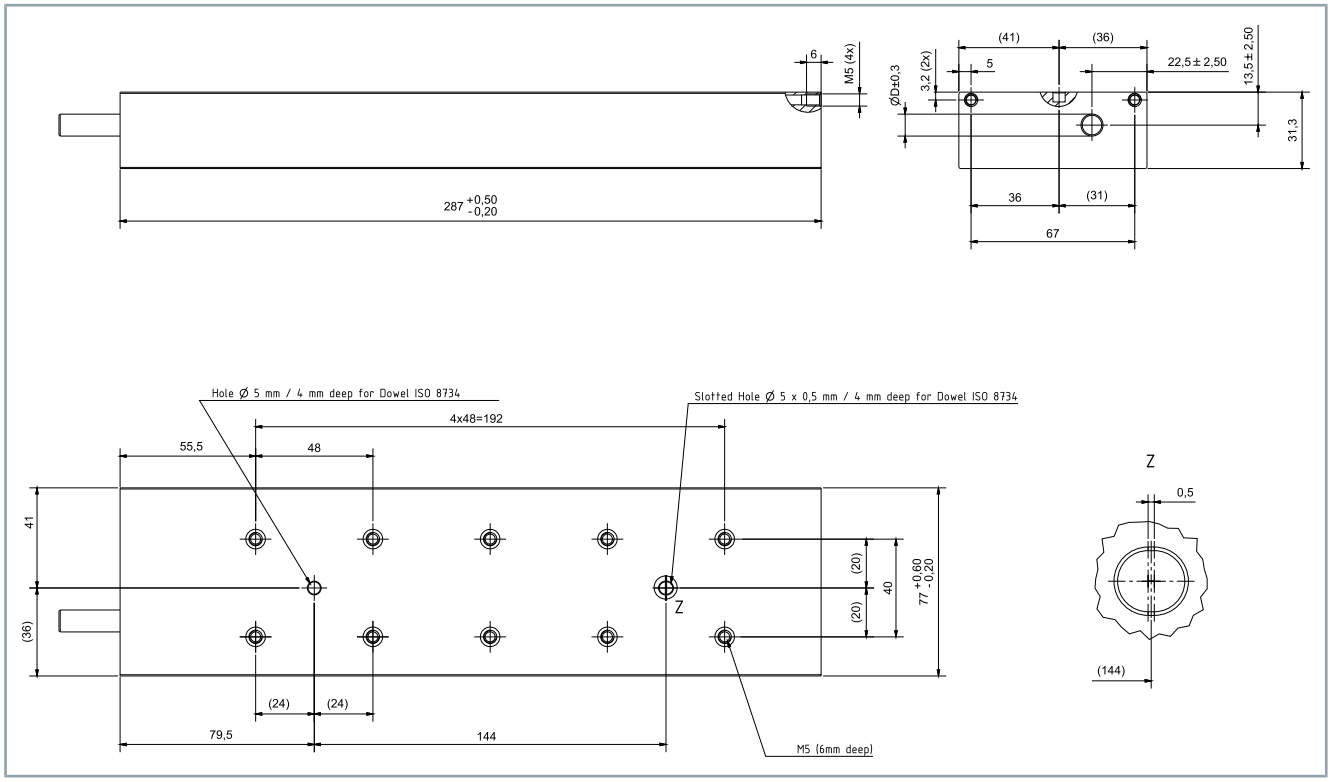
4.5.1.3 AL8043



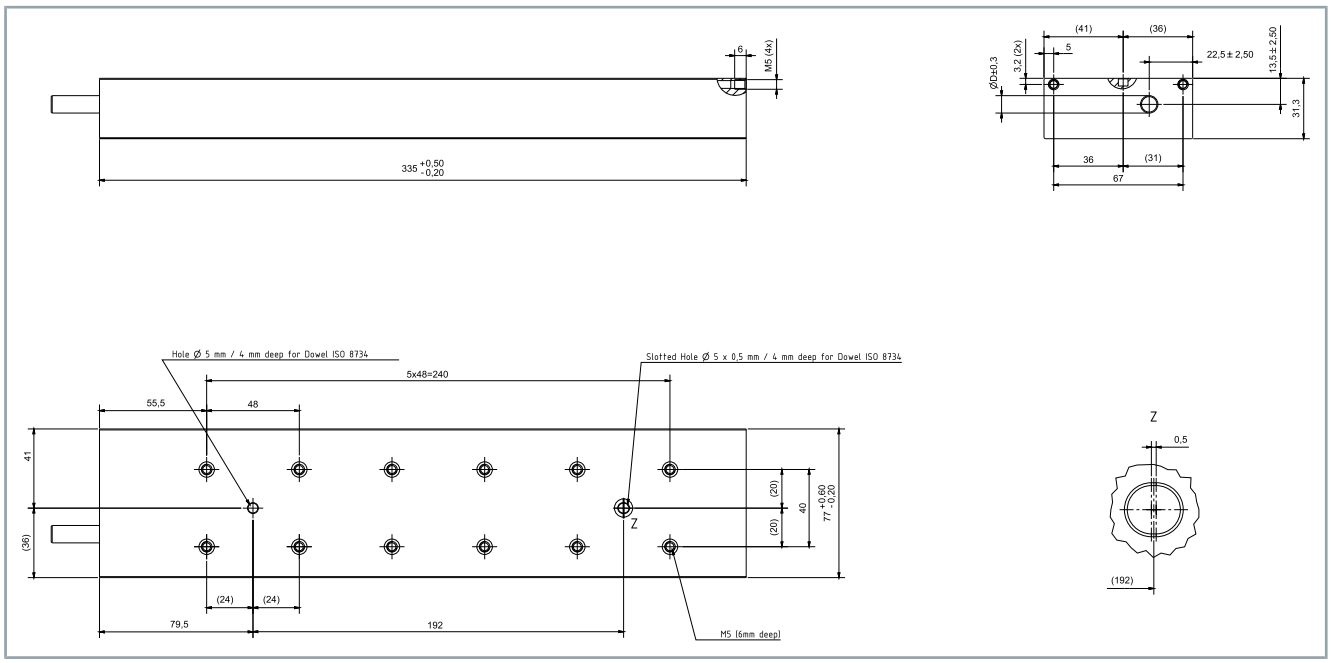
4.5.1.4 AL8044



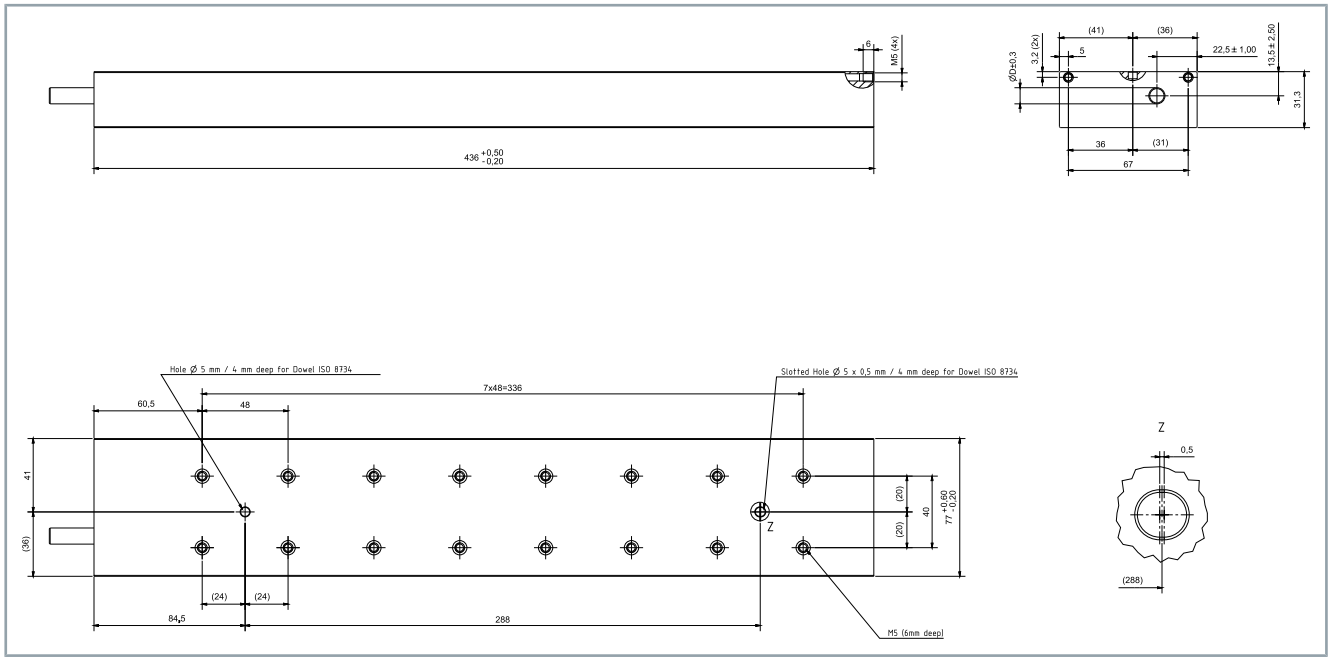
4.5.1.5 AL8045



4.5.1.6 AL8046



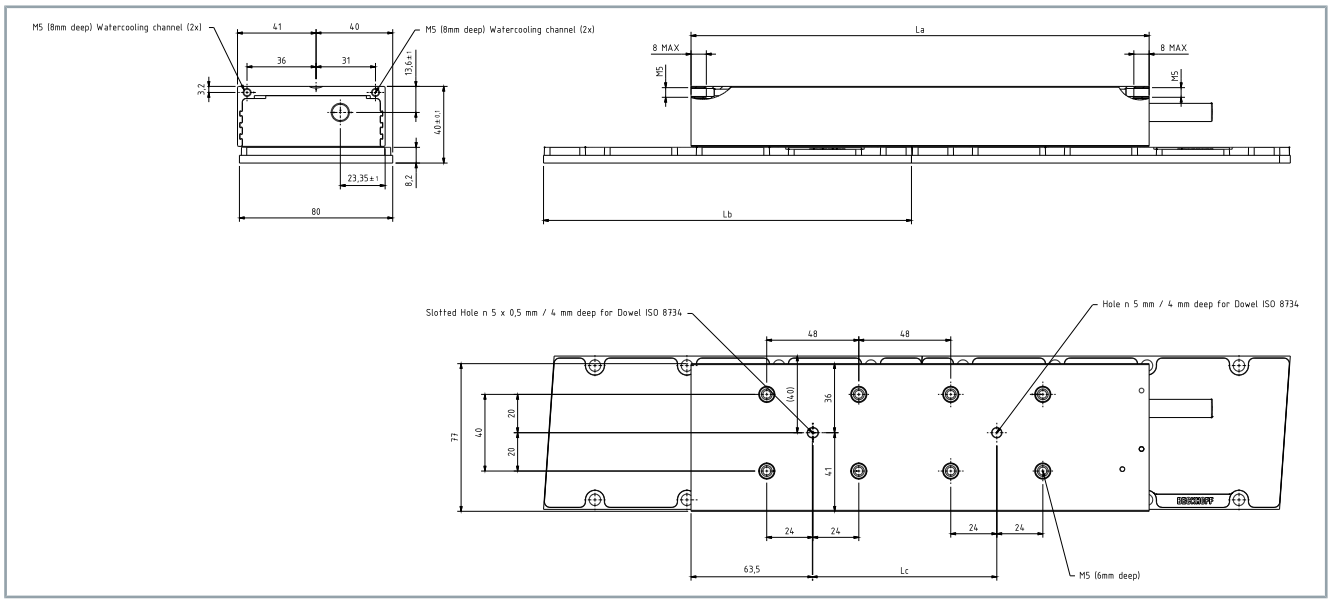
4.5.1.7 AL8048

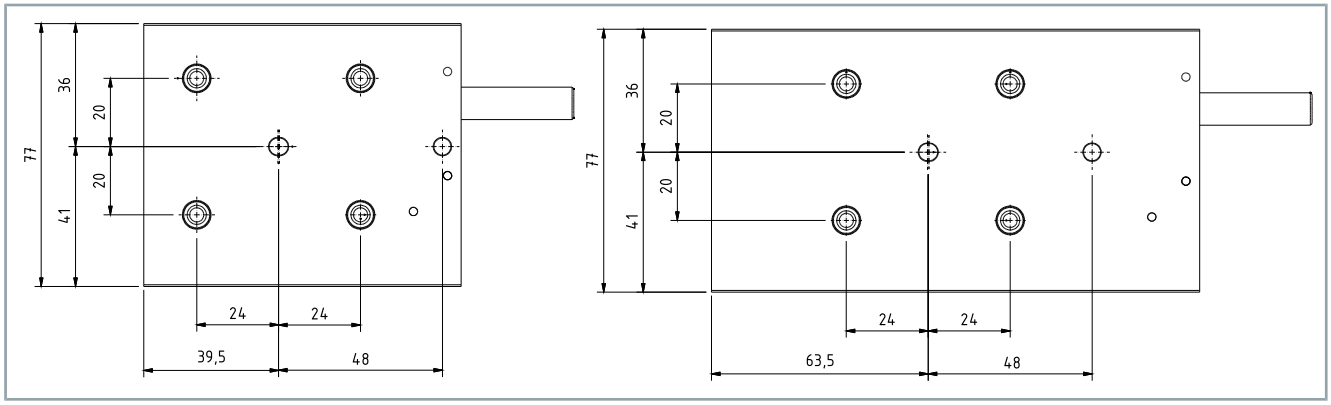

6
M5 (4x)
436 +0,50 -0,20
(41)
(36)
22,5 ± 1,00
13,5 ± 2,50
ØD±0,3
3,2 (2x)
5
31,3
36
(31)
67
Hole Ø 5 mm / 4 mm deep for Dowel ISO 8734
Slotted Hole Ø 5 x 0,5 mm / 4 mm deep for Dowel ISO 8734
7x48=336
60,5
48
41
(36)
(20)
40
77 +0,80 -0,60
(24)
(24)
84,5
288
M5 (6mm deep)
Z
0,5
(288)

4.5.2 AL804x alignment

Alignment based on AL804x as an example
The figure shows the positioning of a coil unit in relation to the magnetic track.

- All figures in millimeters



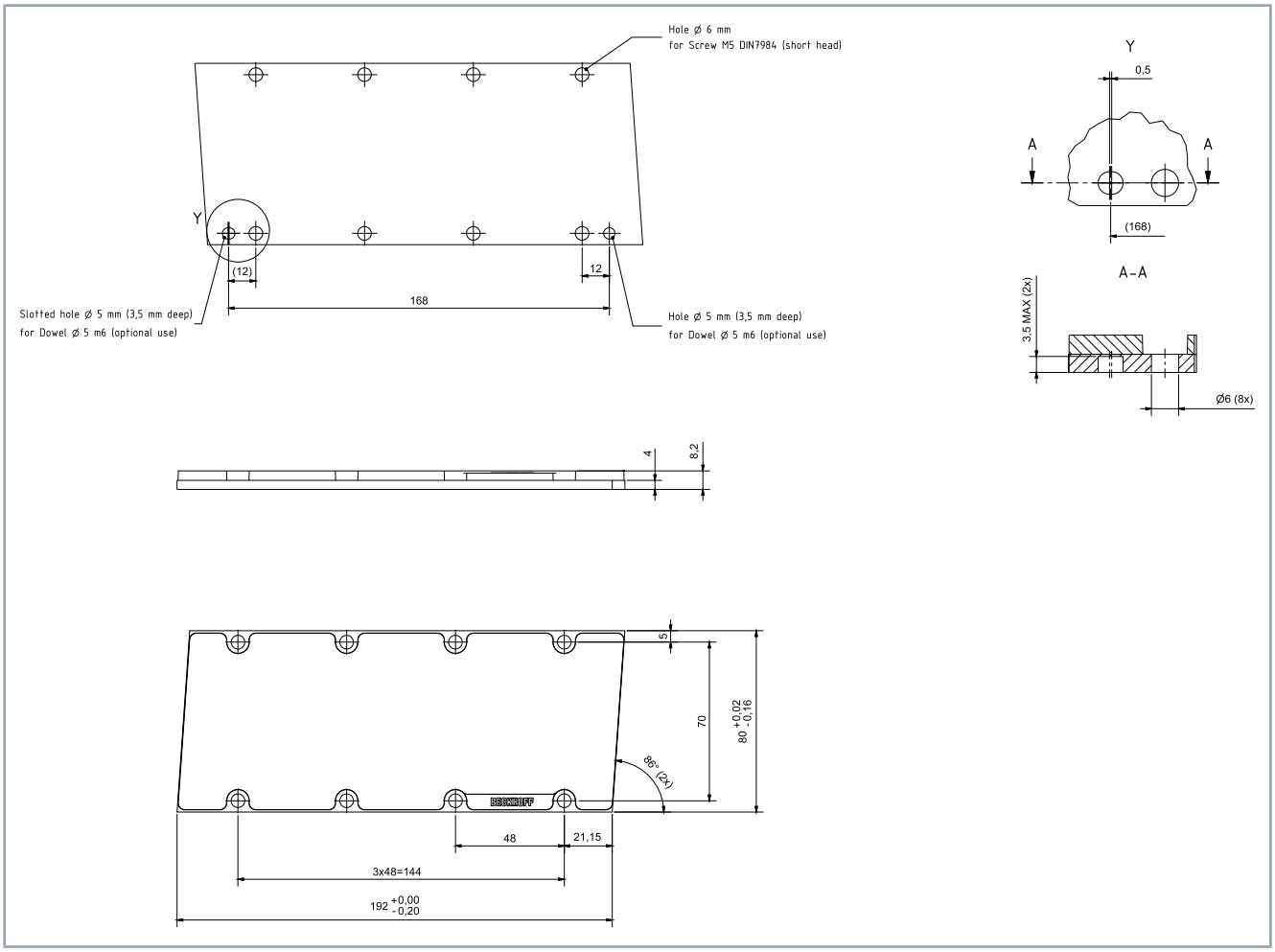


4.6 AL854x magnetic plates

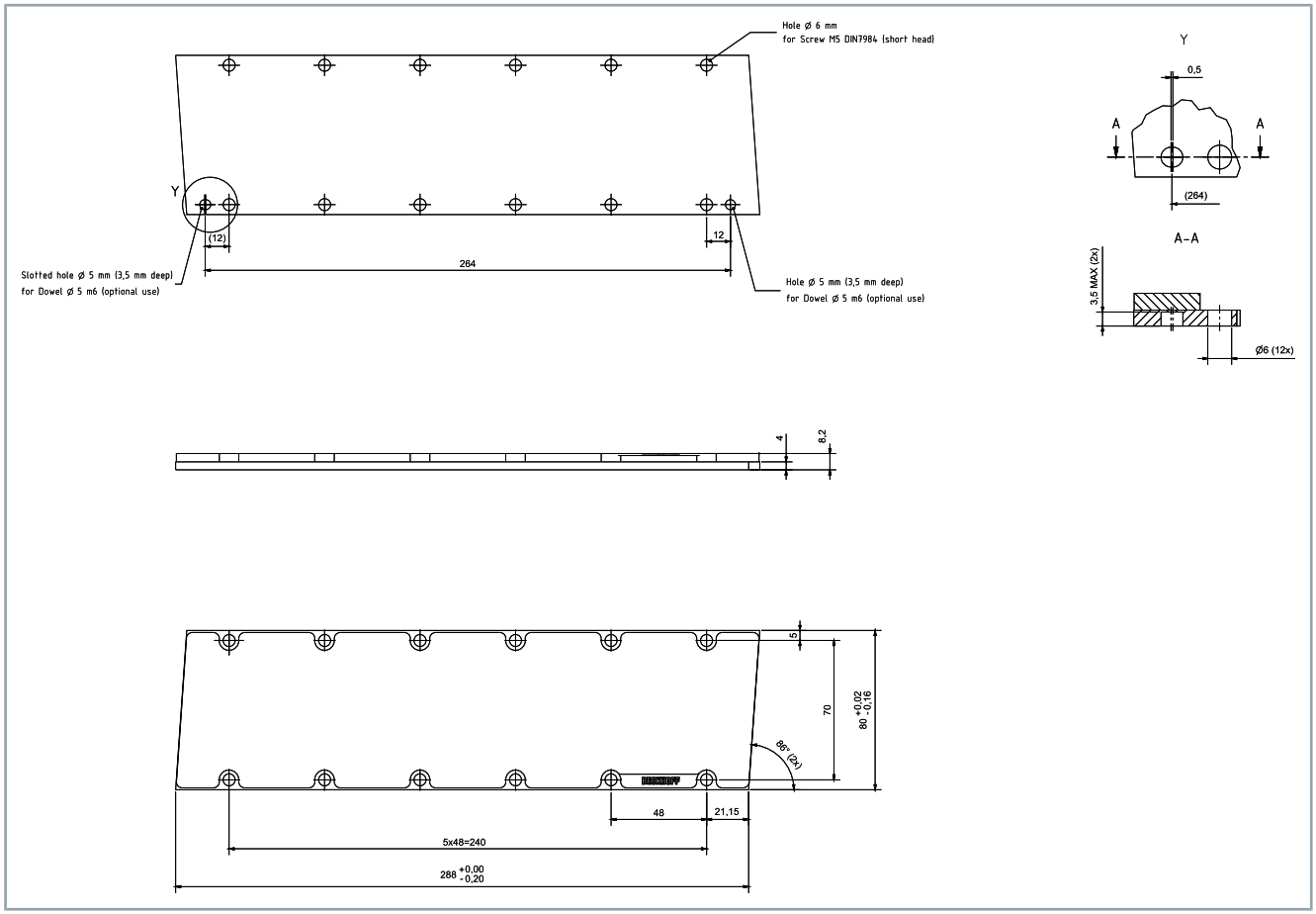
4.6.1 Dimensional drawings AL854x

- All figures in millimeters

4.6.1.1 AL8541



4.6.1.2 AL8542


Hole Ø 6 mm
for Screw M5 DIN7984 (short head)
Y
(12)
12
264
Slotted hole Ø 5 mm (3,5 mm deep)
for Dowel Ø 5 m6 (optional use)
Hole Ø 5 mm (3,5 mm deep)
for Dowel Ø 5 m6 (optional use)
Y
0,5
A
A
(264)
A-A
3,5 MAX (2x)
Ø6 (12x)
4
8,2
5
70
80 +0,02 -0,16
86° (2x)
48
21,15
5x48=240
288 +0,00 -0,20

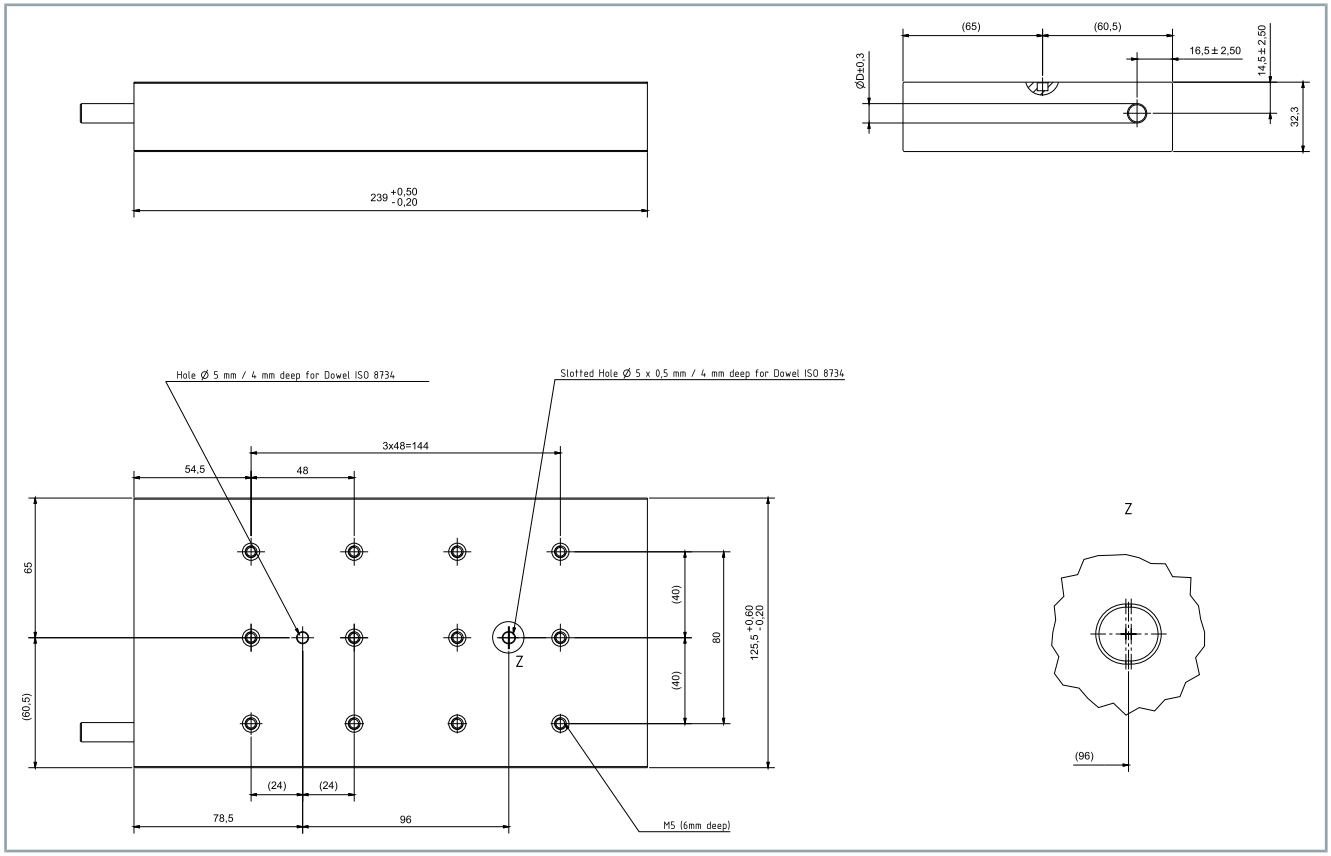
4.7 AL806x-0 | Coil unit with convection cooling

Performance data	AL80						
	64-0F	64-0K	65-0H	65-0K	66-0J	6A-0K	6A-0Q
Peak force F_{max} [N]	1800	1800	2250	2250	2700	4500	4500
Peak current I_{max} [A]	12	24	15	24	18	24	72
Continuous force F_c [N]	760	760	950	950	1140	1900	1900
Continuous current I_c [A]	4.0	8.3	5.3	8.3	6.1	8.3	25
Maximum velocity v_{max} [m/s]	3	6	3	6	3	3	6
Force constant K_f [N/A]	191	91	178	114	187	228	76
Magnetic force of attraction F_a [N]	3200	3200	3950	3950	4650	7500	7500
Winding resistance ph-ph [Ω]	11.5	2.75	8.2	3.3	8.0	6.7	0.9
Winding inductance ph-ph [mH]	77	18	53	22	49	44	5
Counter EMF ph-ph [V/m/s]	108	52	101	65	106	130	43
Power loss P_L [W]	366	394	483	493	589	986	1084
Motor constant [N²/W]	1579	1465	1867	1831	2206	3662	3329
Thermal resistance [K/W]	0.16	0.15	0.12	0.12	0.10	0.06	0.06
Pole pair distance [mm]	24	24	24	24	24	24	24
Weight							
Coil unit [kg]	4.9	4.9	5.9	5.9	6.9	11.4	11.4
Magnetic plate [kg/m]	10.5						
Sensors							
Temperature sensor	LPTC-600; compatible with KTY 84-130						
Cable and motor data							
Outer diameter [mm]	9	9.5	9	9.5	9.5	9.5	12.2
Wire cross-section	4 x 1 mm² + 2 x AWG26	4 x 1.5 mm² + 2 x AWG26	4 x 1 mm² + 2 x AWG26	4 x 1.5 mm² + 2 x AWG26	4 x 1.5 mm² + 2 x AWG26	4 x 1.5 mm² + 2 x AWG26	4 x 4 mm² + 2 x AWG26
Minimum static bending radius	4 x outer diameter						
Cable length, assembled [m]	0.5						
Cable length unassembled [m]	1						
Connector	itec®	M23-SpeedTec®	itec®	M23-SpeedTec®	M23-SpeedTec®	M23-SpeedTec®	M40-SpeedTec®
Recommended servo drive assignment							
AX5000	AX5x06	AX5112	AX5x06	AX5112	AX5x06 AX5112	AX5112	AX5125
AX8000	AX8108 AX8206	AX8108	AX8108 AX8206	AX8108	AX8206 AX8108	AX8108	AX8525
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							

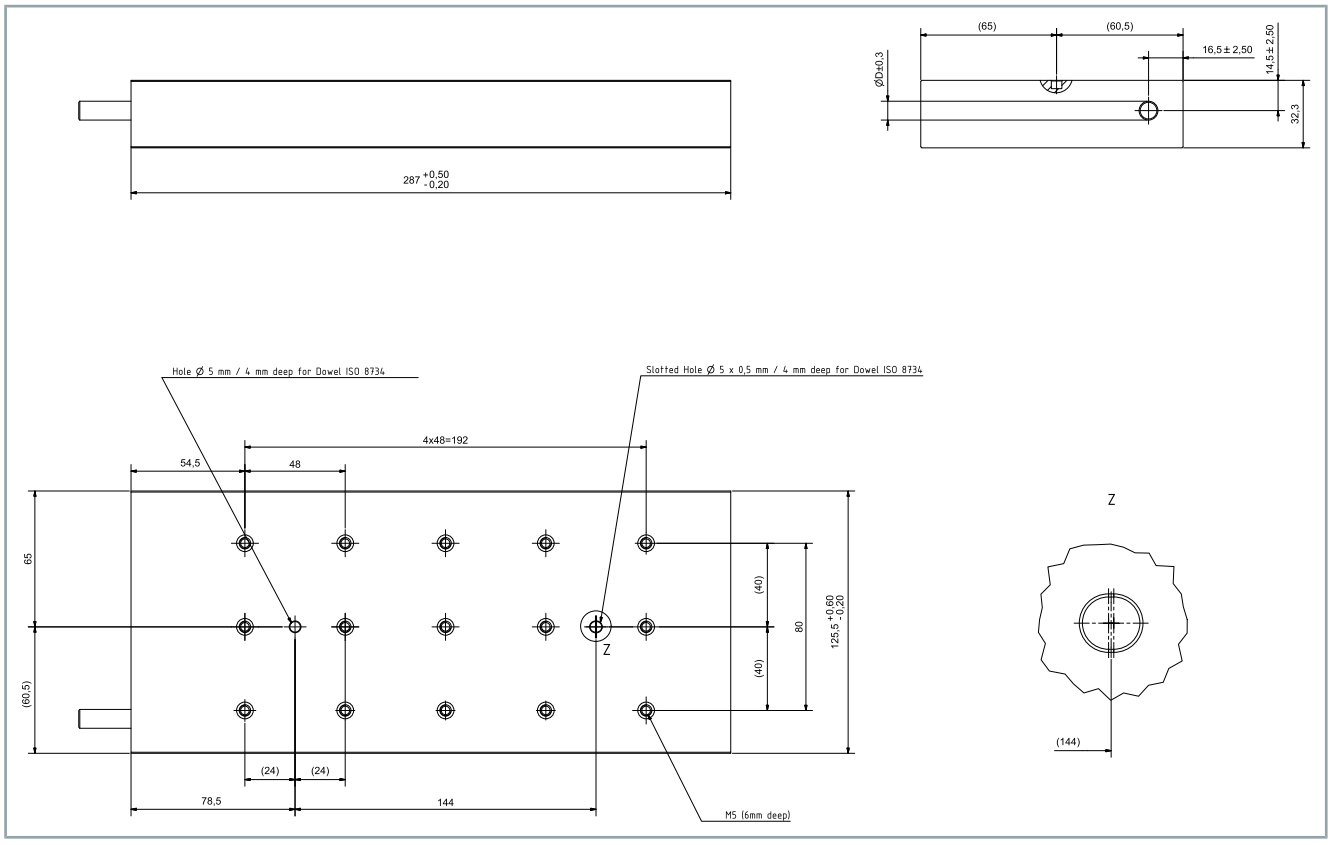
4.7.1 Dimensional drawings AL806x-0

- All figures in millimeters

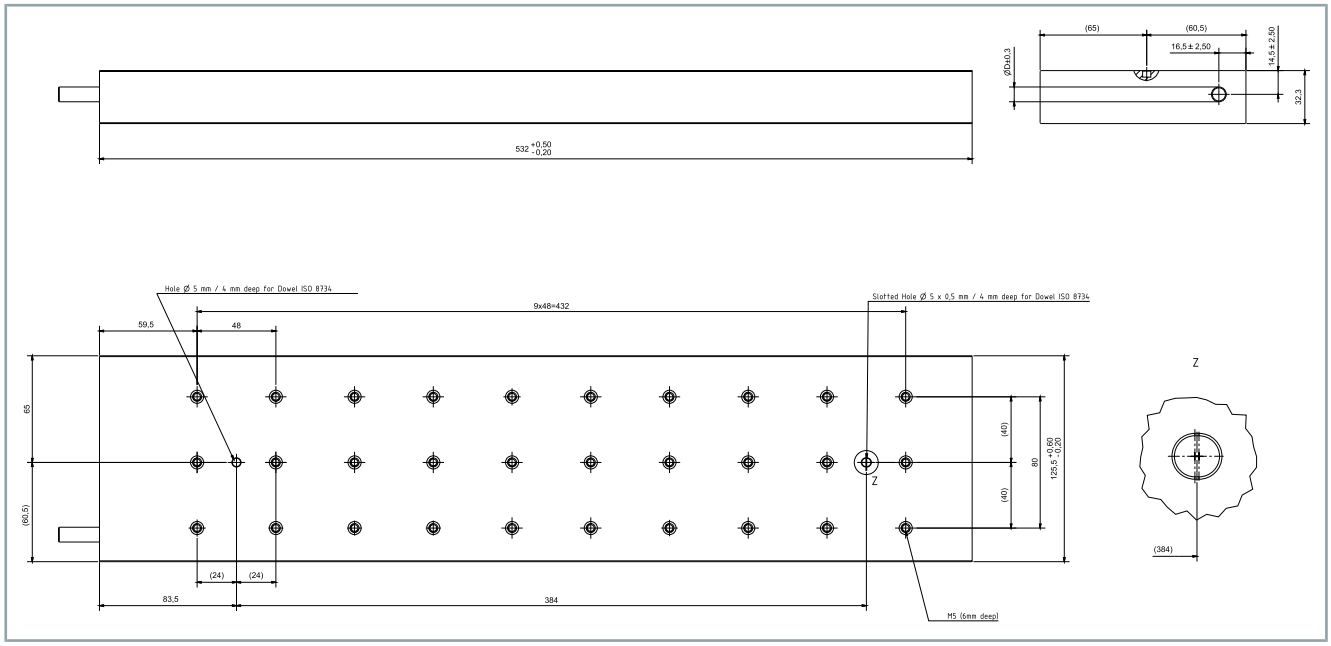
4.7.1.1 AL8064



4.7.1.2 AL8065



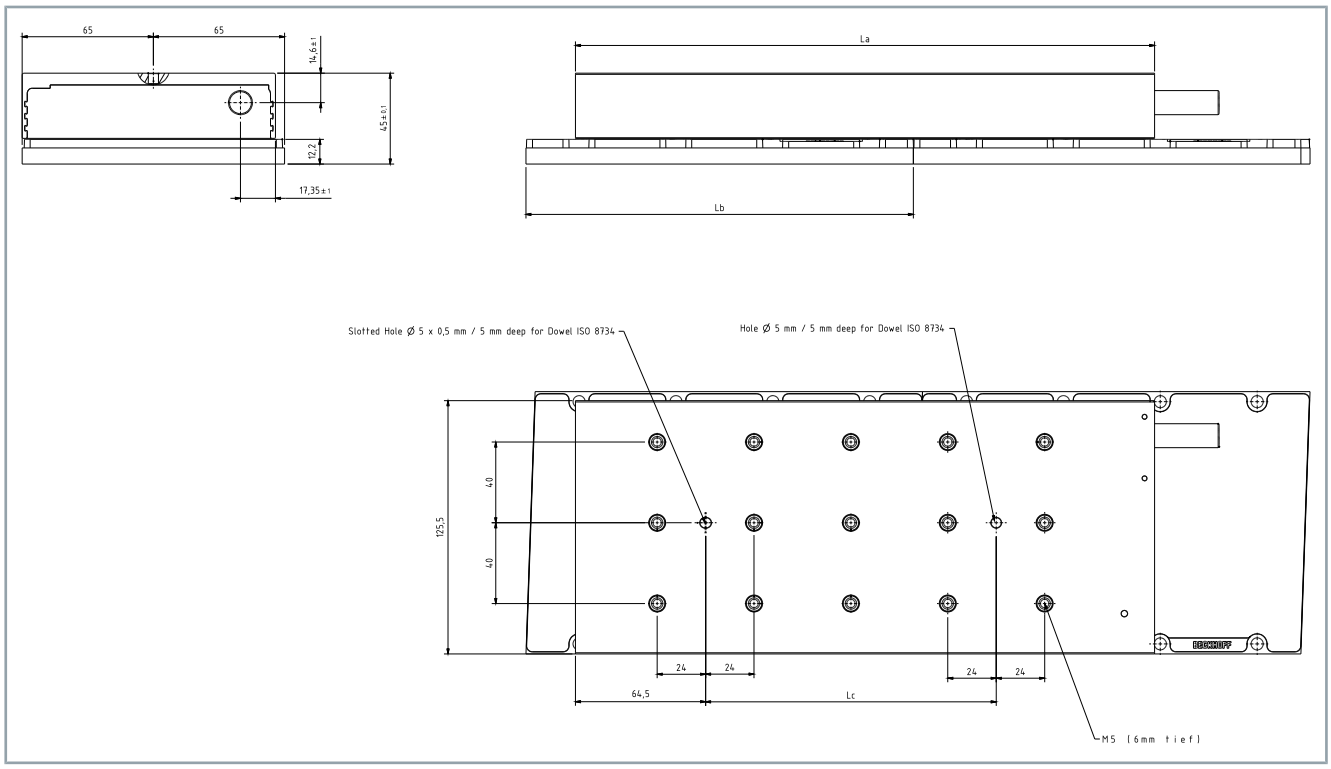
4.7.1.3 AL806A



4.7.2 AL806x-0 alignment

Alignment based on AL806x-0 as an example
The figure shows the positioning of a coil unit in relation to the magnetic track.

- All figures in millimeters



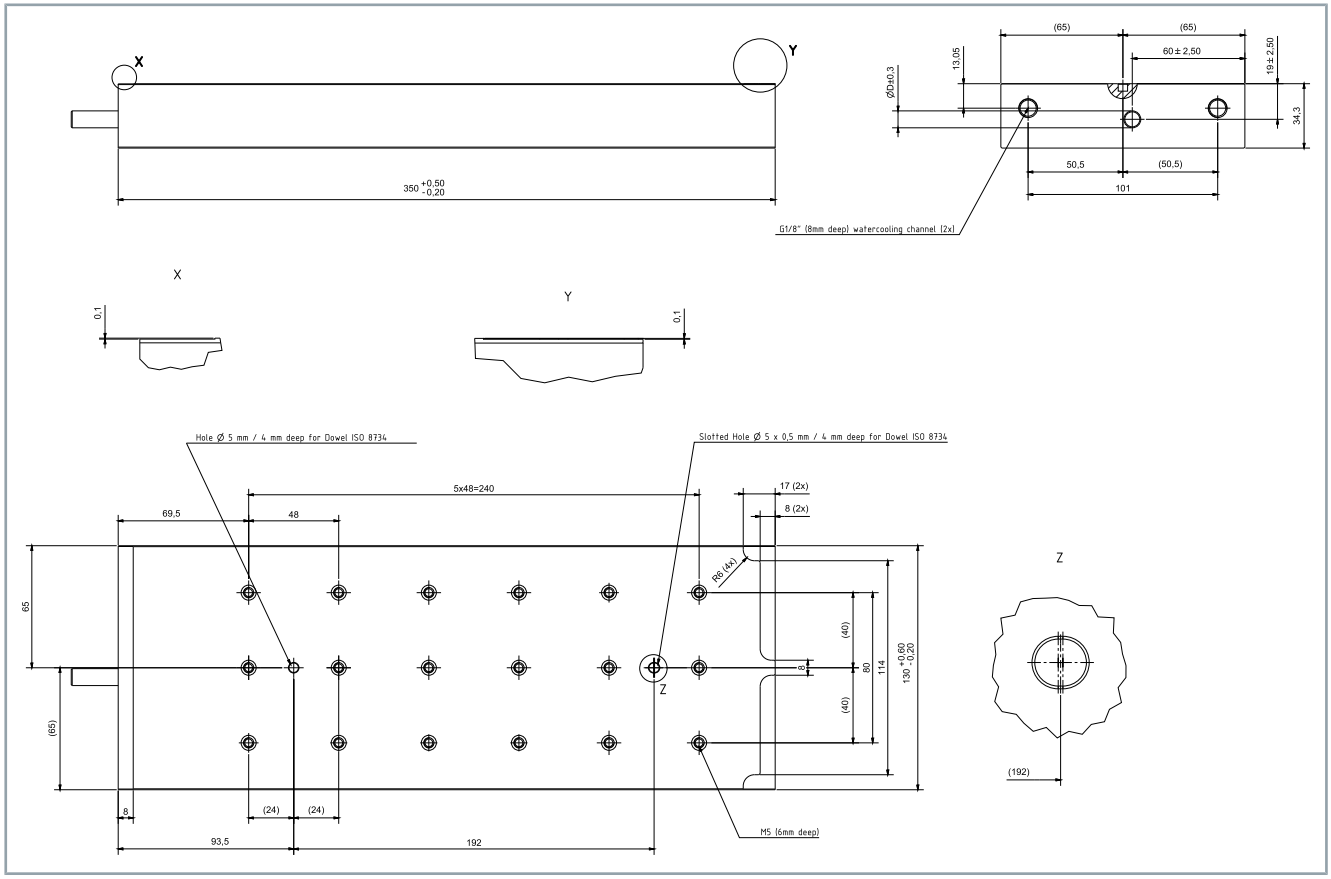
4.8 AL806x-1 | Coil unit with water cooling

Performance data	AL80						
	66-1J	66-1N	6A-1K	6A-1R	6B-1L	6F-1N	6F-1T
Peak force F_{max} [N]	2700	2700	4500	4500	4950	6750	6750
Peak current I_{max} [A]	18	42	24	72	29	42	100
Continuous force F_c [N]	1200	1200	2000	2000	2200	3000	3000
Continuous current I_c [A]	6.4	15	8.8	26	10.5	15	36
Maximum velocity v_{max} [m/s]	3	6	3	6	3	3	6
Force constant K_f [N/A]	186	79	228	76	209	197	83
Magnetic force of attraction F_a [N]	4650	4650	7500	7500	8250	11250	11250
Winding resistance ph-ph [Ω]	8	1.4	6.7	0.9	5.2	3.6	0.8
Winding inductance ph-ph [mH]	49	9	44	5	34	22	4
Counter EMF ph-ph [V/m/s]	106	45	130	43	119	112	47
Power loss P_L [W]	658	661	1096	1206	1140	1654	1710
Motor constant [N²/W]	2187	2177	3649	3317	4245	5443	5263
Thermal resistance [K/W]	0.09	0.09	0.05	0.05	0.05	0.04	0.04
Pole pair distance [mm]	24	24	24	24	24	24	24
Weight							
Coil unit [kg]	7.4	7.4	11.5	11.5	12.7	16.8	16.8
Magnetic plate [kg/m]	10.5						
Sensors							
Temperature sensor	LPTC-600; compatible with KTY 84-130						
Cable and motor data							
Outer diameter [mm]	9.5	10.9	9.5	12.2	10.9	10.9	12.2
Wire cross-section	4 x 1.5 mm² + 2 x AWG26	4 x 2.5 mm² + 2 x AWG26	4 x 1.5 mm² + 2 x AWG26	4 x 4.0 mm² + 2 x AWG26	4 x 2.5 mm² + 2 x AWG26	4 x 2.5 mm² + 2 x AWG26	4 x 4.0 mm² + 2 x AWG26
Minimum static bending radius	4 x outer diameter						
Cable length, assembled [m]	0.5						
Cable length unassembled [m]	1						
Connector	M23-Speedtec ®	M23-Speedtec ®	M23-Speedtec ®	M40-Speedtec ®	M23-Speedtec ®	M23-Speedtec ®	M40-Speedtec ®
Recommended servo drive assignment							
AX5000	AX5106 AX5112	AX5118	AX5112	AX5125	AX5112 AX5118	AX5118	AX5140
AX8000	AX8108 AX8206	AX8118	AX8108	AX8525	AX8118	AX8118	AX8540
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							

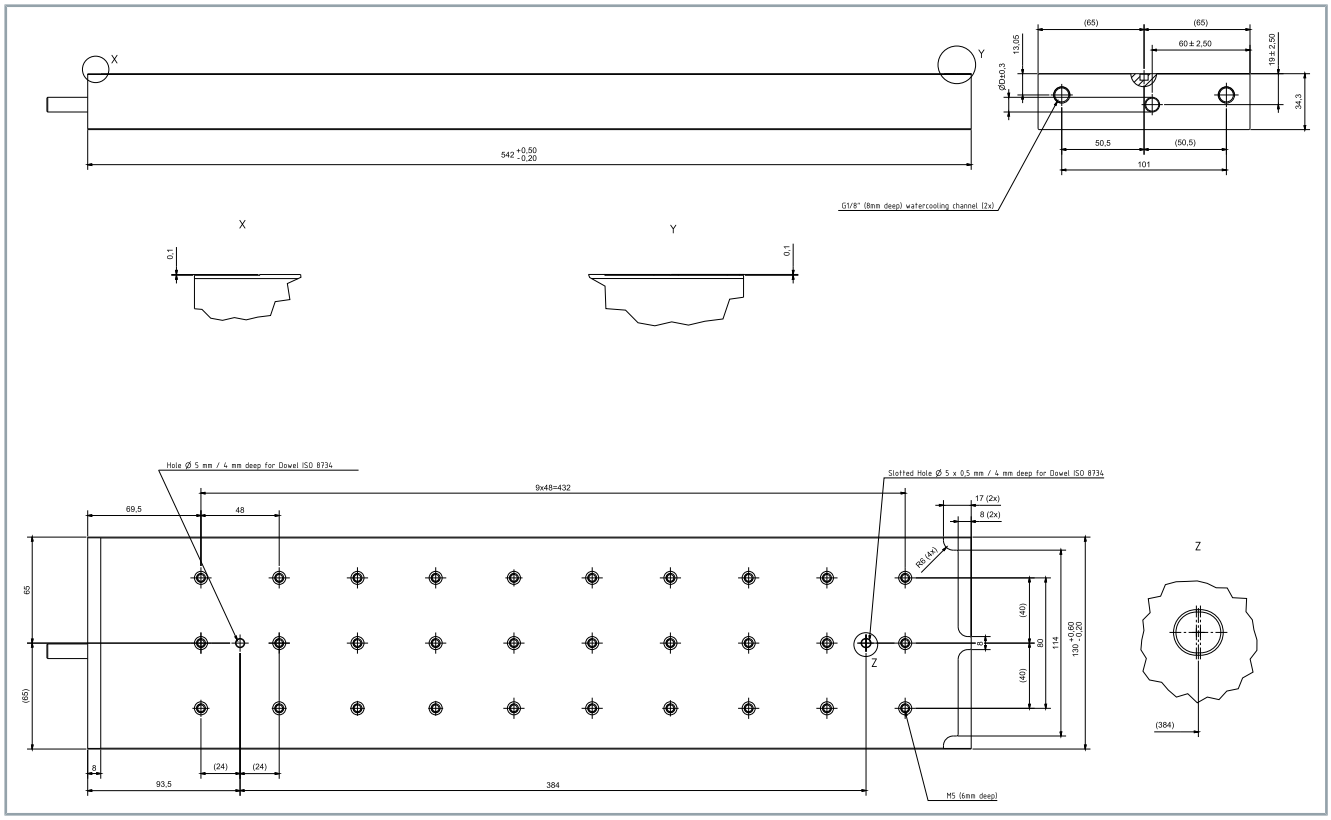
4.8.1 Dimensional drawings AL806x-1

- All figures in millimeters

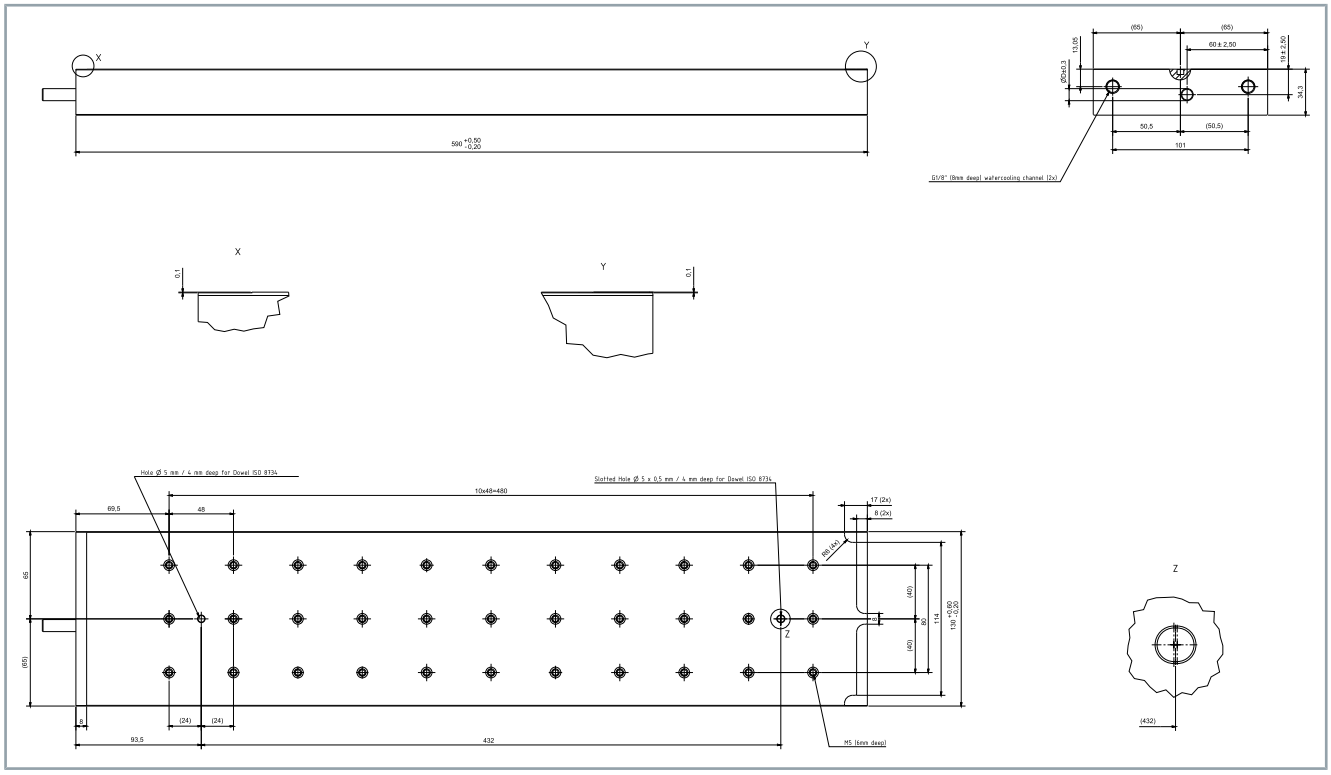
4.8.1.1 AL8066-1



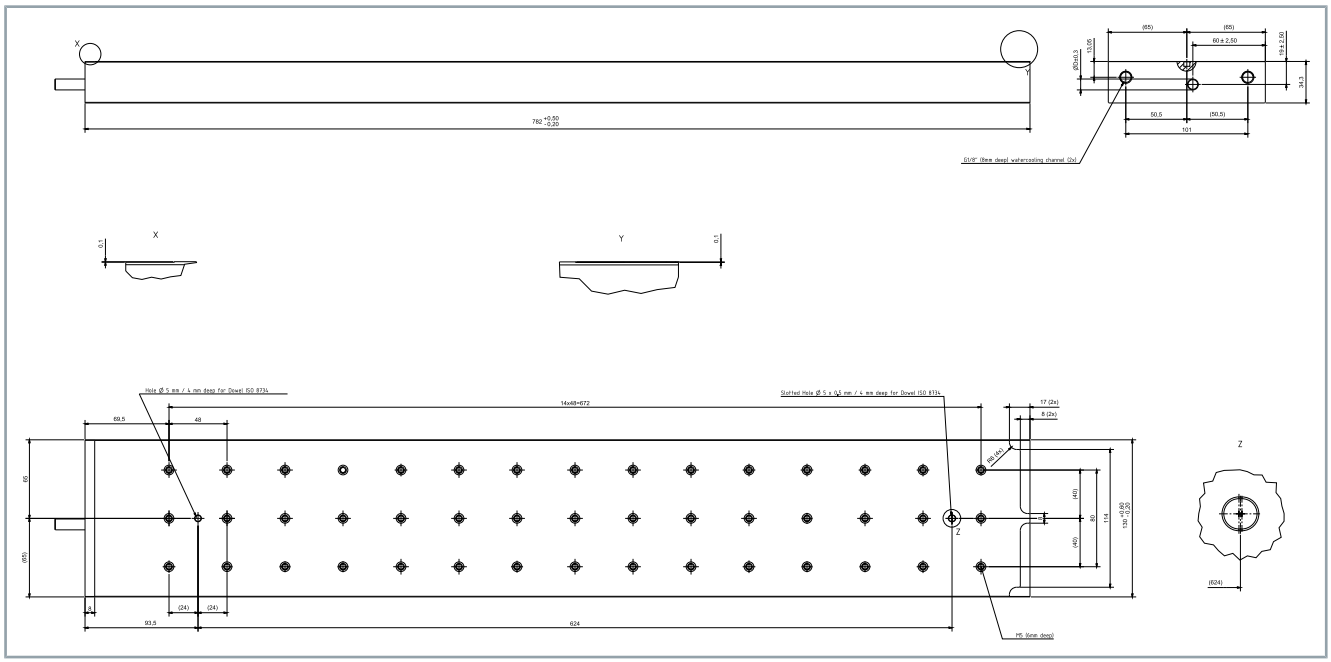
4.8.1.2 AL806A-1



4.8.1.3 AL806B-1



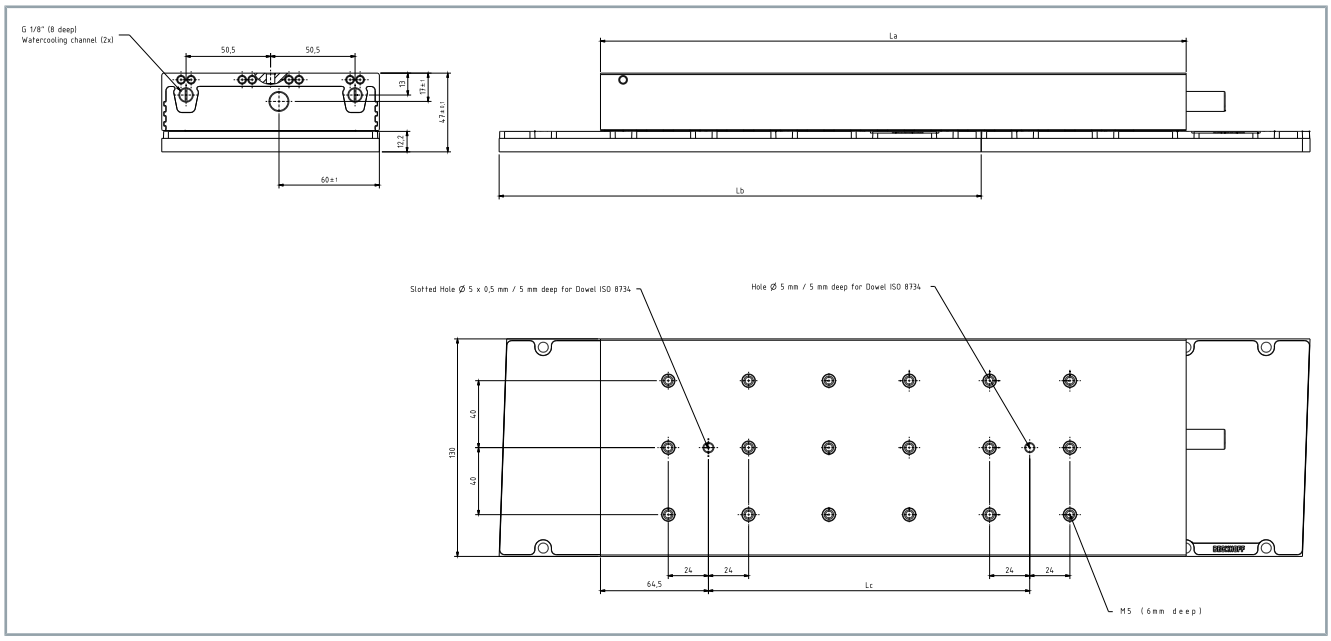
4.8.1.4 AL806F-1



4.8.2 AL806x-1 alignment

Alignment based on AL806x-1 as an example
The figure shows the positioning of a coil unit in relation to the magnetic track.

- All figures in millimeters

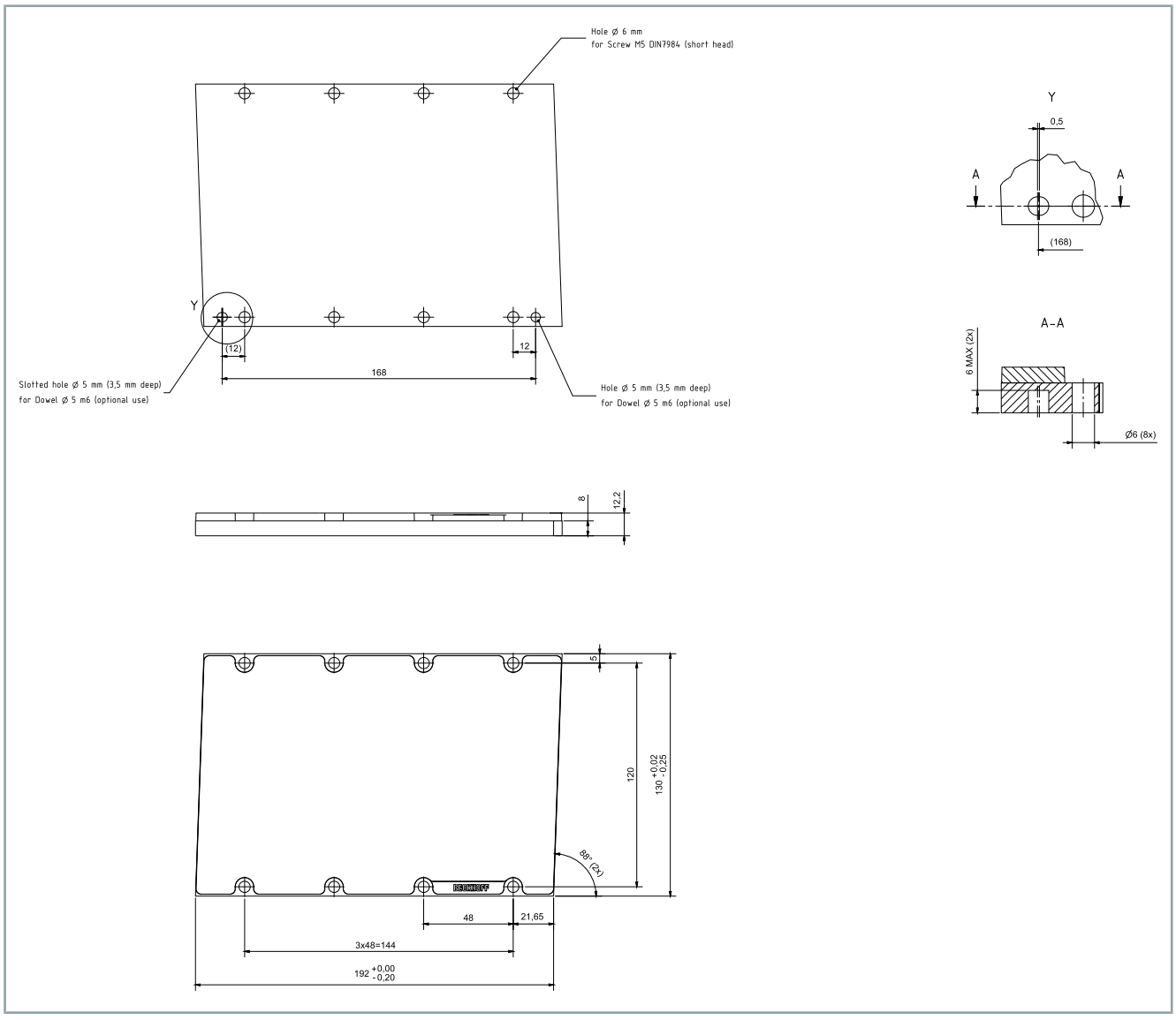


4.9 AL856x magnetic plates

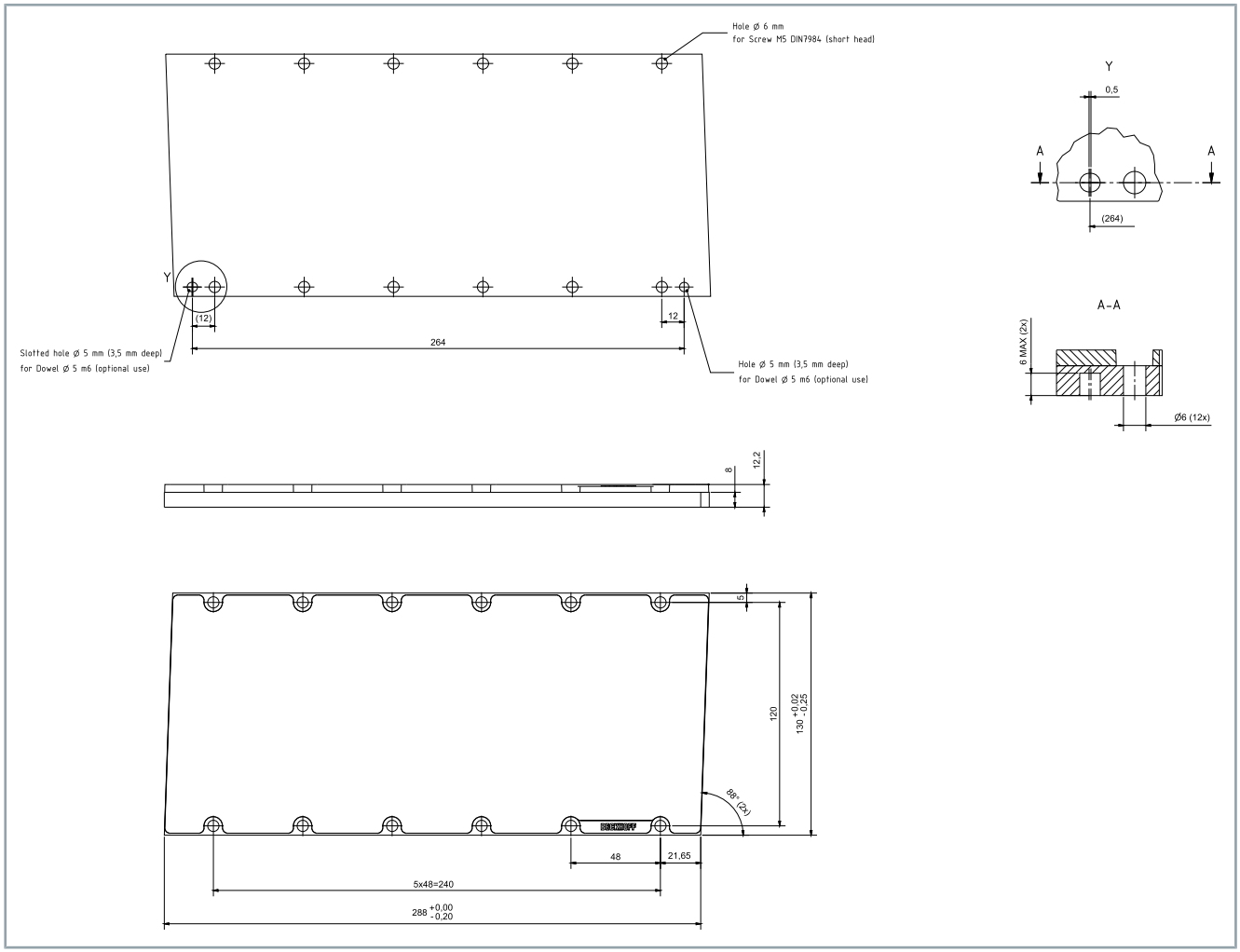
4.9.1 Dimensional drawings AL856x

- All figures in millimeters

4.9.1.1 AL8561



4.9.1.2 AL8562


Hole Ø 6 mm
for Screw M5 DIN7984 (short head)
Y
(12)
12
264
Slotted hole Ø 5 mm (3,5 mm deep)
for Dowel Ø 5 m6 (optional use)
Hole Ø 5 mm (3,5 mm deep)
for Dowel Ø 5 m6 (optional use)
Y
0,5
A
A
(264)
A-A
6 MAX (2x)
Ø6 (12x)
8
12,2
15
120
130 +0,02 -0,25
88° (2x)
48
21,65
5x48=240
288 +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:

- AL8000 series coil unit
- 2x adhesive name plates
- Short information

When ordering a magnetic plate:

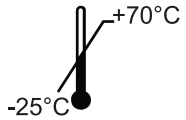
- AL85xx series magnetic plate with protective cover, without fixing material
- Short information

5.1 Packaging

The coil units 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
	This symbol indicates magnetic fields. 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 units, 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 units on a pallet in the original packaging:

Motor type	Stacking height [pieces]
AL802x	6
AL804x	5
AL806x	1

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 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:

AL802x, AL804x

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

AL806x

From series AL806x, we recommend hoists for lifting and transporting the coil units. A coil unit of the AL806x series can be transported horizontally or vertically:

- By means of a suitable hook or eyebolt in the thread on the top of the coil unit, with transport belt and sufficiently dimensioned lifting gear

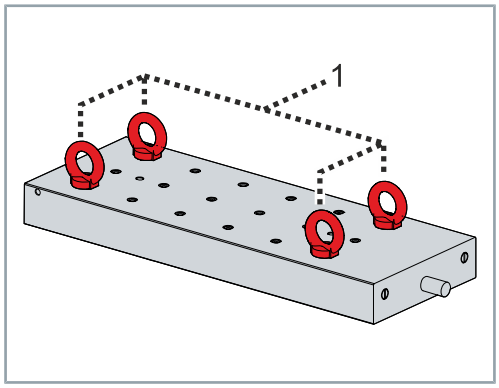
We recommend always lifting the coil unit horizontally in order to distribute the total weight of the motor over several threads. Only lift and transport in a vertical position if absolutely necessary.

Please refer to sections "AL806x horizontal and AL806x vertical", [Page 61]

6.2.1.1 AL806x horizontal

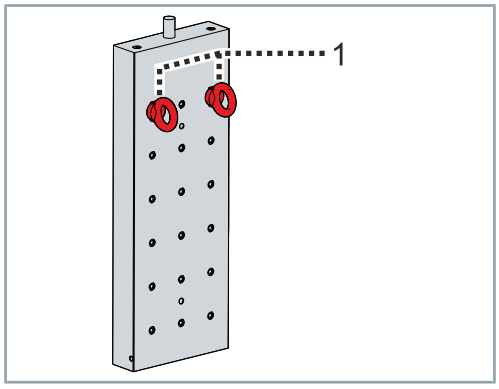
Before screwing the eyebolts into the coil unit, please observe the following instructions:

- ► Use thread on the upper side
- ► Use eyebolts according to DIN 580
- ► Note thread depths and screw depths for the threads in the coil unit
  See Chapter "Mechanical installation, section Assembly, coil unit", [Page 84]
- ► Use washers if the set screws of the eyebolts are too long
- ► Use transport belts of the same length for each eyebolt so that the coil unit does not tilt



- ► Screw eyebolts [1] into the outer adjacent threads on the outer sides. Make sure to always choose the largest possible distance from each other

6.2.1.2 AL806x vertical



If it is absolutely necessary to lift the coil unit vertically:

- ► Screw eyebolts [1] into the outer adjacent threads on the outer edge

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 59].

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 AL8041 = 93 mm
Length of magnetic plate AL8542 = 288 mm

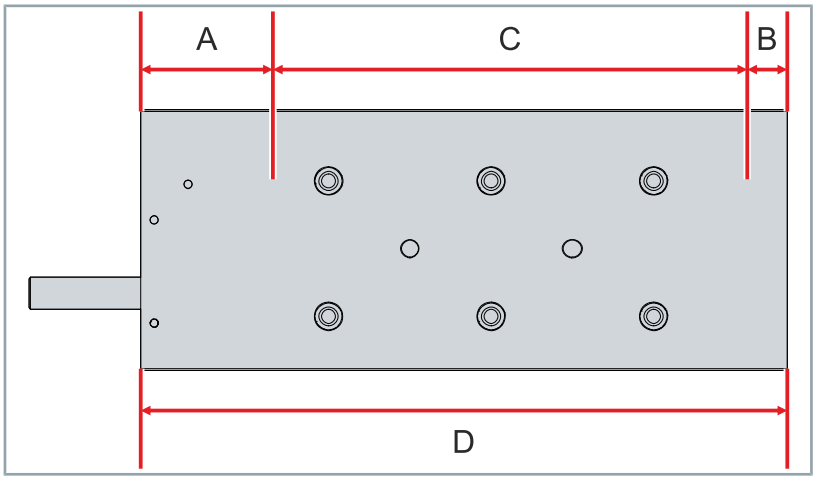
Required number of magnetic plates:
(490 mm + 93 mm)/288 = 2.02 magnetic plates < 3 magnetic plates are required

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 AL8041 = 76 mm
Length of magnetic plate AL8542 = 288 mm

Required number of magnetic plates:
(490 mm + 76 mm)/288 = 1.97 magnetic plates < 2 magnetic plates are required

AL802x

Designation	AL80			
	21	22	24	26
Passive part of the cable side A [mm]	15.5	17.5		
Passive part of the end side B [mm]	1.5			
Effective range C [mm]	76	124	220	316
Housing length D [mm]	93	143	239	335

AL804x

Designation	AL80						
	41	42	43	44	45	46	48
Passive part of the cable side A [mm]	15.5	17.5					22.5
Passive part of the end side B [mm]	1.5						
Effective range C [mm]	76	124	172	220	268	316	412
Housing length D [mm]	93	143	191	239	287	335	436

AL806x

Convection-cooled coil unit

Designation	AL80			
	64-0	65-0	66-0	6A-0
Passive part of the cable side A [mm]	17.5	17.5	17.5	22.5
Passive part of the end side B [mm]	1.5			
Effective range C [mm]	220	268	316	508
Housing length D [mm]	239	287	335	532

Water-cooled coil unit

Designation	AL80			
	66-1	6A-1	6B-1	6F-1
Passive part of the cable side A [mm]	31.5			
Passive part of the end side B [mm]	2.5			
Effective range C [mm]	316	508	556	748
Housing length D [mm]	350	542	590	782

7.2 Overall mounting height

You can increase the overall mounting height and the associated air gap between the bottom of the coil unit and the top of the magnetic plate in the event of tolerance deviations. Tolerance deviations can result from:

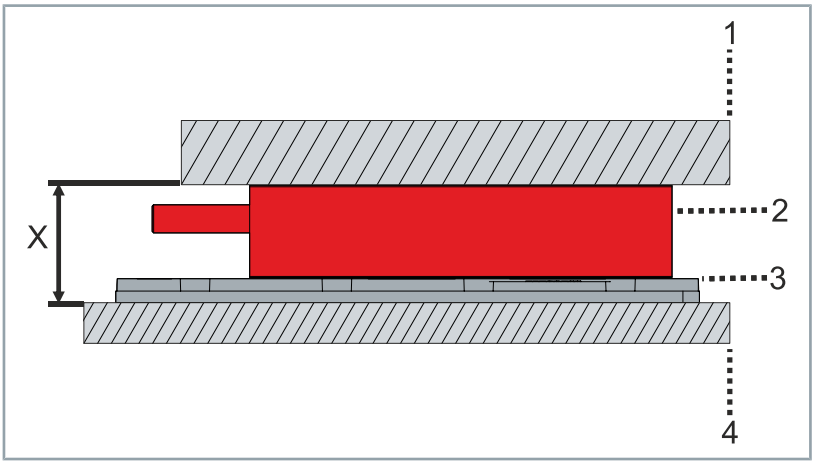
- deviations in parallelism or
- deviations in the evenness of the mounting surface

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 the chapter: "Dependencies", [Page 67].

Avoid reducing the air gap
Reducing the air gap increases the forces of attraction between the coil unit 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]
AL802x	40 ± 0.1
AL804x	40 ± 0.1
AL806x-0xxx	45 ± 0.1
AL806x-1xxx	47 ± 0.1

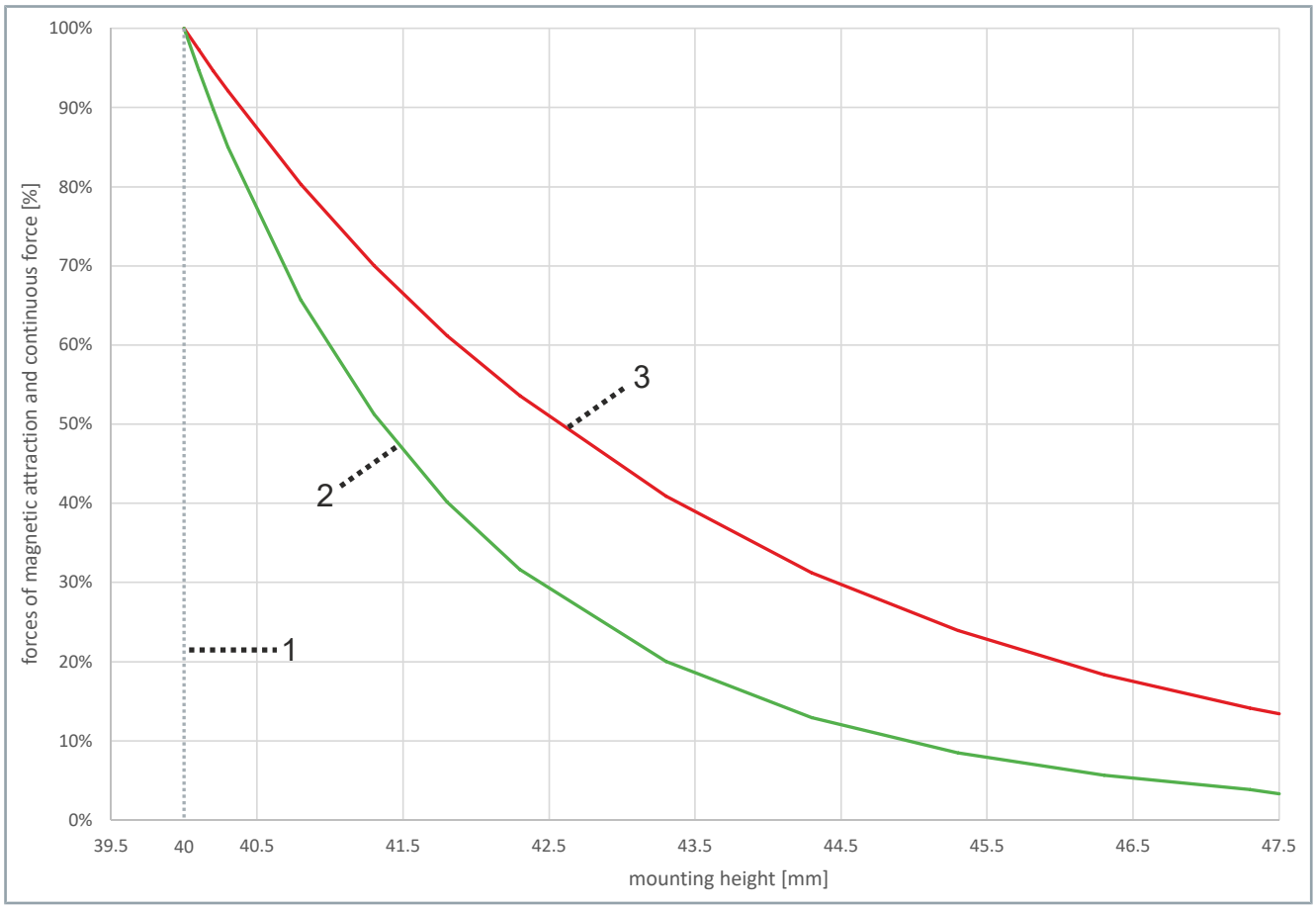


Position	Description
1	Machine carriage
2	Coil unit
3	Magnetic plate
4	Machine bed

7.2.1 Dependencies

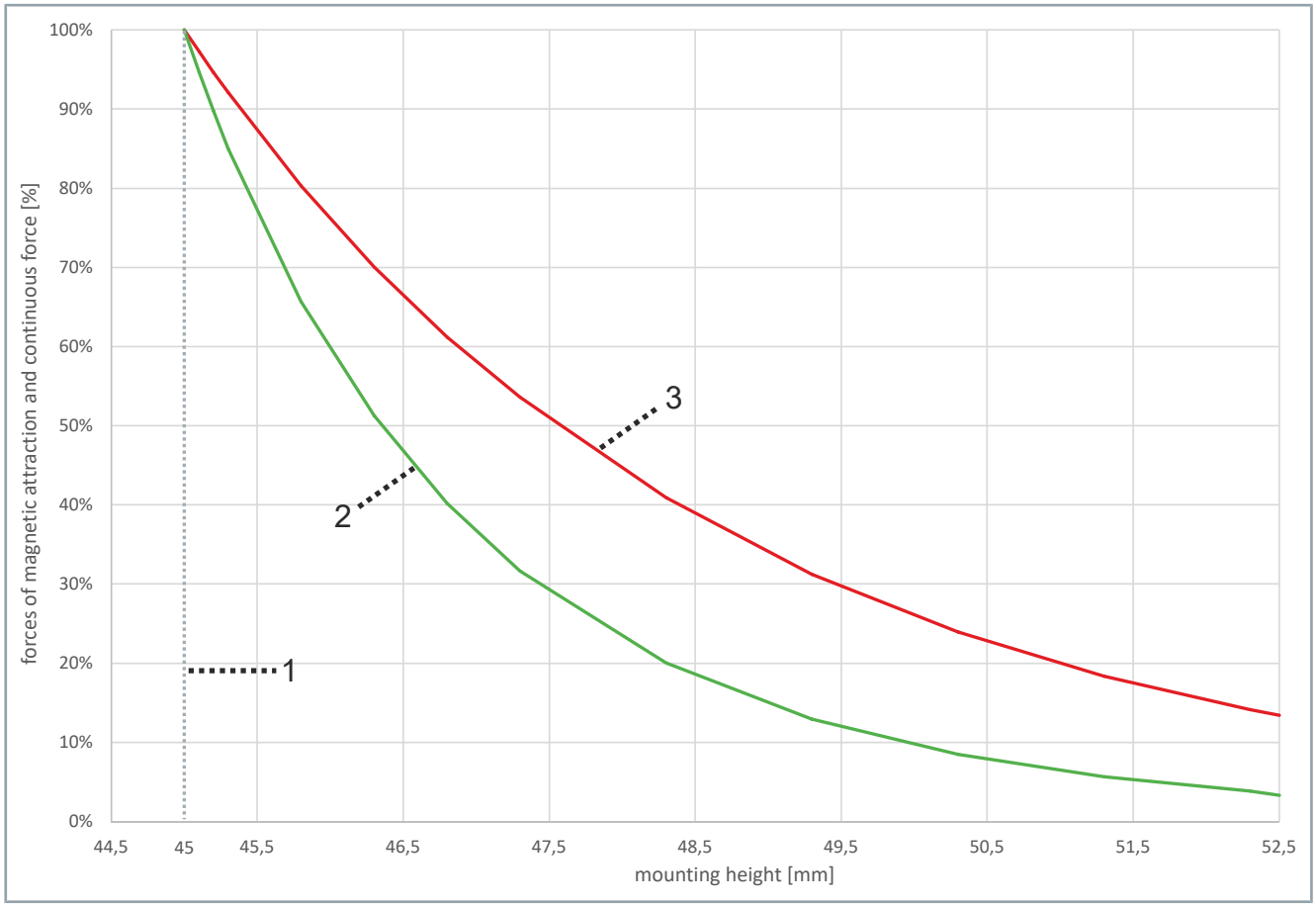
The following diagrams show the continuous force in relation to the force of attraction as a function of the mounting height:

AL802x and AL804x



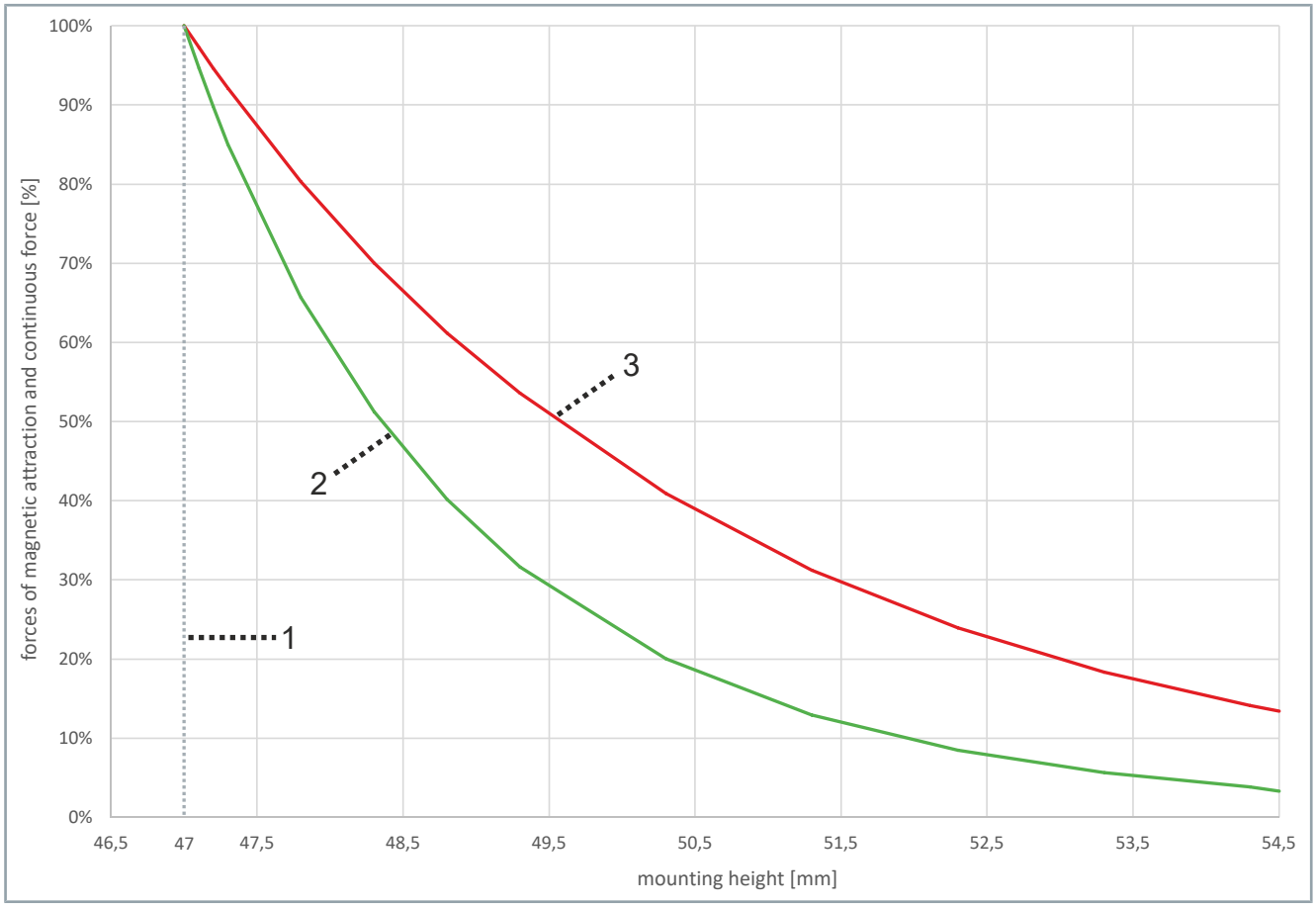
Position	Definition
Setpoint 1	Ideal air gap
Curve 2	Forces of magnetic attraction F_a
Curve 3	Continuous force F_c

AL806x-0



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

AL806x-1



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

7.3 Protection equipment

A temperature sensor LPTC-600 is installed in all coil units of the AL8000 series. The LPTC-600 is integrated into the monitoring system of the servo drives for motors with preassembled plugs. Configure the servo drive 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.

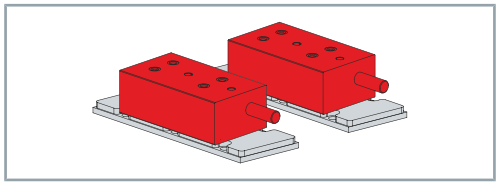
- Coil units should only be coupled in a parallel connection. Series connection is not permitted

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 drive, which leads to higher sum currents. 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

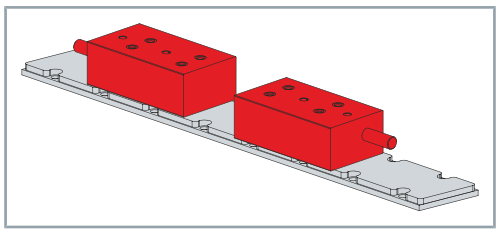


In a gantry structure, two parallel magnetic tracks each have a coil unit. The coil units are rigidly coupled and electrically connected in parallel. The movements are synchronized. Synchronization must be maintained at the best possible level even in the event of a drive error.

All coil units 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 units is overridden by the electrically parallel switching.

8.1.2 Common magnetic track



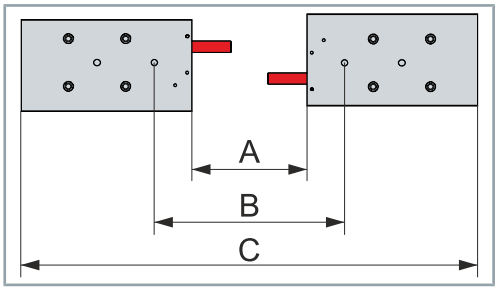
With this type of coupling, the coil units are arranged one after the other on a common magnetic track. This type of coupling tends to be used for applications with long strokes, since a second magnetic track with associated costs is avoided.

By coupling two coil units 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 units

The coil units 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 Cable arrangement



This figure shows an example of two coil units 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

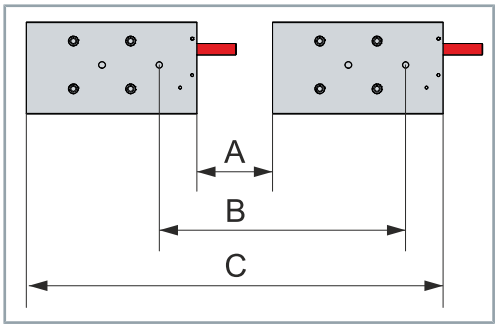
AL802x				
Motor 1	Motor 2	A	B	C
		[mm]		
AL8021-0Eyz	AL8021-0Eyz	53	76	239
AL8022-0Eyz	AL8022-0Eyz	49	112	335
AL8024-0Gyz	AL8024-0Gyz	49	208	527
AL8026-0Gyz	AL8026-0Gyz	49	208	719

AL804x				
Motor 1	Motor 2	A	B	C
		[mm]		
AL8041-0Eyz	AL8041-0Eyz	53	64	239
AL8042-0Eyz	AL8042-0Eyz	49	112	335
AL8043-0Eyz	AL8043-0Eyz	49	208	431
AL8043-0Gyz	AL8043-0Gyz	49	208	431
AL8044-0Eyz	AL8044-0Eyz	49	208	527
AL8044-0Hyz	AL8044-0Hyz	49	208	527
AL8045-0Gyz	AL8045-0Gyz	49	208	527
AL8045-0Kyz	AL8045-0Kyz	49	208	527
AL8046-0Gyz	AL8046-0Gyz	49	208	527
AL8046-0Kyz	AL8046-0Kyz	49	208	527
AL8048-0Hyz	AL8048-0Hyz	49	208	527
AL8048-0Kyz	AL8048-0Kyz	49	208	527

AL806x-0xxx				
Motor 1	Motor 2	A	B	C
		[mm]		
AL8064-0Fyz	AL8064-0Fyz	51	208	529
AL8064-0Kyz	AL8064-0Kyz	51	208	529
AL8065-0Hyz	AL8065-0Hyz	51	208	625
AL8065-0Kyz	AL8065-0Kyz	51	208	625
AL8066-0Jyz	AL8066-0Jyz	51	208	721
AL806A-0Kyz	AL806A-0Kyz	57	224	1121
AL806A-0Qyz	AL806A-0Qyz	57	224	1121

AL806x-1xxx				
Motor 1	Motor 2	A	B	C
		[mm]		
AL8066-1Jyz	AL8066-1Jyz	53	240	753
AL8066-1Nyz	AL8066-1Nyz	53	240	753
AL806A-1Kyz	AL806A-1Kyz	53	240	1137
AL806A-1Ryz	AL806A-1Ryz	53	240	1137
AL806B-1Lyz	AL806B-1Lyz	53	240	1233
AL806F-1Nyz	AL806F-1Nyz	53	240	1617
AL806F-1Tyz	AL806F-1Tyz	53	240	1617

8.2.2 Cables in the same direction



This figure shows an example of an arrangement of two coil units 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

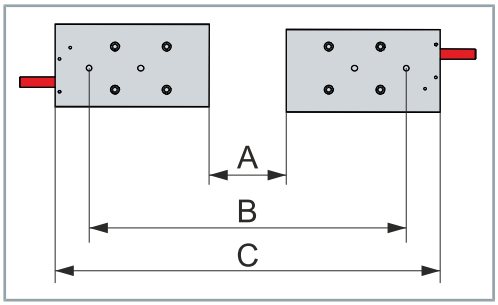
AL802x				
Motor 1	Motor 2	A	B	C
		[mm]		
AL8021-0Eyz	AL8021-0Eyz	51	144	237
AL8022-0Eyz	AL8022-0Eyz	49	192	335
AL8024-0Gyz	AL8024-0Gyz	49	288	527
AL8026-0Gyz	AL8026-0Gyz	49	384	719

AL804x				
Motor 1	Motor 2	A	B	C
		[mm]		
AL8041-0Eyz	AL8041-0Eyz	51	144	237
AL8042-0Eyz	AL8042-0Eyz	49	192	335
AL8043-0Eyz	AL8043-0Eyz	49	240	431
AL8043-0Gyz	AL8043-0Gyz	49	240	431
AL8044-0Eyz	AL8044-0Eyz	49	288	527
AL8044-0Hyz	AL8044-0Hyz	49	288	527
AL8045-0Gyz	AL8045-0Gyz	49	288	527
AL8045-0Kyz	AL8045-0Kyz	49	288	527
AL8046-0Gyz	AL8046-0Gyz	49	288	527
AL8046-0Kyz	AL8046-0Kyz	49	288	527
AL8048-0Hyz	AL8048-0Hyz	49	288	527
AL8048-0Kyz	AL8048-0Kyz	49	288	527

AL806x-0xxx				
Motor 1	Motor 2	A	B	C
		[mm]		
AL8064-0Fyz	AL8064-0Fyz	49	288	527
AL8064-0Kyz	AL8064-0Kyz	49	288	527
AL8065-0Hyz	AL8065-0Hyz	49	336	623
AL8065-0Kyz	AL8065-0Kyz	49	336	623
AL8066-0Jyz	AL8066-0Jyz	49	384	719
AL806A-0Kyz	AL806A-0Kyz	60	592	1124
AL806A-0Qyz	AL806A-0Qyz	60	592	1124

AL806x-1xxx				
Motor 1	Motor 2	A	B	C
		[mm]		
AL8066-1Jyz	AL8066-1Jyz	50	400	750
AL8066-1Nyz	AL8066-1Nyz	50	400	750
AL806A-1Kyz	AL806A-1Kyz	50	592	1134
AL806A-1Ryz	AL806A-1Ryz	50	592	1134
AL806B-1Lyz	AL806B-1Lyz	50	640	1230
AL806F-1Nyz	AL806F-1Nyz	50	832	1614
AL806F-1Tyz	AL806F-1Tyz	50	832	1614

8.2.3 Cables opposite



This figure shows an example of an arrangement of two coil units 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

AL802x				
Motor 1	Motor 2	A	B	C
		[mm]		
AL8021-0Eyz	AL8021-0Eyz	1	164	187
AL8022-0Eyz	AL8022-0Eyz	1	224	287
AL8024-0Gyz	AL8024-0Gyz	1	320	479
AL8026-0Gyz	AL8026-0Gyz	1	512	671

AL804x				
Motor 1	Motor 2	A	B	C
		[mm]		
AL8041-0Eyz	AL8041-0Eyz	1	176	187
AL8042-0Eyz	AL8042-0Eyz	1	224	287
AL8043-0Eyz	AL8043-0Eyz	1	224	383
AL8043-0Gyz	AL8043-0Gyz	1	224	383
AL8044-0Eyz	AL8044-0Eyz	1	320	479
AL8044-0Hyz	AL8044-0Hyz	1	320	479
AL8045-0Gyz	AL8045-0Gyz	1	320	479
AL8045-0Kyz	AL8045-0Kyz	1	320	479
AL8046-0Gyz	AL8046-0Gyz	1	320	479
AL8046-0Kyz	AL8046-0Kyz	1	320	479
AL8048-0Hyz	AL8048-0Hyz	1	320	479
AL8048-0Kyz	AL8048-0Kyz	1	320	479

AL806x-0xxx				
Motor 1	Motor 2	A	B	C
		[mm]		
AL8064-0Fyz	AL8064-0Fyz	15	336	493
AL8064-0Kyz	AL8064-0Kyz	15	336	493
AL8065-0Hyz	AL8065-0Hyz	15	432	589
AL8065-0Kyz	AL8065-0Kyz	15	432	589
AL8066-0Jyz	AL8066-0Jyz	15	528	685
AL806A-0Kyz	AL806A-0Kyz	15	912	1079
AL806A-0Qyz	AL806A-0Qyz	15	912	1079

AL806x-1xxx				
Motor 1	Motor 2	A	B	C
		[mm]		
AL8066-1Jyz	AL8066-1Jyz	15	528	715
AL8066-1Nyz	AL8066-1Nyz	15	528	715
AL806A-1Kyz	AL806A-1Kyz	15	912	1099
AL806A-1Ryz	AL806A-1Ryz	15	912	1099
AL806B-1Lyz	AL806B-1Lyz	15	1008	1195
AL806F-1Nyz	AL806F-1Nyz	15	1392	1579
AL806F-1Tyz	AL806F-1Tyz	15	1392	1579

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.

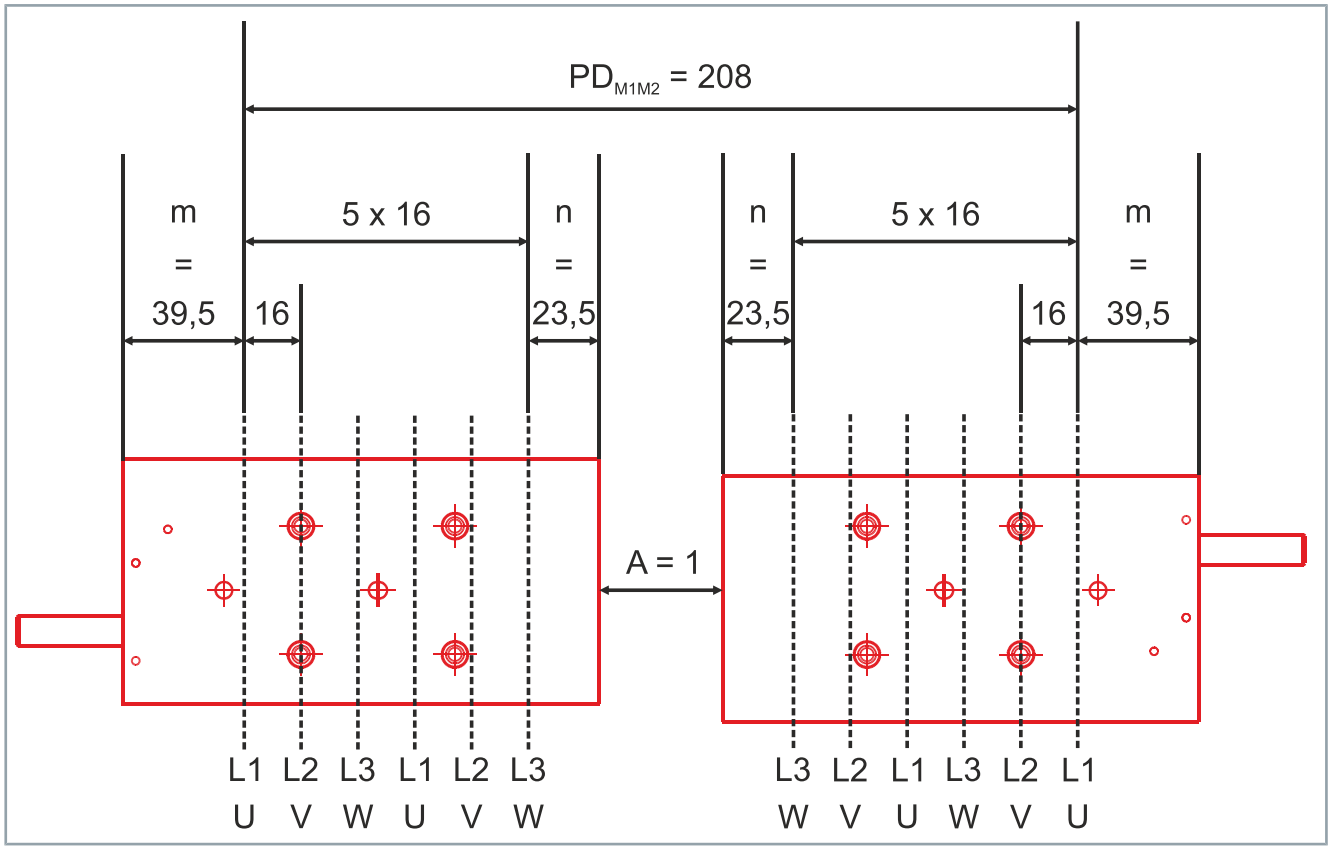
If the coil units are coupled to one another, there must also be a multiple of this winding distance between the windings of the connected coil units. The phase repetition is 48 mm and is made up of three times the winding distance.

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

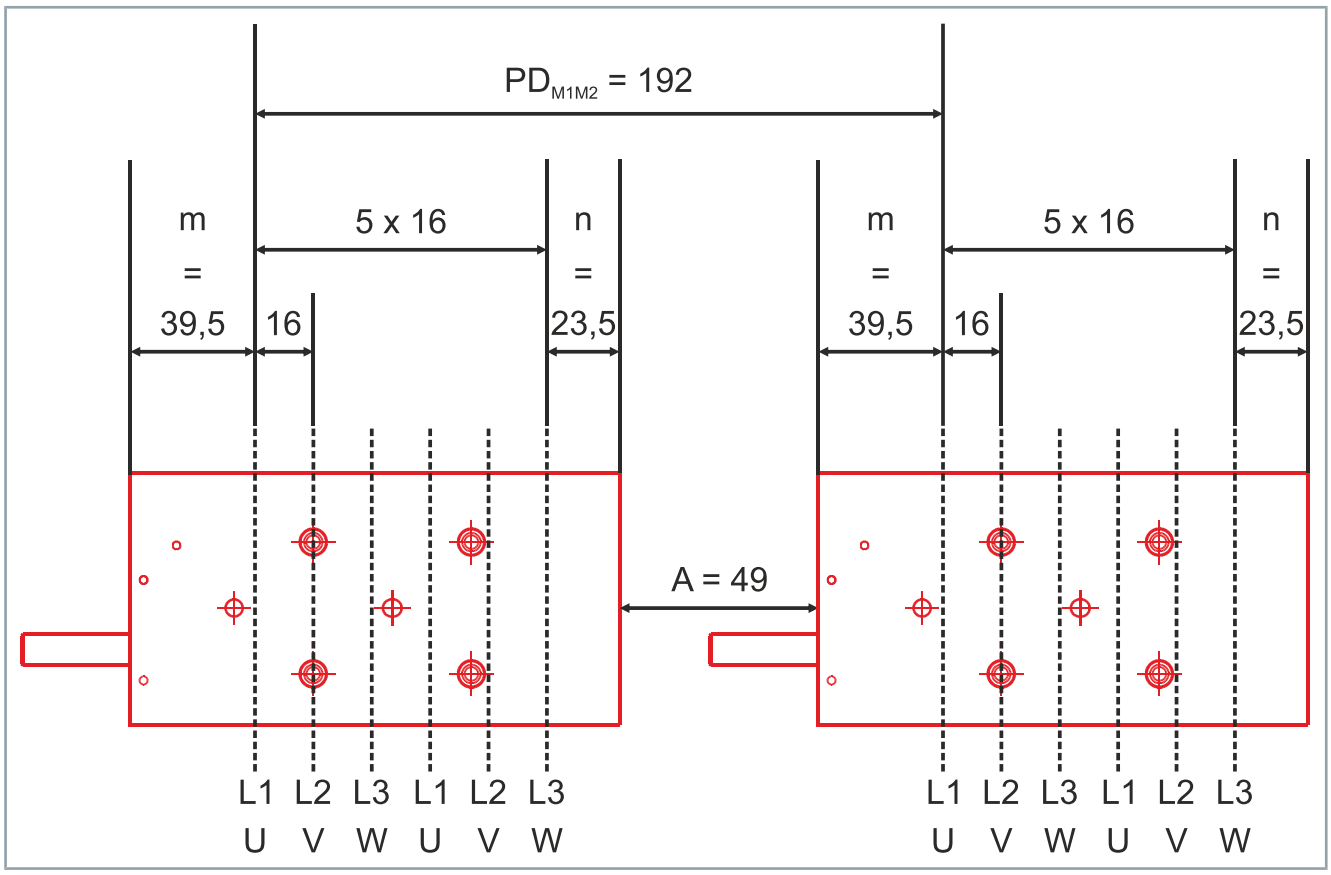
The following information is included in the figures:

- 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: AL8042 and AL8042 with cables in opposite directions
This alignment of the coil units enables the minimum distance between the coil units.



Example 2: AL8042 and AL8042 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

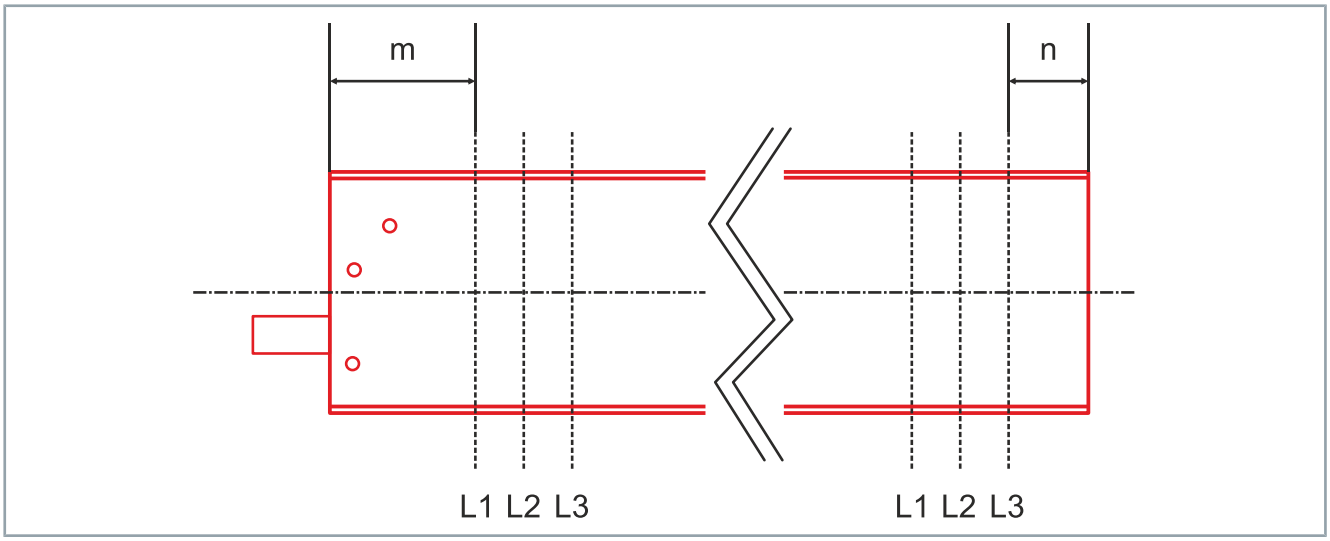
Information on PD_{M1M2} can be found in the chapter: "Electrical connection", [Page 78]

Information on the wiring can be found in the chapter: "Power supply", [Page 81]

Example 1: AL8042 and AL8042 with cables in opposite directions
PD_{M1M2} = 208 mm
Offset = (208/16) MOD 3 = 1

Example 2: AL8042 and AL8042 with cables in opposite directions
PD_{M1M2} = 192 mm
Offset = (192/16) MOD 3 = 0

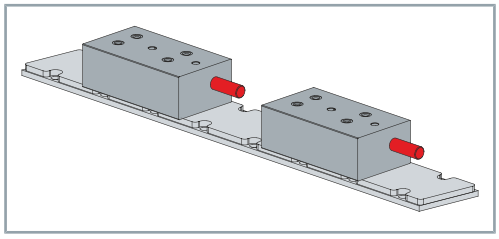
8.3.2 Phase lines



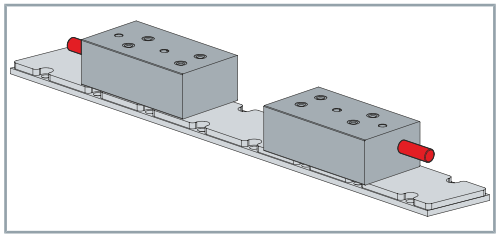
Motor	m	n
	[mm]	
AL8021	37.5	23.5
AL8022	39.5	23.5
AL8024	39.5	23.5
AL8026	39.5	23.5
AL8041	37.5	23.5
AL8042	39.5	23.5
AL8043	39.5	23.5
AL8044	39.5	23.5
AL8045	39.5	23.5
AL8046	39.5	23.5
AL8048	44.5	23.5
AL8064-0xxx	38.5	24.5
AL8065-0xxx	38.5	24.5
AL8066-0xxx	38.5	24.5
AL8066-1xxx	53.5	24.5
AL806A-0xxx	43.5	24.5
AL806A-1xxx	53.5	24.5
AL806B-1xxx	53.5	24.5
AL806F-1xxx	53.5	24.5

8.3.3 Power supply

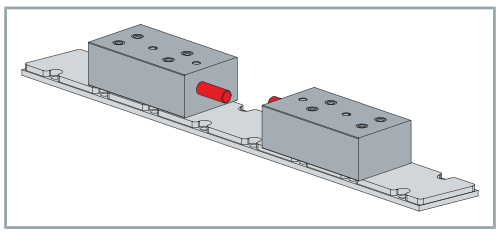
With the calculated offset and using the following tables, you can carry out the wiring of the coupled coil units.



Cables in 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

8.3.4 Temperature sensor

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

9 Mechanical installation

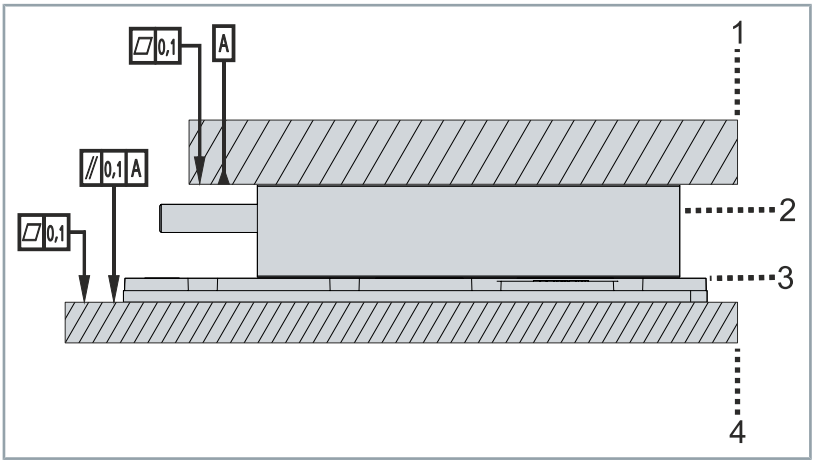
All work should be carried out with great care and without time pressure.

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 unit 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 unit
3	Magnetic plate
4	Machine bed

Please refer to Chapter "Air gap, section Overall mounting height", [Page 66]

9.2 Installation

⚠ 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 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 unit

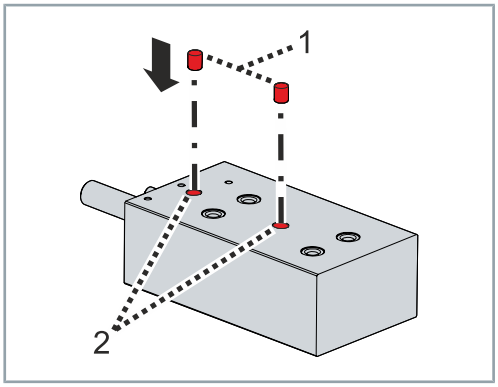
Loss of force due to asymmetry
Place the coil unit symmetrically to the magnetic plate for the AL806x-1xxx series. For the AL8x2x, AL804x and AL806x-0xxx series, the coil unit is positioned with an offset to the magnetic plate.
Failure to observe this may result in loss of force at the linear motor and loss of performance in the machine or system.

Dimensional drawings for alignment
Please read the following chapters:

- "Technical data, paragraph AL802x, "alignment AL802x", [Page 35]"
- "Technical data, paragraph AL804x, "alignment AL804x", [Page 45]"
- "Technical data, paragraph AL806x-0, "alignment AL806x-0", [Page 50]"
- "Technical data, paragraph AL806x-1, "alignment AL806x-1", [Page 54]"

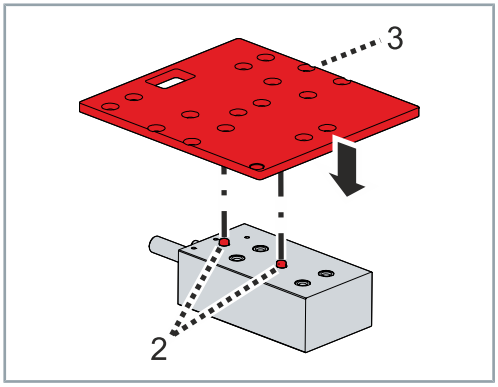
Mounting

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



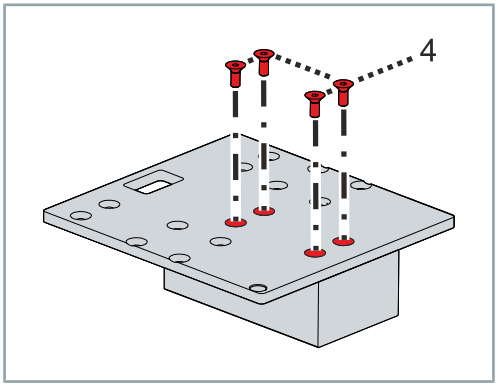
► Insert locating pins [1] into the holes of the coil unit [2]:

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

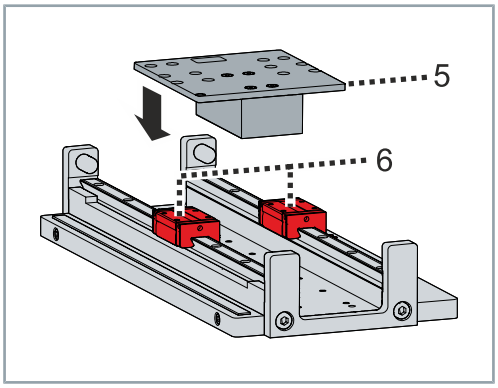
► Align the coil unit, making sure that all the holes are aligned



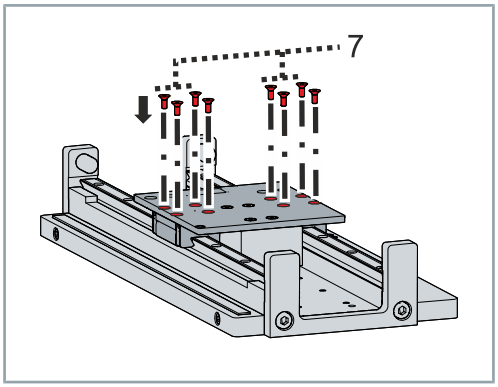
► Insert the screws [4] and tighten them crosswise from inside to outside

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



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



► 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.

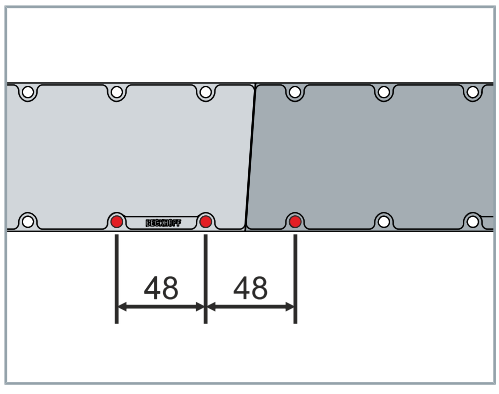
- Do not remove the protective cover

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.

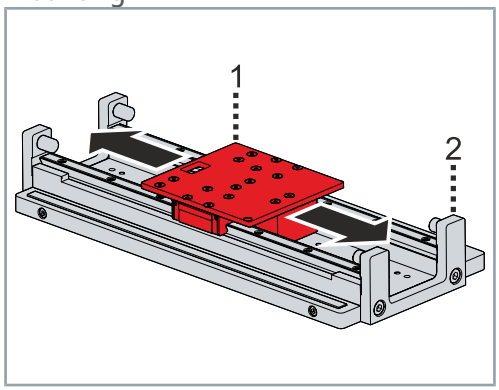
Observe minimum gap
Keep the required minimum gap when mounting additional magnetic plates. This is 48 mm between hole centers. During mounting, maintain a distance of at least 10 cm between the magnetic plate to be mounted and the mechanically protected coil unit.
Failure to observe this can lead to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

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

- Distance between hole centers: 48 mm



Mounting



⚠ WARNING

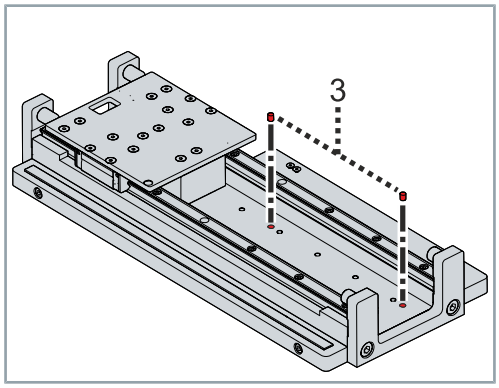
Serious injuries due to uncontrolled movement of the machine carriage
If the strong magnetic field of the permanent magnets in the magnetic plate unexpectedly attracts the components magnetically during assembly, it is not possible to hold the machine carriage by hand. Severe injuries to limbs can be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

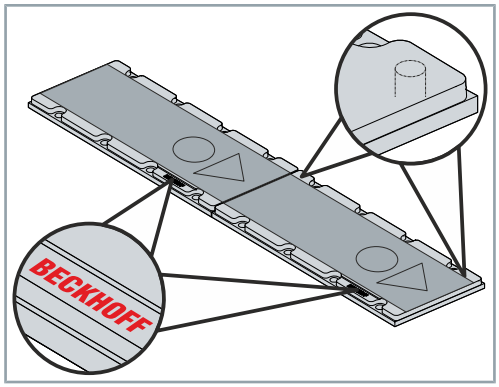
► Mechanically secure the machine carriage against the forces of attraction and uncontrolled movements of the magnetic plate



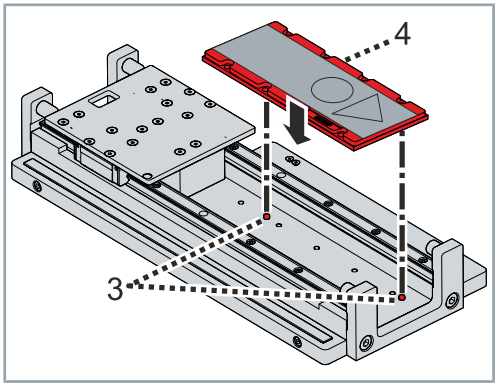
► Insert locating pins [3] into the machine bed

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

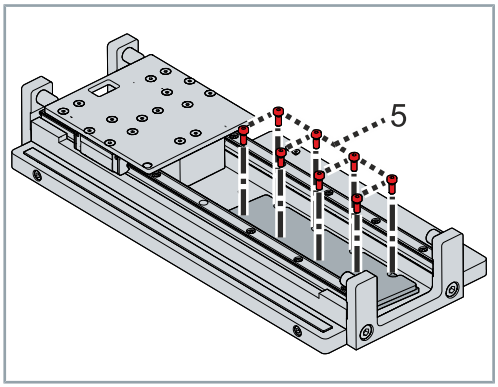
Locating pins	AL852x	AL854x	AL856x
Tolerance zone	M6		
Maximum immersion in the magnetic plate [mm]	3.2		5.5



► 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]

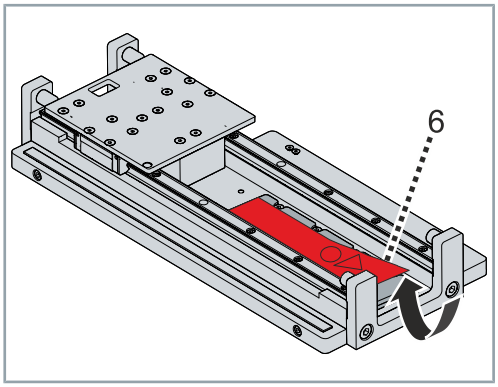


► Insert screws [5] into the magnetic plate on the machine bed

► Tighten the screws crosswise and from inside to outside

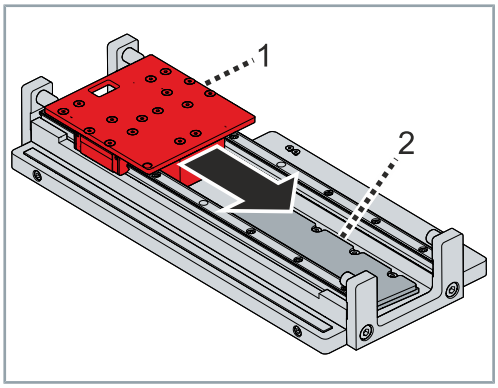
Observe tightening torque:

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



► 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.

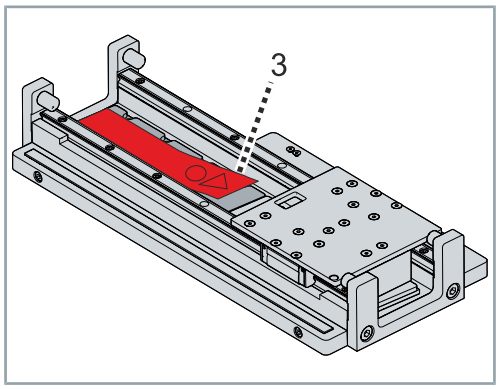
Other magnetic plates



► 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

9.2.3 Water cooling [+]

Further information regarding the design and requirements of the cooling circuit, the coolant to be used and other important information can be found in the document:

General specifications | AM8300 and AL8000

NOTICE

Damage caused by open systems
Open cooling circuits can lead to contamination and germs. This can result in damage to the machine or system and loss of performance.

- Install cooling circuits as closed systems

NOTICE

Power loss due to deposits in the cooling circuit
Grease, dirt residues or long-term deposits can hinder the flow of coolant and block the cooling circuits. Pressure loss and loss of performance can be the result.

- If necessary, install an additional cooling circuit to cool the coil units

NOTICE

Motor damage due to impermissible coolant
The use of an unsuitable coolant (e.g. tap water) can cause irreversible damage to the motor, for which the manufacturer cannot be held liable.

- Only operate the motor with suitable coolant

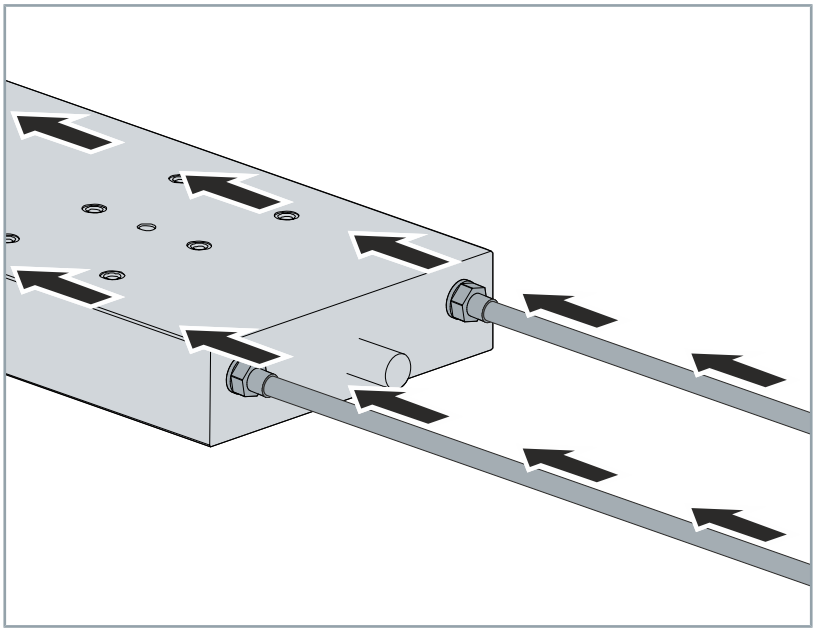
9.2.3.1 Technical specifications

- The table below contains important technical specifications for the installation of the cooling circuit. Adhere to the specifications for flow rate and pressure drop in order to achieve the continuous force. We recommend monitoring the flow rates and the pressure. If an error should occur, you can counteract and avoid the overheating of the motor at an early stage.
- Operating pressure p_{max}: 6 bar

AL804x

AL804x			
Motor	**Power loss P_L**	**Flow rate Q_{min}**	**Pressure drop Δp**
	[W]	**[l/min]**	**[bar]**
AL8041	63	0.1	0.00
AL8042	126	0.2	0.01
AL8043	169	0.2	0.03
AL8044	238	0.3	0.05
AL8045	298	0.4	0.08
AL8046	358	0.5	0.10
AL8048	458	0.7	0.16
All values valid for a temperature increase of the coolant ΔT = 10 K			

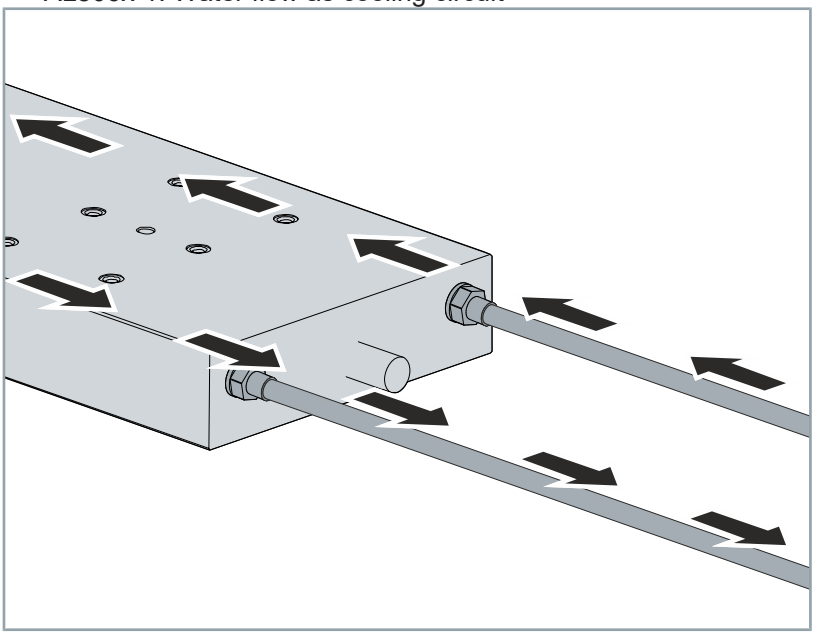
- AL804x: Water flow in the same direction



AL806x-1

AL806x-1			
Motor	**Power loss P_L**	**Flow rate Q_{min}**	**Pressure drop Δp**
	[W]	**[l/min]**	**[bar]**
AL8066-1xyz	661	1.0	0.1
AL806A-1xyz	1206	1.8	0.3
AL806B-1xyz	1140	1.95	0.4
AL806F-1xyz	1710	2.5	0.7
All values valid for a temperature increase of the coolant ΔT = 10 K			

- AL806x-1: Water flow as cooling circuit



9.2.3.2 Connection to the cooling circuit

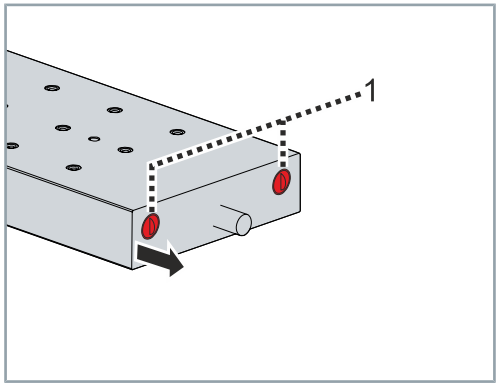
NOTICE

Damage due to faulty sealing
Failure to observe the provisions for sealing the connections can result in damage to the motor and the entire system.

- The cooling connections may only be sealed via the end faces of the water connections
- Do not use conical screw connections or sealants in the thread (liquid sealant, Teflon tape, hemp, etc.) for sealing
- The usable thread depth and the maximum tightening torque in aluminum must be taken into account

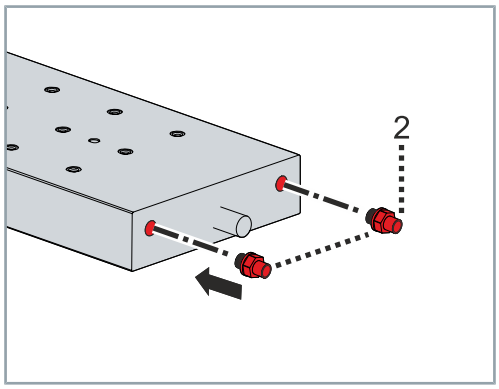
For the connection of the cooling hoses we recommend push-in fittings with male thread:

Coil unit	Male thread
AL804x	M5
AL806x-1xxx	G 1/8 “



► Remove the plug [1] at the front of the coil unit

AL804x:
► Remove the plug on the opposite side of the coil unit



► Screw the threaded push-in fittings [2] into the holes provided

AL804x:
► Screw in the threaded push-in fittings on the opposite side of the coil unit

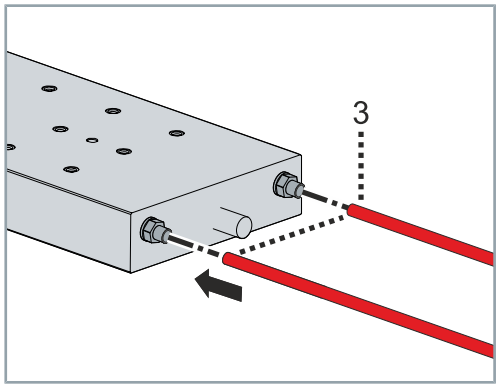
NOTICE

Shortened service life of the cooling hoses due to algae formation
Algae can form in the cooling system if the wrong hoses are chosen. This can shorten the service life of the cooling hoses and reduce the performance of the motor.

- Use opaque cooling hoses to connect the water cooling system
- Add suitable chemical additives to the coolant

For connecting the threaded push-in fittings, we recommend the following cooling hose sizes:

Coil unit	Hose	
	Inner diameter	Outer diameter
	[mm]	
AL804x	4	6
AL806x-1xxx	6	8



► Insert the cooling hoses [3] into the threaded push-in fittings

AL804x:
► Connect cooling hoses at the opposite side of the coil unit

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 unit and the magnetic track.
If you cannot move the coil unit smoothly, check the assembly of your application. Observe all specifications from Chapter "Mechanical installation", [Page 82]

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 AL8000 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

Maximum cable lengths depend on the servo drive used
Excessively long cables between the motor and servo drive can lead to voltage drops, signal delays, and increased susceptibility to faults. Depending on the servo drive selected, additional measures may be required in order to use longer cables.

- Refer to the manuals of the servo drive used for the dimensioning of the cable lengths.
- Use additional components such as mains filters or motor chokes.

Information on the maximum cable lengths for the AX5000 servo drive can be found under this link AX5000.

Information on the maximum cable lengths for the AX8000 servo drive can be found under this link AX8000.

Hint for trouble-free application and assembly:

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

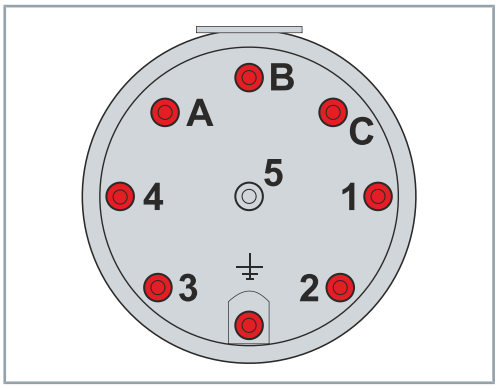
Beckhoff offers pre-assembled cables for faster and flawless installation of the motors. These cables are tested with regard to the material used, shielding and connection type. The use of other cables can cause unexpected faults and result in exclusion of warranty.

10.2 Connector assignment

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

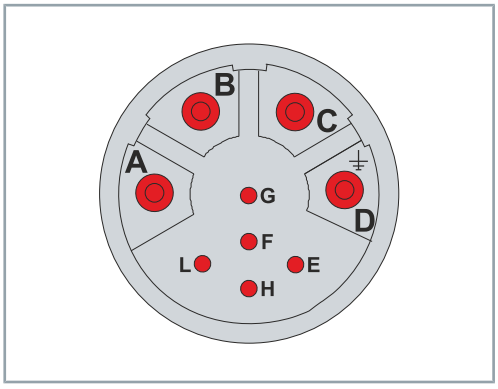
The following tables show the connector assignment:

10.2.1 itec® connector



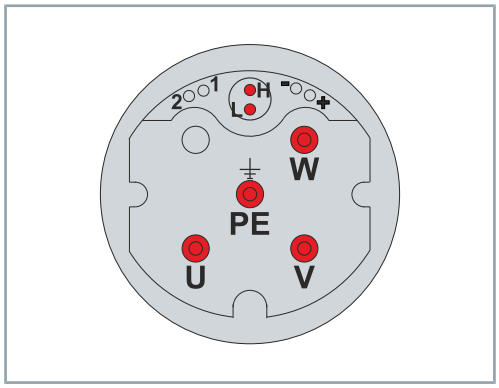
Pin assignment cable diameter 1.0 mm²			
Contact	**Function**	**Color**	**Core identification**
A	U	Black	1
B	W	Black	3
C	V	Black	2
1	---	---	---
2	---	---	---
3	Temperature+/ U_s	White	---
4	Temperature-/ GND	Blue	---
5	Shield	Shield	---
PE	PE	Green/yellow	---

10.2.2 M23-SpeedTec® connector



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	---	---	---

10.2.3 M40-SpeedTec® connector



Pin assignment cable diameter 4 mm²			
Contact	**Function**	**Color**	**Core identification**
U	U	Black	1
V	V	Black	2
W	W	Black	3
PE	PE	Green/yellow	---
N	n.c.	---	---
+	---	---	---
-	---	---	---
1	---	---	---
2	---	---	---
H	Temperature+/ U_s	White	---
L	Temperature-/ GND	Blue	---

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 drive
- ► 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 drive

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 drives and motors and configuration with Beckhoff TwinCAT 3 Drive Manager 2 | TE5950.

Carry out the instructions in the operating manual for servo drives:

- ► 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, humidity or dust
- ► Check temperature development
- ► Check for lubricant leakage
- ► Check function of safety devices

For motors with water cooling:

- ► Check hoses and cables for soiling
- ► Check that the motor and connections are firmly seated
- ► Observe tightening torques

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 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

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.

Read the 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 104].

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 AL8000 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 meets all the requirements of the Eurasian Economic Union. These include Armenia, Belarus, Kazakhstan, Kyrgyzstan, and Russia. The EAC logo can be found on the nameplate.

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.

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 AL8000 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.

Index

Trademark statements

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

Third-party trademark statements

itec is a registered trademark of TE Connectivity Industrial GmbH.

More Information:
www.beckhoff.com/al8000

Beckhoff Automation GmbH & Co. KG
Hülshorstweg 20
33415 Verl
Germany
Phone: +49 5246 9630
info@beckhoff.com
www.beckhoff.com