LIMAline 60™

Drive system

EN **Operating instructions**
Please take care of the operating instructions!

04/2016, TN: 2011538

EN

Translation from the original German version.

All other documents in different languages are translations of the original version.

Table of contents

EN

1 General

1.1 Information relating to the installation instructions

The contents are classified in accordance with the life stages of the LIMAline 60^{TM} worm gear (hereinafter referred to as the "device"). The manufacturer reserves the right to make changes to the technical specifications stated in these installation instructions. In detail these can differ from the respective version of the device without the factual information being fundamentally changed and without losing their validity. The current status of the technical specifications can be requested from the manufacturer at any time. Any claims arising from this cannot be asserted. Deviations from the text and pictorial statements are possible and are dependent on the technical development, equipment and accessories of the device. The manufacturer shall provide information about any differing details relating to special versions by means of the sales documentation. Other specifications shall remain unaffected by this.

1.2 Standards and guidelines

During construction the fundamental health and safety requirements were applied and provision was made for the appropriate legislation, standards, directives and guidelines. The safety element is confirmed by the Declaration of Incorporation (see section 5 “Declaration of Incorporation”). All information relating to safety in these installation instructions refers to the laws and regulations that are currently valid in Germany. All information in these installation instructions must be complied with at all times and without limitation. In addition to the safety notices and directions in these installation instructions, the regulations applicable at the place of installation with regard to accident prevention, environmental protection and occupational safety must be observed and adhered to. The guidelines and standards for safety assessment can be found in the Declaration of Incorporation.

1.3 Intended use

The device is designed for adjusting slats and elements with a symmetrical shape and a symmetrical bearing/axis in façade construction. Other fields of application must be agreed in advance with the manufacturer.

The device must not be used in areas where there is a risk of injury to personnel or in rooms in potentially explosive environments.

If a direct or indirect hazard to personnel cannot be ruled out, additional measures (e.g. covers, barriers, etc.) must be taken in order to minimise the potential risk accordingly.

The operator alone is liable for any damage arising from the non-intended use of the device. The manufacturer assumes no liability for personal injury or damage to property caused through misuse or procedural errors, improper operator control or improper start of operation.
The device must be operated only by trained and authorized skilled personnel subject to compliance with all safety notices and directions.

Safe and error-free use and operating safety of the device can only be guaranteed subject to use in compliance the intended use in accordance with the specifications set out in these installation instructions.

Intended use includes observation of and adherence to all the safety notices and directions instructions specified in these installation instructions, as well as all applicable regulations of trade associations and the valid laws in relation to environmental protection. Use in compliance with the intended use also includes adherence to the operating regulations prescribed in these installation instructions.

1.4 Foreseeable misuse

Any installation into other equipment that deviates from the purpose cleared by the manufacture applies as being a foreseeable misuse.

1.5 Warranty and liability

In principle, the General Terms & Conditions of Sale and Delivery of the manufacturer apply. The Terms & Conditions of Sale and Delivery are a component part of the sales documentation and are handed over to the plant operator at the time of delivery. Liability claims for personal injury and damage to property are excluded, if they are attributable to one or several of the following causes:

- Use not in compliance with the intended use of the device
- Improper installation, start of operation or operator control of the device
- Changes to the design and construction of the device without the written approval of manufacturer
- Operation of the device with improperly installed connections and defective or improperly attached safety and protection devices

- Non-compliance with the safety stipulations, notices and directions provided in these installation instructions
- Exceeding of the specified technical specifications

1.6 Customer service of the manufacturer

The device may be repaired only by the manufacturer in the event of a fault. The address for sending in the device to the customer service department can be found on the inside of the back cover.
If you have not purchased the device directly from elero, please contact the manufacturer of the machine or the supplier of the device.

Release and mechanically secure the machine before dismantling the device. The device must not be separated from the machine by force.

2 Safety

2.1 General safety notices and directions

These installation instructions contain all the safety notices and directions that must be observed in order to avoid and prevent dangers when working with the device in the individual life cycles. Safe use of the device is guaranteed when all the specified safety notices and directions are complied with.

2.1.1 Formulation of the safety notices and directions

The safety notices and directions in this document are marked with safety symbols and formulated in accordance with the SAFE principle. They contain specifications relating to the type and source of danger, the possible consequences, as well as the prevention of the danger.
The following table defines the representation and description of the levels of danger with possible physical injury, as used in these installation instructions.

Symbol	Keyword	Meaning
	DANGER	Warns of an accident that will occur if the instructions are not followed, which can lead to life-threatening, irreversible injuries or death.
	WARNING	Warns of an accident that may occur, if the instructions are not followed, which can lead to serious, perhaps life-threatening, irreversible injuries or death.
	CAUTION	Warns of an accident that can occur, if the instructions are not followed, which can lead to minor, reversible injuries.

The following table describes the symbols used in these installation instructions for the graphic display of danger situations in connection with the symbol for the danger level.

Symbol	Meaning
	Danger due to an electrical voltage, electric shock: This symbol refers to dangers associated with electrical currents.
	Danger of crushing and killing people: This symbol refers to dangers due to which the entire body or individual limbs can become crushed or injured.

The following table defines the representation and description used in the installation instructions for situations in which damage can occur to the product or draws attention to important facts, statuses, tips and information.

Symbol	Keyword	Meaning
	*CAUTION*	This symbol warns of possible damage to property.
		This symbol draws attention to important facts and statuses, as well as to further information in these installation instructions. Furthermore, it refers to specific instructions which give additional information on or provide assistance in how to perform a procedure more easily.

The following is an example of the structure of a safety notice:

DANGER

Type and source of danger

Explanation of the type and source of danger

- Measures to avert danger.

2.2 Safety principles

The device is built according to state-of-the-art technology and the generally accepted rules of safety and it is safe to operate. The basic safety and health requirements of the applicable laws, standards, directives and guidelines have been applied in the construction of the device. The safety of the device is confirmed by the Declaration of Incorporation.

All specifications pertaining to safety relate to the currently valid regulations of the European Union. In other countries it must be ensured by the plant operator that the applicable laws and national regulations are complied with.

In addition to the safety notices and directions in these installation instructions, the generally applicable regulations regarding accident prevention and environmental protection must be observed and complied with.

The device must only be used when in perfect working order, for its intended use, and in compliance with the safety notices and directions in these installation instructions. The device is designed for the application in accordance with the section “Intended use”. In the event of use that is not in compliance with the intended use, injury to the life and limb of the user or third parties or impairments to the device and other property can arise. Any accidents or almost accidents during the use of the device that lead to or could have led to personal injuries and/or damage in the working environment must be reported directly and without delay to the manufacturer.

All safety notices and directions specified in the installation instructions and on the device must be adhered to. In addition to these safety notices and directions, the operator must ensure that all national and international regulations applicable in the respective country of use, as well as other binding regulations relating to operational safety, accident prevention and environmental protection are complied with. All work on the device must be performed only by trained, safety instructed and authorized personnel.

2.3 General duties of the plant operator

- ❏ The plant operator is obligated to use the device only in perfect and operationally safe condition. He must ensure that, in addition to the safety notices and directions in the installation instructions, the generally accepted safety and accident prevention regulations, the specifications of DIN VDE 0100 and the provisions relating to environmental protection of the respective country of use, are heeded and complied with.
- ❏ The plant operator is responsible that all work with the device is performed only by trained, safety instructed and authorized personnel.
- ❏ Ultimately responsible for accident-free operation is the plant operator of the device or the personnel authorized by the plant operator.
- ❏ The operator is responsible for compliance with the technical specifications.

2.4 Requirements of the personnel

- ❏ Each person who is charged with performing work on the device must have read and understood the complete operating instructions before he performs the corresponding work. This also applies, if the relevant person has previously worked with such a device or was trained to do so.
- ❏ All work on the device must be performed only by trained, safety instructed and authorized personnel. Prior to the commencement of all activities the personnel must have been made familiar with the dangers that exist while handling the device.
- ❏ All personnel may perform only work that is in accordance with their qualifications. The areas of responsibility of the respective personnel must be clearly defined.
- ❏ Any personnel charged with working with the device must have no physical limitations that temporarily or permanently restrict their attentiveness or judgement (e.g. due to overtiredness).
- ❏ Minors or persons who are under the influence of alcohol, drugs or medication are prohibited from working with the device, as well as performing any installation, dismantling or cleaning work.
- ❏ Personnel must wear suitable personal protective personal protective equipment appropriate to the work incurred and prevailing working environments.

2.5 Safety notices and directions relating to the technical condition

- ❏ The device must be checked before installation for damage and proper condition.
- ❏ The plant operator is obligated to operate the device only in perfect and operationally safe condition. The technical condition must comply with the legal requirements at all times.
- ❏ If dangers to personnel or changes in operating behaviour are recognized, the device must be shut down immediately and the incident reported to your superiors or to the plant operator.
- ❏ No changes, attachments or conversions may be performed on the device without the authorization of the manufacturer.
- ❏ If wear is detected on the trapezoidal or ball screw spindle or on the spindle nut, the device must be brought to the manufacturer for maintenance.

2.6 Safety notices and directions relating to transport, assembly, installation and disassembly

The relevant transport company is fundamentally responsible for the transport of the device. The following safety requirements must be complied with during transport, erection and installation of the device.

- ❏ During transport the device has to be secured in accordance with the regulations of the auxiliary transport means being used.
- ❏ Only the point defined on the device may be used as a securing point.
- ❏ The erection and installation work may be performed fundamentally only by trained and instructed skilled personnel.
- ❏ Before carrying out any work on the device, make sure that the device is not subject to any dynamic and static torque.

2.7 Safety instructions relating to operation

- ❏ The operator of the device is obligated to ensure the safe and proper state of the device before the initial start of operation.
- ❏ This is also necessary during operation of the device at regular intervals to be determined by the plant operator.
- ❏ In the event of a fault, misuse and/or if control components are not connected correctly, this can cause the supporting and retaining function of the device to be impaired.
- ❏ No radial and/or torsional forces must be allowed to act on the device.

2.8 Safety notices and directions relating to the electrical installation

- ❏ All work on the electrical system must be performed only by authorized skilled electricians in accordance with the applicable rules and stipulations of the trade association, in particular the stipulations of DIN VDE 0100. Furthermore, the national statutory regulations of the respective country of use must be observed.
- ❏ In the event of any defects, such as loose connections or defective or damaged cables, the device must not be put into operation.
- ❏ In the event of faults with the electrical equipment, the device must be switched off immediately.
- ❏ The device must be switched off to de-energized before any inspection, installation or dismantling work.
- ❏ The device must not be hosed down with a high-pressure cleaner or steam jet.

The following must be checked before connecting the device to the power supply:

- ❏ Are all electrical connections, safety devices, fuses, etc. properly installed, connected and earthed?
- ❏ Is the power connection provided in accordance with the specifications in the electrical circuit diagram (voltage type, voltage level)?
- ❏ Has the supply line been de-energized?

3 Product description

3.1 General

The device is designed for adjusting slat systems in façade construction.

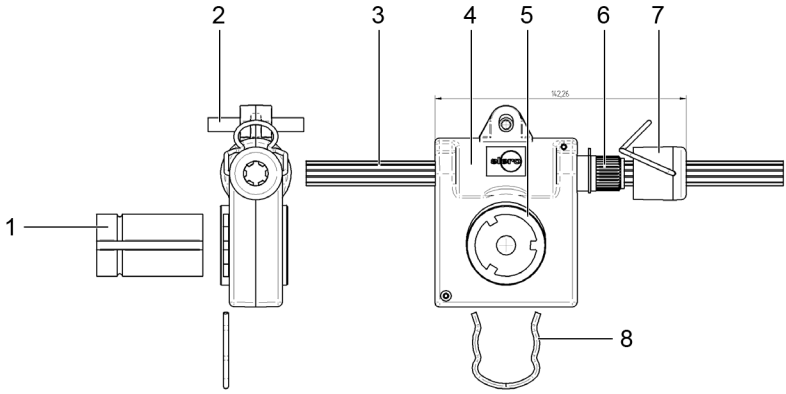

Abb. 1 Components of the device

1 Profile bushing
2 Structural torque arm
3 Profile shaft
4 Housing
5 Worm gear
6 Worm shaft
7 Lug with circlip
8 Profile bush clip

3.2 Technical specifications

All information in this section relates to an ambient temperature of 20°C.

3.2.1 Summary of the technical parameters

Technical specifications	LIMAline 60™
Peak demand, static	60 Nm
Peak demand, dynamic	16 Nm
required driving torque for dynamic peak demand	3 Nm
turning angle	360°
Profile shaft drive speed	max. 26 U/min
operation/standstill	max. 65 s/min. 180 s
Weight	approx. 0,33 kg
Housing	Plastic
Protection class	IP 20
Operating temperature range	-20 °C to +60 °C
Airborne noise emission	< 70 dB(A) [1]
theoretical service life	10 000 x 180° cycles right and left [2]

Tab. 1 Technical parameters

[1] 1 m distance; 1.6 m above unit; nominal operation; measuring tolerance 10 %

[2] compliance with all technical parameters

3.2.2 Information relating to the self-locking facility

WARNING

Danger of injury through loss of the self-locking facility.
Crushing and fatal injuries are possible.

- Pay attention to static loads.

CAUTION

Possible damage to the device or customer's machine through loss of the self-locking facility.

- Pay attention to static loads.

With the devices it is differentiated between dynamic and static self-locking. Dynamic self-locking arises from movement and static self-locking when the device is at a standstill. The self locking facility on the devices is dependent on various factors, e.g.:

- Flight angle of worm gear
- Surface roughness of flanks
- Running speed

The self-locking facility can be negatively influenced by a multitude of factors, e.g. by:

- Shocks and vibrations
- Loads
- Heating

A residual risk cannot be eliminated even with a theoretically self-locking gearbox. For this reason the assumption of any warranty obligations relating to self-locking is excluded.

Self-locking is NOT for the purpose of fulfilling any safety-related properties.

In order to minimize any further dangers, observe the duty of care that is normal for technical products.

4 Installation

The information regarding electrical components refers to the attachment and connection of drive motors for the device. They are not included in the scope of delivery of the device.

WARNING

Danger of life-threatening injury due to faulty electrical connection.

Electric shock possible.

- Have any electric work performed only by an authorized skilled electrician.
- Check the proper connection of the PE conductor prior to initial start of operation.

WARNING

Danger of injury due to weathering influences.

The skin may suffer frostbite or burns.

- Wear personal protective equipment.

WARNING

Danger of injury due to incorrectly dimensioned mountings.

Crushing and fatal injuries are possible.

- Use only fastening materials that are suitable for the dimensions of the mountings.
- The counter-mountings (provided by customer) must be rated at least for the forces for which the device was designed.

WARNING

Danger of injury through loss of the holding function.

Crushing and fatal injuries are possible.

- Pay attention to static loads.

WARNING

Risk of injury by rotating components.

Persons may be crushed.

- All work on the device must be conducted authorised technicians only.
- Do not use where persons may contact the device.
- Wear personal protective equipment.
- Safety distance or safety guards required.

CAUTION

Damage to the device through incorrect customer assembly.

- Observe the protection class.
- The device must be protected from water splashing and dripping water.
- It must also be protected from UV radiation, dirt and dust.

CAUTION

Damage to the device due to radial and/or torsional forces.

- No radial and/or torsional forces must be allowed to act on the device.

CAUTION

Damage to the device by blocking the swing range.

- The swing range must be freely moveable at all times.
- The slats with the device must not contact a seal or limit stop at any slat position.

CAUTION

Damage to the device due to loss of the holding function.

- Pay attention to static loads.

The device has been manufactured with the configuration that you ordered. See the sales documents for the configuration.

The accessibility of the end position adjustment, commissioning of the drive system and service opening for maintenance must be guaranteed.

4.1 Assembly of the device

The device is designed for installation in a building structure. Fasten the device only by the profile bushing and torque arm fastening elements provided for this purpose.

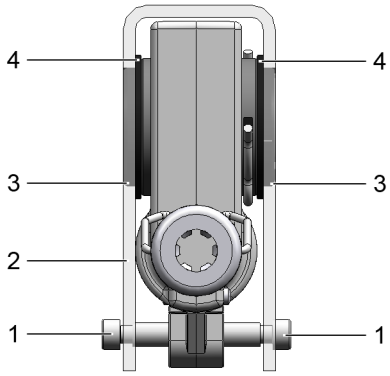

Abb. 2 Assembly of the device

1 Structural torque arm
2 Building structure
3 Structural support of the profile bushing
4 Structural spacer rings

4.1.1 Structural support and assembly of the profile bushing

The profile bushing is supported axially and radially with two flange sleeves (e.g. Igus, ID 35 mm). The flange sleeves are mounted so the flange is in contact with the internal wall of the building structure. The profile bushing must be supported on both sides by the structure. The structural support points must resist all wind loads, the weight of the slats and thrust forces. This will ensure the device is subjected exclusively to the output torque.

The keyed shape of the standard hole (Ø 10.9 mm) of the profile bushing allows the torque to be transferred to both ends of the slat axes. The slat axes can be attached at one end and at both ends. Models with profile holes or keyways are available.

When assembling a drive train all profile bushings must have the same angular setting.

This significantly reduces the supplementary fine adjustment.

The profile bushing is locked by the profile bush clip in the device to prevent axial displacement.
The profile bushing can be removed after the profile bush clip has been pulled to the outside.
To lock the profile bushing again, the slot in the profile bushing and the profile bush clip must be in the same plane.

Spacer rings:
The device can adjusted to the clearance of the structure by installing spacer rings on the right and left. The spacer rings are pushed onto the profile bushing as required during installation.
The spacer rings have an internal diameter of $35.1^{+0,2}$ mm and an external diameter of 45 mm.

Note that a residual play of 0.5 mm always remains in the width.

The radial play between profile bushing and bearing must be min. approx. 0.025 mm and max. approx. 0.1 mm. The support points must never cause jamming or blockage of the profile bushing.

The slat axes must be supported virtually without friction to allow them to be rotated with minimum force (Nm).

4.1.2 Structural torque arm

The structural torque arm supports the torque on the device.
The torque arm must be pushed through the hole in the top end of the device and screwed tightly to the structure. The length is aligned to the clearance of the structure.
The external diameter is uncoated 8_{h11} mm.

It is also stiffened by screwing it to the structure.

4.1.3 Assembly of the profile shaft

The profile shaft transfers the total drive torque in the drive train. The profile shaft is pushed through all the device lugs in the drive train. It is important to ensure that the profile contours can be pushed easily inside one another.
A maximum of 15 devices can be driven in one drive train.

A transverse hole is drilled at one end of the profile shaft. Subsequently an adapter is screwed to the transverse hole (adapter horizontal, TN 75128920x or adapter vertical, TN 75135910x). The drive motor is positioned after the adapter. It must be horizontally attached at the adapter. The vertical adapter can be attached with the drive motor. The screws prevent movement of the shaft. After consultation with the manufacturer other suitable options (e.g. structural fasteners) to prevent movement of the shaft are possible and indeed required for some drive types with ancillary equipment.

The profile shaft must be pushed through all lugs of the devices without jamming during assembly of a drive train.

The maximum driving torque of 20 Nm and the max. length of 5 m per profile shaft (drive train) must not be exceeded.

4.1.4 Readjustment and fine adjustment

WARNING

Danger of injury

Persons may be crushed.

- Before starting this process, disconnect drive motors from the power supply.

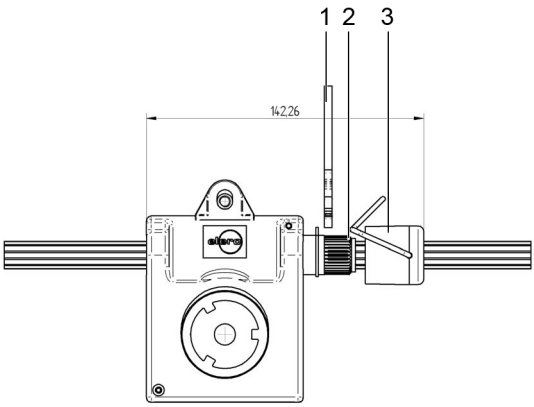

Abb. 3 Readjustment and fine adjustment of the slat axis

1 Adjustment key
2 Worm shaft
3 Lug with circlip

The lug clip is folded outwards for readjustment and fine adjustment of the slat axis. The lug can then be moved approx. 20 mm on the profile shaft. Now the slat axis can be adjusted by rotating it with the adjustment key.

4.2 Installation dimensions

The clearance for the installation dimensions in the structure is min. 44 mm x 125 mm. The support of the slat axis is not centred in the structure (centre of 125 mm) but approx. 37 mm from the inner edge of the structure.

Dimension 44 mm = (38 mm + 2 x axial bearing with 2 mm collar
+ 1 x spacer ring 1.5 mm + play 0.5 mm)

Installation dimension with the JA drive motor min. 55 mm x 125 mm.

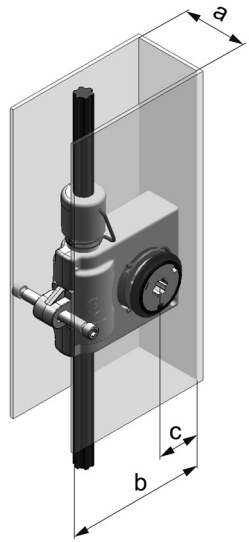

Abb. 4 Installation dimensions

a Clearance without JA drive min. 44 mm/with JA drive min. 55 mm
b Clearance min. 125 mm
c approx. 37 mm

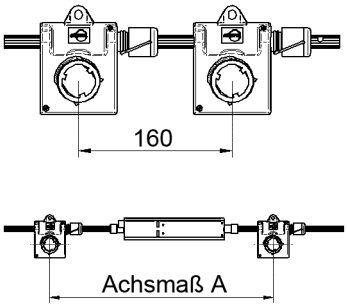

Abb. 5 Axial dimension with JA drive motor on one side and centrally positioned

Installation dimensions when using an elero drive motor of the JA series

JA Drive	driving torque (Nm) both sides	driving torque (Nm) one side	axial dimension A (mm) (JA centred)	axial dimension A (mm) (JA one side)
JA 20 dk	10,0 + 10,0	10,0	min. 525	160 (<160 on request)
JA 10 dk	5,0 + 5,0	10,0	min. 500	160 (<160 on request)
JA 06 dk	3,0 + 3,0	6,0	min. 470	160 (<160 on request)

Tab. 2 Axial dimension after JA drive motor

4.3 Assembly of drive motors

CAUTION

Damage to the drive motor by incorrect assembly.

- Observe the protection class and specified installation position.
- The motor must be protected from water splashing and dripping water.
- Observe the assembly instructions of the motor manufacturer for fastening the motor.

Attachment options:

- centred in drive train (preferred variant)
- parallel to drive train with conversion gearbox
- at the end of the drive train
- angled at the end of the drive train via 90° angle gearbox

When installing note that the adjustment buttons (white and orange) on the drive motor are always at the bottom.

Installation position of JA drive:

Horizontal installation position:

The adjustment buttons (white and orange) must always be at the bottom when installed horizontally.

Vertical installation position:
If the JA drives are installed vertically the cable output must be at the top. If the cable output is at the bottom when vertically installed, lubricants may penetrate the brake, the limit switch area and the electric motor of the JA drive. This will cause faults or premature failure of the JA drives.

The JA drives are preferably mounted centrally in the drive train.
The JA drives must be covered to protect them from splash water, UV radiation, dirt and dust.
Dampers are also required on the structural fastening console (attachment areas).

Drive train offset/alignment:
During assembly and during operation there must be no offset (jamming/tilting) of the conversion gearbox axis, angle gearbox axis, adapters and the JA drive shaft.
The SW 7 drive shaft of the JA drives is designed exclusively for transmission of the driving torque, not for bending or axial loads.

For additional important information on the JA drives see the separate JA operating manual.

The accessibility of the end position adjustment, commissioning of the drive system and service opening for maintenance must be guaranteed.

5 Accessories

5.1 Conversion gearbox

The drive motor can be positioned parallel to the drive train with the conversion gearbox. The gearbox has a ratio of i = 1.91.
Drive torque: max. 10 Nm
Output torque: max. 19 Nm
Pinion: V2A

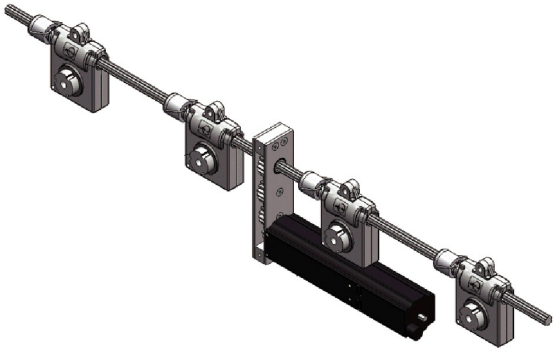

Abb. 6 General view of the application of the conversion gearbox

The fitting position of the conversion gearbox must be centred in the drive train.

Assembly:
The conversion gearbox is fastened to the structure with 4 internal thread M6 x 12 bolts. Note that the gear wheel with internal profile teeth is aligned with the devices to allow easy insertion of the profile shaft when that is installed. The drive motor is adjusted in the gear wheel with an internal hex.

Axial dimension A	Part number
68,7 mm	75220520x
110,7 mm	75211470x

5.2 Angle gearbox 90°

The drive motor can be positioned at 90° to the drive train with the angle gearbox (TN 75153000x). The gearbox has a ratio of i = 2.
Drive torque: max. 10 Nm
Output torque: max. 20 Nm

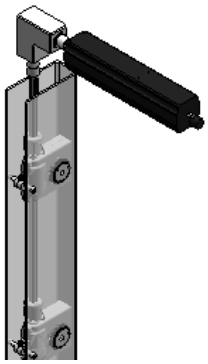

Abb. 7 General view of the application of the angle gearbox

Assembly:
The angle gearbox is pushed onto the profile shaft and fastened to the structure with 4 internal thread M6 x 10 bolts. The drive motor is adjusted in the gear wheel with an internal hex. The separate locking ring is fixed to the profile shaft if required to limit its movement.

5.3 Adapter vertical

Assembly:
The adapter is positioned between profile shaft and drive motor and bolted to the profile shaft. (Adapter vertical TN 75135910x).

5.4 Adapter horizontal

Assembly:
The adapter is positioned between profile shaft and drive motor and fastened on both sides (adapter horizontal TN 75128920x).

6 Declaration of incorporation

The complete declaration of incorporation can be downloaded from our website: www.elero-linear.de/downloads.

7 Waste disposal

7.1 Scrapping

When scrapping the device, comply with the internationally, nationally and regionally specific laws and regulations valid at that point in time.

Ensure that the recycling capability, dismantling capability and separation capability of the materials and subassemblies as well as the environmental and health dangers are all taken into consideration for the recycling and waste disposal.

Material groups, such as plastics and metals of different types, must be sorted before submitting to the recycling and waste disposal process.

7.2 Disposal of waste electrical and electronic components

The disposal and recycling of waste electrical and electronic components must take place in compliance with the relevant laws and national regulations.

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