Linear Actuator LA77

Data Sheet

Contents

Preface

Dear User,

We are delighted that you have chosen a LINAK® product.

LINAK systems are high-tech products based on many years of experience in the manufacture and development of actuators, lifting columns, desk frames, electric control boxes, controls, batteries, accessories and chargers.

This User Manual does not address the end user. It is intended as a source of information for the equipment or system manufacturer only, and it will tell you how to install, use and maintain your LINAK electronics. The manufacturer of the end product has the responsibility to provide a User Manual, where relevant safety information from this manual is passed on to the end user.

We are convinced that your LINAK product/system will give you many years of problem-free operation.

Before our products leave the factory, they undergo both function and quality testing. Should you, nevertheless, experience problems with your product/system, you are always welcome to contact your supplier.

LINAK subsidiaries and some distributors situated all over the world have authorised service centres, which are always ready to help you. Locate your local contact information on the back page.

LINAK provides a warranty on all products. (See warranty section).

This warranty, however, is subject to correct use in accordance with the specifications, maintenance being done correctly, and any repairs being carried out at a service centre, which is authorised to repair LINAK products.

Changes in installation and use of LINAK systems can affect their operation and durability. The products may only be opened by authorised personnel.

This User Manual has been written based on the present technical knowledge. LINAK reserves the right to carry out technical modifications and keeps the associated information updated.

LINAK A/S

Terms of use

LINAK® takes great care in providing accurate and up-to-date information on its products. However, the user is responsible for determining the suitability of LINAK products for a specific application.

Due to continual development, LINAK products are subject to frequent modifications and changes. LINAK reserves the rights to conduct modifications, updates, and changes without any prior notice. For the same reason, LINAK cannot guarantee the correctness and actual status of imprinted information on its products.

LINAK uses its best efforts to fulfil orders. However, for the reasons mentioned above, LINAK cannot guarantee availability of any particular product at any given time. LINAK reserves the right to discontinue the sale of any product displayed on its website or listed in its catalogues or in other written material created and produced by LINAK, LINAK subsidiaries, or LINAK affiliates.

All sales are subject to the 'Standard Terms of Sale and Delivery for LINAK A/S' available on LINAK websites.

Introduction

Powerful electric linear actuator designed to handle high loads and demanding environments. It delivers long-lasting reliability as well as a wide choice of industrial control interfaces.

Safety instructions

Please read this safety information carefully.

Be aware of the following three symbols throughout the document:

Warning!
Failing to follow these instructions can cause accidents resulting in serious personal injury.

Recommendations
Failing to follow these instructions can result in the actuator suffering damage or being ruined.

Additional information
Usage tips or additional information that is important in connection with the use of the actuator.

Furthermore, ensure that all staff who are to connect, mount, or use the actuator are in possession of the necessary information and that they have access to this document.

Persons who do not have the necessary experience or knowledge of the product/products must not use the product/products. Besides, persons with reduced physical or mental abilities must not use the product/products, unless they are under surveillance or they have been thoroughly instructed in the use of the apparatus by a person who is responsible for the safety of these persons.

Moreover, children must be under surveillance to ensure that they do not play with the product.

Before you start mounting/dismounting, ensure that the following points are observed:

- The actuator is not in operation.
- The actuator is free from loads that could be released during this work.

Before you put the actuator into operation, check the following:

- The actuator is correctly mounted as indicated in the relevant user instructions.
- The equipment can be freely moved over the actuator's whole working area.
- The actuator is connected to a mains electricity supply/transformer with the correct voltage and which is dimensioned and adapted to the actuator in question.
- Ensure that the voltage applied matches to the voltage specified on the actuator label.
- Ensure that the connection bolts can withstand the wear.
- Ensure that the connection bolts are secured safely.

During operation, please be aware of the following:

- Listen for unusual sounds and watch out for uneven running. Stop the actuator immediately if anything unusual is observed.
- Do not sideload the actuator.
- Only use the actuator within the specified working limits.
- Do not step on or kick the actuator.

When the equipment is not in use:

- Switch off the mains supply in order to prevent unintentional operation.
- Check regularly for extraordinary wear.

Classification

The equipment is not suitable for use in the presence of a flammable anaesthetic mixture with air or with oxygen or nitrous oxide.

Warnings

- Do not sideload the actuator.
- When mounting the actuator in the application ensure that the bolts can withstand the wear and that they are secured safely.
- If irregularities are observed, the actuator must be replaced.

Recommendations

- Do not place load on the actuator housing.
- Prevent impact or blows, or any other form of stress to the housing.
- Ensure that the cable cover is mounted correctly. Use 3.5 Nm torque.
- Ensure that the duty cycle and the usage temperatures for LA77 actuators are respected.
- Ensure that the cable cannot be squeezed, pulled or subjected to any other stress.
- Furthermore, it will be good practice to ensure that the actuator is fully retracted in the “normal” position. The reason is that there will be a vacuum inside the actuator if it is extended which over time can lead to water entering the actuator.

Features

- Protection class: IP66 for outdoor use (dynamic). Furthermore, the actuator can be washed down by a high pressure cleaner (IP69K - static)
- Highly efficient acme thread spindle
- Safety factor 2: The actuator has been certified to withstand static loads that are twice the magnitude of its dynamic load capacity without sustaining damage.
- Static holding load up to 45 kN in push and pull
- Dynamic wind stress loads 15 kN push/pull 100,000 times
- Hand crank for manual operation
- Integrated brake, high self-lock ability
- Endplay - 2 mm max.
- Non-rotating piston rod eye
- Noise level: 76 dB (A). Measuring method: DS/EN ISO 8746 (actuator not loaded)
- Built-in Zero Point initialisation
- Heavy duty aluminium housing for harsh conditions
- Hall effect sensor for precise positioning
- Current monitoring

Options in general

- 24 / 48 V DC Brushless motor
- Load from 10,000 N - 15,000 N
- Max. speed 8.5 mm/sec. depending on load and spindle pitch
- Stroke length from 100 mm to 600 mm
- Back fixture turnable in steps of 30 degrees
- Different back fixtures and piston rod eyes
- Short Built in Dimension available with spindle type 080
- Exchangeable cables in different lengths
- Analogue or digital feedback for precise positioning
- Endstop reached signals
- IC options (see specific platform manuals at the TECHLINE webpage for Connection Diagrams and I/O Specifications) including:
  - I/O
  - Ethernet/IP
  - Modbus TCP/IP
  - Modbus RTU
  - IO-Link
  - CAN SAE J1939
  - CANopen
  - PROFINET
- PC configuration tool (Actuator Connect™)

Usage

- Duty cycle up to 600 mm stroke: max. 10% (2 min. drive and 18 min. rest)
- Duty cycle at 601-1000 mm stroke:* max. 5% (1 min. drive and 19 min. rest)
- Ambient operating temperature: Full performance from +5°C to +40°C
  -30°C (reduced load 50%) to + 85°C
  -40°C (no load)
- Storage temperature: -40 °C to +70 °C
- Actuator is not activated/connected. -40°C to +85°C for 72 hours
  -55°C to +105°C for 24 hours for Integrated Control platform
- Acclimatization before usage.
- Relative humidity: Full performance from 20 % to 80 % - non-condensing
  (Actuator is not activated/connected)
- Cyclic state: 93 % to 98 % - non-condensing +25°C to +55°C for 12 hours
- Steady state: 93 % to 95 % - non-condensing +40°C for 56 Days
- Atmospheric pressure: 700 to 1060 hPa
- Meters above sea level: Max. 3000 meters

* Special Item

Ordering example

77 080 200 0 0 B3 2 6 = 6 1 2 H 3 XXXX A C S 0 0 0

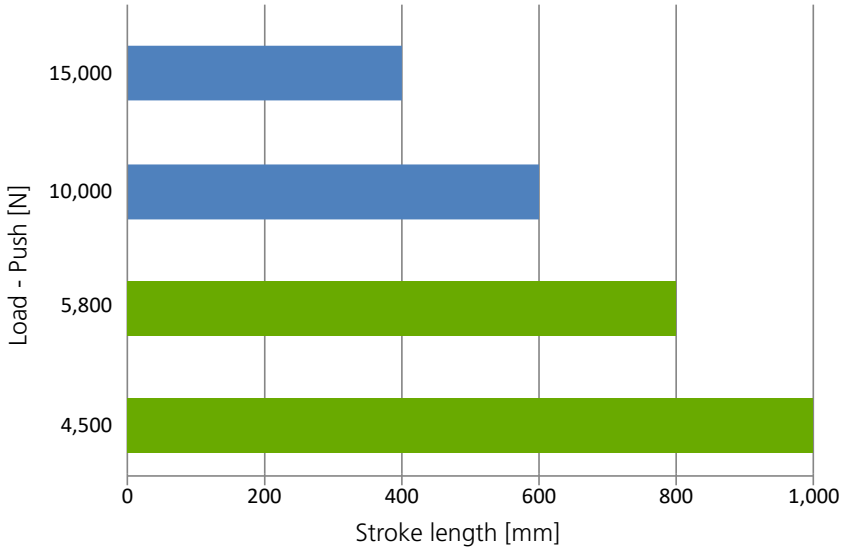
Actuator type	**77**	=	LA77			
Spindle type	025	=	2.5 mm	**080**	=	8 mm
Stroke length	**200**	=	XXX Length in mm (50-999)	A00	=	1000 mm
Safety	**0**	=	No safety nut			
Feedback	**0**	=	No Feedback	K	=	Single Hall
	A	=	Analogue feedback (Hall potentiometer)			
	H	=	Dual Hall	X	=	Special
Platform			**9-pin**			
			Zero Point			**Zero Point with split supply**
	B3	=	I/O Basic	A7	=	CAN SAE J1939
	C3	=	I/O Customised	A8	=	CANopen
	F3	=	I/O Full	0E	=	Modbus TCP/IP
	0B	=	IO-Link	2E	=	Ethernet/IP
	14	=	Modbus RTU	4E	=	Profinet
			XX = Special			
Motor type	**2**	=	24 BLDC	4	=	48 BLDC
IP	**6**	=	IP66 - Reinforced house			
Reed	**=**	=	Brushless motor			
Colour	**6**	=	Dark Olivish Grey NCS S7000-N	X	=	Special
Back fixture	**1**	=	0 °	4*	=	Male Adapter (outer thread)
	2	=	90°	X	=	Special
Piston rod eye	**2**	=	Solid	6	=	Ball eye
	4	=	Male Adapter (Outer thread)	X	=	Special
Gear	**H**	=	Ratio 1:46			

* Max. 10,000 N in Pull applications

Brake	**3**	=	Push/Pull			
Built-in dimension	xxxx	=	Measured in mm			
Endstop reached output	**A**	=	A_HIGH / A_HIGH	D	=	A_LOW / A_LOW
	B	=	A_LOW / A_HIGH	N	=	LOW / LOW
	C	=	A_HIGH / A_LOW	X	=	Special
Plug type	0	=	No plug (when no cable is chosen)	H	=	AMP
	J	=	Deutsch	K	=	AMP Super Seal
	9	=	Deutsch - Moulded	7	=	AMP Super Seal - Moulded
	C	=	Flying leads	E	=	M12 Ethernet Y-cable
	N	=	M12 IO-Link cable	R	=	M12 Modbus cable
				X	=	Special
Cable	0	=	No cable selected	**S**	=	Straight cable
	Y	=	Y-cable	X	=	Special
Parallel mode	**0**	=	The system is NOT parallel	2-8	=	Critical parallel (number of actuators in the parallel system)
SW config.	**0**	=	Standard software	X	=	Special software
Short BID	0	=	Standard	A*	=	Short (conform with LA36)

* Only available with Spindle type 080
See piston rod eyes for further limitations

Load vs stroke length



LA77 is available with stroke lengths from 601 to 1,000 mm as special item. Please note:

- For applications that only operate in pull - the limitations are 1,000 mm stroke with both 10,000 and 15,000 N load

Technical specifications

24 V

Load max. (N)	Self-lock min. (N)	Pitch (mm/ spindle rev.)	Hall Resolution mm/count	Endplay (mm)	Regulated speed (mm/s)	Standard stroke lengths (mm)	Typical amp. (A)	
							No load	Full load
15000	20000	2.5	0.034	2	3.1	100-400	2.0	10.0
10000	20000	2.5	0.034	2	3.1	400-600	2.0	8.0
10000	15000	8.0	0.110	2	8.5	100-600	2.0	11.0

48 V

Load max. (N)	Self-lock min. (N)	Pitch (mm/ spindle rev.)	Hall Resolution mm/count	Endplay (mm)	Regulated speed (mm/s)	Standard stroke lengths (mm)	Typical amp. (A)	
							No load	Full load
15000	20000	2.5	0.034	2	3.1	100-400	1.1	5.5
10000	20000	2.5	0.034	2	3.1	400-600	1.1	5.5
10000	15000	8.0	0.110	2	8.5	100-600	1.1	6.0

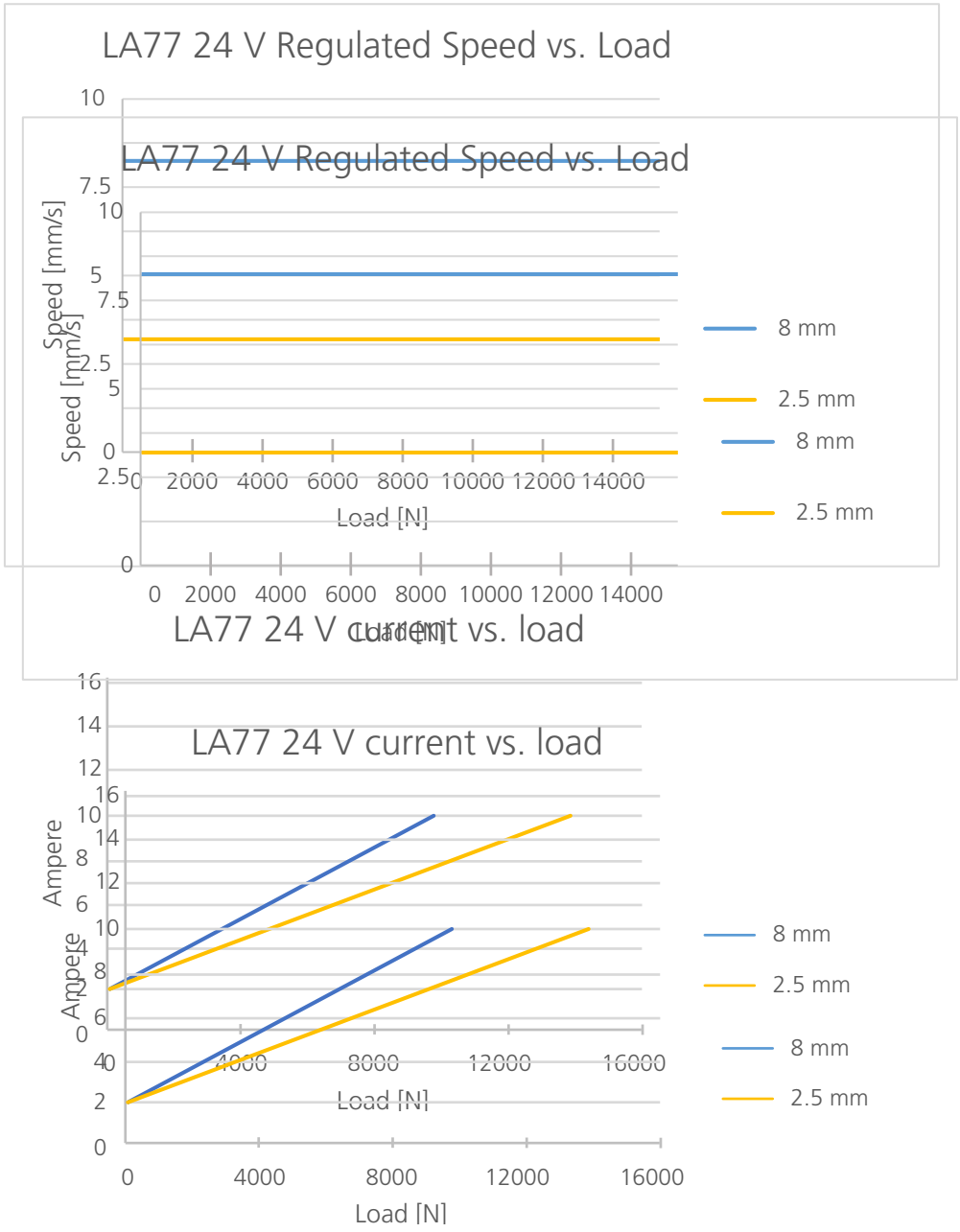
- When using soft stop a short peak of higher voltage will be sent back towards the power supply. It is important when selecting the power supply that it does not turn off the output, when this backwards load dump occurs.

A Hall pulse consists of two Hall counts. A Hall count occurs every time the signal changes state (high to low or vice versa).

The typical values can have a variation of ± 20% on the current values and ± 10% on the speed values. Measurements are made with an actuator in connection with a stable power supply and an ambient temperature of 20°C.

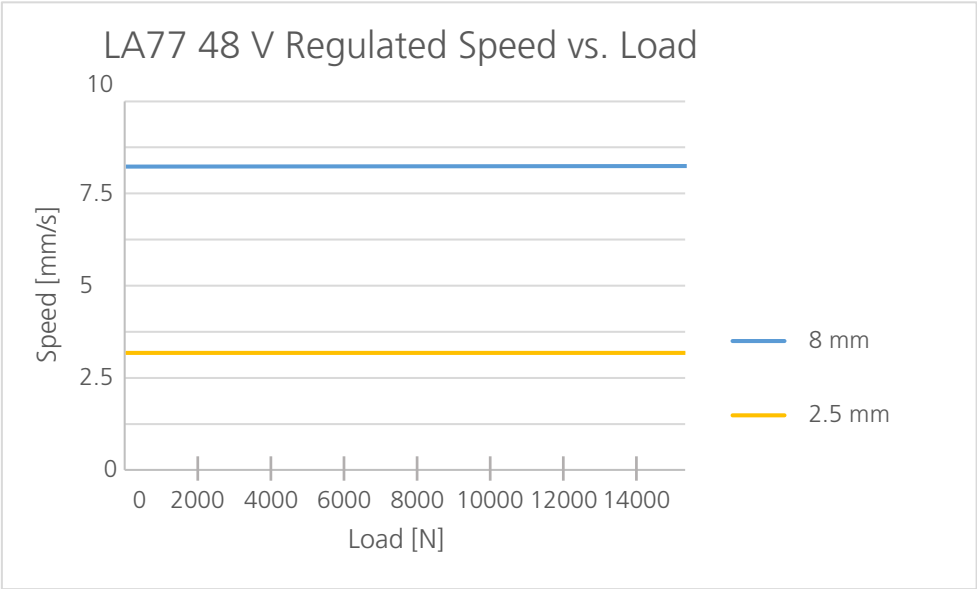
Speed and current curves

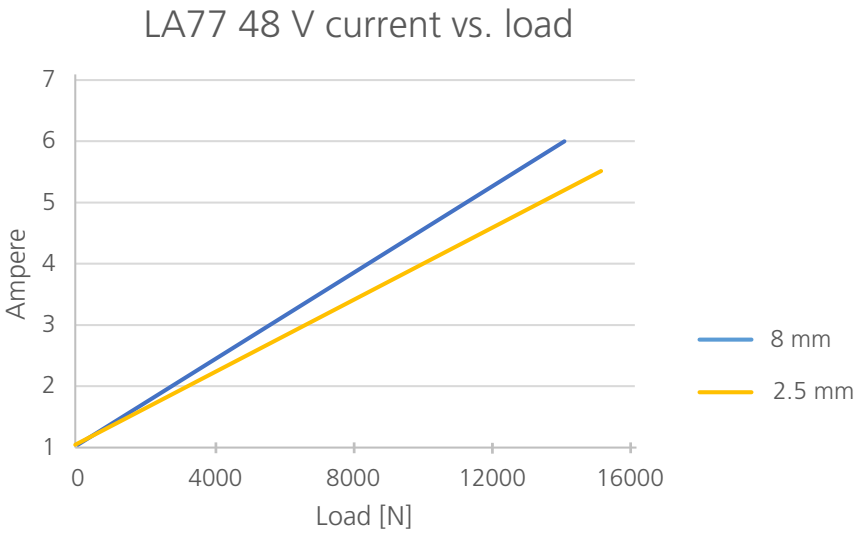
The typical values below are made with a stable power supply of 24 V DC and an ambient temperature of 20˚C.



Speed and current curves

The typical values below are made with a stable power supply of 48 V DC and an ambient temperature of 20˚C.





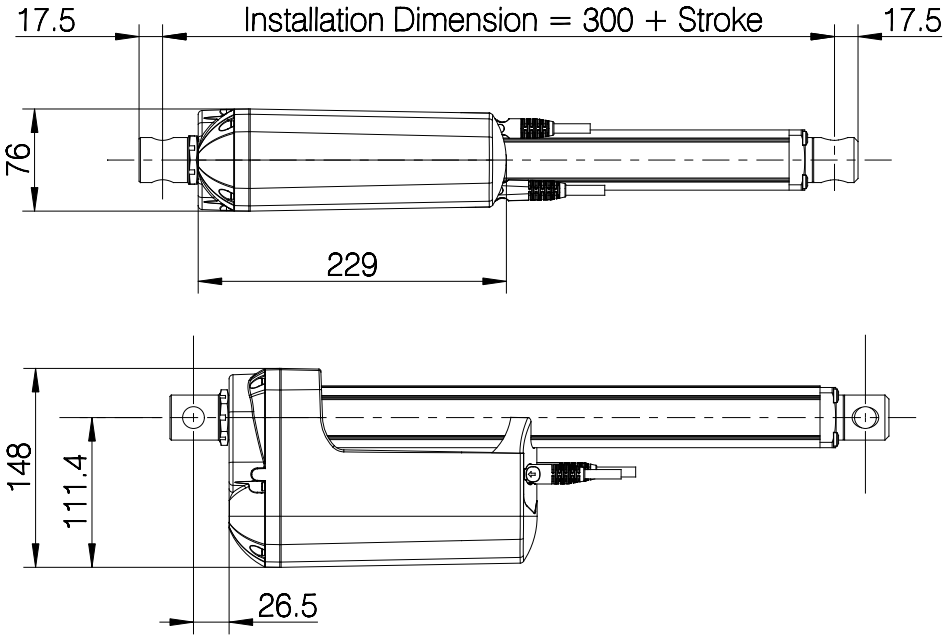
Current limits

Platform	Movement	24 V	48 V	Temperature
All	Outwards	16 A	8A	Above
	Inwards	16 A	8 A	
	Reference temperature 0°C			
	Outwards	26 A	15 A	Below
	Inwards	26 A	15 A	

Stroke and built-in tolerances

Platform	Stroke tolerance	Example for 200 mm stroke	BID tolerance	Example for 400 mm BID
All	+/- 2 mm	198 to 202 mm	+/- 2 mm	398 to 402 mm

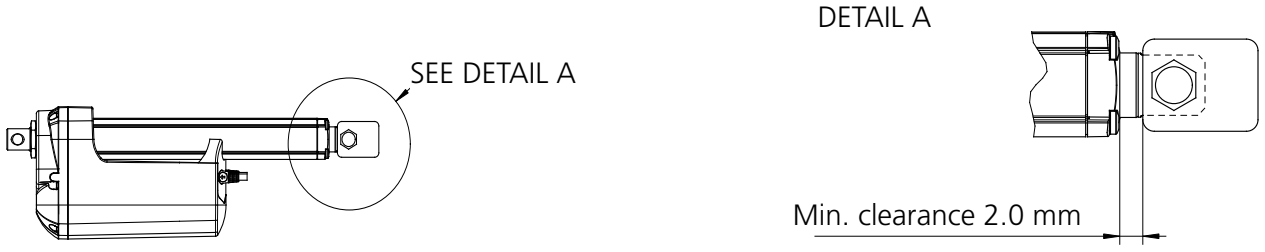
Built-in dimensions (standard length)



The above dimensions apply for all LA77 piston rod eyes and back fixtures.

Keep a clearance when mounting a bracket

When mounting a custom bracket on the moving part of the actuator, please observe the minimum clearance between bracket and cylinder top when fully retracted. This will prevent jamming and destruction of the actuator drive train.



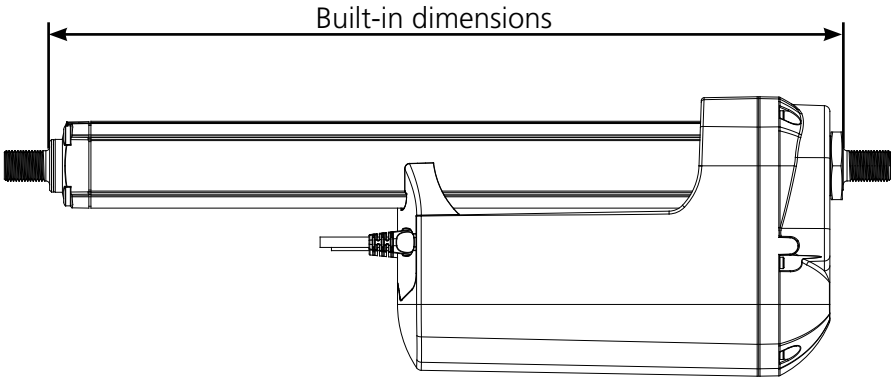
With Zero Point the minimum stroke is 100 mm.
The Zero Point initialisation zone is located between 35-75 mm going from the most inward position.
The movement passing the zone has to be stable for the initialisation to succeed - also, no virtual limits can be set in the initialisation zone.

Built-in dimensions

The built-in dimension depends on the chosen safety option and stroke length(s).

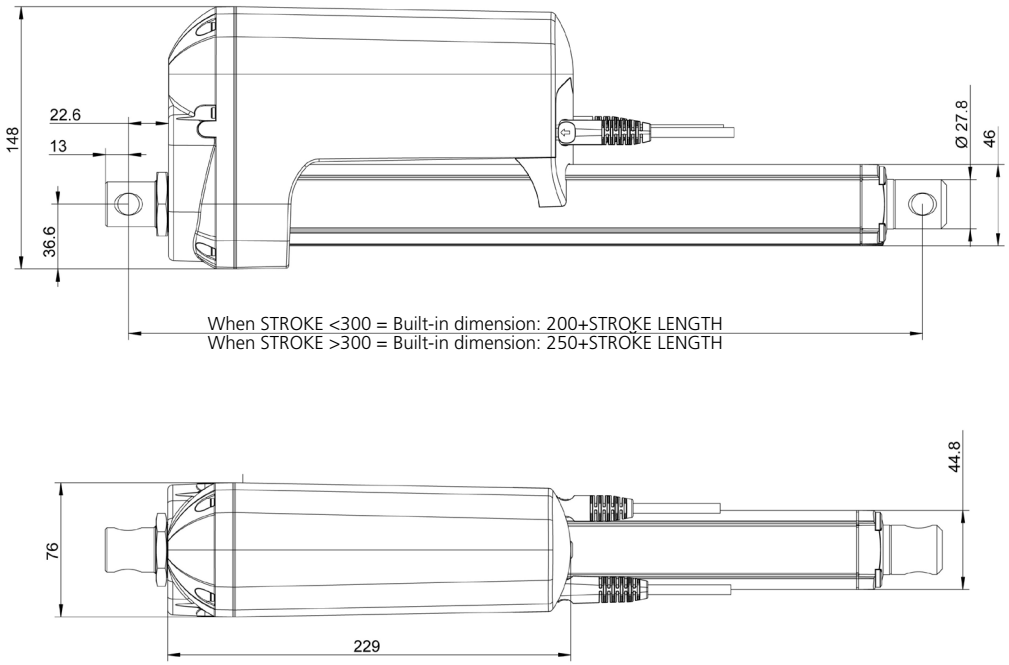
	Piston rod	Ball eye Ø20 H7 / to the centre of the hole	Ball eye Ø19.2 / to the centre of the hole	Solid Ø16.2 mm / to the centre of the hole	Solid Ø19.2 mm / to the centre of the hole	Male adapter M16 X 1.5 / from the surface	Male adapter M20 X 1.5/ from the surface
Back fixture		Stroke from 100 to 600	Stroke from 100 to 600	Stroke from 100 to 600	Stroke from 100 to 600	Stroke from 100 to 600	Stroke from 100 to 600
Solid Ø16.2 mm (0° and 90°) / to the centre of the hole		315 + stroke	315 + stroke	300 + stroke	300 + stroke	287 + stroke	287 + stroke
Solid Ø19.2 mm (0° and 90°) / to the centre of the hole		315 + stroke	315 + stroke	300 + stroke	300 + stroke	287 + stroke	287 + stroke
Male adapter M20 / from the surface		296 + stroke	296 + stroke	281 + stroke	281 + stroke	268 + stroke*	268 + stroke*

* These built-in dimensions are measured according to the illustration below.



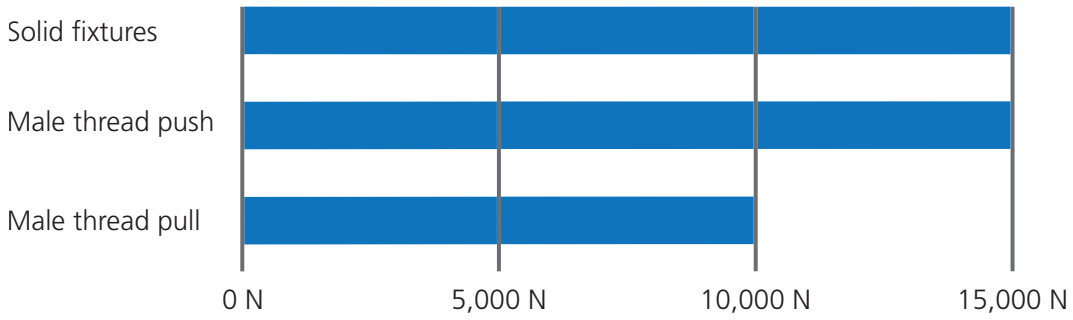
Built-in dimensions (Short BID option)

All dimensions are in mm.



	Back Fixture	Solid (0° and 90°)		Male adapter Outer thread	
Stroke length		**<=300**	**>300**	**<=300**	**>300**
Piston Rod Eye		To the centre of the hole		To the centre of the hole	
Ball Eye	**To the centre of the hole**	215 + stroke	265 + stroke	200 + stroke	250 + stroke
Solid	**To the centre of the hole**	200+ stroke	250 + stroke	185 + stroke	235 + stroke
Male adapter Outer thread	**From the surface**	187+ stroke	237+ stroke	173+ stroke	223 + stroke

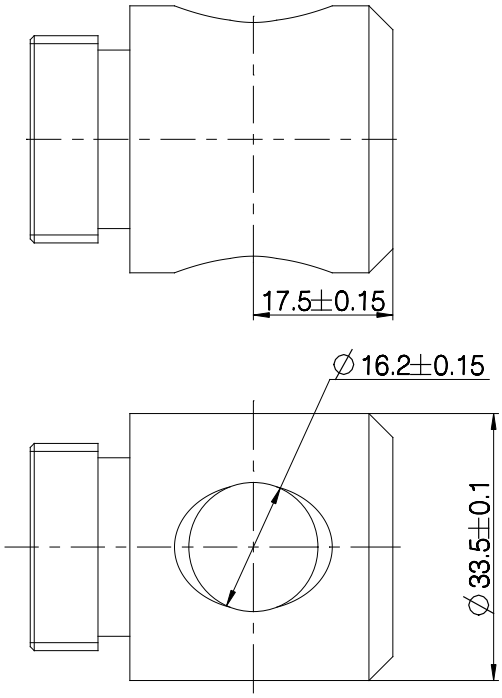
Durability for piston rod eyes and back fixtures



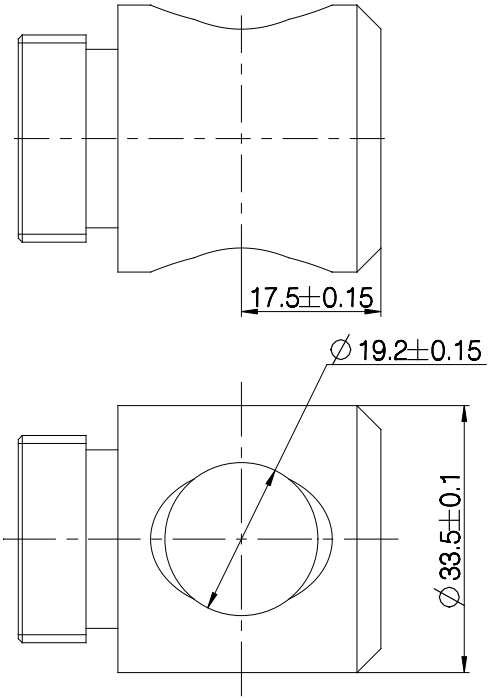
Blue = Full lifetime

Piston rod eyes

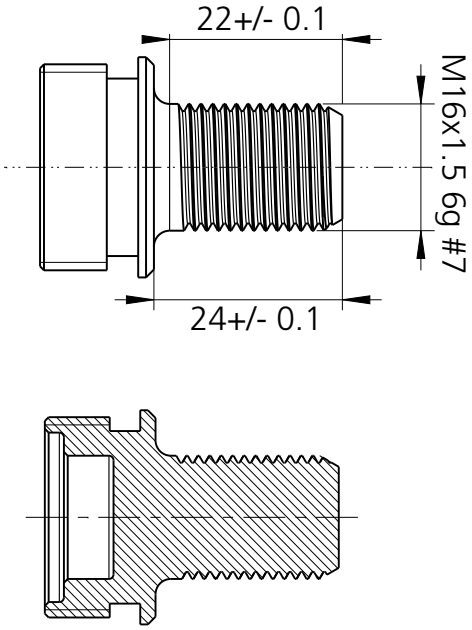
Option "2"
LINAK P/N: 0361387
Free-cutting steel with galvanised surface



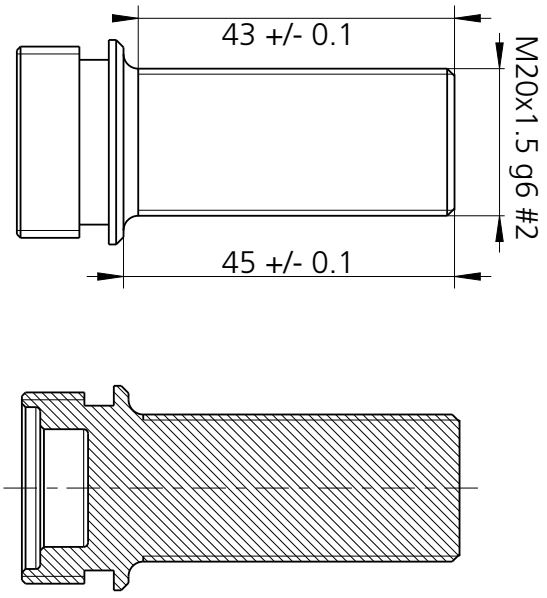
Option "2"
LINAK P/N: 0361393
Free-cutting steel with galvanised surface



Option "4"
LINAK P/N: 0361135
AISI 303



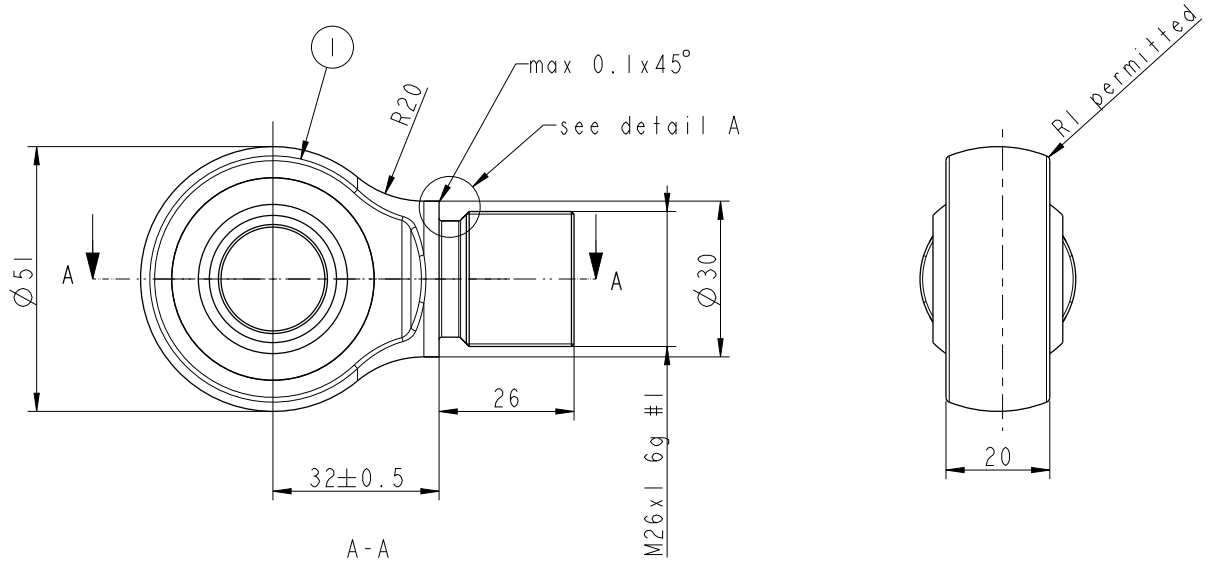
Option "4"
LINAK P/N: 0371044
AISI 303



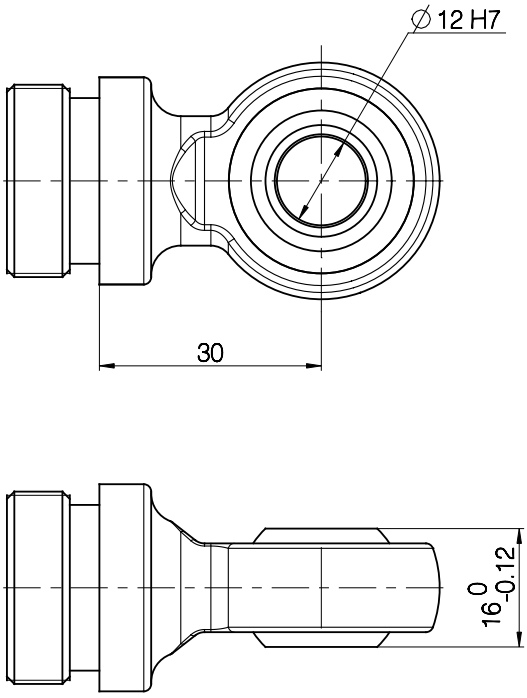
The piston rod eye is only allowed to turn 0 - 180 degrees.

Piston rod eyes

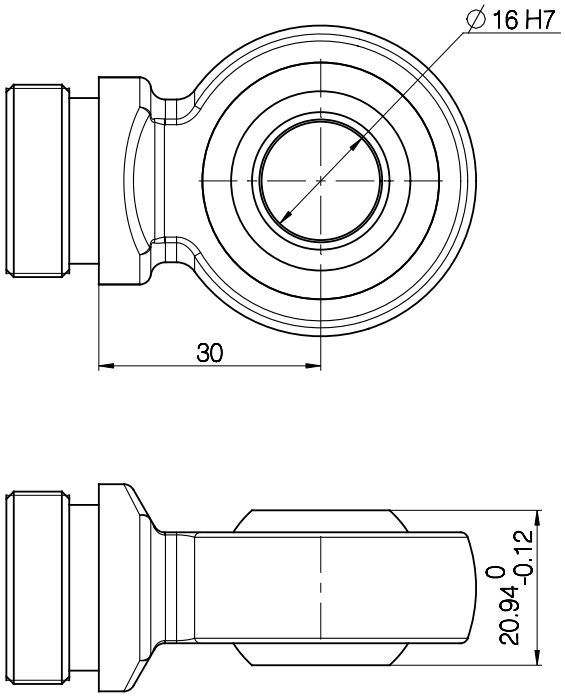
Option "6" -Not available with short BID
LINAK P/N: 0361568 (Ø20H7)
0361571 (19.2 ± 0.1)
AISI 304



Option "6" -only available with short BID
LINAK P/N: 0361350
AISI 304



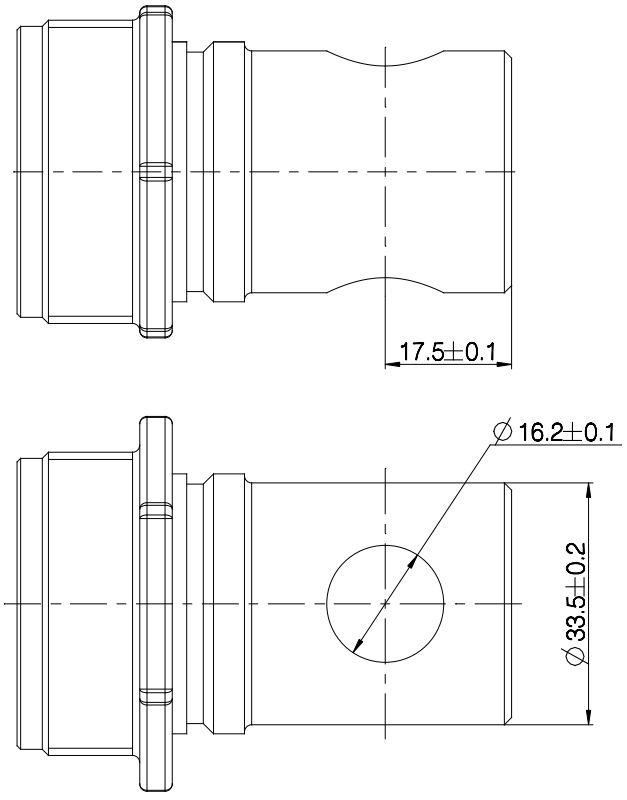
Option "6" -only available with short BID
LINAK P/N: 0361351
AISI 304



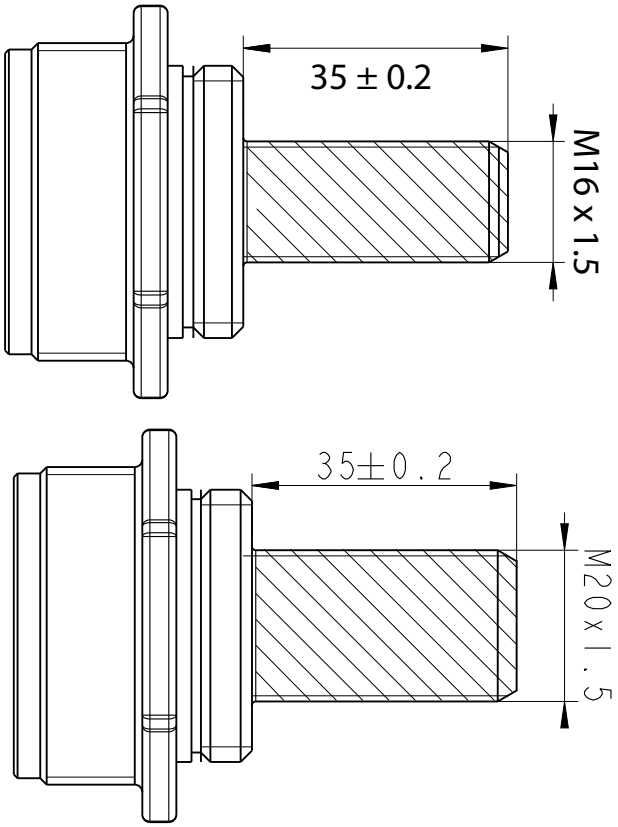
The piston rod eye is only allowed to turn 0 - 180 degrees.

Back fixtures

Option "1&2"
LINAK P/N: 0371019
Free-cutting steel with galvanised surface



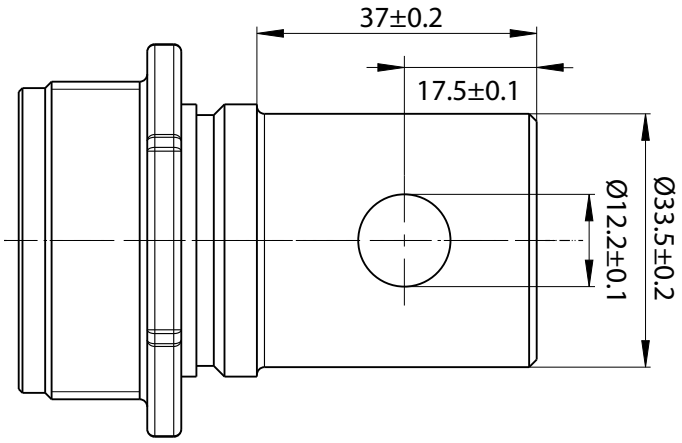
Option "4" - Max. 10,000 N in Pull
LINAK P/N: 0371248 (M16) & 0371247 (M20)
AISI303



Back fixtures for Short Built-in dimension

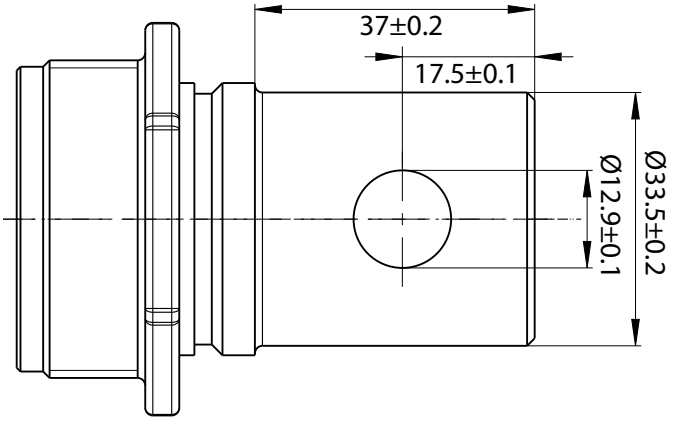
Option 1 & 2

LINAK P/N 0371056
Free-cutting steel with galvanised surface



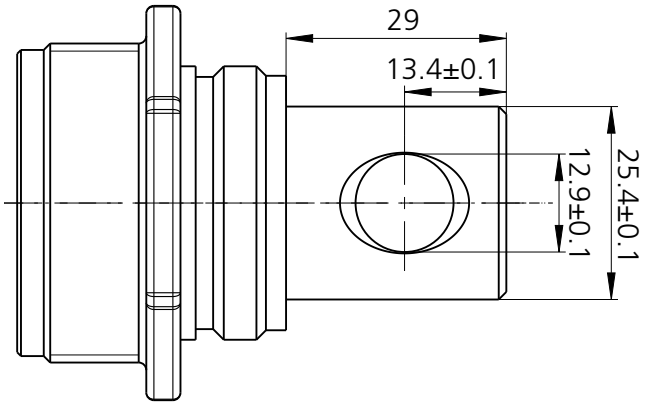
Option 1 & 2

LINAK P/N 0371057
Free-cutting steel with galvanised surface



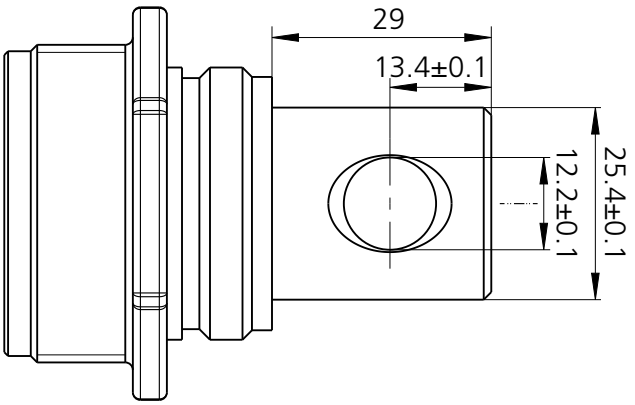
Option 1 & 2

LINAK P/N 0371059
AISI 304

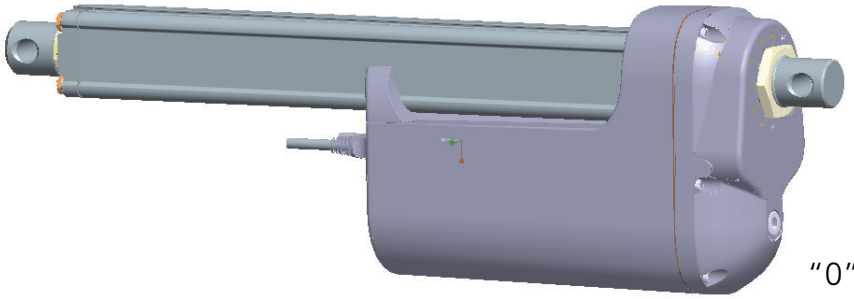


Option 1 & 2

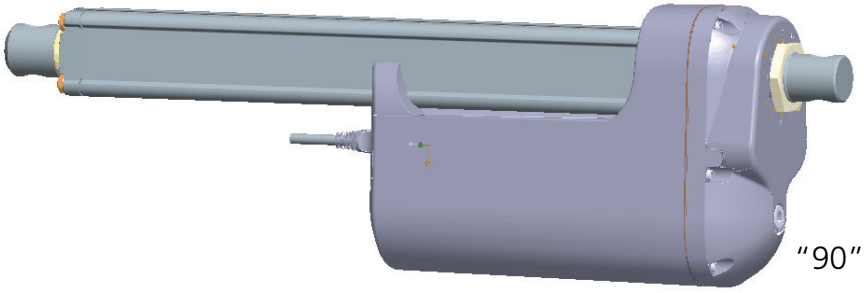
LINAK P/N 0371062
AISI 304



Back fixture orientation



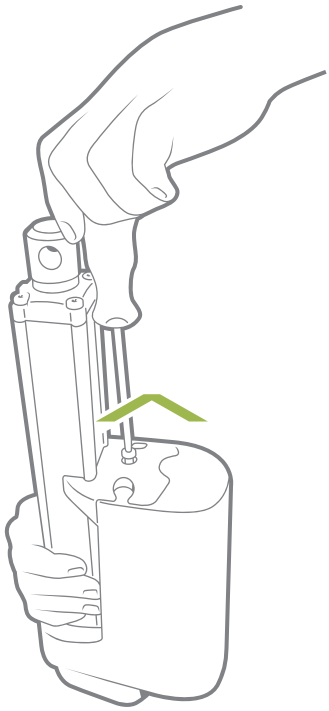
"0" Degrees



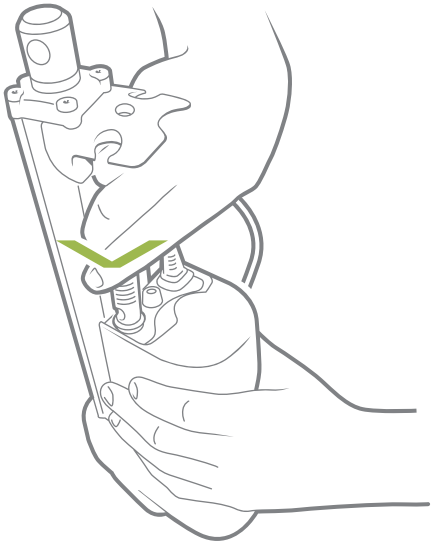
"90" Degrees

NB. Both with tolerance of ±4°

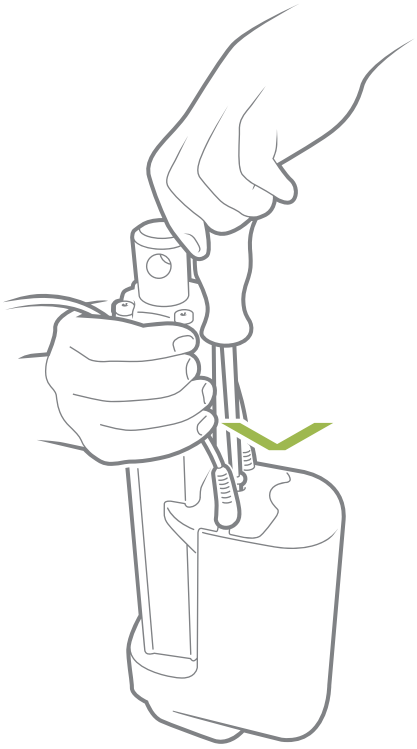
Cable mounting



2. Unscrew the screw and separate the cover from the housing. Remove the blind plug(s).



3. Plug in the power cable and/ or the signal cable.



1. Slide the cover onto the actuator. The torque of the cover screw is approx. 3.5 ± 0.3 Nm TORX 25

When changing the cables on a LINAK® actuator, it is important that this is done carefully, in order to protect the plugs and pins. Before the new cable is mounted, we recommend that the socket is greased with Vaseline®, to keep the high IP protection and ensure an easy mounting. Please be sure that the plug is in the right location and fully pressed in before the cable lid is mounted.

Remove the tinned cable end when the cable end is mechanically connected. The tinned end is only to be used when a soldered connection is made.

Please note that if the cables are mounted and dismounted more than 3 times, the plugs can be damaged. Therefore, we recommend that such cables are discarded and replaced. Also note that the cables should not be used for carrying the actuator.

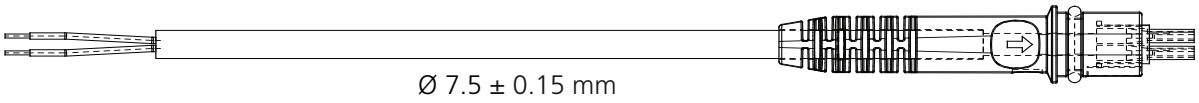
We recommend taking some precaution and designing the wire connection in a way, where the cable end is kept inside a closed, protected area to guarantee the high IP protection.

Cables

Power cable dimensions

LINAK® P/N 0367046

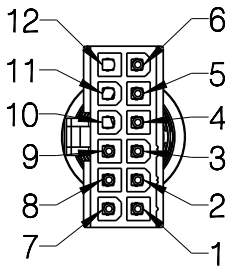
Colour	Outer dimensions	Core mm²	AWG*
Brown	Ø2.8 mm	2.0	14
Blue	Ø2.8 mm	2.0	14



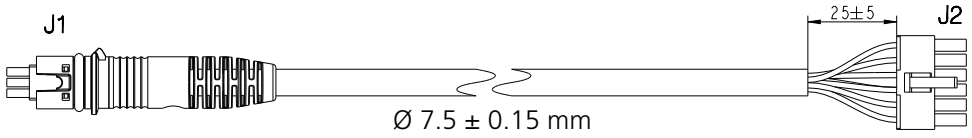
9-pin Signal cable dimensions

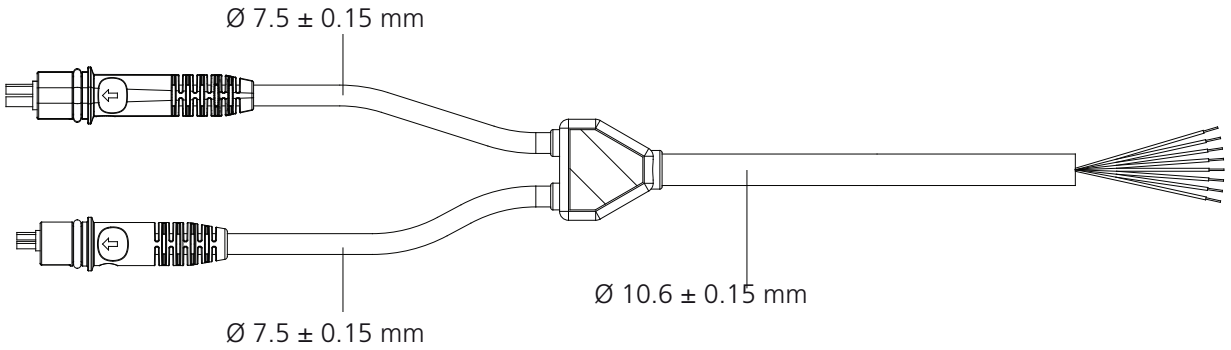
LINAK P/N 0368543

Colour	Outer dimensions	Core mm²	AWG*	Pin
Orange	Ø1.5 mm	0.5	20	5
Black	Ø1.5 mm	0.5	20	1
Red	Ø1.5 mm	0.5	20	2
Light Blue	Ø1.5 mm	0.5	20	6
Yellow	Ø1.5 mm	0.5	20	3
Green	Ø1.5 mm	0.5	20	4
Grey	Ø1.5 mm	0.5	20	0
Violet	Ø1.5 mm	0.5	20	7
White	Ø1.5 mm	0.5	20	8



Front view

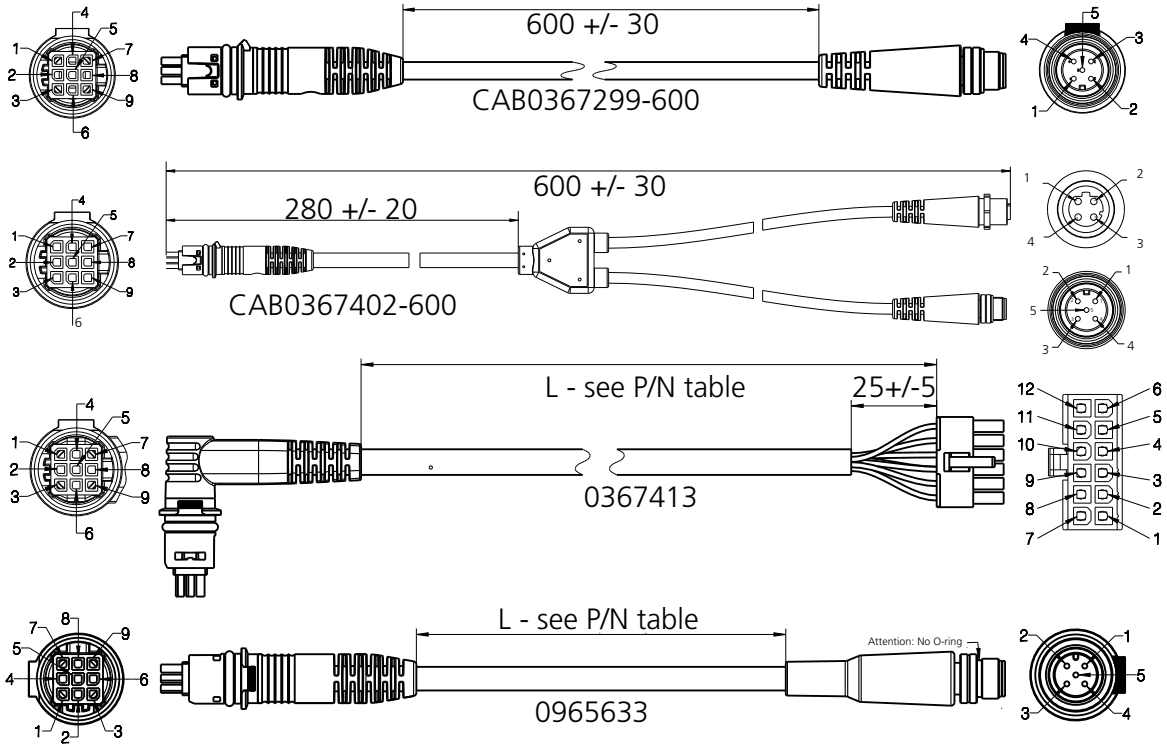




*AWG: American Wire Gauge

Cable P/N Table						
LINAK P/N	**Cable type**		**# Wires**	**mm²**	**AWG***	**Length in mm**
0367006	Power cable with AMP		2	2.0	14	200
CAB0367046-0400	Power cable		2	2.0	14	400
CAB0367046-0600	Power cable		2	2.0	14	600
CAB0367046-1500	Power cable		2	2.0	14	1,500
CAB0367046-5000	Power cable		2	2.0	14	5,000
CAB0368543-1500	Signal cable		9	0.5	20	1,500
CAB0368543-5000	Signal cable		9	0.5	20	5,000
CAB0367299-600	Signal cable for IO-Link		9	0.5	20	600
CAB0367402-600	Signal Y-cable for Ethernet		9	0.5	20	600
0367413-XXXX	Signal cable w. 90° plug		9	0.5	20	600 1,500 5,000
0965633-1000	Signal cable for Modbus		9	0.5	20	1000
0367430-XXXX	Y-Cable Signal and Power	Signal Power	9 2	0.5 2.0	20 14	1,500 5,000 10,000
CAB0367440-XXXX	Y-Cable w. 90° plug	Signal Power	9 2	0.5 2.0	20 14	1,500 5,000 10,000

*AWG: American Wire Gauge



Cable kit article numbers

Actuator Connect™ cable kits:				
System	**Article no.**	**Connection**	**Includes**	**Colour**
All Actuators with 9-pin e.g. I/O: Basic, Customised and Full & CAN SAE J1939 / CanOpen	0367996	Signal-power + RJ45	(Adapter + USB2Lin)	Grey

Latest versions of Actuator Connect can be downloaded at the LINAK/TECHLINE page.

Manual hand crank

The manual hand crank can be used in the case of a power failure and is only intended for emergency use.

The cover over the Allen key socket must be unscrewed before the Allen key can be inserted and the hand crank operated.

Hand crank torque: 6-8 Nm
Hand crank RPM: Max. 65

Piston rod movement per turn: Gear H = 4.0 mm
* 5 mm Allen key -if stainless steel piston rod eye and back fixture are chosen

- The power supply has to be disconnected during manual operation.
- If the actuator is operated as a hand crank, it must only be operated by hand
- otherwise there is a potential risk of overloading and thereby damaging the actuator.
  Do NOT use power tools to operate the hand crank!
- After using the hand crank, the ingress protection IP66 cannot be maintained.
- After using the hand crank, always return the actuator to the most inward position.
  Failing to do so can damage the actuator or the application it is used for.
- Actuators with absolute positioning must be initialised after use of the manual hand crank,
  because their positioning will be displaced when the power is disconnected.

Environmental tests - Climatic

Test	Specification	Comment
Cold test	EN60068-2-1 (Ab)	Storage at low temperature: Temperature: -40°C Duration: 72 h Not connected Tested at room temperature
	EN60068-2-1 (Ad)	Storage at low temperature: Temperature: -30°C Duration: 2 h Actuator is not activated/connected Tested at low temperature
Dry heat	EN60068-2-2 (Bb)	Storage at high temperature: Temperature: +90°C Duration: 72 h Actuator is not activated/connected Tested at room temperature
	EN60068-2-2 (Bd)	Storage at high temperature: Temperature: +70°C Duration: 1000 h Actuator is not activated/connected Tested at high temperature Operating at high temperature: Temperature: +60°C Int. max. 17% Duration: 700 h Actuator is activated Tested at high temperature
Change of temperature	EN60068-2-14 (Na)	Rapid change of temperature: High temperature: +100°C in 60 minutes Low temperature: -30°C in 60 minutes Transition time: <10 seconds Duration: 100 cycles Actuator is not activated/connected Tested at room temperature
	EN60068-2-14 (Nb)	Controlled change of temperature: Temperature change 5°C pr. minute High temperature: +70°C in 60 minutes Low temperature: -30°C in 30 minutes 130 minutes per cycle Duration: 1,000 cycles (90 days) Actuator is not activated/connected Tested at 250, 500 and 1,000 cycles at low and high temperatures.

Environmental tests - Climatic

Damp heat	EN60068-2-30 (Db) EN60068-2-3 (Ca)	Damp heat, cyclic: Relative humidity: 93-98% High temperature: +55°C in 12 hours Low temperature: +25°C in 12 hours Duration: 21 cycles * 24 hours Actuator is not activated/connected Tested within 1 hour after condensation, after upper temperature has been reached. Damp heat, steady state: Relative humidity: 93-95% Temperature: +40 ± 2°C Duration: 56 days Actuator is not activated/connected Tested within one hour after exposure.
Salt spray test		Actuators are tested for corrosion resistance at 500 hours salt spray test.
Degrees of protection IPX6 static		IPX6 static: Actuators are tested for water ingress according to IPX6, without movement. IPX4 dynamic: Actuators are tested in rainy conditions with movement. IP6X: Actuators are tested for dust sealing properties according to IP6X.
Chemicals	BS7691 / 96 hours	Diesel 100% Hydraulic oil 100% Ethylene Glucol 50% Urea Nitrogen saturated solution Liquid lime 10% (Super- Cal) NPK Fertilizer (NPK 16-4-12) saturated Tested for corrosion.
Climate test with Modbus PCB		Actuators with Modbus PCB are tested with 10.000 N load at temperatures of +5°C and +40°C.
Climate test with Hall PCB		Actuators with Hall PCB are tested with 15.000 N load at temperatures of -30°C and +70°C.

Environmental tests - Mechanical

Test	Specification	Comment
Free fall		Free fall from all sides: Height of fall: 0.4 meter onto steel. Actuator not activated/connected.
Vibration	EN60068-2-36 (Fdb) EN 60068-2-6 (Fc)	Random vibration: Short time test: 6.29 g RMS Actuator is not connected Long time test: 7.21 g RMS Actuator is not connected Duration: 2 hours in each direction Sinus vibration: Frequency 5-25Hz: Amplitude = 3.3 mm pp Frequency 25-200Hz: Acceleration 4 g Number of directions: 3 (X-Z-Y) Duration: 2 hours in each direction Actuator is not activated.
Bump	EN60068-2-29 (Eb)	Bump test: Level: 40 g Duration: 6 milliseconds Number of bumps: 500 shocks in each of 6 directions. Actuator is not connected.
Shock	EN60068-2-27 (Ea)	Shock test: Level: 100g Duration: 6 milliseconds Number of bumps: 3 shocks in each of 6 directions. Actuator is not connected.
Static load		Static push and pull tests of basic actuators with 500, 750 and 1000mm strokes.
Dynamic load		Dynamic push/pull tests of the actuator.
Self-locking test		Self-locking tests at dynamic and static load.
Abuse test		Tests at 100% duty cycle until damage.
Lifetime test		Lifetime tests performed at combined loads in push and pull situations.

Environmental tests - Electrical

Test	Specification	Comment
Power supply	ASAE EP455 (1990)	Operating voltages +10 V - +16 V Overvoltage +26 (V) / 5 min. Reverse polarity –26 (V) / 5 min. Short circuit to ground 16 (V) / 5 min. Short circuit to supply 16 (V) / 5 min.
HF-immunity	EN61000-6-2	Level: 30 V/m. at 26 MHz – 1000 mHz 80% 1 KHz
Emmision	EN61000-6-4	Level is within limits for the motor
Insulation test		Level: 500 VAC/25-100 hz for 1 minute
Automotive transients	ISO 7677	Load dump test only accepted on motor power connection.
Current and speed		Actuators with loads of 0 N, 7.500 N and 15.000 N are tested at -30°C, +20°C and 70°C

All electrical and radiated emission (EMC) tests are conducted.

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