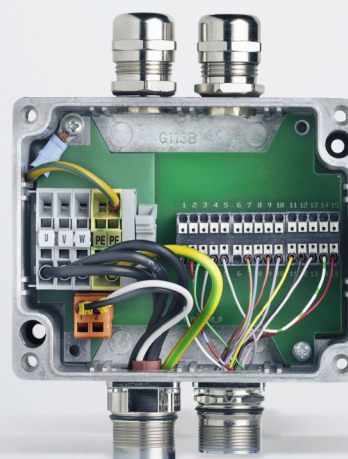


Operating instructions | EN

AL225x

Connector-Box



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1 Foreword

1.1 Notes on the documentation

This description is only intended for the use of trained specialists in control and automation engineering who are familiar with applicable national standards.

It is essential that the documentation and the following notes and explanations are followed when installing and commissioning the components.

It is the duty of the technical personnel to use the documentation published at the respective time of each installation and commissioning.

The responsible staff must ensure that the application or use of the products described satisfy all the requirements for safety, including all the relevant laws, regulations, guidelines and standards.

Disclaimer

The documentation has been prepared with care. The products described are, however, constantly under development.

We reserve the right to revise and change the documentation at any time and without prior announcement.

No claims for the modification of products that have already been supplied may be made on the basis of the data, diagrams and descriptions in this documentation.

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1.2 Intended use

Connector boxes of the AL225x series are exclusively used for connecting linear motors of the AL2000 series to servo drives of the AX8000, AX5000, AX2500 and AX2000 series. The connector boxes of the AL225x series are exclusively installed or mounted as components in electrical installations. Accordingly, they may only be commissioned as integrated system components.

DANGER

Serious risk of injury through high electrical voltage!

Connector boxes are installed at open line ends. All system components and assemblies **MUST** be de-energized when installing and working on the connector boxes.

This documentation must be followed during wiring and commissioning of the connector boxes.

2 Guidelines and Standards

In addition to the safety instructions mentioned in this manual, the general statutory and other rules and regulations for the prevention of accidents (e.g. personal protective equipment) and for environmental protection must be followed.

3 For your safety

Read the section on safety and heed the notices to protect yourself against personal injury and material damages.

Liability limitations

All the components of the AL225x connector box are supplied in certain hardware and software configurations appropriate for the conditions of the application. Unauthorized modifications to the hardware and/or software configurations other than those described in the documentation are not permitted, and nullify the liability of Beckhoff Automation GmbH & Co. KG.

In addition, the following actions are excluded from the liability of Beckhoff Automation GmbH & Co. KG:

- Failure to comply with this documentation
- Untrained personnel
- Use of unauthorized spare parts

3.1 Staff qualification

Only technical personnel with knowledge of control and automation technology may carry out any of the illustrated work steps on the Beckhoff software and hardware, in particular on the connector box AL225x.

The technical personnel must have knowledge of drive technology and electrical systems and must also know how to work safely on electrical equipment and machines.

This also includes:

- work preparation and
- securing of the working environment (e.g. securing the control cabinet against being switched on again).

The technical personnel must be familiar with the current and necessary standards and directives for the automation and drive environment.

3.2 Description of symbols

In this documentation the following symbols are used with an accompanying safety instruction or note. The safety instructions must be read carefully and followed without fail!

Symbols that warn of personal injury:

DANGER

Serious risk of injury!

This is an extremely dangerous situation. Disregarding the safety notice will lead to serious permanent injuries or even death.

WARNING

Risk of injury!

This is a dangerous situation. Disregarding the safety notice may lead to serious injuries.

CAUTION

Personal injuries!

This is a dangerous situation. Disregarding the safety notice may lead to minor injuries.

Symbols that warn of damage to property or equipment:

NOTE

Warning of damage to property or the environment!

This notice indicates disturbances in the operational procedure that could damage the product or the environment.

Symbols indicating further information or tips:



Tip or pointer!

This notice provides important information that will be of assistance in dealing with the product or software. There is no immediate danger to product, people or environment.



UL note!

This symbol indicates important information regarding UL certification.

3.3 Special safety instructions for the connector box

The safety instructions are designed to avert danger and must be followed during installation, commissioning, production, troubleshooting, maintenance and trial or test assemblies. The connector boxes of the AL225x series are not designed for stand-alone operation and are always installed in a machine or system. After installation, the documentation the documentation and the safety instructions provided by the machine manufacturer must be read and applied.

WARNING

Serious risk of injury through high electrical voltage!

- Negligent, improper handling of the connector boxes and bypassing of the safety facilities of the system or machine may result in personal injury or death through electric shock.
- When installing and working on the connector boxes, all machine components and assemblies **MUST** be de-energized and secured against unintentional restoration of electrical power.
- The machine manufacturer must prepare a hazard analysis for the machine, and must take appropriate measures to ensure that unexpected movements cannot lead to injury to persons or to objects.
- Power connections may be live, even if machine components don't move. Never undo the electrical connections to the motor when it is live. Under unfavorable conditions arcing may occur, resulting in injury and damage to contacts.
- Disconnect the linear motor from the servo drive and secure it against reconnection before working on electrical parts with a voltage > 50 V.
- Due to the DC link capacitors, the DC link contacts "ZK+ and ZK- (DC+ and DC-)" and "RB+ and RB-" may be subject to dangerous voltages exceeding 890V_{DC}, even after the servo drive was disconnected from the mains supply. Wait 5 minutes for the AX5101 - AX5125 and AX520x; 15 minutes for the AX5140/AX5160/AX5172; 30 minutes for the AX5190/AX5191; 45 minutes for the AX5192/AX5193 after disconnecting, and measure the voltage at the DC links "ZK+ and ZK- (DC+ and DC-)". The device is safe once the voltage has fallen below 50 V.

WARNING

Risk of injury through failure of the drive system!

Electronic equipment is not fail-safe. The machine manufacturer is responsible for ensuring that the connected motors and the machine are brought into a safe state in the event of a fault in the drive system.

WARNING

Caution – Risk of injury through electric shock!

Remove the motor and feedback lines from the connector box to the servo drive when you open the connector box.

Selection of motor and feedback cables!



For connecting linear drives, we recommend drag chain-capable, highly dynamic motor and feedback cables.

NOTE

Danger for persons, the environment or equipment

- Please read this manual carefully before using the connector boxes. Follow all safety instructions. Should anything be unclear, please contact the sales office for your area and refrain from any further work on the system.
- Only well trained, qualified electricians with sound knowledge of drive equipment may work on the device.

4 Product identification

4.1 Scope of delivery

The scope of delivery consists of the connector box accordingly the product type of the AL225x series and the housing seal.

Before commissioning the products, check the delivery for completeness.

Should delivered components be damaged, notify the logistics company and Beckhoff Automation GmbH & Co. KG immediately.

- Connector box of the AL225x series
- Housing seal

4.2 Name plate



The type key for the AL225x connector box contains information about the selected type. For further information, please refer to the chapter: "Type key".

4.3 Type key

AL225 – x – 000 – x	Definition
AL225	AL225 = Connector-Box
x	Box device: <ul style="list-style-type: none"> ◦ 0 = AL2003 to AL2830-1000 and AL38xx 5 = AL2830-1001 and AL2845-1000 6 = AL2845-1001
000	Undefined
x	Wiring on the Servo drive: <ul style="list-style-type: none"> ◦ 0 = AX2000 1 = AX5000 2 = AX8000

5 Technical description

5.1 Configuration of the connector boxes

The AL225x connector boxes are aluminium boxes with ports for cables to the motor and the amplifier.

With the Beckhoff AL225x connector box you can simply connect the motor, encoder and thermal protection contact cables of the AL2xxx and AL38xx linear motor with the drag chain-capable motor and encoder cables of the AX8000, AX5000, AX2500 and AX2000 servo drives series.

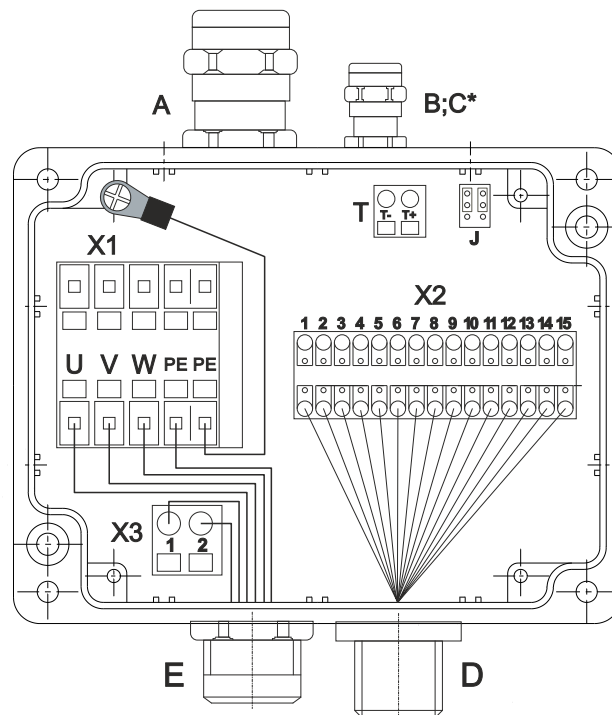
To this end, each connector box has ports for Beckhoff motor and feedback cables on the input side. The output side features screw connections, through which non-assembled motor and feedback system cables can be introduced.

By using the connector box, the wires of the temperature sensor are connected to the motor cable. No separate cable is required. This means that only two outgoing cables from the connector box are required. The terminal strip in the connector box is designed for the signals of several feedback protocols, so that feedback systems from different manufacturers can be used.

The direct connection of individual wires in the connector box avoids the problem of assembling the feedback connector.

5.2 Connection at AX8000

5.2.1 AL2250-0002



Position	Description
T	Thermal protection contact; motor side
A	Cable entry for the motor cable of the linear motor
B	Cable entry for the encoder cable of the linear motor
C	Cable entry for the thermal protection contact of the linear motor
D	Power socket for connecting the feedback system: M23-plug; 17 poles
E	Power socket for connecting the motor cable: M23-plug; 9 poles
X1	Terminal strip for the motor cable
X2	Terminal strip for the feedback system
X3	Terminal strip for the thermal protection contact of the servo drive
*The cable bushings B and C are congruent with each other	

5.2.2 Assignment plan

Pin	Signal	Heidenhain / AMO EnDat 2.2		Renishaw* Resolute BiSS-C	RLS* LA11 BiSS-C
		5 V	3.6 V – 14 V		
X1 – PE	PE / GND	Shield	Shield	Shield	Shield
X2 – 2	GND	White / Green	White / Green	White	White
X2 – 4	+5 V _{DC}	Brown / Green	---	Brown	Brown
X2 – 5	DATA+ / SLO+	Grey	Grey	Grey	Blue
X2 – 6	+11 V _{DC}	---	Brown / Green	---	---
X2 – 8	Clock+ / MA+	Violet	Violet	Violet	Green
X2 – 10	GND sense	White	---	Green	Pink
X2 – 12	+5 V sense	Blue	---	Brown	Grey
X2 – 13	DATA- / SLO-	Pink	Pink	Pink	Red
X2 – 15	Clock- / MA-	Yellow	Yellow	Yellow	Yellow

**In case of long cable lengths and a controlled power supply of + 5 V DC we recommend to bridge the respective sense-contacts to compensate voltage drop.*

Bridge:
X2-4 with X2-12 and X2-2 with X2-10

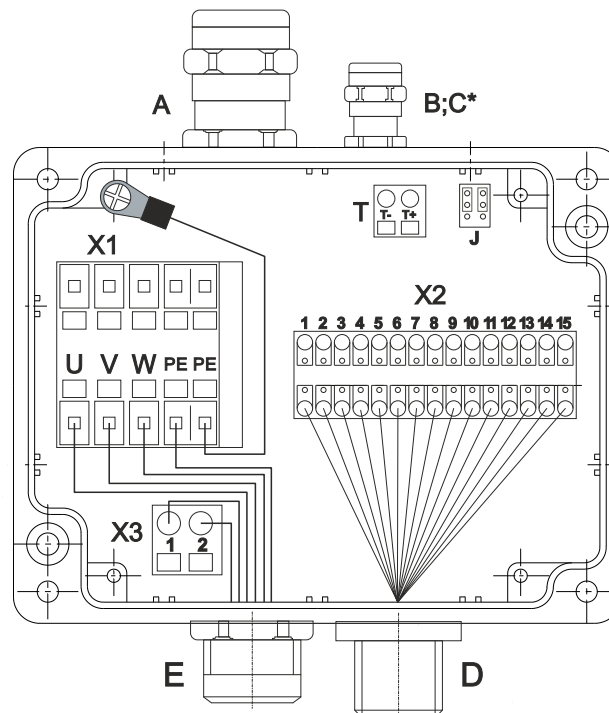
Jumper

Using the jumpers, the wiring of the temperature contact can be determined.

Connector-Box	Connection of the thermo contact	Jumper position
Standard AL2250-0002	Thermo contact (T) connected with feed-back cable (X2)	Jumper downstairs

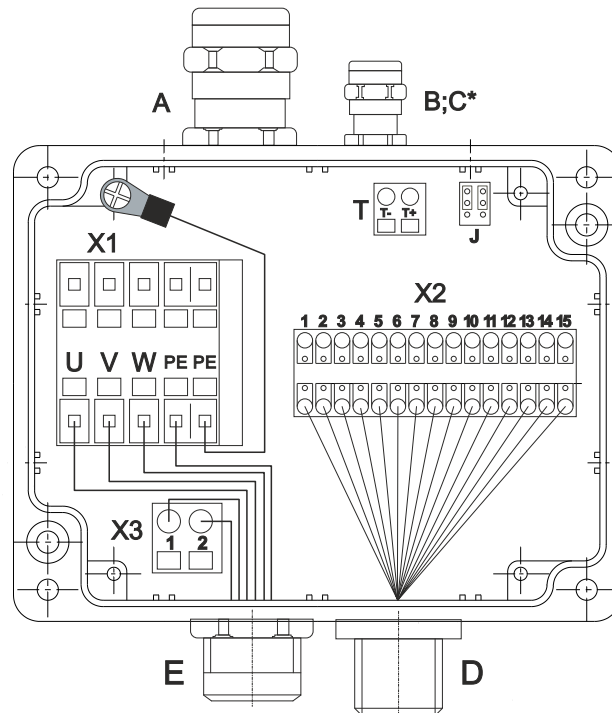
5.3 Connection at AX5000

5.3.1 AL2250-0001



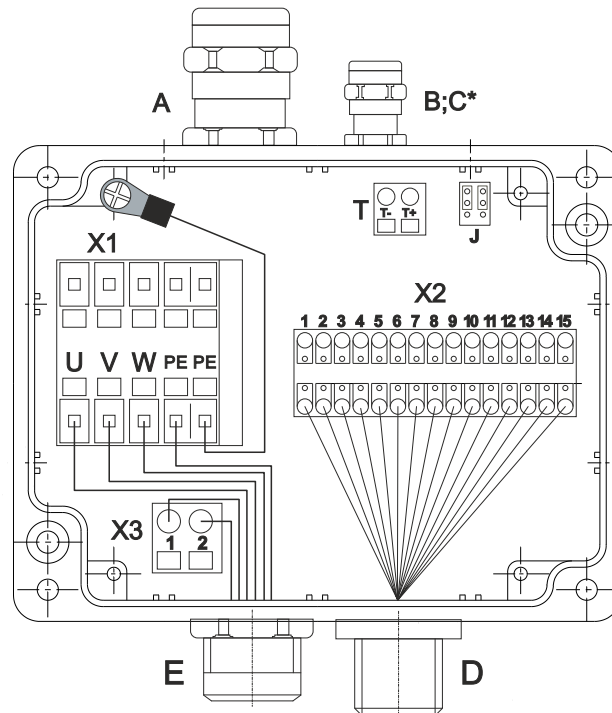
Position	Description
T	Thermal protection contact; motor side
A	Cable entry for the motor cable of the linear motor
B	Cable entry for the encoder cable of the linear motor
C	Cable entry for the thermal protection contact of the linear motor
D	Power socket for connecting the feedback system: M23-plug; 17 poles
E	Power socket for connecting the motor cable: M23-plug; 8 poles
X1	Terminal strip for the motor cable
X2	Terminal strip for the feedback system
X3	Terminal strip for the thermal protection contact of the servo drive
*The cable bushings B and C are congruent with each other	

5.3.2 AL2255-0001



Position	Description
T	Thermal protection contact; motor side
A	Cable entry for the motor cable of the linear motor
B	Cable entry for the encoder cable of the linear motor
C	Cable entry for the thermal protection contact of the linear motor
D	Power socket for connecting the feedback system: M23-plug; 17 poles
E	Power socket for connecting the motor cable: M23-plug; 8 poles
X1	Terminal strip for the motor cable
X2	Terminal strip for the feedback system
X3	Terminal strip for the thermal protection contact of the servo drive
*The cable bushings B and C are congruent with each other	

5.3.3 AL2256-0001



Position	Description
T	Thermal protection contact; motor side
A	Cable entry for the motor cable of the linear motor
B	Cable entry for the encoder cable of the linear motor
C	Cable entry for the thermal protection contact of the linear motor
D	Power socket for connecting the feedback system: M23-plug; 17 poles
E	Power socket for connecting the motor cable: M40-plug; 8 poles
X1	Terminal strip for the motor cable
X2	Terminal strip for the feedback system
X3	Terminal strip for the thermal protection contact of the servo drive
*The cable bushings B and C are congruent with each other	

5.3.4 Assignment plan

Connection	Signal description	MES AL2200	LIKA SMS-V1	SIKO LE100	N J* LIA1Vss	SONY PL101
X1 – PE	PE / GND	shield	shield	shield	white / green	shield
X2 – 1	SIN +	green	yellow	red	green	blue
X2 – 2	GND	white	black	black	white	white
X2 – 3	COS +	blue	green	yellow	blue	orange
X2 – 4	+ 5 V _{DC}	brown	red	brown	brown	red
X2 – 5	DATA +	---	white	blue	grey	pink
X2 – 6	U _S 9 V	---	---	---	---	---
X2 – 7	REF Z -	---	---	---	---	---
X2 – 8	Clock +	---	---	---	---	---
X2 – 9	SIN -	yellow	blue	orange	yellow	yellow
X2 – 10	GND sense	grey	---	---	---	---
X2 – 11	COS -	red	orange	green	red	grey
X2 – 12	+ 5 V sense	pink	---	---	---	---
X2 – 13	DATA -	---	---	pink	pink	green
X2 – 14	REF Z +	---	---	---	---	---
X2 – 15	Clock -	---	---	---	---	---

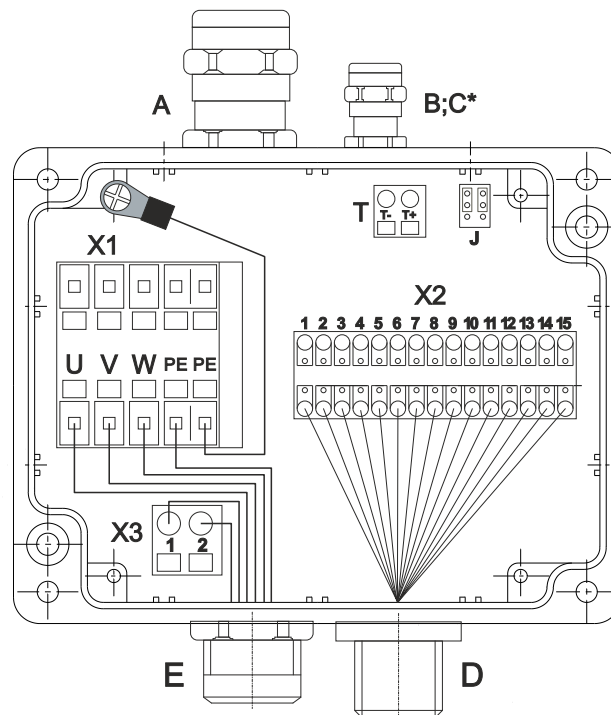
Jumper

Using the jumpers, the wiring of the temperature contact can be determined.

Connector-Box	Connection of the thermo contact	Jumper position
Standard AL225x-0001	Thermo contact (T) connected with motor cable (X3)	Jumper upstairs

5.4 Connection at AX2000

5.4.1 AL2250-0000



Position	Description
T	Thermal protection contact; motor side
A	Cable entry for the motor cable of the linear motor
B	Cable entry for the encoder cable of the linear motor
C	Cable entry for the thermal protection contact of the linear motor
D	Power socket for connecting the feedback system: M23-plug; 17 poles
E	Power socket for connecting the motor cable: M23-plug; 8 poles
X1	Terminal strip for the motor cable
X2	Terminal strip for the feedback system
X3	Terminal strip for the thermal protection contact of the servo drive
*The cable bushings B and C are congruent with each other	

5.4.2 Assignment plan

Connection	Signal description	MES AL2200	LIKA SMS-V1	SIKO LE100	N J* LIA1Vss	SONY PL101
X1 – PE	PE / GND	shield	shield	shield	white / green	shield
X2 – 1	COS -	red	orange	green	red	grey
X2 – 2	GND	white	black	black	white	white
X2 – 3	SIN -	yellow	blue	orange	yellow	yellow
X2 – 4	+ 5 V _{DC}	brown	red	brown	brown	red
X2 – 5	DATA + / Z +	---	white	blue	grey	pink
X2 – 6	n.c.	---	---	---	---	---
X2 – 7	PTC	---	---	---	---	---
X2 – 8	Clock +	---	---	---	---	---
X2 – 9	COS +	blue	green	yellow	blue	orange
X2 – 10	GND sense	grey	---	---	---	---
X2 – 11	SIN +	green	yellow	red	green	blue
X2 – 12	+ 5 V sense	pink	---	---	---	---
X2 – 13	DATA - / Z -	---	---	pink	pink	green
X2 – 14	PTC	---	---	---	---	---
X2 – 15	Clock -	---	---	---	---	---

Jumper

Using the jumpers, the wiring of the temperature contact can be determined.

Connector-Box	Connection of the thermo contact	Jumper position
Standard AL2250-0000	Thermo contact (T) connected with encoder cable (X2)	Jumper downstairs

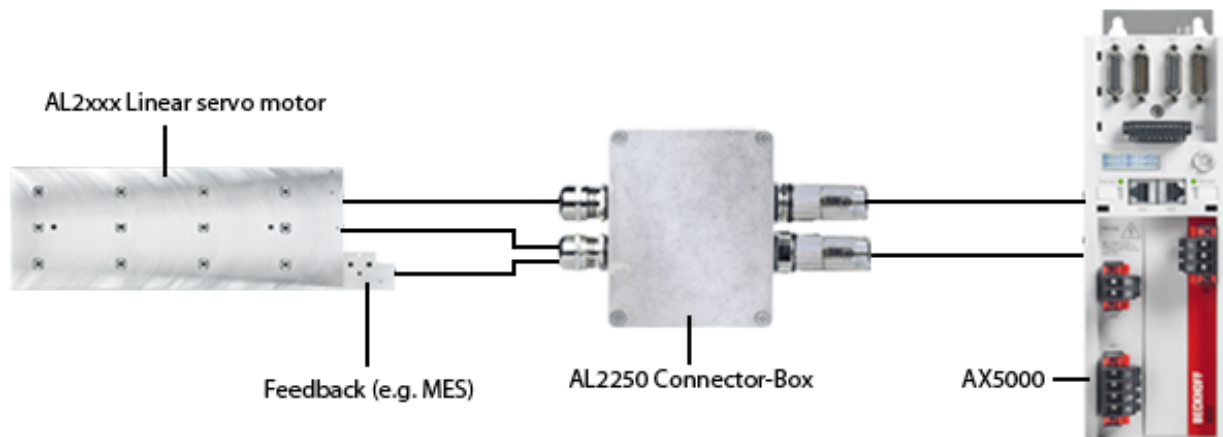
5.5 Selection criteria

The connector boxes are designed for operation with Beckhoff linear motors and Beckhoff servo drives. The choice of connector box depends on the motor and servo drive combination. Please refer to the table below.

Order details	for servo drive	applicable motor types
AL2250-0000	AX2xxx	AL2003 – AL2830-0001 and AL2830-1000 AL3803 – AL3818-0000
AL2250-0001	AX5xxx	AL2003 – AL2830-0001 and AL2830-1000 AL3803 – AL3818-0000
AL2250-0002	AX8xxx	AL2003 – AL2830-0001 and AL2830-1000 AL3803 – AL3818-0000
AL2255-0001	AX5xxx	AL2830-1001-0000 and AL2845-1000-0000
AL2256-0001	AX5xxx	AL2845-1001-0000

5.5.1 Connection examples

Linear motors with Beckhoff encoder (MES) and connector box AL225x



AL2250-000x

Cable	AX2000	AX2500	AX5000	AX8000
Motor cable*	ZK4000-2111	ZK4000-2711	ZK4500-0023	ZK4800-8023
Encoder cable for MES or absolute encoder	ZK4000-2610	ZK4000-2610	ZK4510-0020	---
Encoder cable for EnDat 2.2	---	---	---	ZK4810-8020
Encoder cable for encoder with zero pulse	ZK4000-2610	ZK4000-2610	ZK4520-0020	---

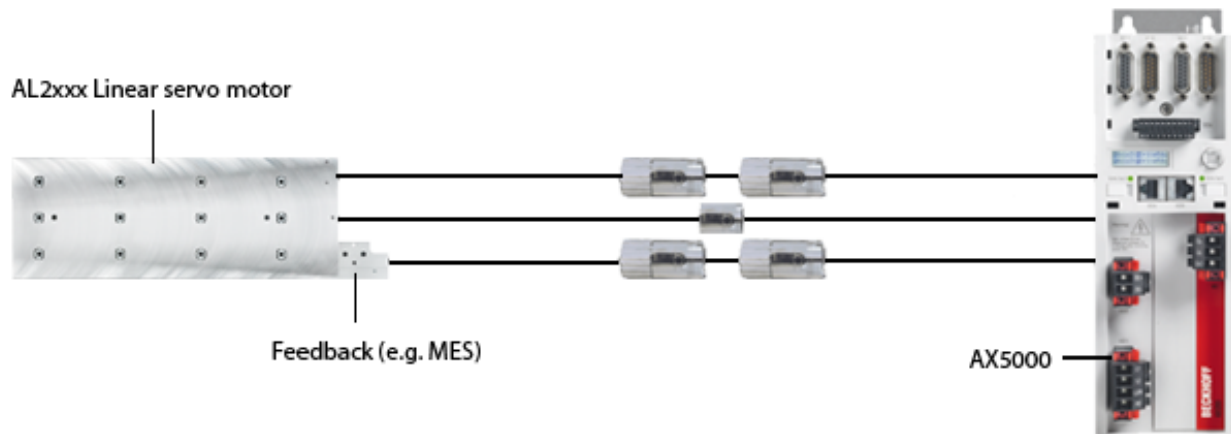
AL2255-0001

Cable	AX5000
Motor cable*	ZK4500-0023
Encoder cable for MES or absolute encoder	ZK4510-0020
Encoder cable for encoder with zero pulse	ZK4520-0020

AL2256-0001

Cable	AX5000
Motor cable*	ZK4500-0017
Encoder cable for MES or absolute encoder	ZK4510-0020
Encoder cable for encoder with zero pulse	ZK4520-0020

Linear motors with Beckhoff encoder (MES) without connector box



Cable	AX2000	AX2500	AX5000
Motor cable*	ZK4000-2111	ZK4000-2711	ZK4500-0023
Thermal protection contact cable	ZK4000-2510	ZK4000-2510	ZK4540-0020
Encoder cable for MES or absolute encoder	ZK4000-2610	ZK4000-2610	ZK4510-0020

*wire cross-section depends on motor/applications current

6 Mechanical installation

6.1 Mounting the connector box on the slide



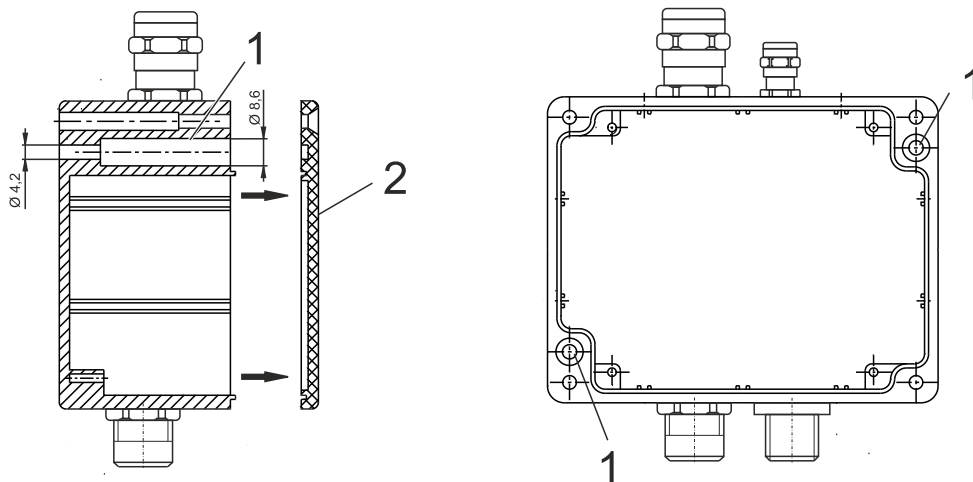
Mounting the connector box on the slide!

The motor cables of the linear motors are generally not drag chain-capable. The connector box must therefore be mounted on the moving part of the linear axis.

Connector boxes AL2250-000x

The connector boxes are mounted with 2 screws (e.g. M4 / DIN13).

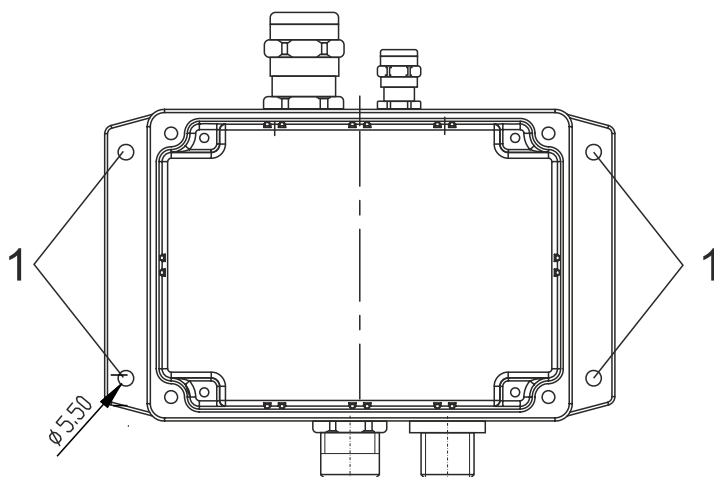
Remove the cover (2) of the connector box and insert the screws through the appropriate slot (1).



Connector boxes AL2255-0001 and AL2256-0001

The connector boxes are mounted with 4 screws (e.g. M5 / DIN13).

Insert the screws through the mounting straps (1) of the boxes.



7 Electrical installation

7.1 Important notes

● Assembling the motor cable (at the linear motor)



Strip the wires of the motor cable and fit wire end sleeves.

Twist the shielding of the motor cable and solder a cable with a minimum diameter of 1.5 mm² to it. Guide the wires through socket "A" in the box and fasten the nut on the socket "A". Fit the shielded and PE cables with a "PE" connection and the power wires on connection "X1".

● Assembling the encoder cable (at the encoder)!



Strip the wires of the encoder cable and fit wire end sleeves!

Twist the shielding of the encoder cable and solder a cable with a minimum diameter of 0.75 mm² to it. Fit wire end sleeves or a cable lug to the free end. Place the nut of socket "B" over the encoder cable and feed the wires through the socket "B" in the box and screw the nut onto socket "B". Fit a "PE" connection to the shielded cable. Wire the signal wires to the "X2" connection as per the table.

DANGER

Serious risk of injury through high electrical voltage!

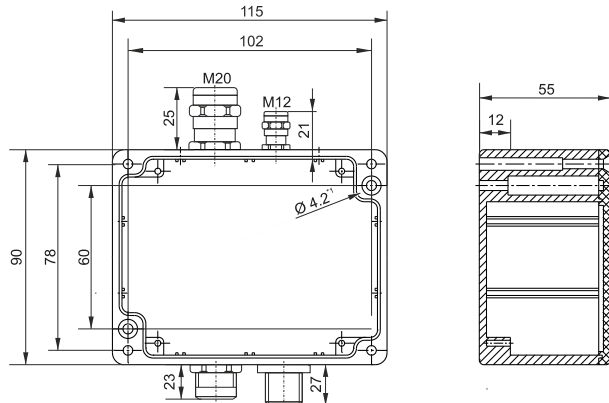
The connector box must be opened for assembling the cables as described above.

- Make sure all system and machine components and assemblies are de-energized and secured against unintentional restoration of electrical power.
- Check the earthing of the system or machine and all relevant components and assemblies.
- Remove the motor and feedback cables from the connector box and the servo drive. When removing the cables from the servo drive, please note that there are residual charges at the DC link contacts of the servo drive, even after the power has been switched off. Wait 5 minutes for the AX5101 - AX5125 and AX520x; 15 minutes for the AX5140/AX5160/AX5172; 30 minutes for the AX5190/AX5191; 45 minutes for the AX5192/AX5193 after disconnecting, and measure the voltage at the DC links "ZK+ and ZK- (DC+ and DC-)". The device is safe once the voltage has fallen below 50 V.

8 Technical data

8.1 Dimensional drawing of connector box AL2250

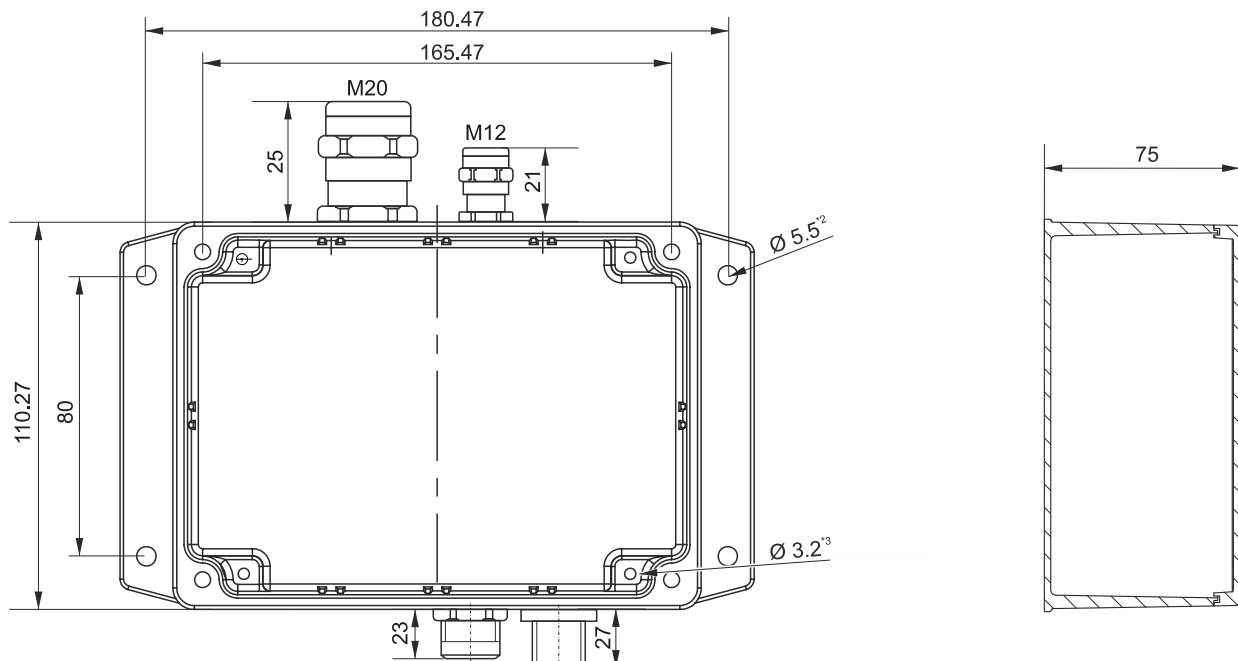
All dimensions in mm



1*) The holes with the diameter $\varnothing 4.2$ are provided for mounting the connector box. The holes are provided for M4 flat head screws DIN 7984.

8.2 Dimensional drawing of connector box AL2255/AL2256

All dimensions in mm



2*) The holes on the mounting lugs are provided for M5 flat head screws.

3*) The holes with M4 x 20 threads on the connector box (for mounting the cover) are provided for countersunk head screws.



Connection plugs and cables:

For further information about connection technology and cables, please take a look at the chapter: [“Technical description \[► 12\]”](#).

9 Appendix

9.1 Support and Service

Beckhoff and their partners around the world offer comprehensive support and service, making available fast and competent assistance with all questions related to Beckhoff products and system solutions.

Beckhoff's branch offices and representatives

Please contact your Beckhoff branch office or representative for local support and service on Beckhoff products!

The addresses of Beckhoff's branch offices and representatives round the world can be found on her internet pages:

<http://www.beckhoff.com>

You will also find further documentation for Beckhoff components there.

Beckhoff Headquarters

Beckhoff Automation GmbH & Co. KG

Huelshorstweg 20
33415 Verl
Germany

Phone:	+49(0)5246/963-0
Fax:	+49(0)5246/963-198
e-mail:	info@beckhoff.com

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- hotline service

Hotline:	+49(0)5246/963-460
Fax:	+49(0)5246/963-479
e-mail:	service@beckhoff.com

More Information:
www.beckhoff.com/al2000

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

