LCB Manual - Installation, Commissioning, Maintenance and Repair

LCB Compact Linear Actuator

192-510014 N03

July 2006

Sizes LCB040 and LCB060

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1. Introduction

In this chapter you can read about:

1.1 Device assignment

This manual applies to the following devices:

Linear actuator: LCB040

Linear actuator: LCB060

Contents

2. Safety Instructions

2.1 Intended use

The LCB linear actuator has a number of uses including:

Positioning, transporting, feeding, removing, pallet handling, loading, unloading, processing and manipulating workpieces or tools.

Since the LCB can be used in a very wide range of applications, the user is responsible for its use in specific applications.

The user must ensure that mounting workpieces or tools on the sliding carriage of the linear actuator does not cause danger of injury to persons and/or damage to property. This also applies, for example, to the case of a broken timing belt.

The linear actuator must only be used in areas that are not accessible to persons during operation.

If the linear actuator is used in areas accessible to people, it must be installed in such a manner that no one can be endangered during operation.

2.2 Identifying Residual Dangers and Hazardous Areas

If there are still residual dangers present to persons or property from the linear actuator in spite of operating it in a safe manner, the user must make reference to these residual dangers through signs and written rules requiring appropriate procedures.

The following safety signal words are used:

Danger	Indicates that an imminent hazardous situation may lead to death or serious bodily harm if not prevented using appropriate safety measures.
Warning	Indicates a potentially hazardous situation which, if not avoided using appropriate safety measures, could result in serious or minor injury.
Caution	Indicates a potentially hazardous situation which, if not avoided using appropriate safety measures, may result in minor injury or damage.
Hint	Provides important information about the product, how to handle the product or about the part of the manual to which particular attention must be paid.

2.3 General hazards on Non-compliance

This machine component has been designed in accordance with state-of-the-art technical developments and is operationally reliable. If it is not operated by qualified or at least trained personnel or if it is operated improperly or not in accordance with the operating instructions, however, the unit may bear the risk of hazards.

- The following danger may occur:
  - Physical danger and threat to the life of the user or other parties
  - Detriment to the machine and the property of the user

If the linear motor module is installed in a machine, the safety requirements noted in the operating instructions for that machine must be combined with those described in this manual.

2.4 Working safely

2.4.1. Heed the Instructions

The information (such as instructions and notes) contained in the commissioning instructions must be heeded for all work involved in installing, commissioning, setting up, operating, changing operating conditions and modes, servicing, inspecting and repairing the unit.

2.4.2. Operating personnel.

The following jobs must only be performed by appropriately trained and authorised personnel:

- Installation and set-up tasks on the linear motor module
- Attaching safety transmitter switches (initiators)
- Connecting the drive and testing the travel direction

2.5 Safety Instructions for the Company Using the System

Supervisors must also become familiar with the entire chapter entitled "Safety" and handling required on the linear motor module.

Supervisors must ensure that installation and operating personnel have read and understand the chapter entitled "Safety" and the description of how to work with the machine, and that they observe the instructions.

The linear motor module must always be in flawless condition during operation.

2.6 Safety Instructions for Operating Personnel

Any work step that has a negative effect on the operating safety of the linear motor module must be omitted.

Operating and supervisory personnel are required to check the linear motor module or machine at least once per shift for externally visible damage or defects. Changes that have occurred (including the operating behaviour) that could have a negative effect on the operating safety must be reported immediately.

Components and accessories are designed especially for this product. When purchasing spare and wearing parts, use only original Parker parts. We note here explicitly that we are unable to check or release spare parts or accessories that were not provided by us. Installing and/or using such products may cause negative changes in the required design properties in some circumstances, which in turn could negatively effect the active and/or passive operating safety of the product.

The manufacturer is unable to accept any liability for damage caused by using non-original parts and accessories.

Safety and protection devices are strictly NOT to be removed or bypassed or set out of order.

Applicable requirements and national accident prevention regulations must always be observed when installing and operating our linear motor module.

2.7 Instructions for Special Hazards

The LCB must be fastened or supported at the required minimum distances according to information provided in this manual.

The operator must ensure that movements of the LCB do not cause any danger.

If the LCB moves in hazardous areas, these areas can be safeguarded with safety transmitter switches.

2.8 User Conversions and Changes are Not Permitted

The linear actuator must not be changed in its design or in terms of safety without our approval. Any change as defined here made by the user excludes any liability on our part.

2.9 Transport

Danger	Never step under overhead loads – danger of being injured! Moving parts – especially the sliding carriage* of the linear actuator – must always be secured against slipping or moving.

*By wrapping several turns of strong adhesive tape around the sliding carriage, which if possible is in the centre of the profile, for example.

Hint	Danger when transporting long actuators. Because the actuator bends under its own weight, guiding accuracy may deteriorate significantly. In addition, the shape of the profile may change and the travel behaviour of the sliding carriage may be negatively affected.

In general no means of transport are needed for the LCB. The linear actuator can be carried, depending on the size, by one or two persons.

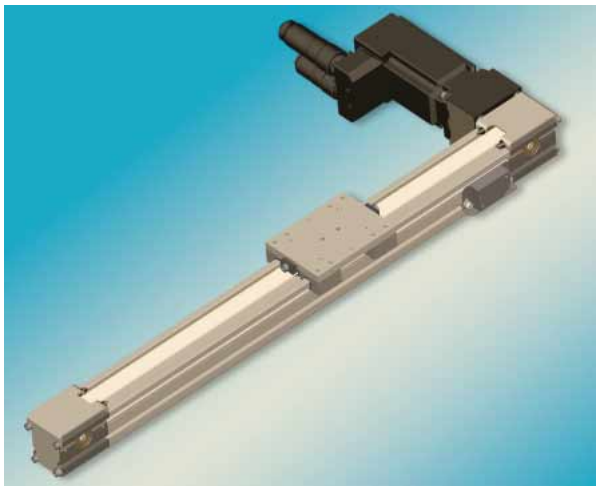
2.9.1. Product description

Features

- Available in 2 sizes
  - LCB040
  - LCB060
- Maximum thrust force
  - 160N (LCB040)
  - 560N (LCB060)
- Typical payload
  - 1kg - 6kg (LCB040)
  - 1kg - 30kg (LCB060)
- Maximum static bearing capacity in normal direction:
  - 1,250N (LCB040)
  - 3,850N (LCB060)
- Maximum stroke
  - 2m (LCB040)
  - 5.5m (LCB060)
  - Velocity up to 8m/s
  - Acceleration up to 20m/s^2
  - Repeatability: ±0.2mm

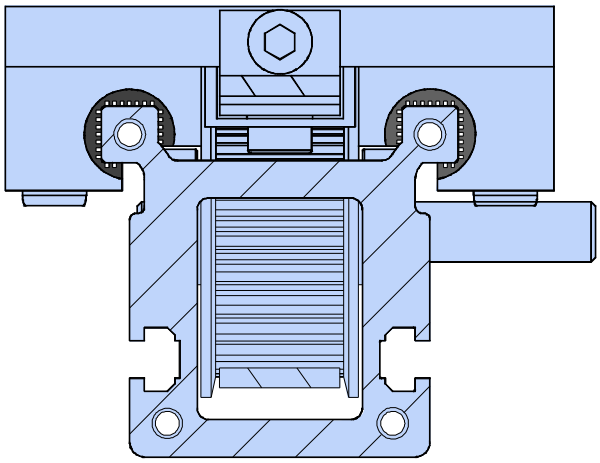
Typical areas of application

- Pick-&-Place applications
- Packaging, labelling and wrapping systems
- Sensor and format adjustment (e.g. back-stop)
- Pusher-, picker- and gripper applications
- Positioning
- Feeding
- Cutting

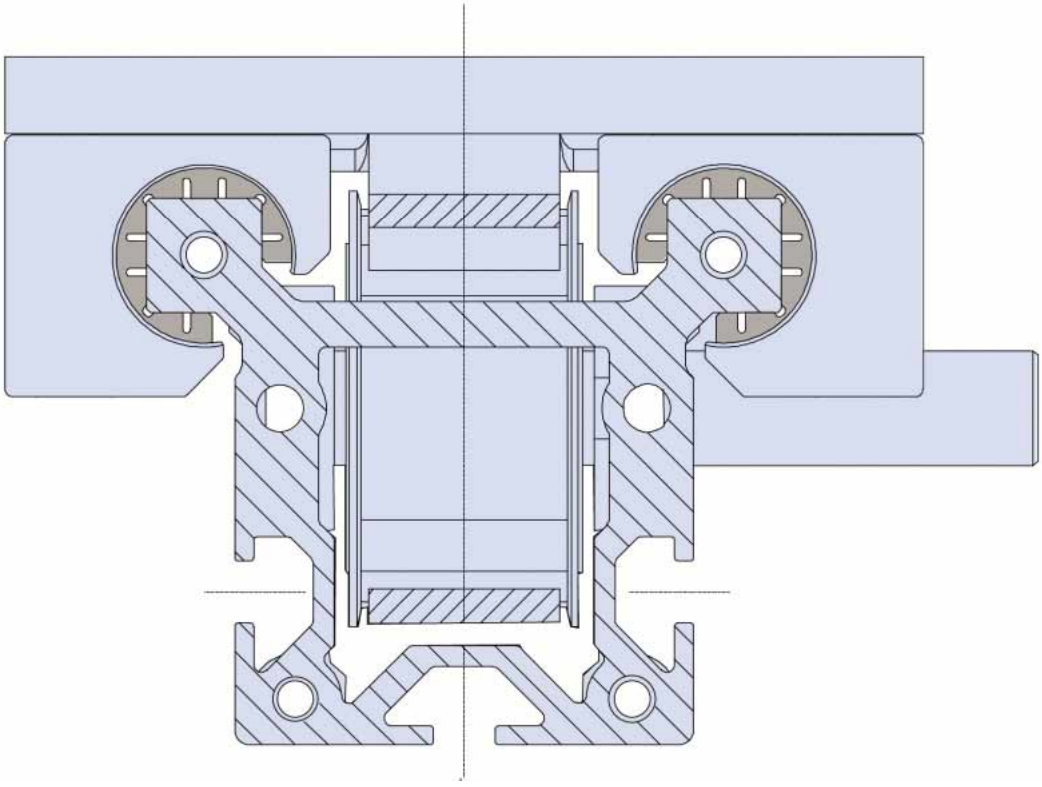


3. LCB040 & LCB060

In this chapter you can read about:



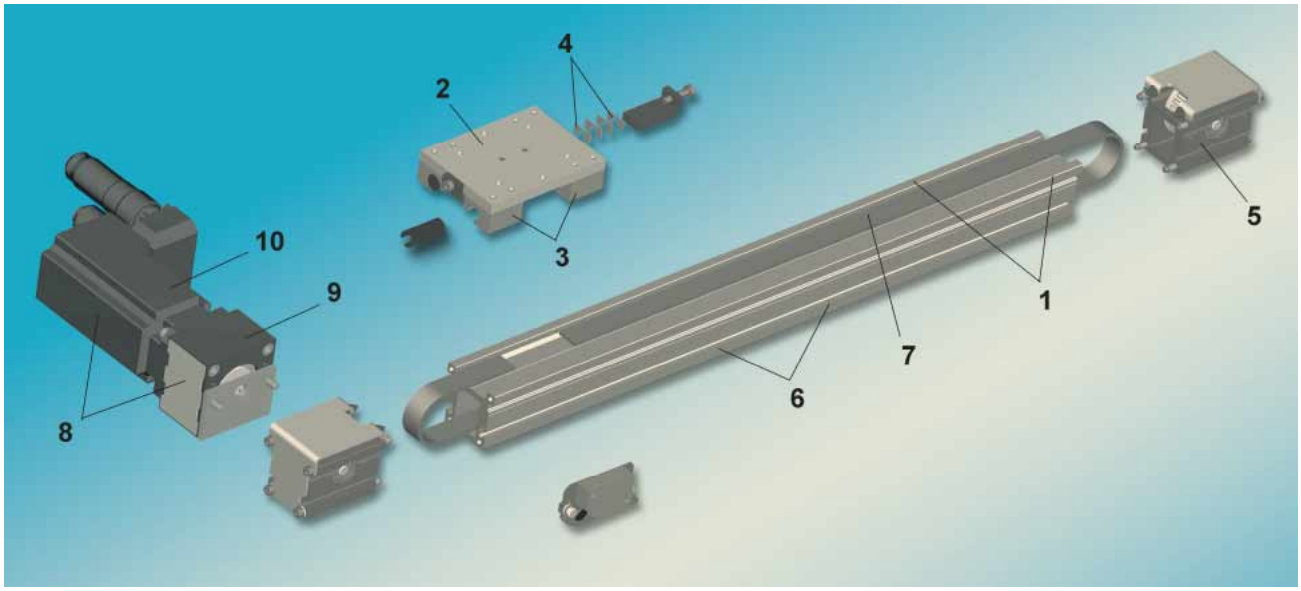
LCB040



LCB060

M1:1
(protection of utility patents: 20 2004 014 821.8)

3.1 Product design



The LCB is protected
by registered design No. 20 2004 014 821.8 20 2004 014 821.8

Guide (1) / sliding carriage (2):

- The external sliding guide is incorporated as part of the aluminium profile. It is unnecessary to adjust two separate guiding rails.
- The sliding carriage is available in three lengths. With a longer sliding carriage there is greater distance between the sliding blocks (3) and this improves the load capacity with respect to yawing and pitching moments.
- Maintenance-free sliding guiding with integrated dry-film lubricant.
- Sliding carriage (3) can be easily changed within 2 minutes without detensioning the timing belt.
- The timing belt of LCB40 is tensioned directly at the sliding carriage by means of spacer plates (4). On the LCB060, the timing belt is tensioned via tensioning screws at the tensioning station (5).
- The low moving mass allows highly-dynamic movement to be achieved and saves operating power.

Profile (6):

- Available in 2 sizes
- High resistance to flexing
- High torsional stiffness due to the closed profile
- Compact design, minimum installation space required
- Dirt tolerant, chemically and mechanically robust

Timing belt drive (7):

- High stiffness and accuracy provided by the generously-dimensioned timing belt.

Drive (8):

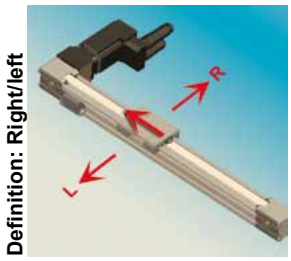
- Drive options:
  - Linear actuator with free shaft end
  - Coupling (9) & gearbox
  - Coupling, gearbox and motor (stepper or servo)
  - Coupling, gearbox, motor and controller
  - Coupling and direct-drive motor (10) with Compax3.

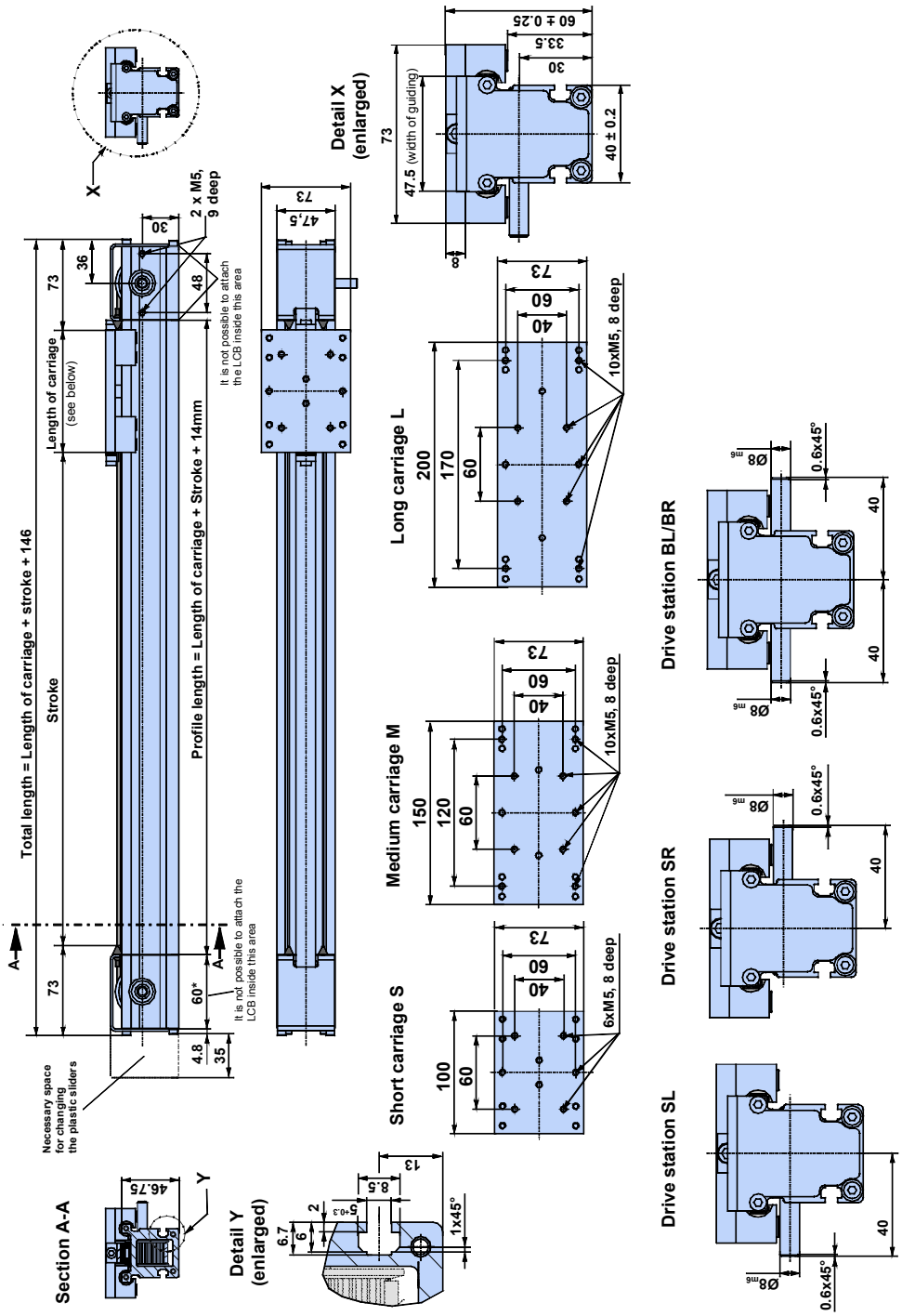
3.2 Mechanical data

3.2.1. Dimensional drawings LCB040 & LCB060

LCB040 Basic unit dimensions

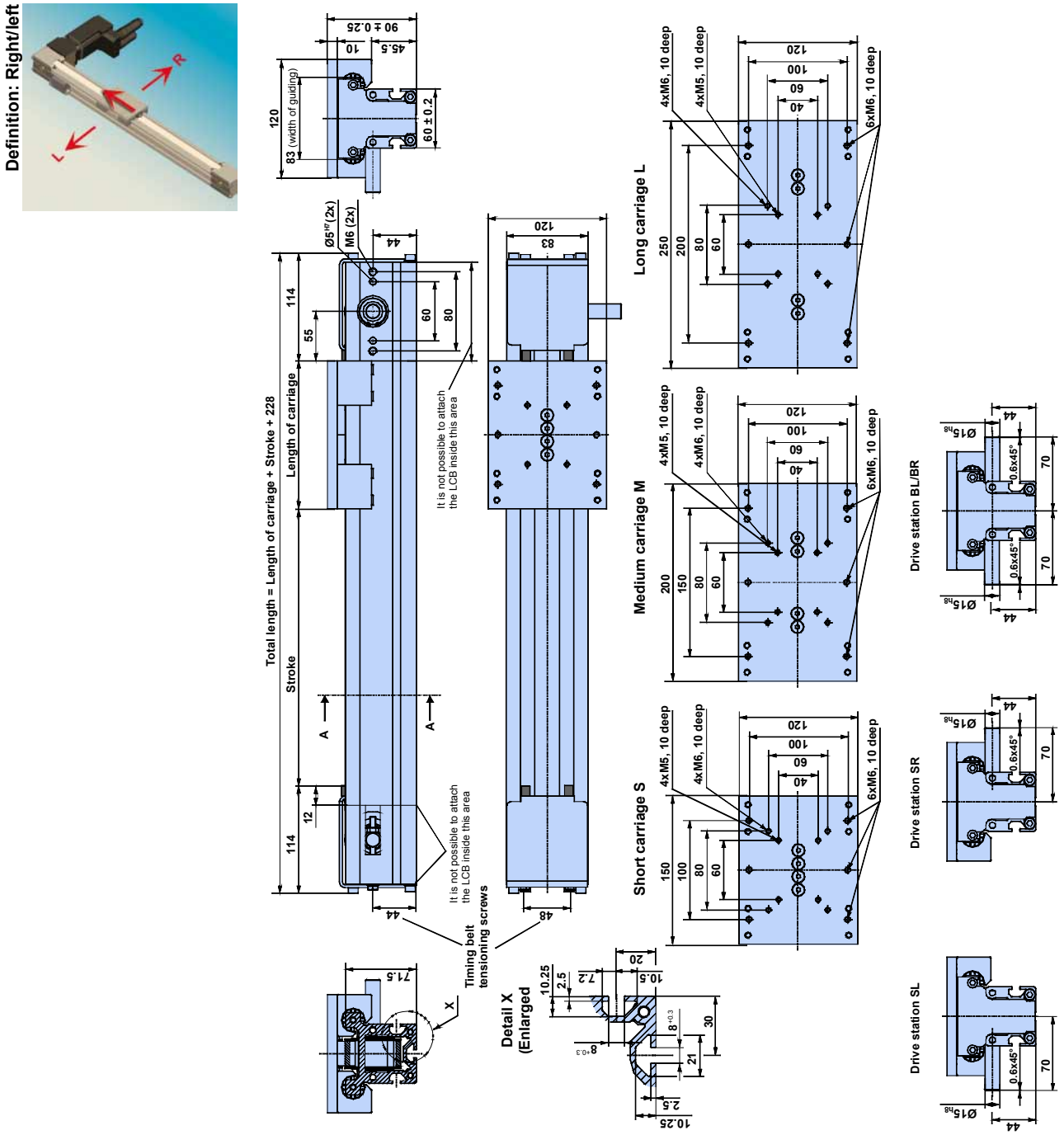
3D CAD-Data http://www.parker.com/ead/cm2.asp?cmid=10008





LCB060 Basic unit dimensions

3D CAD-Data http://www.parker.com/ead/cm2.asp?cmid=10008

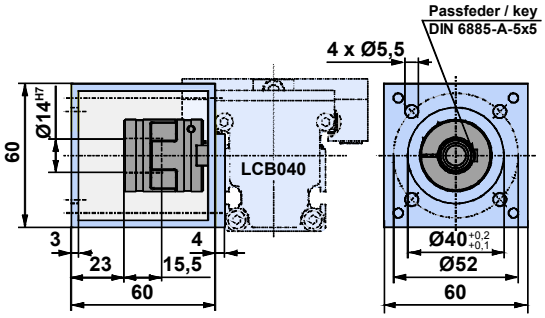


3.2.2. Dimensional drawings of drive options

LCB drive options L, M

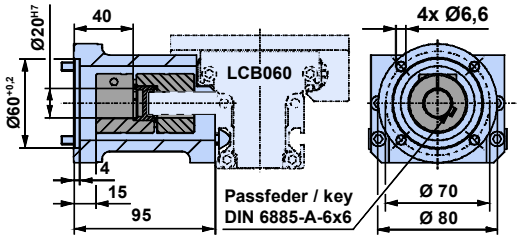
Drive option L

LCB040 prepared for planetary gearbox PTN060



Drive option M

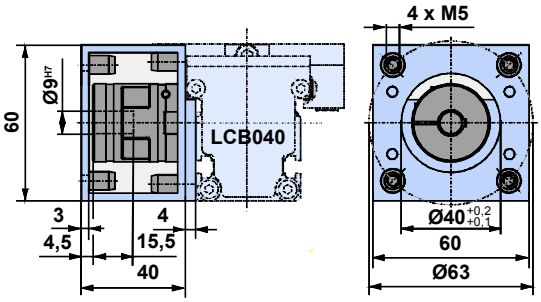
LCB060 prepared for planetary gearbox PTN080



LCB drive options U, W

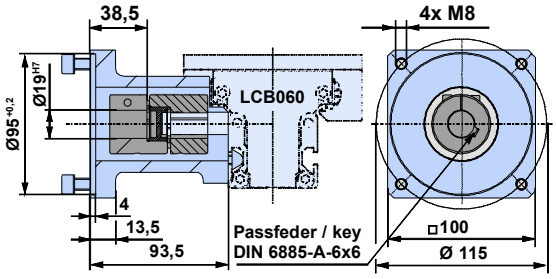
Drive option U

LCB040 prepared for servo motor SMH60 (direct drive)
only for single actuators with horizontal installation position



Drive option W

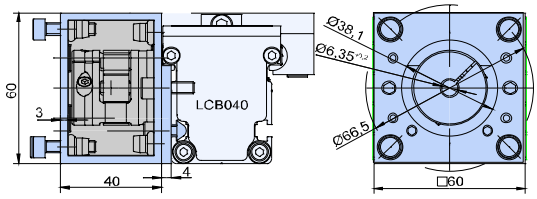
LCB060 prepared for servo motor SMH100 (direct drive)
only for single actuators with horizontal installation position



LCB drive options N, P

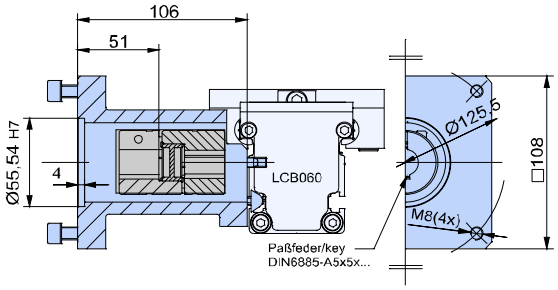
Drive option N

LCB040 prepared for stepper motor SY56 (direct drive)
only for single actuators with horizontal installation position



Drive option P

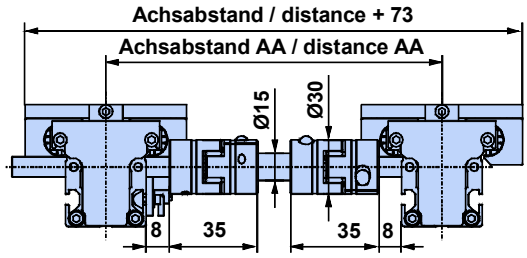
LCB060 prepared for stepper motor SY107 (direct drive)
only for single actuators with horizontal installation position



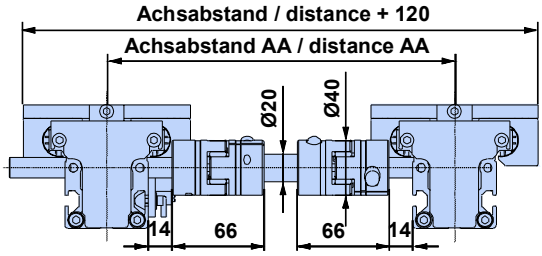
3.2.3. Dimensions dual-axis actuator

Dimensions dual-axis actuator

LCB040



LCB060



3.3 Technical data

Technical data issued 05/2005, using safety factor S=1. The technical data applies under standard conditions and only for the individually specified operating mode and load. In the case of compound loads, it is necessary to verify in accordance with normal physical laws and technical standards whether individual ratings should to be reduced. In case of doubt please contact Parker Hannifin.

Travel length and speed

LCB - Size	Units	LCB040	LCB060
Maximum travel speed	m/s	5	8
Maximum acceleration	m/s^2	20	20
Maximum stroke	mm	2000	5500

Torques, forces, dimensions of pulley and timing belt

LCB - Size	Units	LCB040	LCB060
Travel distance per revolution	mm/rev	125	170
Diameter of pulley	mm	39.79	54.11
Timing belt width / pitch	mm	16 / 5	25 / 10
Weight of timing belt	kg/m	0.048	0.167
Maximum drive torque	Nm	3.2	15.2
Static load capacity in normal direction	N	1250	3850
Maximum thrust force (effective load)	N	160	560
Repeatability	mm	± 0.2	± 0.2

Weight and mass moments of inertia

LCB - Size	Units	LCB040	LCB060
Weight of base unit with zero stroke			
LCB with short sliding carriage	kg	1.47	4.33
LCB with medium sliding carriage	kg	1.66	4.71
LCB with long sliding carriage	kg	1.85	5.10
Weight of moved mass with short sliding carriage	kg	0.39	1.41
Weight of moved mass with medium sliding carriage	kg	0.46	1.53
Weight of moved mass with long sliding carriage	kg	0.53	1.66
Additional weight per metre of stroke	kg/m	2.45	5.21
Mass moment of inertia relative to the drive shaft			
LCB with free shaft, short sliding carriage, 1m of stroke	$kgcm^2$	2.44	14.83
LCB with free shaft, medium sliding carriage, 1m of stroke	$kgcm^2$	2.72	15.80
LCB with free shaft, long sliding carriage, 1m of stroke	$kgcm^2$	3.00	16.72
Mass moment of inertia of coupling	$kgcm^2$	0.01	0.06
Additional mass moment of inertia due to the weight of the timing belt per metre of stroke	$(kgcm^2)/m$	0.37	5

Overall dimensions & physical data

LCB - Size	Units	LCB040	LCB060
Length with short sliding carriage, zero stroke	mm	246	378
Length with medium sliding carriage, zero stroke	mm	296	428
Length with long sliding carriage, zero stroke	mm	346	478
Cross-section (height x width x profile width)	mm x mm	40 x 60 x 73	60 x 90 x120
Moment of inertia I_x	cm^4	17.93	92.9
Moment of inertia I_y	cm^4	17.79	109.3
Moment of inertia I_t	cm^4	35.68	202.2
E-modulus (aluminium)	N/mm^2	$0.72x10^5$	

Temperature data

Temperature range	-20°C to +60°C The nominal data are valid for ambient temperatures between +15°C and +30°C.

3.3.1. Load diagrams / wear

Requirements: The diagrams are valid solely for the guiding and under ideal operating conditions, faultless guidings provided.
The diagrams are based on a trapezoidal motion sequence with 3 identically long sections for acceleration, constant travel and deceleration.

The diagrams are normalized on defined payloads: LCB040 with 1 kgs, LCB060 with 5 kgs.

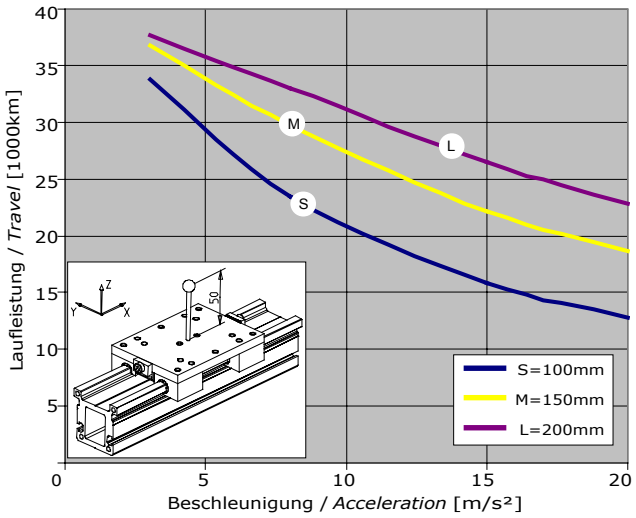
Shown are the respective mass centroids with their typical load arms.

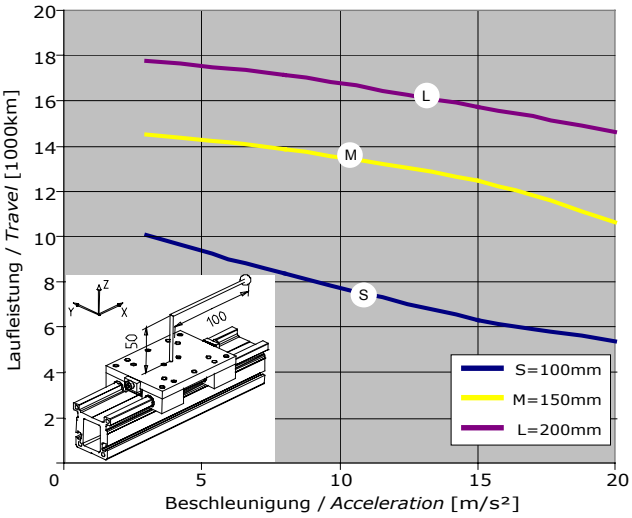
Lifetime: Naturally, the sliding guiding has already a slight play under new condition, so that the guiding does not jam and the sliding carriage moves smoothly. The play is measured as a gap for each slide and is approx. 0.1 to 0.2mm in normal direction and at the sides.
During the operation, the play increases according to the loads shown in the diagrams.

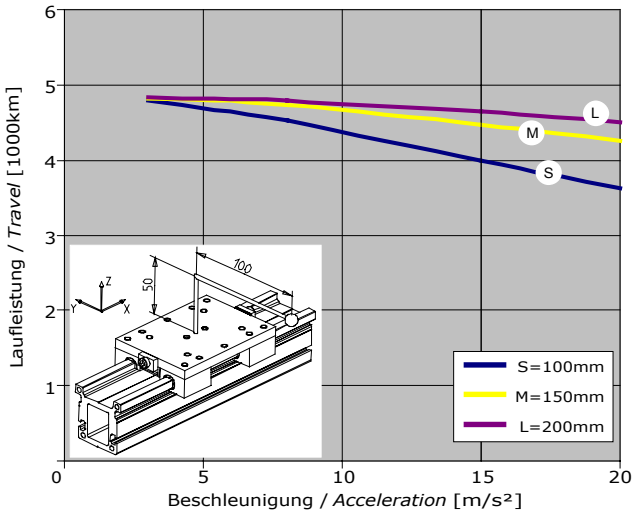
If a certain state of wear is reached, at the lastest however at the wear limit (0.5mm for the LCB040, 1.0mm for the LCB060), the slides can be exchanged easily within a few minutes. After the exchange, a new liftime cycle begins according to the diagrams.

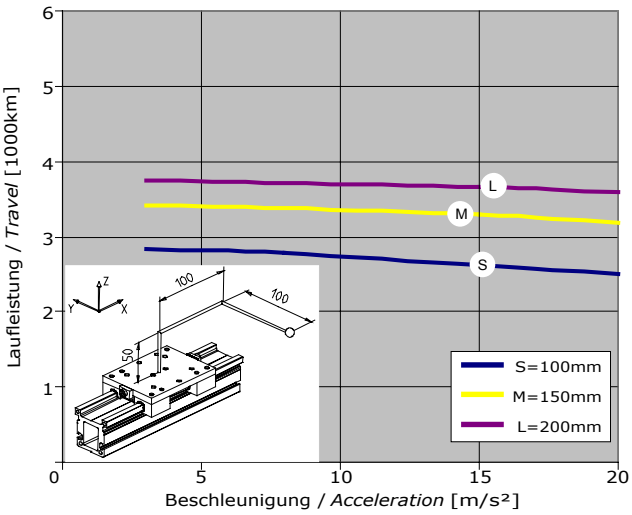
Use of the diagrams: The diagrams can be interpolated with respect to lifetime and extrapolated with respect to load. (for example: halfed operational performance results in halfed wear, doubled load will result in halfed mileage in km).

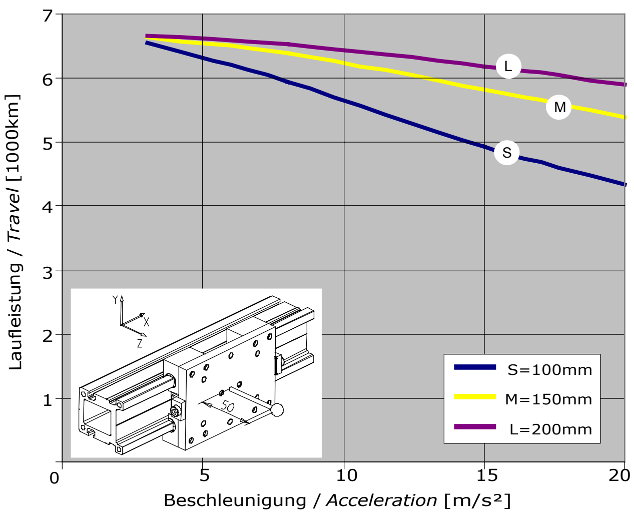
LCB040 – Lifetime / slides

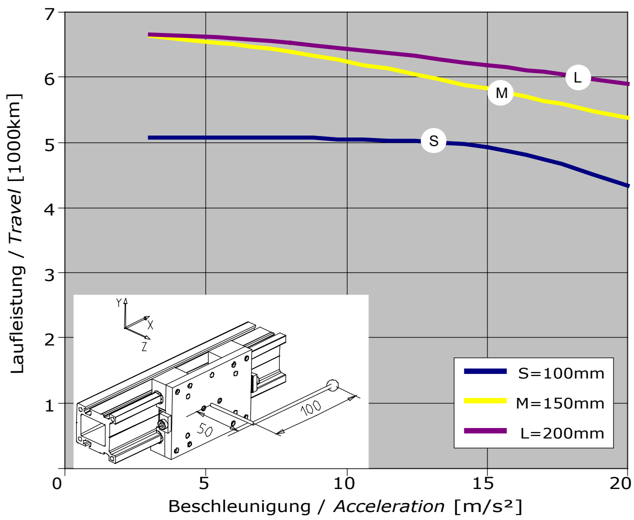









Laufleistung / *Travel* [1000km]
Beschleunigung / *Acceleration* [m/s²]
S=100mm
M=150mm
L=200mm
L
M
S
50


Laufleistung / *Travel* [1000km]
Beschleunigung / *Acceleration* [m/s²]
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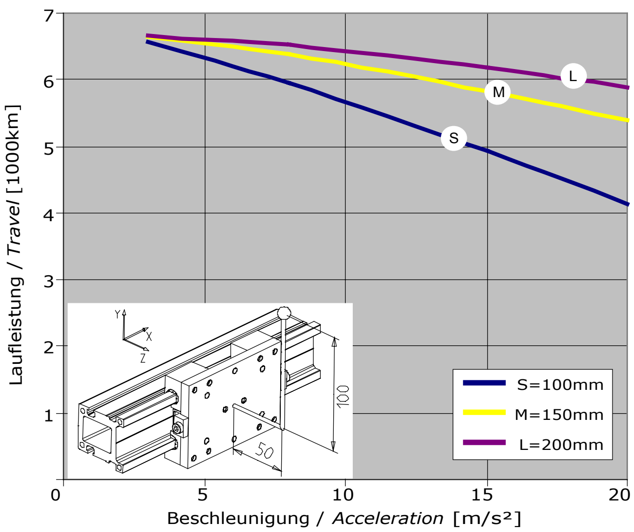
M=150mm
L=200mm
L
M
S
50
100


Laufleistung / *Travel* [1000km]
Beschleunigung / *Acceleration* [m/s²]
S=100mm
M=150mm
L=200mm
L
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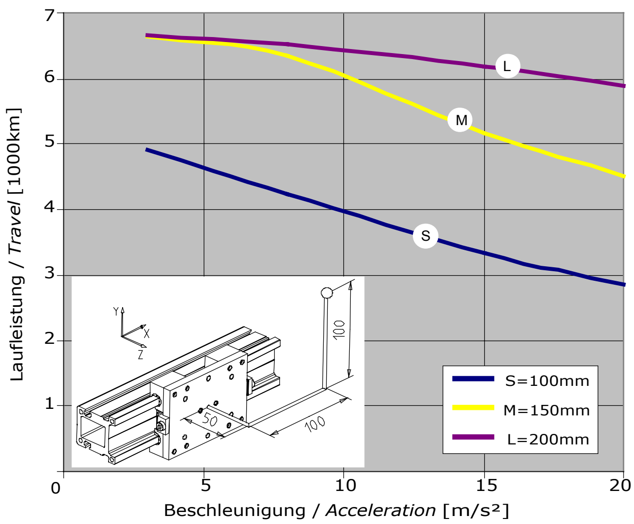
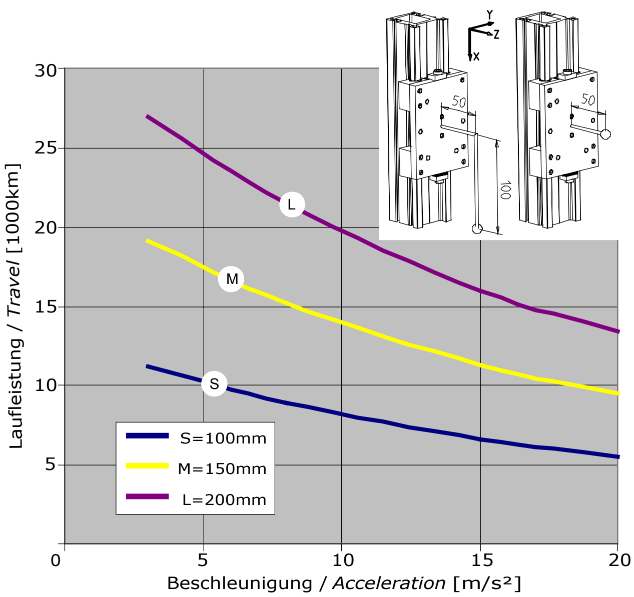
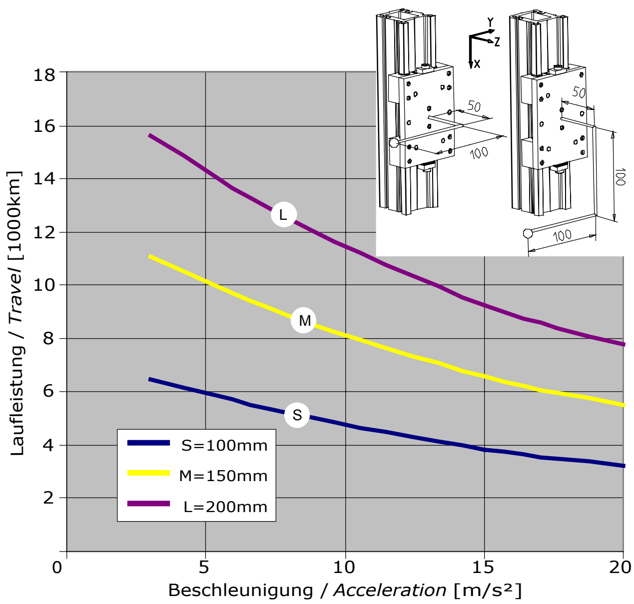
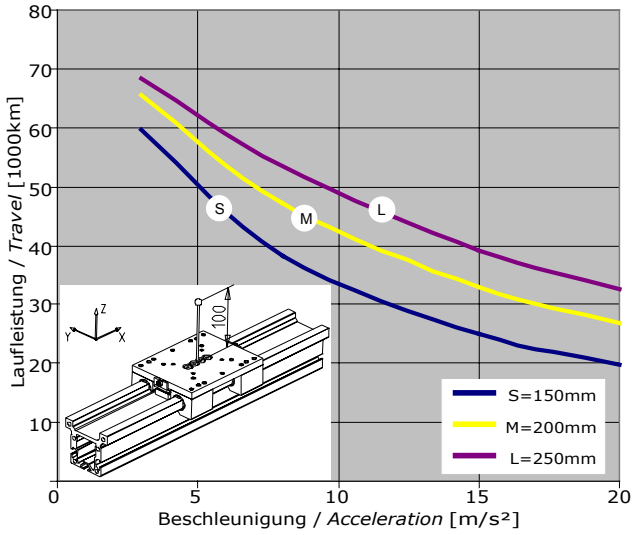
100

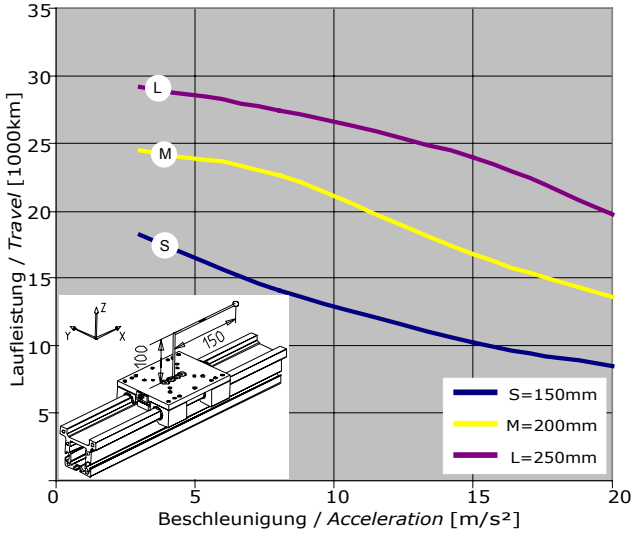

Laufleistung / *Travel* [1000km]
Beschleunigung / *Acceleration* [m/s²]
S=100mm
M=150mm
L=200mm
L
M
S
50
100

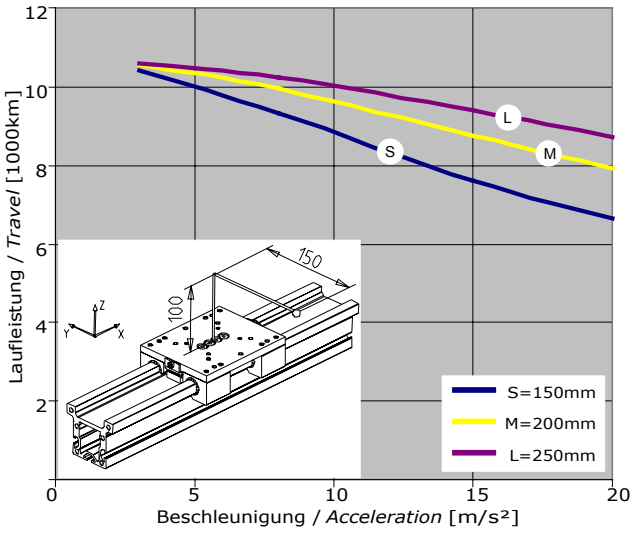

Laufleistung / *Travel* [1000km]
Beschleunigung / *Acceleration* [m/s²]
S=100mm
M=150mm
L=200mm
L
M
S
50
100

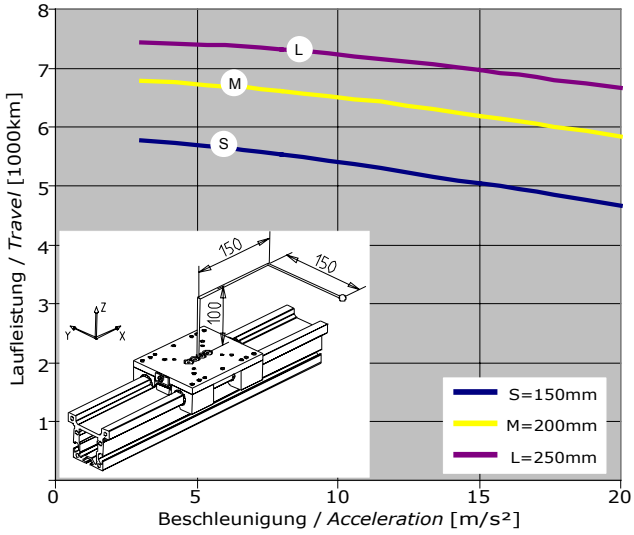

Laufleistung / *Travel* [1000km]
Beschleunigung / *Acceleration* [m/s²]
S=100mm
M=150mm
L=200mm
L
M
S
50
100

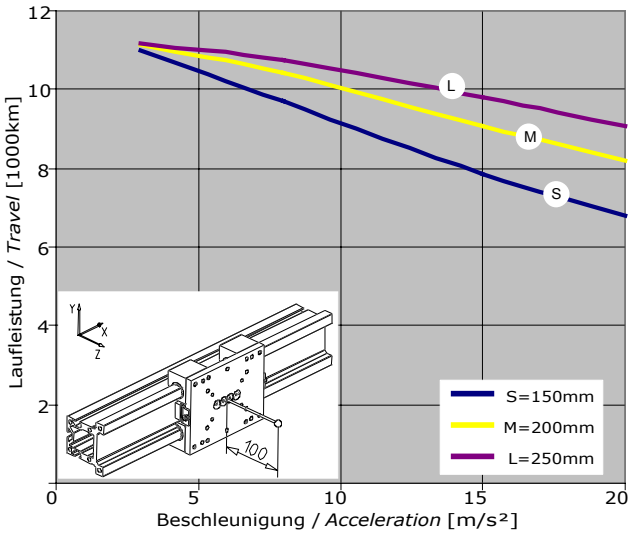
LCB060 – Lifetime / slides

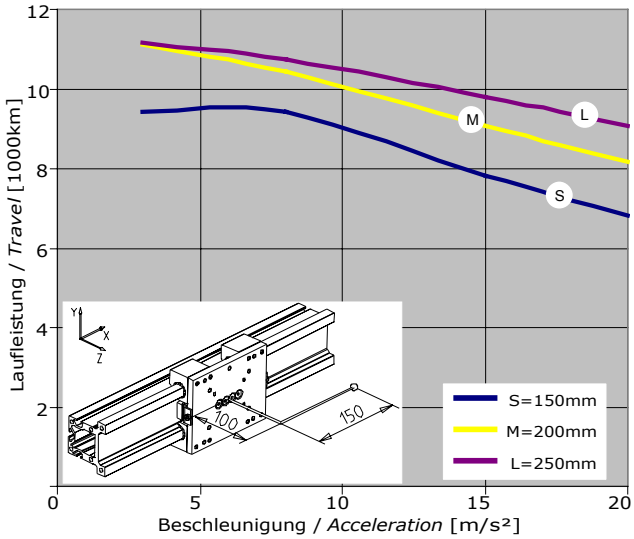


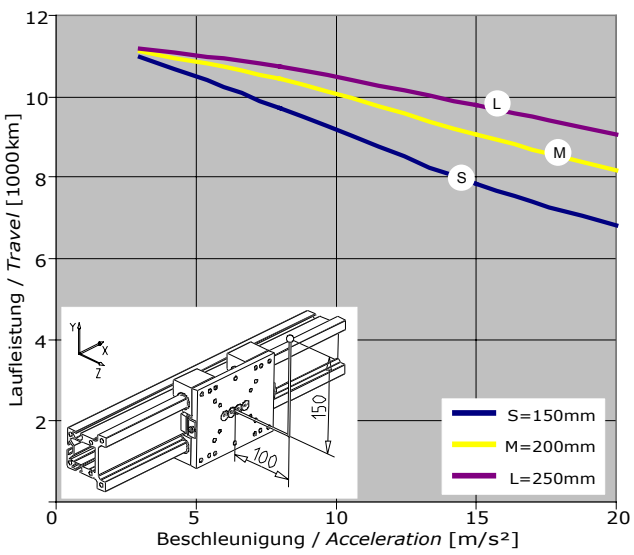


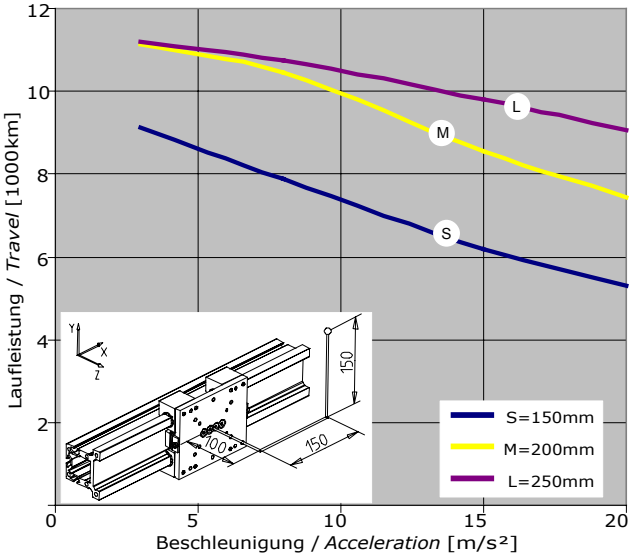


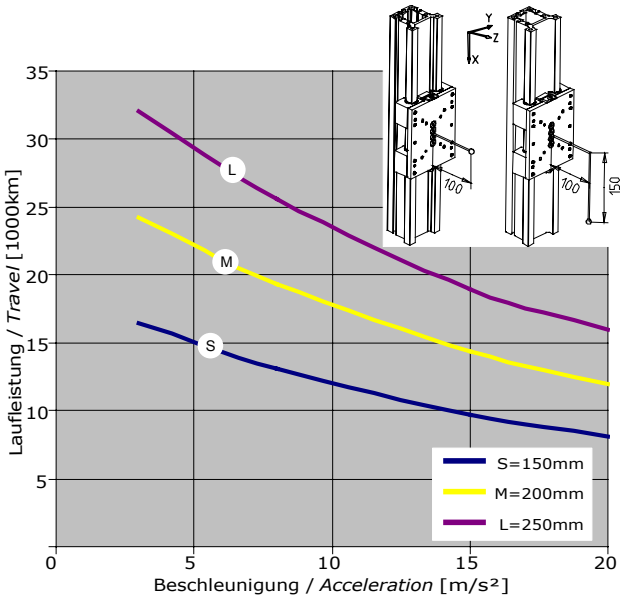


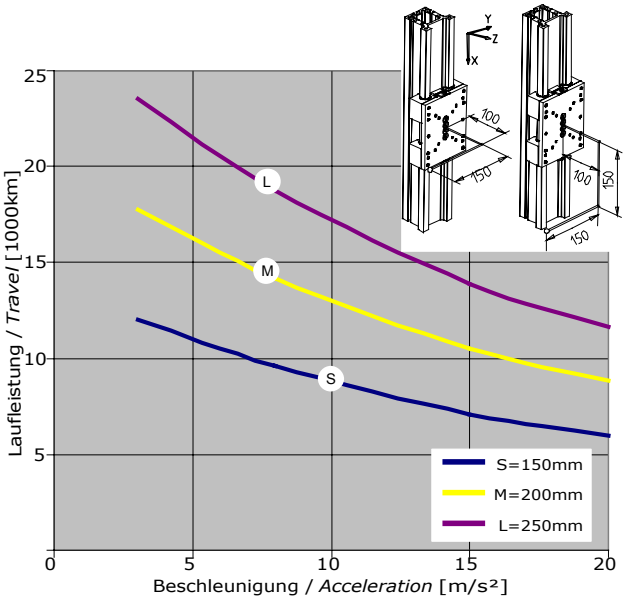





Laufleistung / *Travel* [1000km]
Beschleunigung / *Acceleration* [m/s²]
L
M
S
S=150mm
M=200mm
L=250mm
100
150


Laufleistung / *Travel* [1000km]
Beschleunigung / *Acceleration* [m/s²]
L
M
S
S=150mm
M=200mm
L=250mm
100
150


Laufleistung / *Travel* [1000km]
Beschleunigung / *Acceleration* [m/s²]
L
M
S
S=150mm
M=200mm
L=250mm
100
100
150

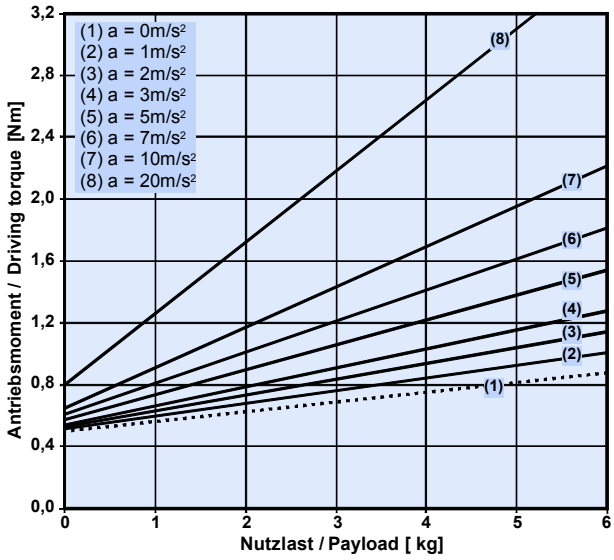

Laufleistung / *Travel* [1000km]
Beschleunigung / *Acceleration* [m/s²]
L
M
S
S=150mm
M=200mm
L=250mm
100
150
100
150
150

3.3.2. Required drive torque

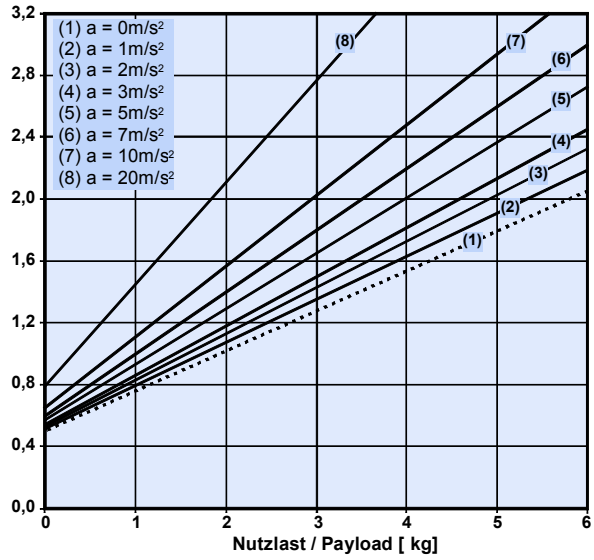
The diagrams include both acceleration and friction forces!

LCB040 – required drive torque

Horizontal mounting position



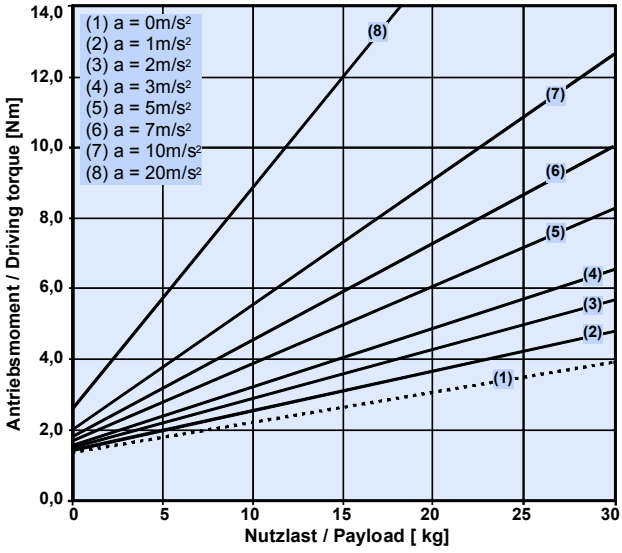
vertical mounting position (upward acceleration)



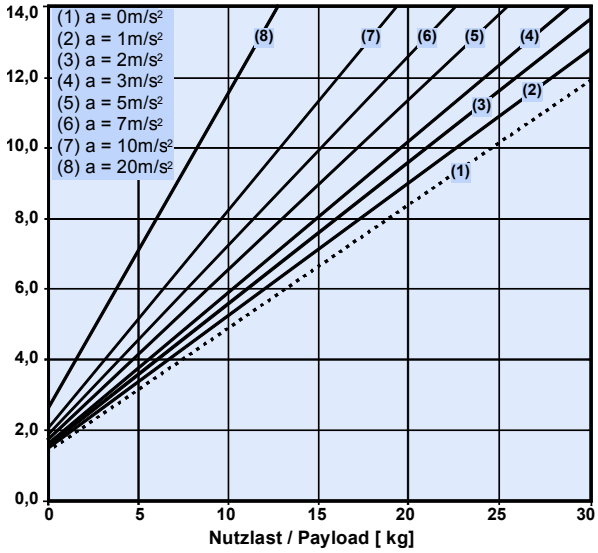
(1): Constant movement
(8): Acceleration

LCB060 – required drive torque

Horizontal mounting position



vertical mounting position (upward acceleration)



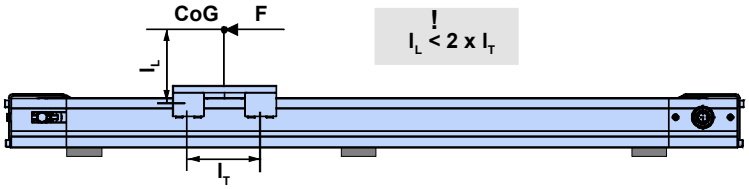
(1): Constant movement
(8): Acceleration

3.3.3. Location of mass barycenter or point of force application

2:1 rule

Displayed at the example of the pitching moment, is also valid for rolling and yawing moments respectively

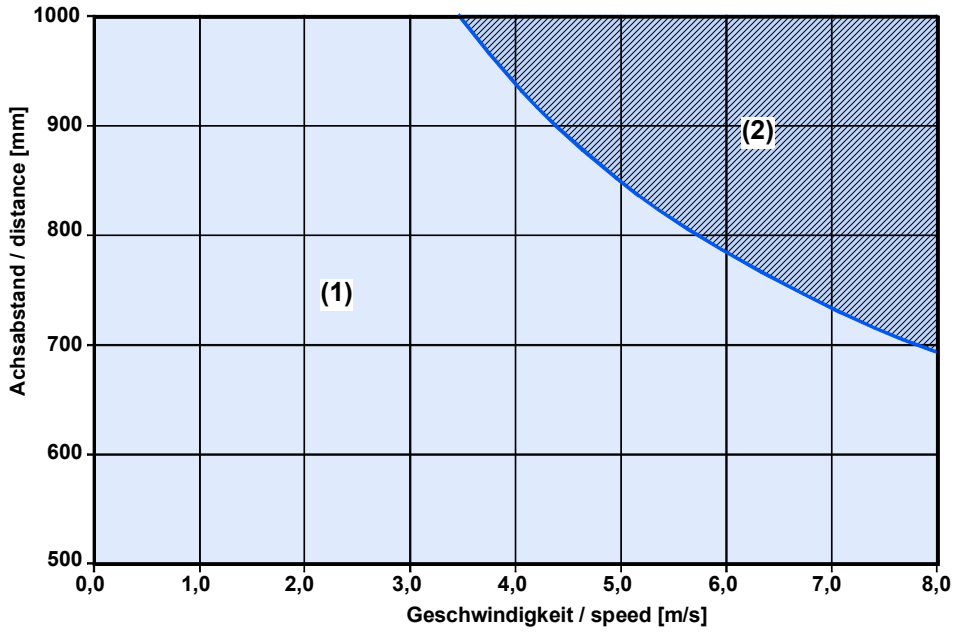
l_L = Load lever
l_T = Support lever



3.3.4. Critical whirling speed of the dual-axis actuator connection shaft

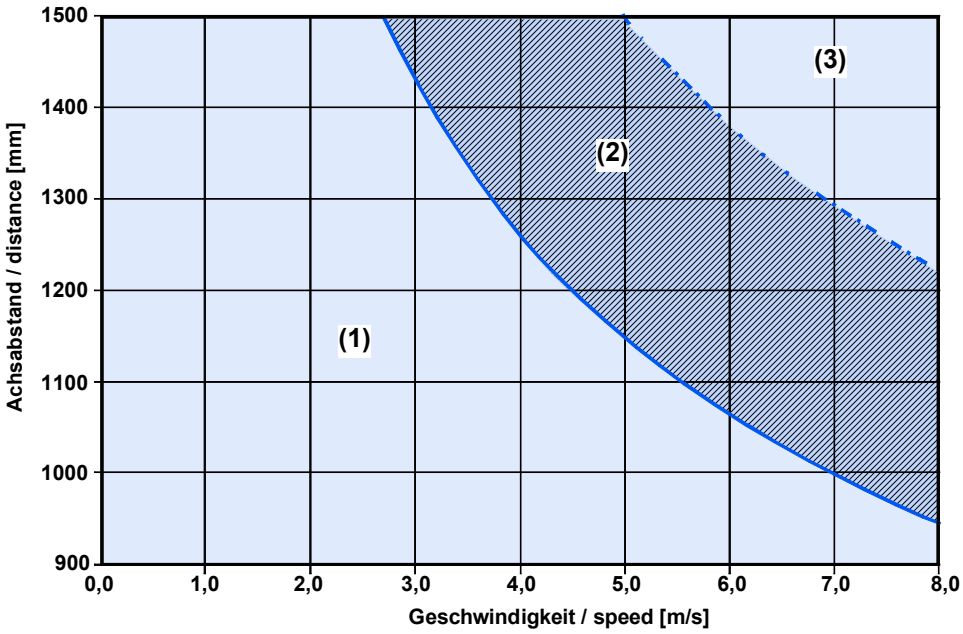
The critical whirling speed is the speed from which the connection shaft of the double-axis actuator shows natural oscillation. This oscillation can get so strong that, in an extreme case, the double-axis connection is destroyed.
The critical whirling speed depends on the length of the connection shaft (=linear to the axis distance) and on the speed of the shaft (=linear to the speed of the actuator). The diagrams show from where it is necessary to equip the connection shaft with an additional support in the middle of the shaft.

LCB040



(1) Connection shaft without intermediate shaft bearing
(2) Connection shaft must be supported

LCB060



(1) Connection shaft without intermediate shaft bearing
(2) Connection shaft must be supported
(3) impermissible range

4. Set-Up

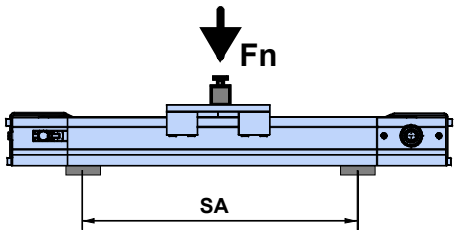
In this chapter you can read about:

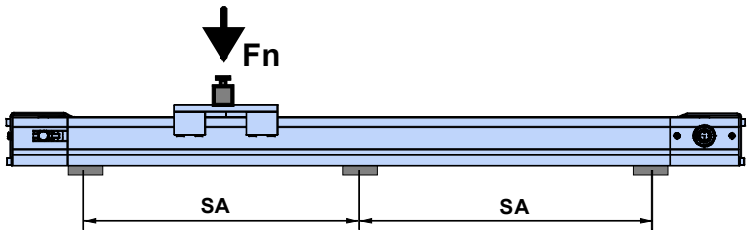
4.1 Preparations for substructure

Each holding point must be even with a flat parallelism of 0.2 mm. All holding points must be aligned with parallelism to each other of better than 0.5 mm.

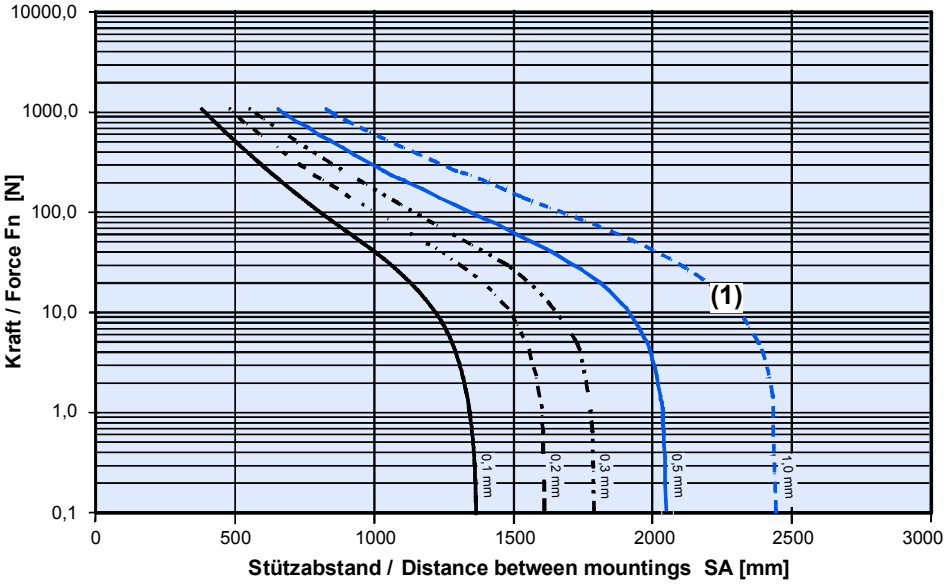
To simplify installation and adjustment, the holding points for the linear actuator can also consist of adapter plates. They can be aligned with tightening and pressure screws.

Deflection vs. distance between mountings and payload



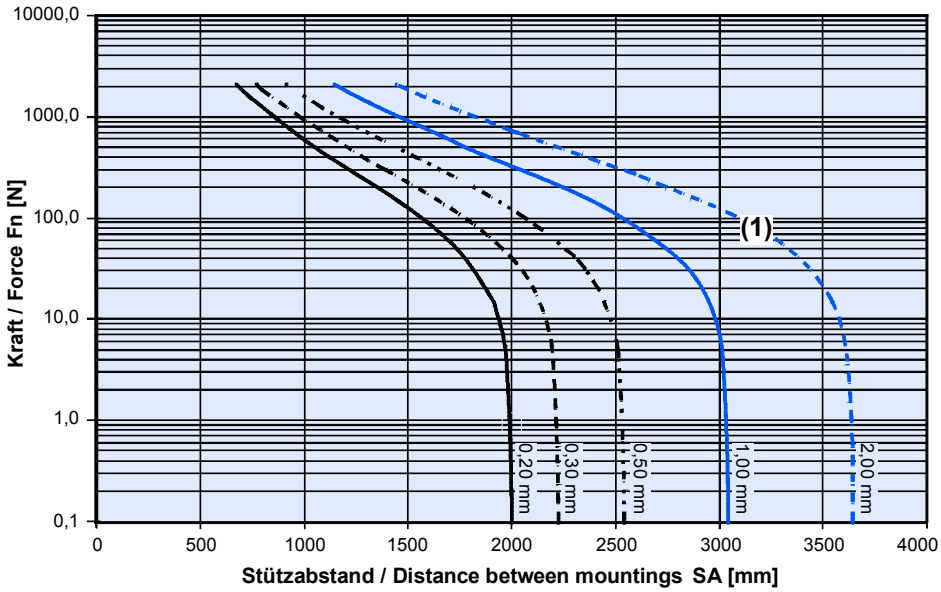


LCB040



(1): Max. permissible deflection

LCB060



(1): Max. permissible deflection

4.2 Fitting / mouting

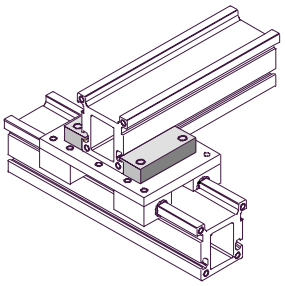
4.2.1. Installation of a single actuator

Caution	Danger when transporting long actuators. Because the actuator bends under its own weight, guiding accuracy may deteriorate significantly. In addition, the shape of the profile may change and the travel behaviour of the sliding carriage may be negatively affected. **Additional information on transport:** (see on page 8)

Hint	When fitting the LCB into your plant, please make sure that the deflection station and the sliding carriage are accessible for maintenance! (Provide enough space behind the deflection station so that the sliding blocks or the sliding carriage can be removed).

- Take the linear actuator out of the shipping crate.
- Place the LCB on the connection points, which have been previously levelled (water level, levelling device).
- Fasten the actuator in place. **(mounting possibilities for LCB** (see on page 25)**)**
- Fasten the connection parts in place.

Hint	**There are two ways to fasten the LCB in place.**



- Mounting with clamping profiles or

With T slot bolts/nuts that are guided into the grooves of the aluminium profile.

Type	Designation		D	E	l1	K	GA	L	Art. No.
LCB040	**T-Nut**		M4	8	11.5	4	4	--	127-004020
LCB040	**T-Nut**		M5	8	11.5	4	4	--	127-004021
LCB040	**Square nuts***	**DIN 562-M4**	M4	7	--	2.2	--	--	135-700001
LCB040	**Square nuts***	**DIN 562-M5**	M5	8	--	2.7	--	--	135-700003
LCB040	**Hexagon nut***	**DIN 934-M4**	M4	7	--	2.9	--	--	135-700600
LCB040	**Hexagon nut***	**DIN 934-M5**	M5	8	--	3.7	--	--	135-700700
LCB060	**T-bolt**	**DIN787 M8x8x25**	M8	13	13	6	--	25	131-700001
LCB060	**T-bolt**	**DIN787 M8x8x32**	M8	13	13	6	--	32	131-700002
LCB060	**T-bolt**	**DIN787 M8x8x40**	M8	13	13	6	--	40	131-700003
LCB060	**T-Nut**		M4	13.7	22	7	7.5	--	127-006015
LCB060	**T-Nut**		M5	13.7	22	7	7.5	--	127-006016
LCB060	**T-Nut**		M6	13.8	23	7.3	5.5	--	400-000033
LCB060	**T-Nut**		M8	13.8	23	7.3	7.5	--	400-000034

* Square and hexagon nuts should only be used for lightly-loaded attachments

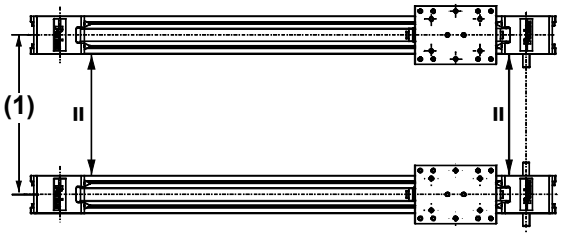
Hint	The standard installation position is horizontal with the sliding carriage up. Optionally (after consultation with the manufacturer) a horizontal installation position with the sliding carriage on the side or at the bottom or vertical installation are also possible.

4.2.2. Installation of a double-axis actuator

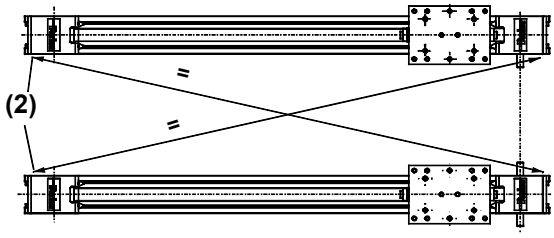
- Take the linear actuator out of the shipping crate.
- Place the LCB on the connection points, which have been previously levelled (water level, levelling device).
- Fix the module **(mounting possibilities for LCB** (see on page 25))
- Place second actuator and fix slightly.
- Measuring the parallelism (measure tape).
- Measure both diagonals in order to verify rectangularity (measuring tape). Correct diagonal measure by parallel movement of the second linear actuator, if necessary.
- Verify the horizontal alignment of the linear actuators (water level, levelling device) and correct if needs be.
- Fix the second actuator permanently.
- If the sliding carriages of the two linear actuators are to be linked mechanically, please take care that the system is mounted nondistortedly with respect to the guiding and the drive train. In order to avoid torsional stress, loosen and refasten the couplings of the shaft kit if needs be.

Alignment of a double-axis actuator

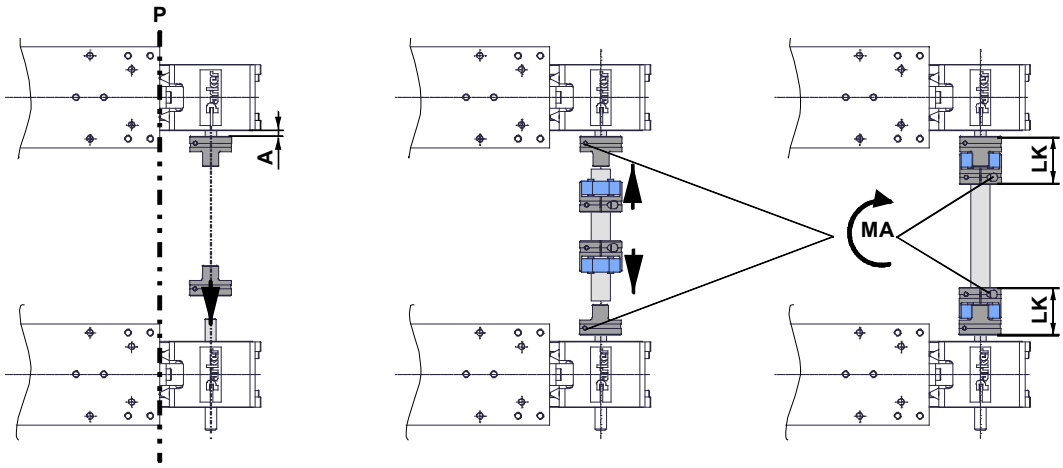
(1) Axis distance



(2) Measure to profile end



Installation of a shaft kit



- The sliding carriages of the two linear actuators must stand on the same position P (Recommendation: push both actuators to the same stop).
- Place half-coupling for small shaft diameter on the free shaft ends with distance A und tighten clamping screw with torque MA. Insert plastic part.
- Slide the two other coupling halves on to the connection shaft.
- Position connection shaft between the free shaft ends and push the respective coupling halves towards each other. Caution! Do not push to block – coupling package must have total length LK.
- Tighten clamping screws on both coupling halves on the connection shaft with torque MA.

		LCB040	LCB060	Units
A	**Distance coupling / drive station**	8	14	mm
MA	**Tightening torque of clamping screws**	1.4	10.5	Nm
LK	**Length of coupling package**	35	66	mm

4.2.3. End limits

The software end limits (programmable end limits) can be used to define the maximum travel path in the positive and negative direction. The machine zero initiator (home switch) must always be within the software end limits. The switch must be mounted so that the sliding carriage can under no circumstances travel beyond (the switch should ideally be mounted in proximity of the drive station or the deflection station. switching distance 2 – 4 mm) if needs be an additional external buffer must be fitted.

Caution	The software end limits are not preset. For this reason, they must be defined and entered into the control system before the unit is placed in service.
Hint	Recommendation: the actual zero point of your controller should be the same as the machine zero point.

4.2.4. Attachment of Motor or Gearbox

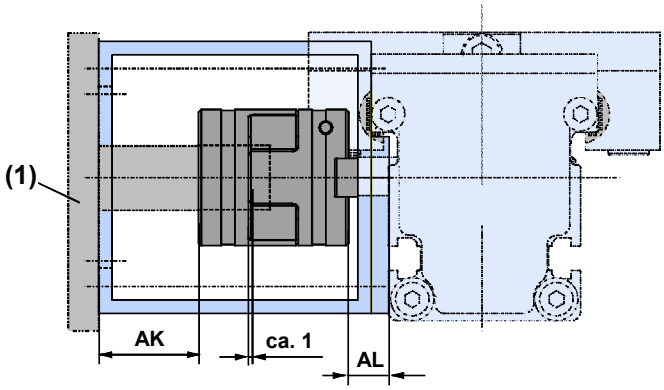
If you ordered the LCB together with a coupling kit, the coupling housing with the half-coupling is already mounted on the drive shaft of the linear actuator. In this case please proceed with step 2, if not start with step 1.

(1) If the coupling housing and the half-coupling are not pre-assembled, please proceed as follows:

- Place half-coupling for small shaft diameter on the drive shaft (with distance AL to LCB) and tighten clamping screw with torque MA.
- Insert plastic part.
- Mount coupling housing

(2) Coupling housing and half coupling are pre-assembled:

- Place the other half-coupling on the gear- or motor shaft and fix with distance AK to the flange surface of the drive unit with torque MA.
- Fix gearbox and motor to the coupling housing (the gearbox shaft must be exactly centrical with respect to the drive shaft of the linear actuator!
- There should be only an air gap of about 0.5-1mm between the half-coupling on the gearbox- or motor shaft and the other half-coupling.



Drawing without lateral cover

		LCB040			LCB060			Units
	Drive option	L (PTN060)	U (SMH60)	N (SY56)	M (PTN080)	W (SMH100)	P (SY107)	
AK	Distance between flange surface of the coupling housing and the coupling	23	4.5	40	15	13.5	54	mm
MA	Tightening torque of clamping screws	1.4			10.5			Nm
AL	Distance between flange surface of the coupling housing and the drive station	8			14			mm

Dimensional drawing drive options (see on page 14)

5. Maintenance and service

In this chapter you can read about:

Use only repair parts of Parker Hannifin GmbH & Co.KG.

Improper or unprofessional repair will lead to an expiry of any warranty.

If you encounter problems, please contact:

Parker Hannifin GmbH & Co KG

Electromechanical Automation

Service Dept.

Tel.: (+49) (0)781 509-700

Fax: (+49) (0)781 509-98316

5.1 Safety Instruction

Before performing any maintenance or repair work, turn the power switch to the '0' setting and secure it with a padlock against manipulation. If the unit needs to be operable for specific repair works, you have to be especially cautious: Ensure by all means that no persons are in the hazardous area. If required, safeguard the hazardous area with additional barriers or gratings against unauthorised persons.

Repair jobs must only be performed by qualified specialists or employees of Parker.

Only qualified expert personnel is permitted to perform works on the linear actuator. All the applicable regulations and provisions must be heeded (IEC, EN, national accident prevention regulations etc.).

Qualified persons as the term is used in this manual are persons who:

- Persons who, by virtue to their training, experience and instruction, and their knowledge of pertinent norms, specifications, accident prevention regulations and operational relationships, have been authorised by the person responsible for the safety of the system to perform the required task and are capable of recognising potential hazards and avoiding them (definition of technical personnel according to VDE015 or IEC364),
- Persons who have a knowledge of first-aid techniques and the local emergency rescue services.
- Persons who have read and will observe the safety instructions.

If set-up, repair or maintenance works require that safety installations be dismounted, these must be reinstalled immediately after the respective works have been completed. The unit must be shut down before any of the safety installations are dismounted.

5.2 Maintenance schedule

Hint	Please take special care during all maintenance and repair that the guiding surface remains intact!

WHEN	WHAT	ACTION
After commissioning	Sliding carriage	Check free movement of the sliding carriage by manually moving the sliding carriage. **(Check)** (see on page 29)
every 4 weeks or every 1000km*	Sliding carriage	Check sliding carriage play and replace sliding blocks if necessary. **(exchange wearing parts)** (see on page 29) Check free movement of the sliding carriage by manually moving the sliding carriage. **(Check)** (see on page 29)
Semi-annually or every 5,000km	Toothed belt	Visual inspection of the timing belt for wear. Change timing belt if necessary. **(Check timing belt)** (see on page 31)

*With the very first set of sliding blocks (new LCB) please check the sliding carriage play weekly or every two weeks, as an increased wear can be expected during the initial break-in phase.

5.3 Check free movement of the sliding carriage

Move the sliding carriage manually over the entire stroke distance after assembly or setup. The sliding carriage must move easily and with constant force. If the sliding carriage does not move easily or rather "joltily", please check the following:

- Make a visual inspection of the guiding. Check for visual wear and for smoothness of the guiding surface. If necessary, replace profile. If the force needed to move the sliding carriage changes continually (increases or decreases continually), an alignment error of the double-axis actuator could be the case. **Realign double axis actuator** (see on page 26).
- Possibly too high deflection of the guiding profile If needs be, reduce **distance between supports** (see on page 23).
- If the causes mentioned above do not apply, please check the sliding carriage play **(check sliding play)** (see on page 29).

5.4 Replacment interval for wearing parts

Check sliding carriage / play of sliding carriage

The diagrams **"load-bearing capacity of sliding carriage / wear"** (see on page 17) show the wear of the slides under ideal load conditions. The wear can differ from the indicated curves in a specific application.

Depending on the load and the distance traveled, the sliding blocks in the sliding carriage wear down and the sliding carriage play will increase accordingly. If the increased sliding carriage play does not have a negative influence on the application, the sliding blocks can be operated up to the wear limit (0.5mm wear for LCB040 and 1.0mm wear for LCB060).

The wear limit given in the diagrams may under no circumstances be exceeded – this could damage the surface of the guiding irreversibly!

Check sliding play (LCB)

Use a feeler gauge stock to determine the current wear as shown in the photograph on the left.

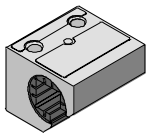
Lift sliding carriage plate for measurement.

Exchange sliding block (LCB)

The sliding block is a wearing part.

You need 4 pieces per linear actuator .

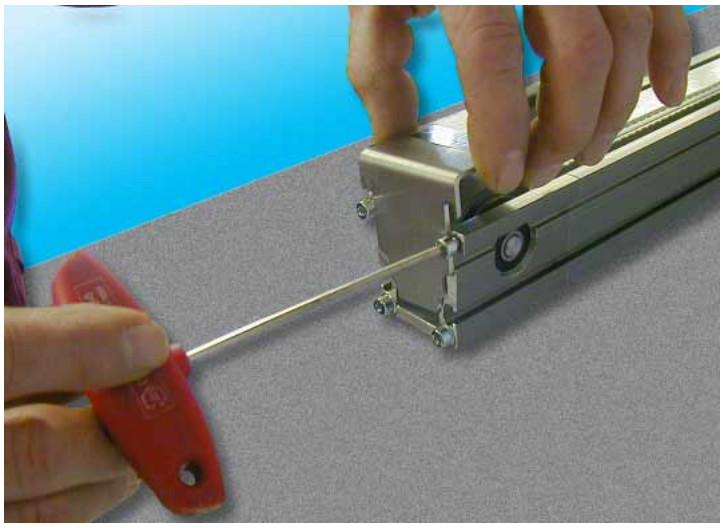
LCB040: Order-No.: 127-004016
LCB060: Order-No.: 127-006014



We recommend to have at least 4 sliding blocks on stock.

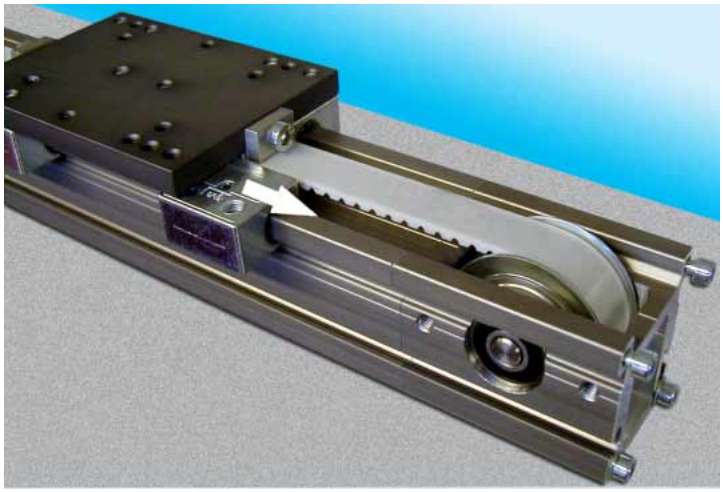
We recommend to drive or to push the sliding carriage to the deflection station for changing the sliding blocks.

Remove/mount covers:



Unscrew only the two upper screws of the cover at the deflection station (unscrew for about 1 – 3mm, not more as they do not only fix the cover but also the deflection station itself).

Remove cover in upwards direction



Unscrew the two fixing screws at all four sliding blocks entirely and remove sliding blocks.

Mount new sliding blocks in reverse order. Tighten screws only slightly. Move sliding carriage forwards and backwards several times (so that the sliding blocks are aligned) and then tighten screws.

Check sliding carriage again for free movement.

5.5 Checking / exchanging / tensioning timing belt

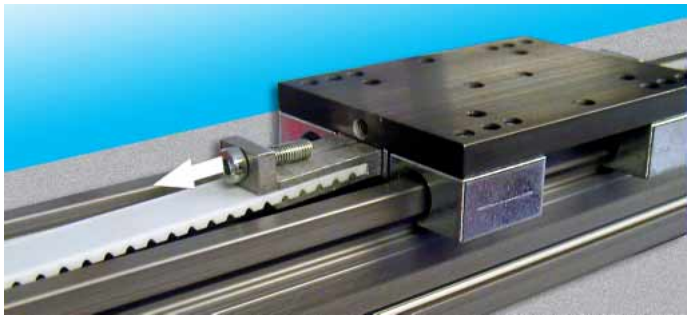
Visual inspection of the timing belt

A sign of wear may have different causes so that it is not always possible, to determine the exact cause. The following table shows possible causes for typical damages:

Problem	mögliche Ursache	Action
Abnormal wear of loaded tooth flanks of the belt	Faulty belt pre-tension	Exchange timing belt, set pre-tension.
	Overload	Exchange timing belt, set pre-tension. Check, if the load is in the admissible range.
Abnormal wear at the tooth root surface of th belt	Pre-tension too high	Exchange timing belt, set pre-tension.
	Drive torque too high	Verify drive dimensioning.
Abnormal wear at the side flank of the belt	Faulty alignment of timing belt	Exchange timing belt, set pre-tension.
	Twisted edge of the roller/pulley	Please contact us.
Sheared off belt teeth	Pre-tensioning too weak Overload (by collision)	Exchange timing belt, set pre-tension.
Splits at the belt teeth	Faulty belt pre-tension	Exchange timing belt, set pre-tension.
	Overload	Exchange timing belt, set pre-tension. Check, if the load is in the admissible range.
	Deterioration of the belt material	Exchange timing belt, set pre-tension.
Breaking of the timing belt	Faulty belt pre-tension	Exchange timing belt, set pre-tension.
	Overload	Exchange timing belt, set pre-tension. Check, if the load is in the admissible range.
Softening of the timing belt material	Operating temperature too high	Exchange timing belt, set pre-tension. Lower operating temperature.
	Contact with solvent	Exchange timing belt, set pre-tension. Do not clean belt with solvents.
Skipping of teeth, loss of machine zero	Pre-tension too low Wrong motor position (below) with vertical application	Set pre-tension correctly. If possible move drive upwards Alternatively: Increase pre-tension or reduce load in lengthwise direction.

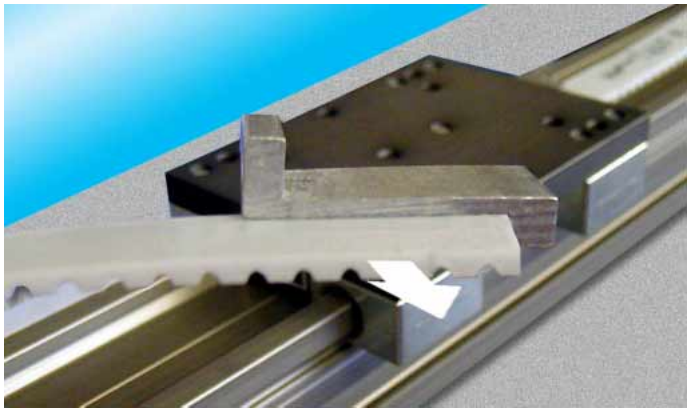
5.5.1. Dismantling the timing belt

We recommend to remove the covers at the drive station and the deflection station before dismantling the timing belt (easy access)
Remove cover plates (see on page 30)).



- Unscrew tensioning bracket on both sides of the sliding carriage and remove from support in the sliding carriage plate.

(Caution! Make sure not to loose the small distance plate of the LCB040! Unless you can no longer set the original belt tension!)



- Push timing belt sidewards out of the clamping bracket.

5.5.2. Insert new timing belt

- Remove old timing belt (**dismountig** (see on page 32) and mount new belt.
- The new timing belt must have exactly the same length and pitch as the old timing belt!
- In the case of a long axis it may be helpful to connect the new belt to the old one (e.g. with tape) in order to insert the new belt while removing the old one.
- Insert ends of belt cautiously into both clamping brackets .
- On the LCB040, first screw the clamping bracket to the sliding carriage on the side of the drive station (as the timing belt of the LCB040 is tensioned on the other side of the sliding carriage).

LCB040 Tension belt

- On the LCB040, first screw the clamping bracket to the sliding carriage on the side of the drive station (as the timing belt of the LCB040 is tensioned on the other side of the sliding carriage).
- Fix the clamping bracket on the opposite side of the sliding carriage (side towards the deflection station) and place the original small distance distance plates. The belt has now its originally preset tension.
- If you dispose of a **belt tension measuring device** (see on page 33)**,** you may use this to tension the belt to a value of 220N.

LCB060 Tension belt

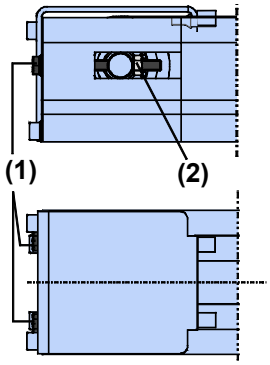
- The belt of a LCB060 must be tensioned to a value of 760N.
- Please use a suitable **belt tension measuring device RMS** (see on page 33) for measuring and setting this value.

Belt tension measuring device RSM

The RSM belt tension measuring device determines the tension of the belt on the basis of preset data (specific mass of belt, freely oscillating length of belt) and the oscillating frequency of the belt.

The belt tension measuring device can be purchased at Parker (Part No. 037-000200).

An operating manual with a description of the measuring procedure comes with the device.

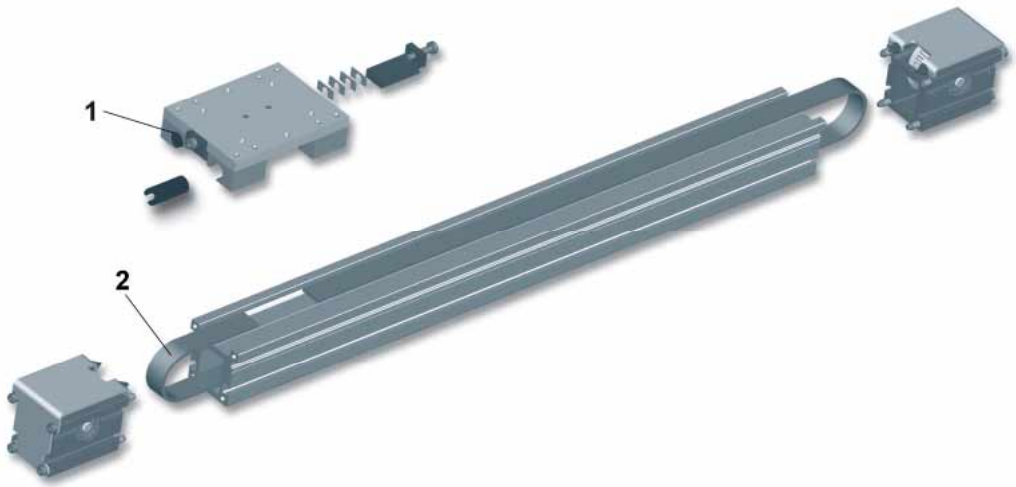


(1) timing belt tensioning screws

(2) counter screws

- The belt is tensioned with the aid of the timing belt tensioning screws at the tensioning station (loosen lock nut during tensioning process and re-fasten afterwards)
- After tensioning, the belt must be aligned.
  - An exact alignment is only possible during movement of the sliding carriage, with correct adjustment the timing belt always oscillates from left to right (in the driving direction).
- In order to keep the pre-tension of the belt, please turn the tensioning screws only in very small steps.
- If necessary, check belt tension again after the alignment.

6. Spare and Wearing Parts



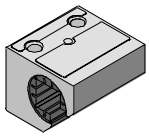
1: Sliding block
2: Toothed belt

6.1 Sliding block

The sliding block is a wearing part.

You need 4 pieces per linear actuator .

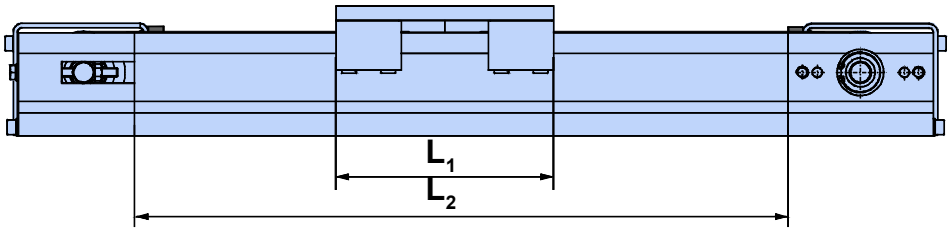
LCB040: Order-No.: 127-004016
LCB060: Order-No.: 127-006014



We recommend to have at least 4 sliding blocks on stock.

6.2 Timing belt

Type	Designation	desired length	Art. No.
LCB040	Timing belt	L_1 : Length of carriage or L2 : Length of profile must be stated	420-000004
LCB060	Timing belt	L_1 : Length of carriage or L2 : Length of profile must be stated	420-000016

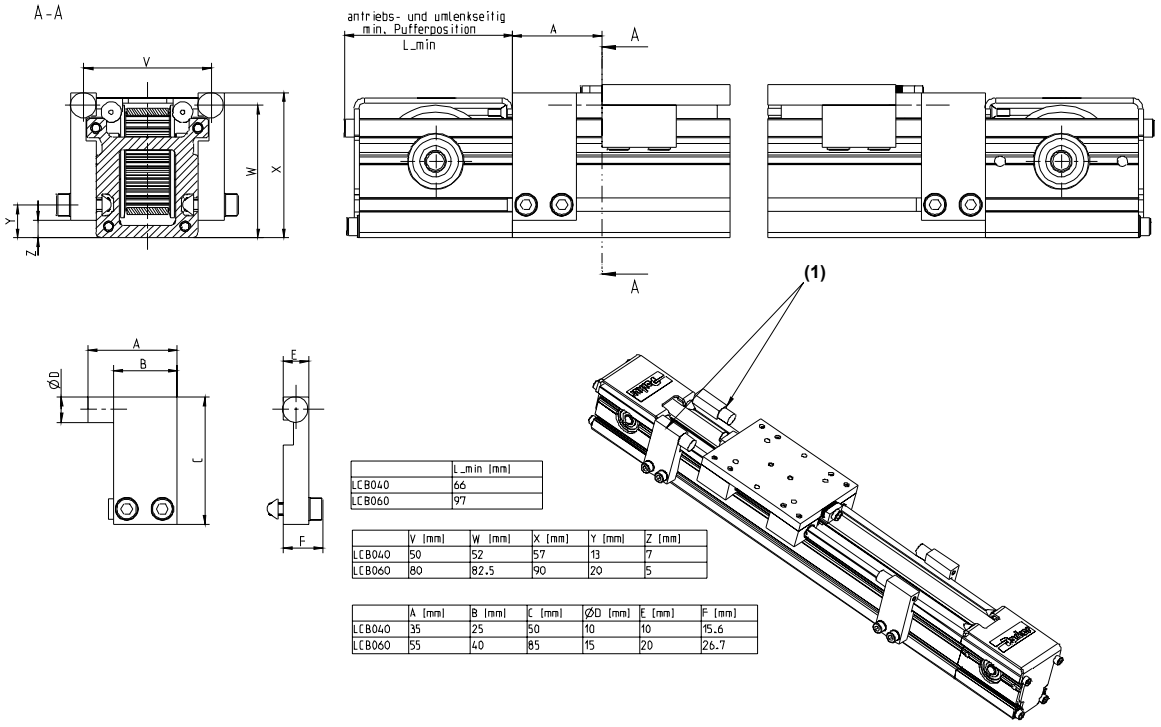


L_1 : Length of sliding carriage
L2 : Length of profile

7. Accessories

In this chapter you can read about:

7.1 External buffers



	L_min [mm]
LCB040	66
LCB060	97

	V [mm]	W [mm]	X [mm]	Y [mm]	Z [mm]
LCB040	50	52	57	13	7
LCB060	80	82.5	90	20	5

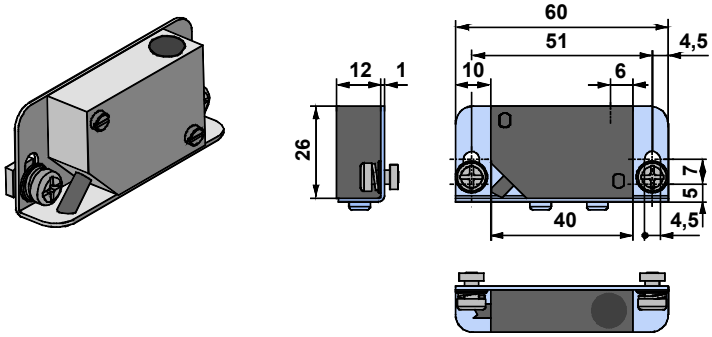
	A [mm]	B [mm]	C [mm]	ØD [mm]	E [mm]	F [mm]
LCB040	35	25	50	10	10	15.6
LCB060	55	40	85	15	20	26.7

(1) We recommend to mount always two external buffers per side.

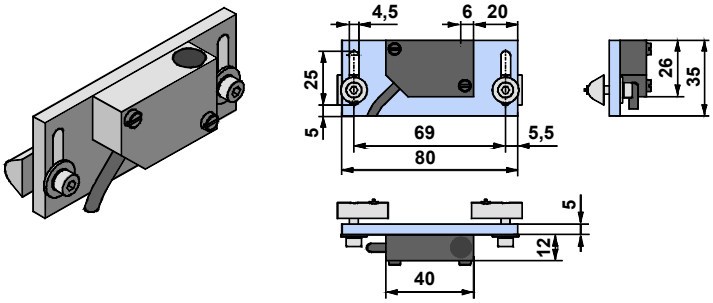
Type	Designation	Art. No.	Art. No. stainless
LCB040	Buffer module	510-001445	510-001495
LCB060	Buffer module	510-001645	510-001695

7.2 Electrical limit switches

LCB040



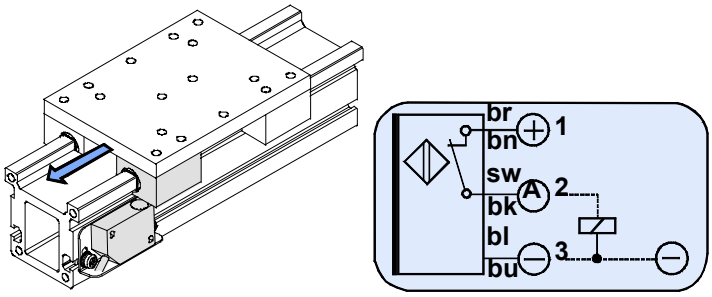
LCB060



Connection diagram LCB040 and LCB060

1: PNP normally closed contact

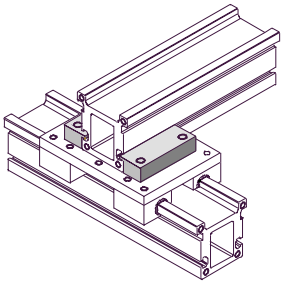
2 -3: Load



Technical data: limit switches LCB040 and LCB060		Electrical characteristics	
Switching distance	2mm / 4mm ± 10%	**Rated Voltage**	24VDC
Switch hysteresis	> 1% ...< 15%	**Voltage range**	10...35VDC
Repeatability	0.01mm	**Supply current**	< 15mA
Temperature drift	< 10%	**Maximum load current**	300mA
Ambient temperature	-25°C - +70°C	**Residual voltage**	< 2,5VDC
Protection class	IP67	**Max. switching frequency**	2 kHz
Cable length	6m	**Connecting cables**	3 x 0.25mm^2

Type	Designation	Art. No.
LCB040	Electrical limit switch NPN normally closed contact with 6m cable and fixing material	510-001435
LCB040	Electrical limit switch NPN normally open contact with 6m cable and fixing material	510-001436
LCB040	Electrical limit switch PNP normally closed contact with 6m cable and fixing material	510-001437
LCB040	Electrical limit switch PNP normally open contact with 6m cable and fixing material	510-001438
LCB060	Electrical limit switch NPN normally closed contact with 6m cable and fixing material	510-001635
LCB060	Electrical limit switch NPN normally open contact with 6m cable and fixing material	510-001636
LCB060	Electrical limit switch PNP normally closed contact with 6m cable and fixing material	510-001637
LCB060	Electrical limit switch PNP normally open contact with 6m cable and fixing material	510-001638

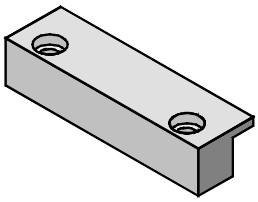
7.3 Clamping profiles

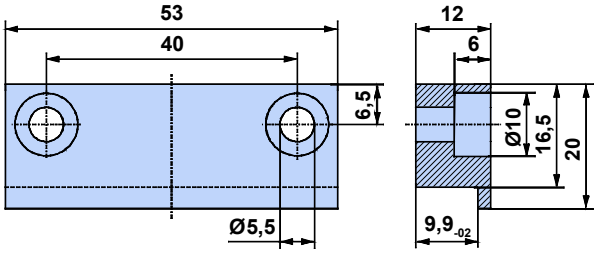


The toe clamps are used in conjunction with the standard load attachment plate to rapidly install and attach various combinations of linear actuators. Two clamping profiles are needed to fix a LCB on a flange plate. (The clamping profiles may not be used in the range of the drive- or of the clamping station).

LCB040

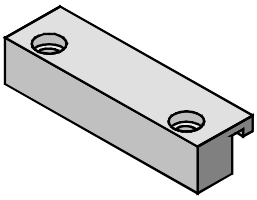
Order-No.: 500-000910

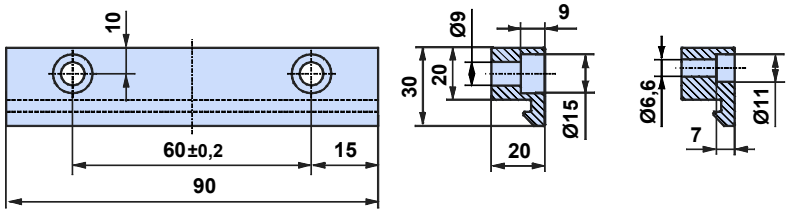




LCB060

Order-No.: 500-000901 **Order-No.: 500-000905**

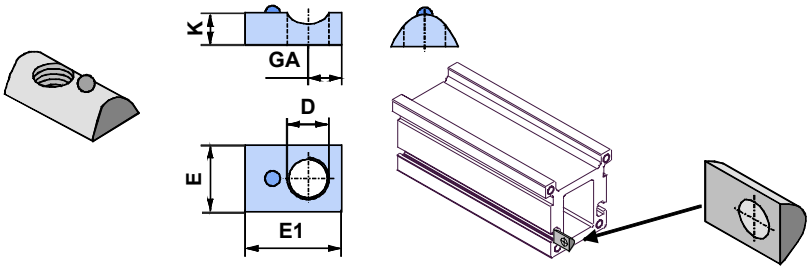




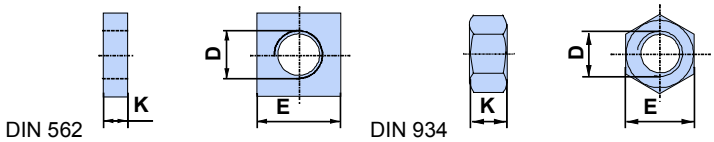
7.4 T-Nuts and bolts

The T-nuts and bolts are used to attach external components to the T-grooves of the profile

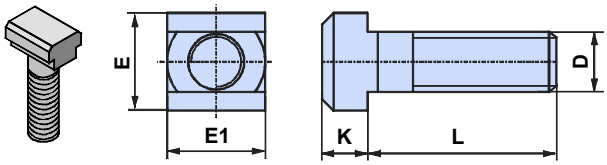
Nuts



T slot bolts and nuts



DIN 787



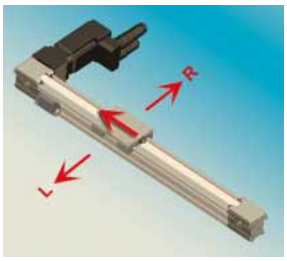
Type	Designation		D	E	l1	K	GA	L	Art. No.
LCB040	**T-Nut**		M4	8	11.5	4	4	--	127-004020
LCB040	**T-Nut**		M5	8	11.5	4	4	--	127-004021
LCB040	**Square nuts***	**DIN 562-M4**	M4	7	--	2.2	--	--	135-700001
LCB040	**Square nuts***	**DIN 562-M5**	M5	8	--	2.7	--	--	135-700003
LCB040	**Hexagon nut***	**DIN 934-M4**	M4	7	--	2.9	--	--	135-700600
LCB040	**Hexagon nut***	**DIN 934-M5**	M5	8	--	3.7	--	--	135-700700
LCB060	**T-bolt**	**DIN787 M8x8x25**	M8	13	13	6	--	25	131-700001
LCB060	**T-bolt**	**DIN787 M8x8x32**	M8	13	13	6	--	32	131-700002
LCB060	**T-bolt**	**DIN787 M8x8x40**	M8	13	13	6	--	40	131-700003
LCB060	**T-Nut**		M4	13.7	22	7	7.5	--	127-006015
LCB060	**T-Nut**		M5	13.7	22	7	7.5	--	127-006016
LCB060	**T-Nut**		M6	13.8	23	7.3	5.5	--	400-000033
LCB060	**T-Nut**		M8	13.8	23	7.3	7.5	--	400-000034

* Square and hexagon nuts should only be used for lightly-loaded attachments

8. Accessories order code

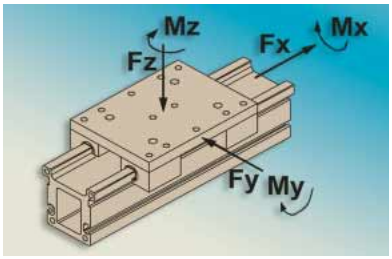
In this chapter you can read about:

Right/left Indication:



Right/left Indication: Looking from load attachment plate to drive module.

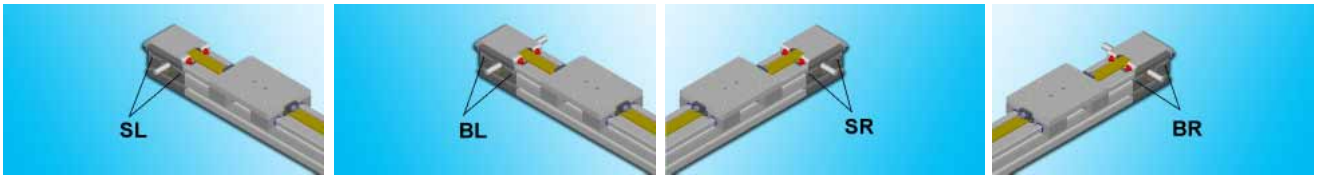
Length of sliding carriage:



All sliding carriages have 4 sliding blocks. On a longer sliding carriage the load bearing capacity for yawing and pitching moments is greater (My and Mz).

Description of all variants of the drive station and the drive orientation: with free drive shaft

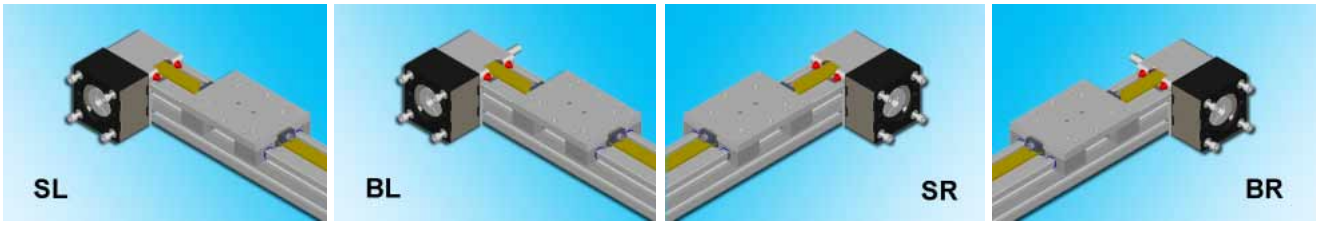
The threads to attach the coupling are on the side defined under "Drive orientation".



Attachment thread:			
only left	only left	only right	only right

With attached coupling kits:

The coupling is always mounted in the factory. BL and BR have an additional shaft on the opposite side of the coupling. This is used to attach the shaft for dual-axis actuators.



Available stroke lengths (in mm)

Depending on your application an additional safety travel on both sides of your travel path could be necessary.

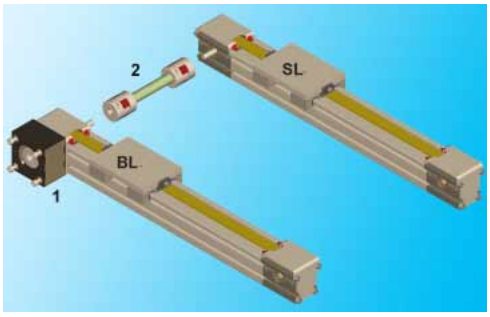
Stroke	250	300	350	400	450	500	600	700	800	900	1000	1250	1500	1750	2000
LCB040	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
LCB060	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Stroke	2250	2500	2750	3000	3250	3500	3750	4000	4250	4500	4750	5000	5250	5500
LCB060	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Dual-axis actuator variants:

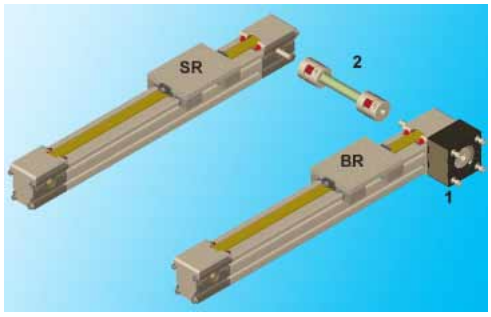
For a dual-axis actuator with the drive on the left side you need two LCB basic units. The left unit with drive option BLN, the right unit with drive option SLN.

1: Coupling kit
2: Shaft kit



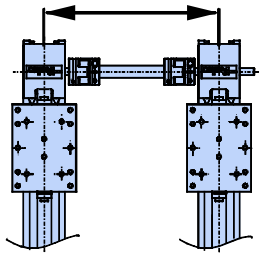
For a dual-axis actuator with the drive on the right side you need two LCB basic units. The right unit with drive option BRN, the leftt unit with drive option SRN.

1: Coupling kit
2: Shaft kit



Drive shaft kit for LCB (for dual-axis actuator)

Center distance: from center line to center line



For a dual-axis actuator two LCB basic units and a shaft corresponding to the desired center-distance are required. Parker will deliver the two basic units (with mounted couplings - if this was ordered) and a separate shaft-kit.

8.1 Order code for the LCB basic unit

Example	L	C	B	0	4	0	M	G	0	0	2	5	0	S	R	N
Drive system																
LCB linear actuator	L	C	B													
Model /size																
040 (LCB040)				0	4	0										
060 (LCB060)				0	6	0										
Sliding carriage length (see on page 39)																
Short sliding carriage							S									
Medium sliding carriage							M									
Long sliding carriage							L									
Special carriage (on request)							X									
Guide system																
Sliding guide								G								
Stroke (see on page 40)																
Stroke in mm									n	n	n	n	n			
Drive station																
One drive shaft														S		
Two drive shafts (Shaft on both sides)*														B		
Drive orientation (see on page 39)																
Drive on right															R	
Drive on left															L	
Interface to the drive																
Mandatory statement																N

*only LCB040: Feather key groove DIN6885 – 2x2x10 on the left or on the right of the drive side

8.2 Order code for the LCB coupling kit

Example	L	C	B	0	4	0	K	L
Drive system									
LCB linear actuator	L	C	B					
Model /size									
040 (LCB040)				0	4	0		
060 (LCB060)				0	6	0		
Coupling Kit* (see on page 39)								
With coupling							K	
Drive option (see on page 14)								
Prepared for planetary gearbox PTN060 (for LCB040)								L
Prepared for planetary gearbox PTN080 (for LCB060)								M
Prepared for servo motor (Direct drive) SMH60..B8, D=9 (for single actuator LCB040)								U
Prepared for servo motor (Direct drive) SMH100..B5, D=19 (for single actuator LCB060)								W
Prepared for stepper motor (Direct drive) SY56 (for single actuator LCB040)								N
Prepared for stepper motor (Direct drive) SY107 (for single actuator LCB060)								P

*The coupling is always mounted in the factory.

8.3 Order code for intermediate drive shaft for LCB (for dual-axis actuator)

Example	L	C	B	0	4	0	W	0	2	5	0
Drive system											
LCB linear actuator	L	C	B								
Model /size											
040 (LCB040)				0	4	0					
060 (LCB060)				0	6	0					
Connecting shaft											
Connecting shaft							W				
Center distance (in mm)											
Center distance from center line to center line								n	n	n	n

Center distances (in mm)

Center distance	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850
LCB040	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
LCB060	--	--	x	x	x	x	x	x	x	x	x	x	x	x	x
Axis distance	900	950	1000	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500		
LCB040	x	x	x	--	--	--	--	--	--	--	--	--	--		
LCB060	x	x	x	x	x	x	x	x	x	x	x	x	x		

9. Index