TECHLINE®
IMPROVING FLEXIBILITY

Linear Actuator LA36

Data Sheet

LINAK®
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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.

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Introduction

Extremely powerful linear actuator made by LINAK. Up to 6,800 N thrust, or up to 168 mm/s. Designed to operate in extreme conditions. Solid choice for industrial and agricultural applications.

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 user manual.

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.
- 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.
- The standard actuator (without Integrated Controller) without clutch, is not allowed to run into a mechanical block before reaching the end of stroke.

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 LA36 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 negative pressure inside the actuator if it is extended which over time can lead to water entering the actuator.

Features

- 12, 24, 36 or 48 V DC permanent magnetic motor (IC only 12/24/48 V DC)
- Load from 500 N - 6.800 (depending on gear ratio and spindle pitch)
- Max. speed 168 mm/sec. (depending on gear ratio and spindle pitch)
- Stroke length from 25 to 1200 mm (with Integrated Controller from 75 to 1200 mm)
- Built-in endstops reached function
- 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.
- Heavy duty aluminium housing for harsh conditions
- Protection class: IP66 for outdoor use (dynamic). Furthermore, the actuator can be washed down by a high pressure cleaner (IP69K - static)
- Hand crank for manual operation
- Integrated brake with high self-lock ability
- Endplay: see Technical Specifications
- Non-rotating piston rod eye
- Noise level: 76 dB(A). Measuring method: DS/EN ISO 3746 (actuator not loaded)
- Weight: 4.55 kg for 100 mm stroke; additional 0.24 kg for each additional 50mm stroke

  (Cable not included; weight varies by selected options)
- Off-highway Features:
  - 12 or 24 V DC brushed permanent magnetic motor
  - Load from 1,700 N - 6,800 N (depending on gear ratio and spindle pitch)
  - Max. speed 7 mm/sec. to 100 mm/sec. (depending on gear ratio and spindle pitch)
  - Reinforced aluminium housing for harsh conditions
  - IPC-A-610 Class 3 (High-performance electronic products)
  - IP54 without cable mounted
    IP69K (static) with cable mounted with shell or moulded cable
  - Connector plug type: DT16-18SA-K004, AT16-18SA-K004 or TE 2600047-1

An Off-highway vehicle is intended for use on steep or uneven ground and includes those used for construction or agriculture. They are specifically designed for off-road use.

Quad bikes, dirt bikes, dune buggies and other types of all-terrain vehicles are also types of Off-highway vehicles, although their function is very different from motor vehicles designed for industrial and farming use.

Options in general

- Back fixture can be ordered in steps of 30 degrees
- Exchangeable cables in different lengths
- Hall effect sensor
- Analogue or digital feedback for precise positioning
- Endstop reached signals
- Mechanical overload protection through integrated slip clutch -Standard actuators only
- Mechanical potentiometer (not applicable with IC)
- When ordering AISI (304 and up) piston rod eye and back fixture, stainless steel screws are automatically included
- Special anodised housing for Harsh environment
- Adjustable magnetic sensors for endstop signals (code no. 1017031)
- IC options including:
    - I/O
    - Ethernet/IP
    - Modbus TCP/IP
    - Modbus RTU
    - PROFINET
    - IO-Link
    - LIN bus
    - CAN SAE J1939
    - CANopen
    - Off-highway LIN bus
    - Off-highway CAN SAE J1939
    - Off-highway CANopen

See specific interface user manuals at the TECHLINE webpage for Connection Diagrams and I/O specifications

- PC configuration tool (BusLink or Actuator Connect™)
- ATEX/IECEx/CCC (Ex) certified for Zone 21 (Not applicable for Off-highway actuators)

Usage

- Duty cycle at full load up to 600 mm stroke: max. 20% (4 minutes drive and 16 minutes rest)
- Duty cycle at full load for 601-999 mm : max. 15% (3 minutes drive and 17 minutes rest)
- Duty cycle at full load for 1000-1200 mm stroke: max. 10% (2 minutes drive and 18 minutes rest)

These duty cycles are specified for an ambient temperature of 40 °C.
Variations in load or ambient temperature will change the actual duty cycle values.
The maximum run time of the actuator must be determined based on an overall cycle time of 20 minutes or less.

- Ambient operating temperature: Full performance from +5°C to +40°C
  -30°C (reduced load 50%) to +85°C (reduced duty cycle 10%)
  -40°C (no load)
- Ambient operating temperature for ATEX/IECEx/CCC: -25°C to +65°C
- Storage temperature: Actuator is not activated/ connected
  -40 °C to +70 °C
  -40°C to +85°C for 72 hours
  -55°C to +95°C for 24 hours for Standard platform
  -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 neither activated nor 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

  - For applications operated at constantly low temperatures LINAK recommends a stronger version of the actuator to reduce the current consumption that in some combinations can be up to 3 times higher (at -40° Celsius)

- Off-highway:
  - Tested according to: ISO14982-1 / Agricultural and forestry machinery - Electromagnetic compatibility - Part 1: General EMC requirements (clamped capacitor circuit)
  - Compliant with: ROHS2 : 2011/65/EU: Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment EMC Directive - 2014/30/EU

Ordering Example

36 120 200 0 A 01 B 6 - 6 1 1 H 3 0300 N C S 0 0 0

Actuator type

36 = LA36

Spindle type

080 = 8 mm
160 = 16 mm
120 = 12 mm
200 = 20 mm

Stroke length

200 = XXX Length in mm (25-995)
BXX = 11XX Length in mm (1,100-1,195)
AXX = 10XX Length in mm (1,000-1,095)
C00 = 1,200 mm

Safety

0 = No safety nut
A = Safety nut (Push only)

Feedback

0 = No Feedback
A = Analogue feedback (Hall potentiometer)
F = PWM
H = Dual Hall
I = Potential Free
P = Potentiometer (standard platform actuators only)
K = Single Hall
X = Special

Platform

6-pin

Endstop switch principle

00 = Standard
01 = Standard with power switch
07 = CAN SAE J1939
08 = CANopen

Zero Point

16 = LIN bus
17 = CAN SAE J1939
18 = CANopen

18-pin Off-highway**

C6** = LIN bus*
D6** = CAN SAE J1939*
E6** = CANopen*

XX = Special*

9-pin

Zero Point

B3 = I/O Basic
C3 = I/O Customised
F3 = I/O Full
0B = IO-Link
14 = Modbus RTU

Zero Point with split power supply

A7 = CAN SAE J1939
A8 = CANopen
0E = Modbus TCP/IP*
2E = EtherNet/IP*
4E = PROFINET*

Motor type

A = 12 V DC with Clutch
B = 24 V DC with Clutch
C = 36 V DC with Clutch
J = 48 V DC with Clutch*
1 = 12 V DC
2 = 24 V DC
3 = 36 V DC
4 = 48 V DC*

* Not available with **Housing** option T (ATEX/IECEx/CCC approval)
** Requires **Housing** option C (IP66 Off-highway), also only available with **Motor type** option 1 or 2

Housing	**6**	=	IP66 - Reinforced house	A	=	IP66
	9	=	Harsh environment	T*	=	IP66 ATEX / IECEx / CCC approved
				C**	=	IP66 Off-highway
Reed	**-**	=	No magnet for Reed limit switch	+***	=	With magnet for Reed limit switch
Colour**	**6**	=	Dark Olivish Grey NCS S7000-N	9	=	Black NCS S8800-N
				X	=	Special
Back fixture	**1**	=	0 °	A	=	30°
	2	=	90°	B	=	60°
	4	=	Male Adapter (Outer thread)	C	=	120°
	5	=	Female Adapter (Inner thread)	D	=	150°
	6	=	Rotated in 30° intervals	X	=	Special
Piston rod eye	**1**	=	Slotted	5	=	Female Adapter (Inner thread)
	2	=	Solid	6	=	Ball eye
	4	=	Male Adapter (Outer thread)	X	=	Special
Gear	E	=	Ratio 1:7	F	=	Ratio 1:18
	G	=	Ratio 1:31	**H**	=	Ratio 1:46
Brake	**3**	=	Push/Pull			
Built-in dimension	**0300**	=	300 mm (min. length)	xxxx	=	Measured in mm
Endstop reached output In/Out	A	=	A_HIGH / A_HIGH	J	=	A_HIGH / LOW
	B	=	A_LOW / A_HIGH	K	=	A_LOW / LOW
	C	=	A_HIGH / A_LOW	L	=	A_HIGH / HIGH
	D	=	A_LOW / A_LOW	M	=	A_LOW / HIGH
	E	=	LOW / A_HIGH	**N**	=	LOW / LOW
	F	=	HIGH / A_HIGH	O	=	HIGH / LOW
	G	=	LOW / A_LOW	P	=	LOW / HIGH
	H	=	HIGH / A_LOW	Q	=	HIGH / HIGH
				X	=	Special

* ATEX and IECEx are available with **Platform** options with both 6 and 9 pins
-CCC is available with **Platform** options with 6-pins only.

** Requires **Platform** option 18-pin Off-highway and only available with **Motor type** option 1 or 2

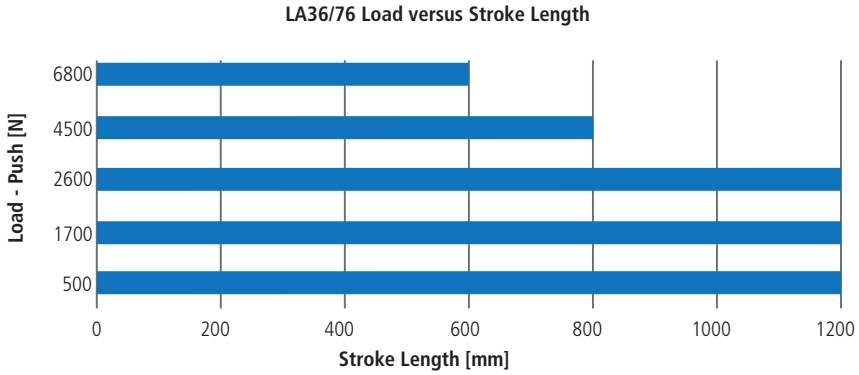
*** The Reed limit switch is ordered separately (1017031). Reed is Not available with Zero point **Platforms**

**** The choice of **Colour** is not optional but is determined by the type of **Housing**

Plug type	0*	=	No plug (requires cable '0')	E***	=	M12 Y Ethernet
	J	=	Deutsch	R	=	M12 Modbus RTU
	9	=	Deutsch - Moulded	N	=	M12 IO-Link
	C	=	Flying leads**	X	=	Special
Cable	0*	=	No cable selected	A	=	Mounted with 90° angled connectors
	S**	=	Straight cable**	Y	=	Y-Cable (combined power and signal cable)
	V	=	Y-Cable with 90° angled connectors	X	=	Special
Parallel mode	**0**	=	Parallel disabled	2-8	=	Critical parallel (number of actuators in the parallel system)
SW config.	**0**	=	Default software	X	=	Special software
Not used	**0**	=	Not used			

* Shall be chosen with 'Off-highway' **Platform** options C6, D6 and E6
** Required for ATEX/IECEx/CCC approval
***Actuators with **Platform** option Ethernet/IP are only compatible with **Plug** option E and **Cable** option S

Load vs stroke length



Please note:

500-1,700 N is with 20 mm spindle pitch

500-5,600 N is with 16 mm spindle pitch

500-6,800 N is with 8/12 mm spindle pitch

- For applications that only operate in pull, the limitations are 1,200 mm stroke and 6,800 N load

Technical specifications

12 V

Load max. [N]	Self-lock min. [N]	Pitch [mm/ spindle rev.]	Gear/ Ratio	Hall Resolution [mm/count]	End-play in mm	Speed [mm/s]			Consumption [A]	
						No load	No-min-al load	Reg-ula-ted	No load	No-min-al load
500*	1,000	20	E 1:7	0.721	4.5	160	135	114	7.6	20
1,700	2,200	20	F 1:18	0.721	3.5	73	52	52	4.5	22
2,000	2,600	16	F 1:18	0.577	2.9	57	43	44	4.5	21
2,400	3.400	20	G 1:31	0.432	3.5	42	35	31	4,5	19
2,600	3,400	12	F 1:18	0.433	2.6	43	30	34	4.5	21
3,400	4,400	16	G 1:31	0.339	2.3	35	25	25	4.5	21
4,500	5,800	12	G 1:31	0.254	2.3	26	18	18	4.5	21
5,600	6,600	16	H 1:46	0.221	2.2	23	17	16	4.5	21
6,800	8,800	12	H 1:46	0.166	2.2	17	12	13	4.5	21
6,800	13,000	8	H 1:46	0.110	2.2	12	7	8.8	4.5	17

24 V

Load max. [N]	Self-lock min. [N]	Pitch [mm/ spindle rev.]	Gear/ Ratio	Hall Resolution [mm/count]	End-play in mm	Speed [mm/s]			Consumption [A]	
						No load	No-min-al load	Reg-ula-ted	No load	No-min-al load
500*	1,000	20	E 1:70	0.721	4.5	160	135	114	4.2	10.0
1,700	2,200	20	F 1:18	0.721	3.5	72	52	54	2.4	10.3
2,000	2,600	16	F 1:18	0.577	2.9	60	43	44	2.4	10.3
2,400	3,400	20	G 1:31	0.432	3.5	42	35	31	2.4	9
2,600	3,400	12	F 1:18	0.433	2.6	44	32	33	2.4	10.4
3,400	4,400	16	G 1:31	0.339	2.3	35	25	25	2.4	10.3
4,500	5,800	12	G 1:31	0.254	2.3	26	19	19	2.4	10.2
5,600	6,600	16	H 1:46	0.221	2.2	23	17	17	2.4	10.3
6,800	8,800	12	H 1:46	0.166	2.2	17	13	12	2.4	10.3
6,800	13,000	8	H 1:46	0.110	2.2	17	7	9	2.4	8

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 at 20°C.

* Note: Fully loaded actuators need a soft start in order to prevent the clutch from slipping when starting (see curves). (Not available for 'Off-highway' actuators).

Please note that all actuators featuring ‘LIN bus’, ‘CAN SAE J1939’, 'CANopen' and ‘Modbus’ will run at a regulated speed, see table above.

Technical specifications

36 V

Load max. [N]	Self-lock min. [N]	Pitch [mm/ spindle rev.]	Gear/ Ratio	Hall Resolution [mm/count]	End-play in mm	Speed [mm/s]			Consumption [A]	
						No load	No-minal load	Reg-ula-ted	No load	No-minal load
500*	1,000	20	E 1:7	0.721	4.5	160	135	-	2.8	8.0
1,700	2,200	20	F 1:18	0.721	3.5	68	52	-	2.0	8.0
2,000	2,600	16	F 1:18	0.577	2.9	55	43	-	2.0	8.0
2,600	3,400	12	F 1:18	0.433	2.6	45	33	-	2.0	8.0
3,400	4,400	16	G 1:31	0.339	2.4	31	25	-	2.0	8.0
4,500	5,800	12	G 1:31	0.254	2.3	23	19	-	2.0	8.0
5,600	6,600	16	H 1:46	0.221	2.3	21	17	-	2.0	8.0
6,800	8,800	12	H 1:46	0.166	2.2	16	13	-	2.0	8.0
6,800	13,000	8	H 1:46	0.110	2.2	11	7	-	2.0	6.5

48 V

Load max. [N]	Self-lock min. [N]	Pitch [mm/ spindle rev.]	Gear/ Ratio	Hall Resolution [mm/count]	End-play in mm	Speed [mm/s]			Consumption [A]	
						No load	No-minal load	Reg-ula-ted	No load	No-minal Load
500*	1,000	20	E 1:7	0.721	4.5	168	141	120	2.4	7
1,700	2,200	20	F 1:18	0.721	3.5	78	59	55	1.5	7
2,000	2,600	16	F 1:18	0.577	2.9	57	35	44	1.5	7
2,600	3,400	12	F 1:18	0.433	2.6	48	35	33	1.5	7
3,400	4,400	16	G 1:31	0.339	2.4	37	27	26	1.5	7
4,500	5,800	12	G 1:31	0.254	2.3	28	20	19	1.5	7
5,600	6,600	16	H 1:46	0.221	2.3	25	18	17	1.5	7
6,800	8,800	12	H 1:46	0.166	2.2	18	15	13	1.5	7
6,800	13,000	8	H 1:46	0.110	2.2	13	9	5	1.5	5.5

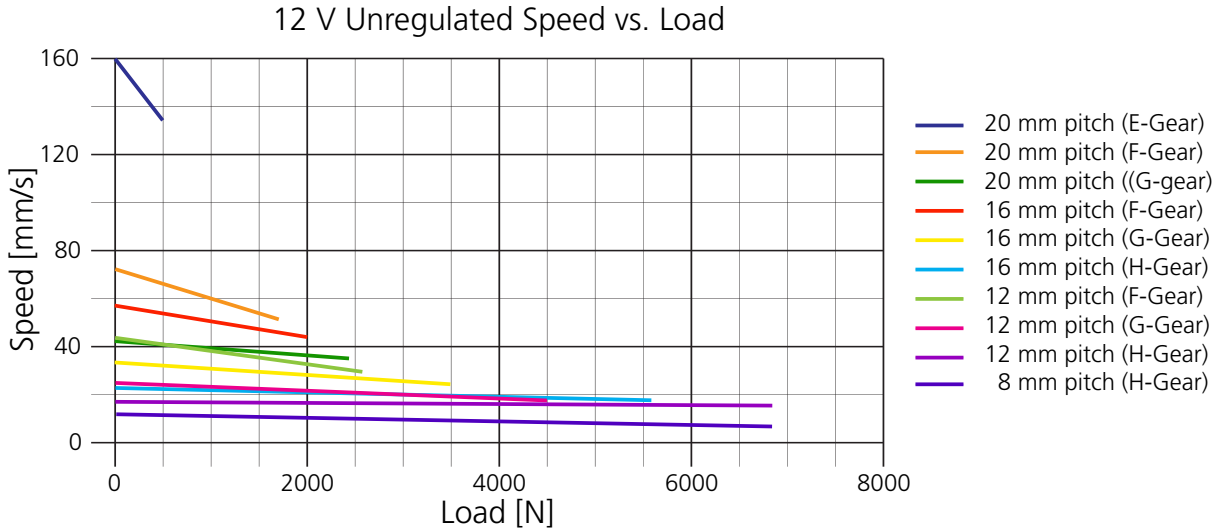
The typical values can have a variation of ± 20% on the current values and ± 10% on the speed values. Measurements are made with an actuator in connection with a stable power supply and an ambient temperature at 20°C.

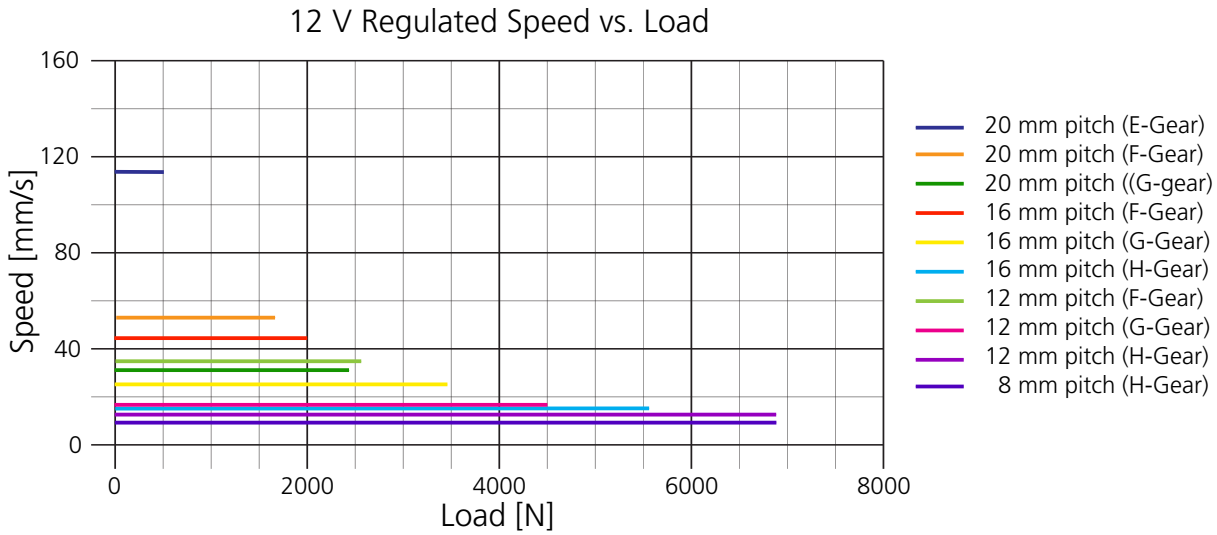
* Note: Fully loaded actuators need a soft start in order to prevent the clutch from slipping when starting (see curves).

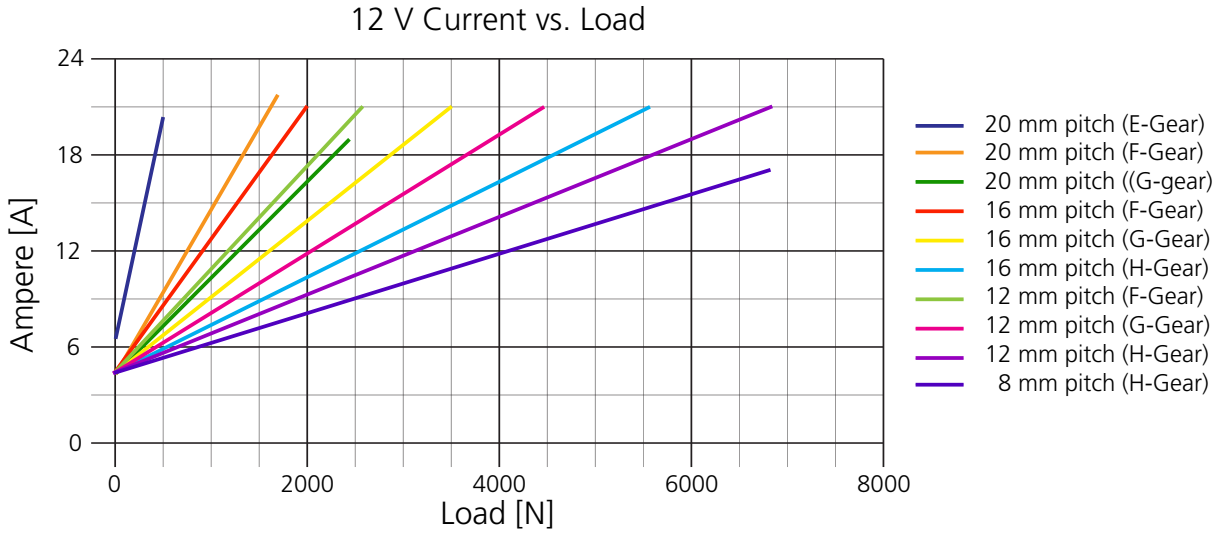
Please note that all actuators featuring “LIN bus’, ‘CAN SAE J1939’, 'CANopen' and ‘Modbus’ will run at a regulated speed, which is typically around 80% of the speed at the nominal load.

Speed and current curves

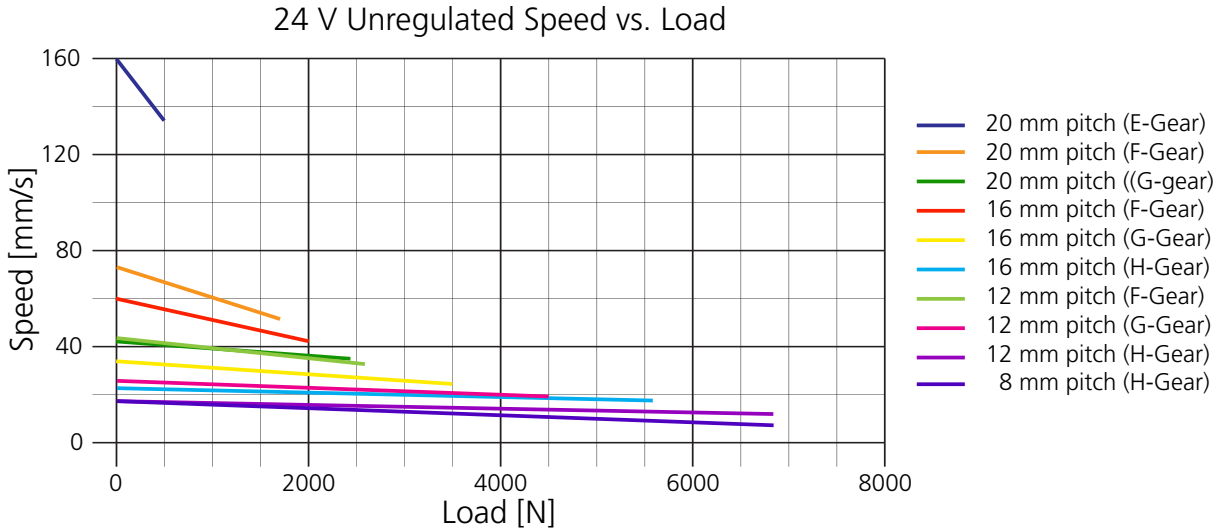
The typical values below are made with a stable power supply and an ambient temperature of 20°C.

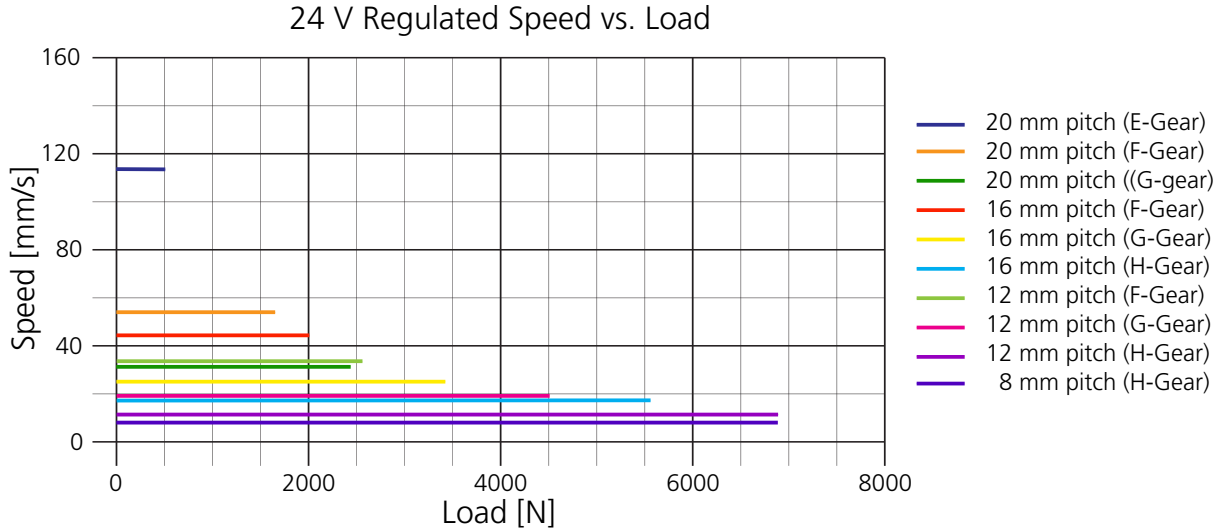


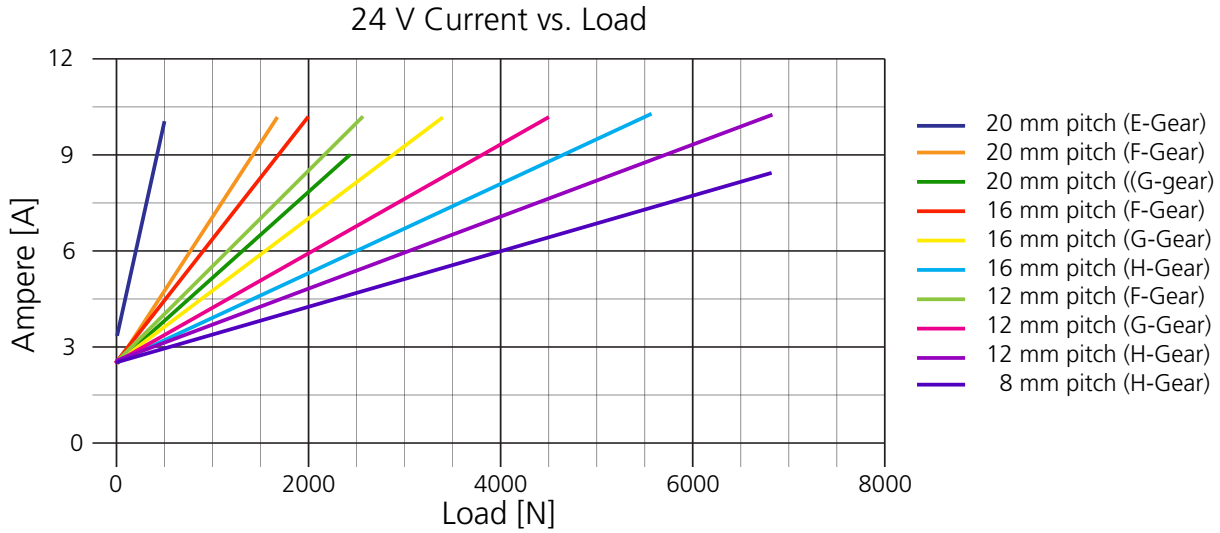




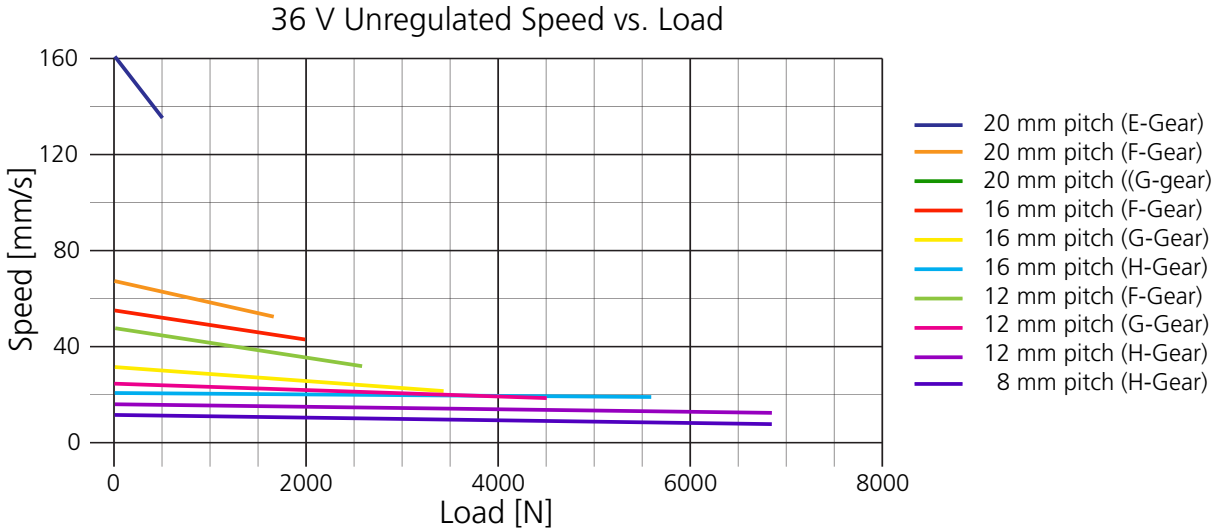
The typical values below are made with a stable power supply and an ambient temperature of 20°C.

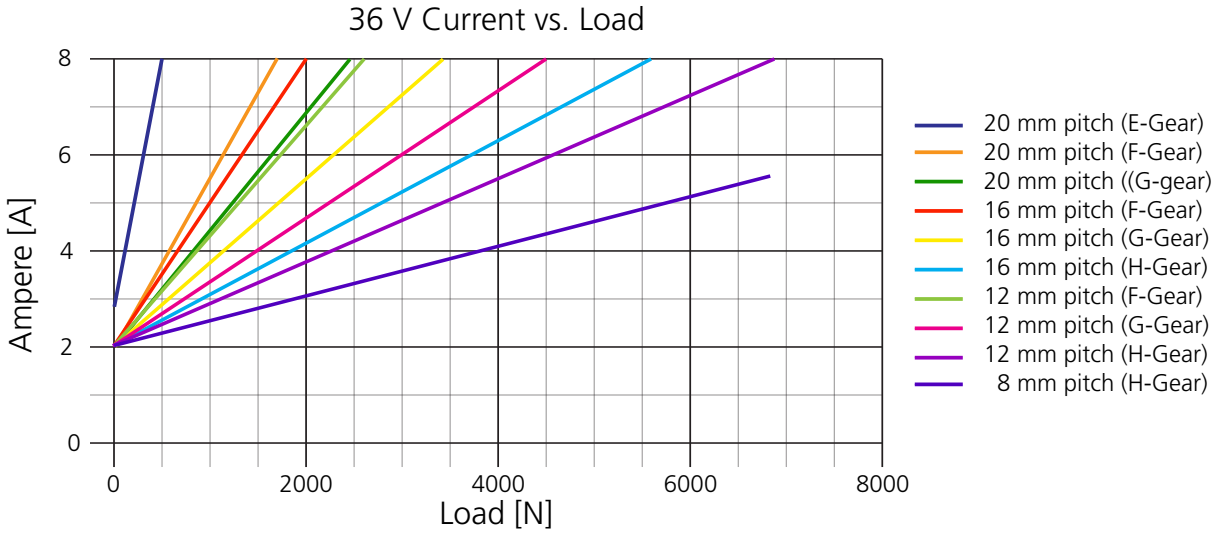




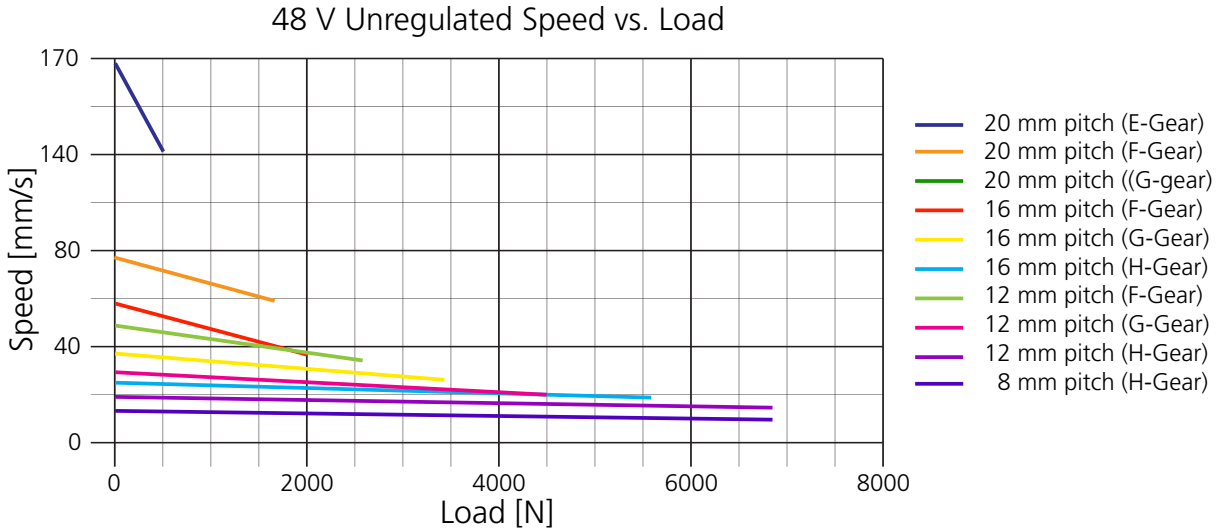


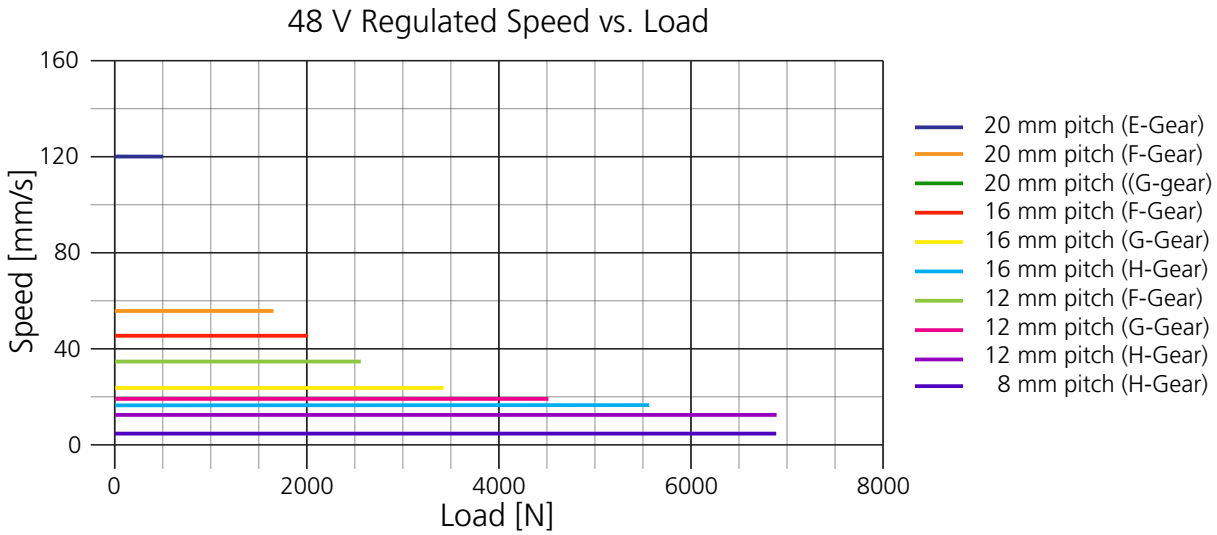
The typical values below are made with a stable power supply and an ambient temperature of 20°C.

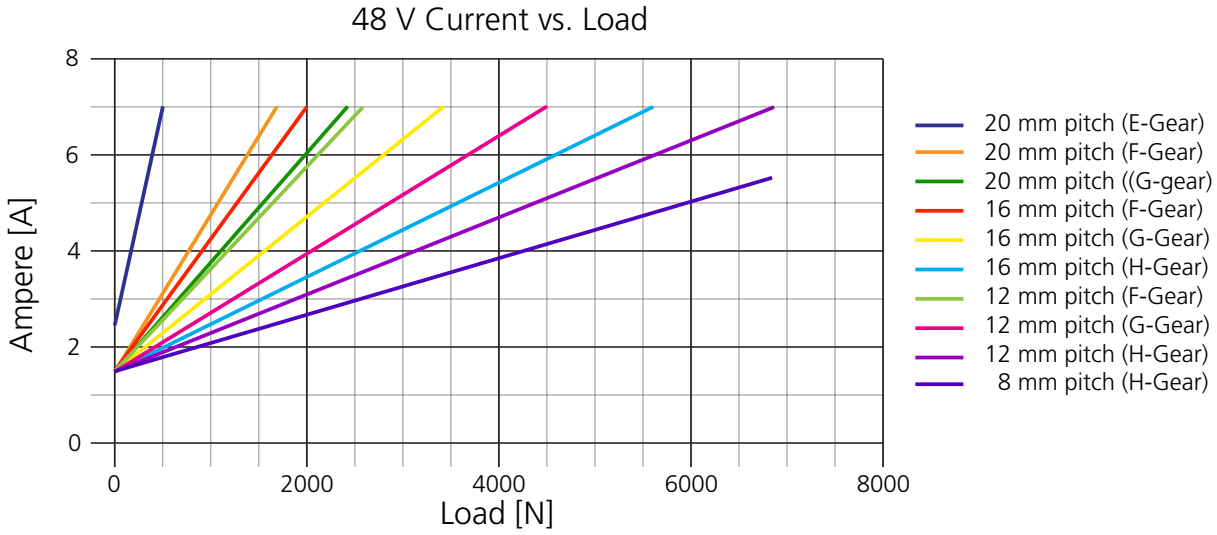




The typical values below are made with a stable power supply and an ambient temperature of 20°C.



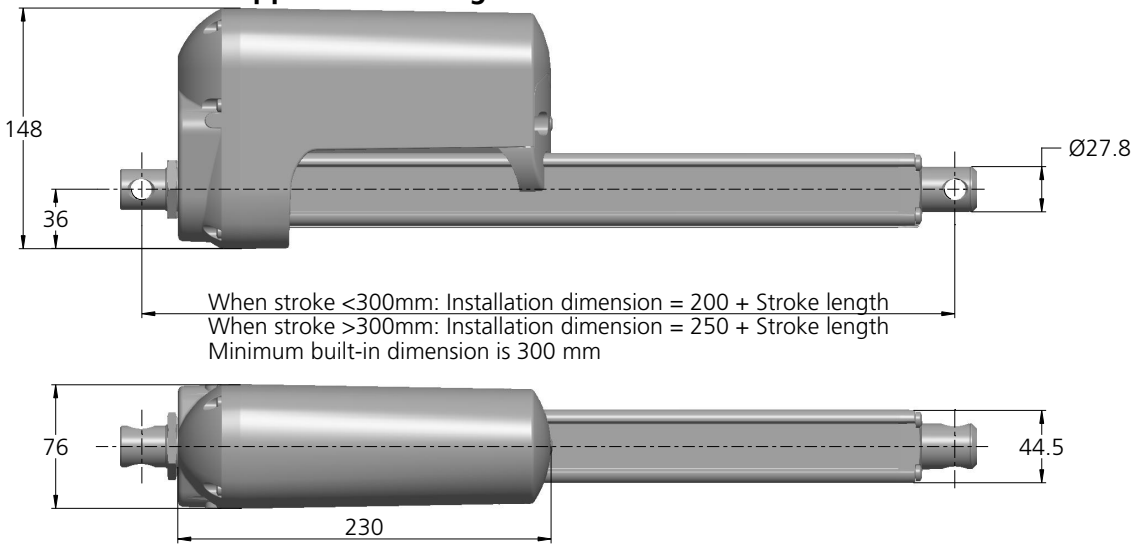




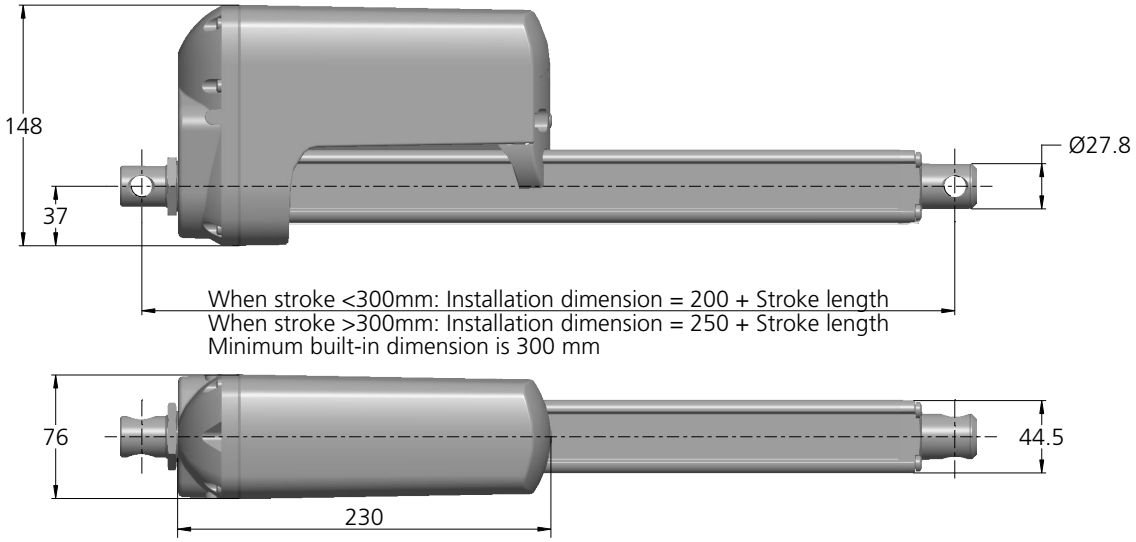
Built-in dimensions

All measurements are in mm.

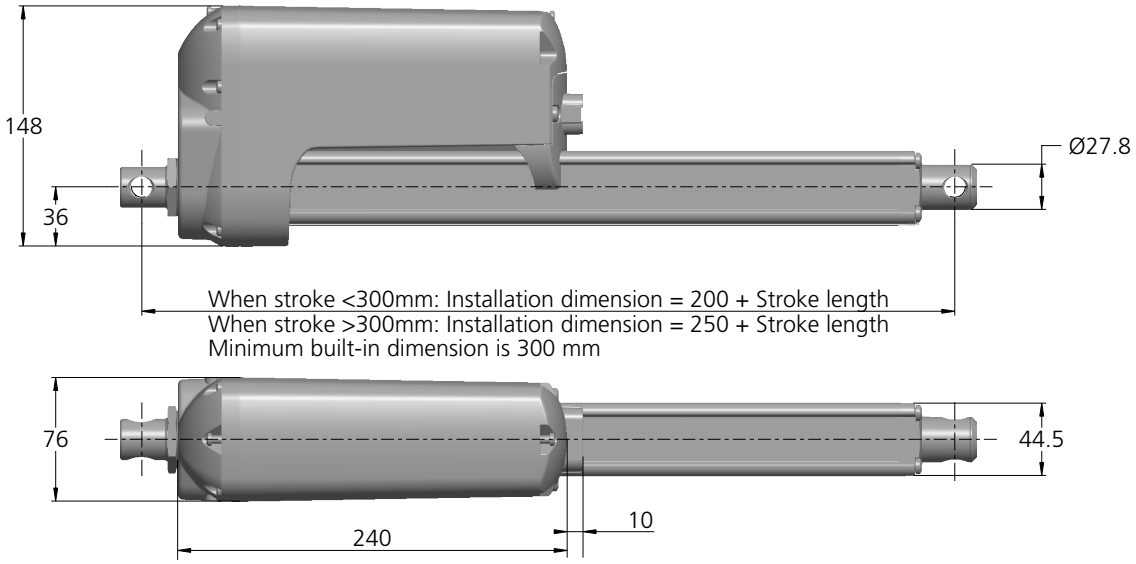
IP66, ATEX / IECEx / CCC approved housing



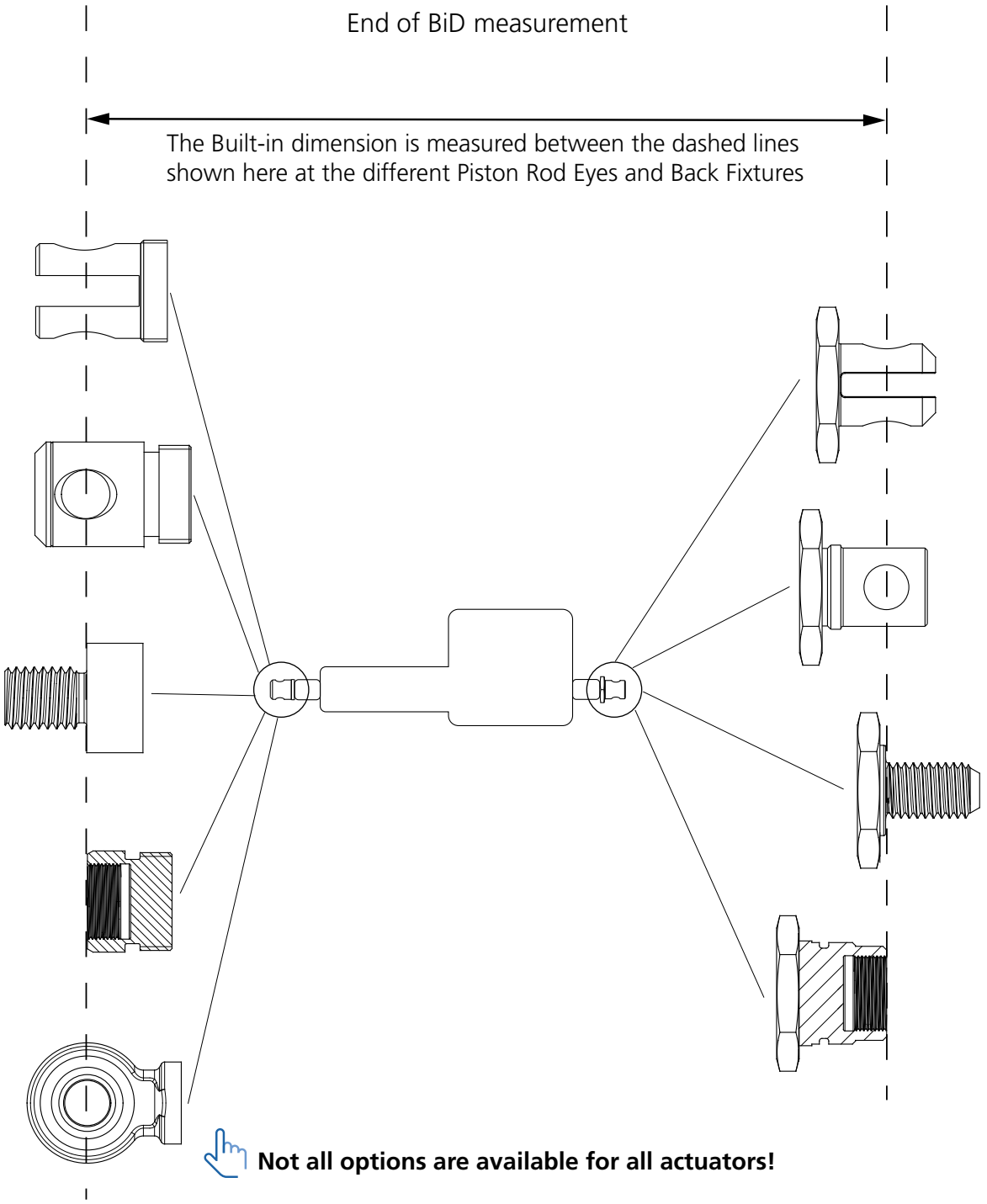
Reinforced housing



Off-highway



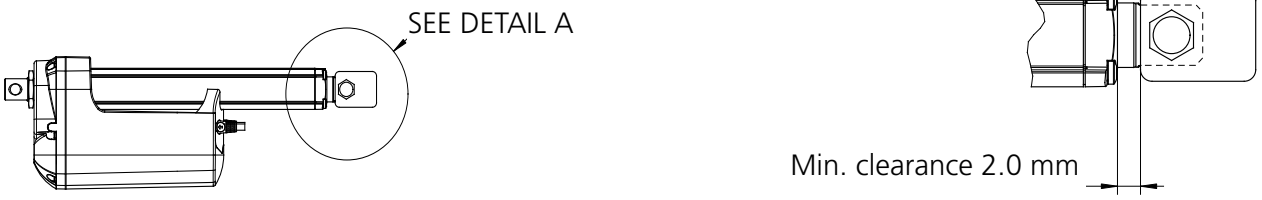
Built-in dimensions to and from measure points



	Back fixture	Slotted/Solid		Male adapter		Female adapter	
Stroke length		<=300	>300	<=300	>300	<=300	>300
Piston rod eye		From center of hole		From the surface		From the surface	
Slotted/Solid	From center of hole	200	250	185	235	194	244
Male Adapter	From the surface	187	237	173	223	181	321
Female adapter	From the surface	195	245	180	230	189	239
Ball Eye	From center of hole	215	265	200	250	209	259
All dimensions are in mm. The stroke length added to the above numbers, results in the built-in dimension.							

Keep a clearance when mounting a bracket

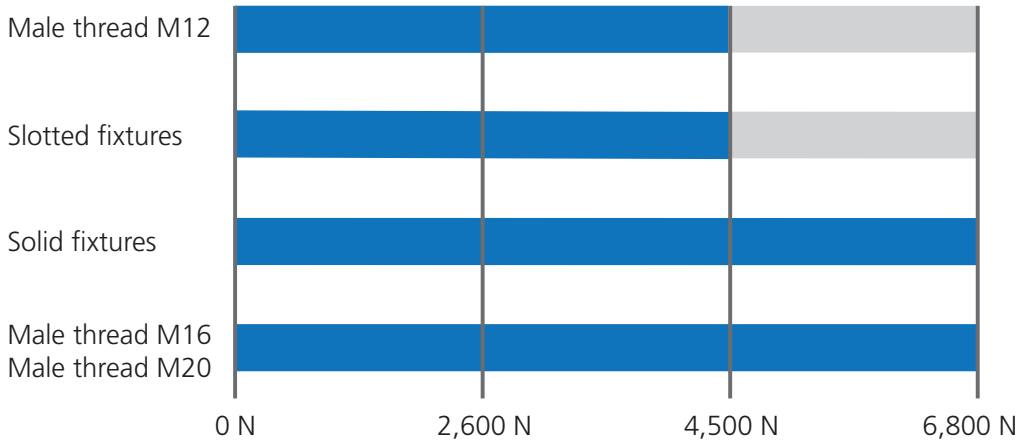
When mounting a custom bracket on the moving part of the actuator, please observe the minimum clearance between bracket and cylinder top when fully retracted. This will prevent jamming and destruction of the actuator drive train.



With Zero point the minimum stroke is 75 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.

Durability for piston rod eyes and back fixtures



Blue = Full Lifetime

Grey = Reduced lifetime

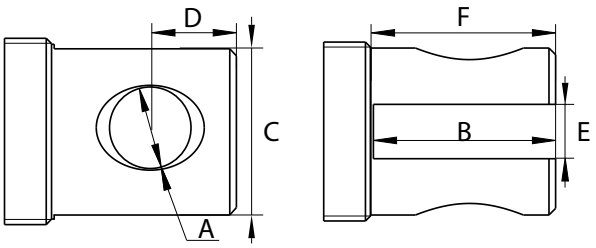
(If e.g. a Male thread M12 is used with an actuator with a larger load than 4,500 N and a Slotted fixture is used with an actuator with a larger load than 4,500 N their lifetime will be shorter than if the other fixtures are chosen).

In some applications the bolt through the fixtures can, duríng movement, rotate inside the fixture.
The friction between bolt and fixture creates excessive wear that shortenes the lifetime of the fixtures.
In applications where this is happening, we recommend solid fixtures with bushings which prevent this specific type of wear.

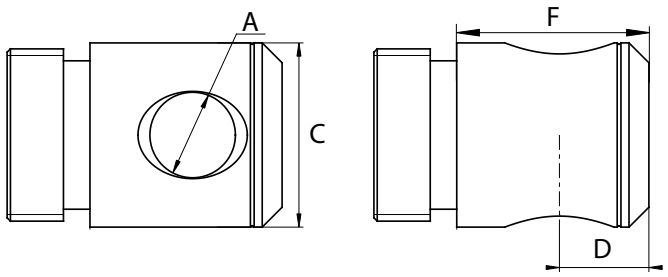
Piston rod eyes

All dimensions are in mm. Piston rod eyes are allowed to turn 0-180°

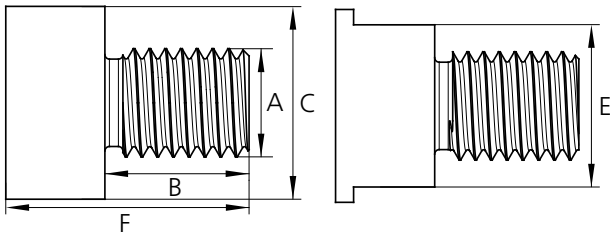
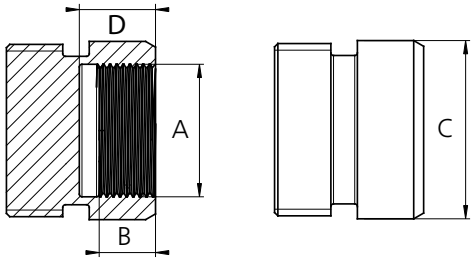
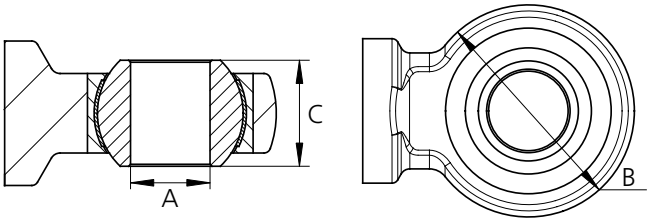
Option	Piston rod eye	Material	A	B	C	D	E	F (~)	Change in BiD	P/N
1	Slotted	Free cutting steel	Ø 12.2	27.5	27.8	13.5	7	29	0	0361137
1	Slotted	Free cutting steel	Ø 12.2	27.5	27.8	13.5	8.2	29	0	0361138
1	Slotted	AISI 304	Ø 12.2	27.5	27.8	13.5	8.2	29	0	0361260
1	Slotted	AISI 316	Ø 12.2	27.5	27.8	13.5	8.25	29	0	0361304
1	Slotted	Free cutting steel	Ø 12.9	27.5	27.8	13.5	8.2	29	0	0361636
1	Slotted	AISI 304	Ø 12.9	27.5	27.8	13.5	8.2	29	0	0361275



2	Solid	Free cutting steel	Ø 12.2	-	27.8	13.5	-	29	0	0361109
2	Solid	AISI 304	Ø 12.2	-	27.8	13.5	-	29	0	0361382
2	Solid	Free cutting steel	Ø 12.9	-	27.8	13.5	-	29	0	0361018
2	Solid	AISI 304	Ø 12.9 H10	-	27.8	13.5	-	29	0	0361340
2	Solid w/ bushing*	AISI 304 Bushing: PTFE composit	Ø 12 H9	-	27.8	13.5	-	32.5	0	0368081
2	Solid w/ bushing*	AISI 304 Bushing: PTFE composit	Ø 12.9 H7	-	27.8	13.5	-	32.5	0	0368092



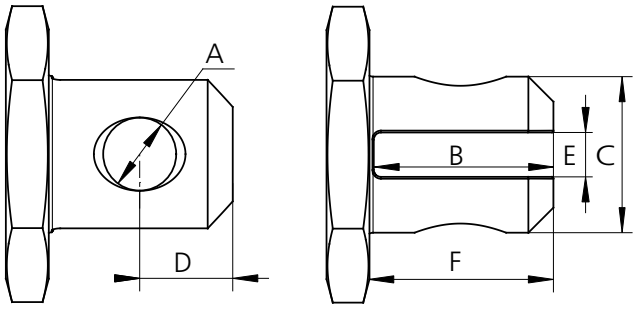
* Shoulderbolt (ISO7379) with hardness 150 - 600 HB and a surface roughness of max. R_a 0,8 must be used. Shoulderbolt shall be rotationally locked with customer application. Grease may NOT be used in the bushings. Keep a clearence of 0.5 - 1.0 mm between the bracket and the application. Max. misallignment ± 0.1°

Option	Piston rod eye	Material	A	B	C	D	E	F (~)	Change in BiD	P/N
4	Male adaptor	AISI 303	M12 X 1.75	25	27.8	-	27.8	27	-13	0361224
4	Male adaptor	AISI 303	M16 X 1.5	24	27.8	-	27.8	26	-13	0361135
4	Male adaptor	AISI 303	M16 X 1.5	35	25	-	27.8	27	-13	0361151
4	Male adaptor	AISI 316	M16 X 1.5	25	25	-	27.8	27	-13	0361354
										
5	Female adaptor	AISI 303	M20 X 1	8.5	26.9	11.5	-	-	-5	0361016
										
6	Ball eye	AISI 304 (Ball 440C only)	Ø 12 H7	32	16	-	-	-	+14	0361350
6	Ball eye	AISI 304 (Ball 440C only)	Ø 12.7 H7	38	16	-	-	-	+22	0361273
6	Ball eye	AISI 304 (Ball 440C only)	Ø 16 H7	42	21	-	-	-	+14	0361351
										

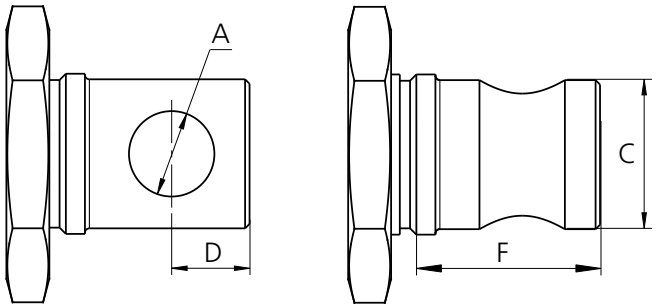
Back fixtures

All dimensions are in mm

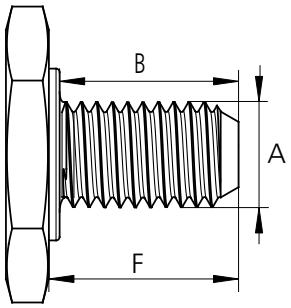
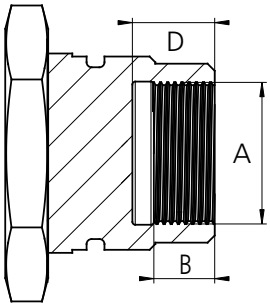
Option	Back fixture	Material	A	B	C	D	E	F (~)	Change in BiD	P/N
1,2,6, A,B,C,D	Slotted	AISI 304	Ø 12,2	25.2	25.2	13	8.2	27.5	0	0361742
1,2,6, A,B,C,D	Slotted	AISI 316	Ø 12.2	25.2	25.2	13	8.25	27.5	0	0361749
1,2,6, A,B,C,D	Sotted	Free cutting steel	Ø 12.3	25.2	25.2	13	8.2	27.5	0	0361713
1,2,6, A,B,C,D	Slotted	Free cutting steel	Ø 12.9	25.2	25.2	13	8.2	27.5	0	0361741
1,2,6, A,B,C,D	Slotted	AISI 304	Ø 12.9	25.2	25.2	13	8.2	27.5	0	0361743
Off-highway options:										
1,2,6, A,B,C,D	Slotted	Automatic Steel DIN 1651	Ø 12.3	27.5	25.2	13	-	27.9	0	0361811
1,2,6, A,B,C,D	Slotted	Automatic Steel DIN 1651	Ø 12.9	27.5	25.2	13	-	27.9	0	0361814



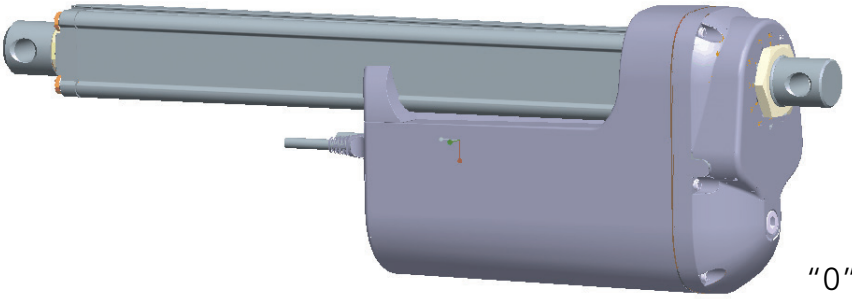
Option	Back fixture	Material	A	B	C	D	E	F (~)	Change in BiD	P/N
1,2,6, A,B,C,D	Solid	Free cutting steel	Ø 12.2	-	25.2	13	-	27.9	0	0361714
1,2,6, A,B,C,D	Solid	AISI 304	Ø 12.2	-	25.2	13	-	27.9	0	0361745
1,2,6, A,B,C,D	Solid	Free cutting steel	Ø 12.9	-	25.2	13	-	27.9	0	0361715
1,2,6, A,B,C,D	Solid	AISI 304	12.9 H10	-	25.2	13	-	27.9	0	0361744
1,2,6, A,B,C,D	Solid	Free cutting steel	Ø 16	-	25.2	13	-	39.9	+ 10	0361712
1,2,6, A,B,C,D	Solid w/ bushing*	AISI 304 Bushing: PTFE composit	Ø 12 H9	-	25.2	13	-	27.9	0	0368080
1,2,6, A,B,C,D	Solid w/ bushing*	AISI 304 Bushing: PTFE composit	Ø 12.9	-	25.2	13	-	27.9	0	0368091
Off-highway options:										
1,2,6, A,B,C,D	Solid	Automatic Steel DIN 1651	12.2	-	25.2	13	-	27.9	0	0361815
1,2,6, A,B,C,D	Solid	Automatic Steel DIN 1651	12.9	-	25.2	13	-	27.9	0	0361816
1,2,6, A,B,C,D	Solid	AISI 304	12.9	-	25.2	13	-	27.9	0	0361818



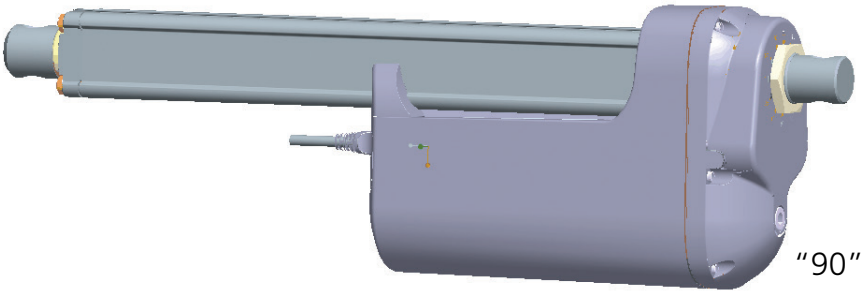
* Shoulderbolt (ISO7379) with hardness 150 - 600 HB and a surface roughness of max. R_a 0,8 must be used. Shoulderbolt shall be rotationally locked with customer application. Grease may NOT be used in the bushings. Keep a clearence of 0.5 - 1.0 mm between the bracket and the application. Max. misallignment ± 0.1°

Option	Back fixture	Material	A	B	C	D	E	F (~)	Change in BiD	P/N
4	Male adapter	AISI 303	M12 X 1.75	25	-	-	-	25	-15	0361753
4	Male adapter	AISI 303	M16 X 1.5	35	-	-	-	35	-15	0361711
4	Male adapter	AISI 303	M16 X 1.5	25	-	-	-	25	-15	0361754
Off-highway option:										
4	Male adapter	AISI 303	M16 X 1.5	22.5	-	-	-	25	-15	0361870
										
5	Female adapter	AISI 303	M20 X 1	8.5	-	11.5	-	-	-6	0361761
										

Back fixture orientation



"0" Degrees



"90" Degrees

"30" Degrees

"60" Degrees

"120" Degrees

"150" Degrees

NB. All with tolerance of ±4°

Electrical installation

- To ensure maximum self-locking ability, please be sure that the motor is shorted when stopped. Actuators with integrated controller provide this feature, as long as the actuator is powered
- When using soft stop on a DC-motor, the actuator can send a short high-voltage pulse to the power supply. It is important to make sure that it does not turn off the output when this backwards load dump occurs
- Deutsch DTP is to be used for power supply in 12 V applications due to the high current draw

The power supply for actuators without integrated controller must be monitored externally and cut off in case of current overload. IC actuators have an integrated overcurrent protection.

Current limits

As described in the algorithm on previous page

Platform		12 V	24 V	48 V	Reference temperature: 0°C
B3 C3 F3	I/O Basic I/O Customised I/O Full	26 A	13 A	8 A	Above
		26 A	26 A	13 A	Below
0B	IO-Link	-	16 A	-	Above
		-	26 A	-	Below
14	Modbus RTU	-	16 A	8 A	Above
		-	26 A	15 A	Below
A7 A8	CANbus J1939 CANopen	-	**13 A**	**8 A**	Above
		-	**26 A**	**13 A**	Below
0E 2E 4E	Modbus TCP/IP Ethernet PROFINET	-	16 A	8 A	Above
		-	26 A	16 A	Below
C6 D6 E6	Off-highway: LIN bus CAN SAE J1939 CANopen	26 A	13 A	-	Above
		26 A	26 A	-	Below

Max. Current

The current is not limited by the actuator below is the anticipated consumption at max. load.
See: Recommended fuse for actuators without Integrated Controller

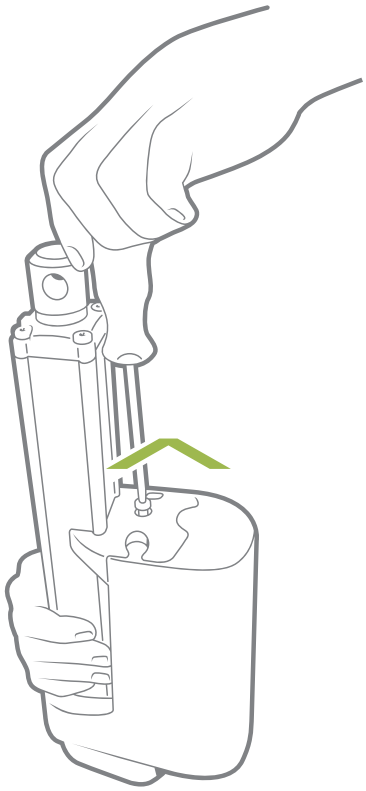
Platform		12 V	24 V	36 V	48 V	Reference temperature: 0°C
00 01	Standard Standard with power switch	26 A	13 A	10 A	8 A	Above
		26 A	13 A	10 A	8 A	Below

Current cut-offs

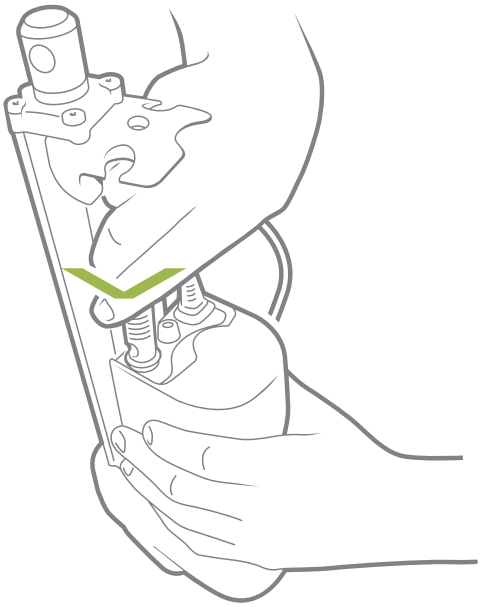
The principle behind the current cut-off measurement is an ‘above limit’ and a ‘below limit’ accumulating counter. When the time-out counter reaches a specific value the current cut-off goes into effect.
The system stops after 200 milliseconds if the current is too high.

Platform		12 V	24 V	48 V	Reference temperature: 0°C
16	LIN bus	30 A	-	-	Above
		30 A	-	-	Below
07 08	CAN SAE J1939 CANopen	30 A	20 A	13 A	Above
		30 A	25 A	15 A	Below
17 18	CAN SAE J1939 CANopen	30 A	20 A	-	Above
		30 A	25 A	-	Below

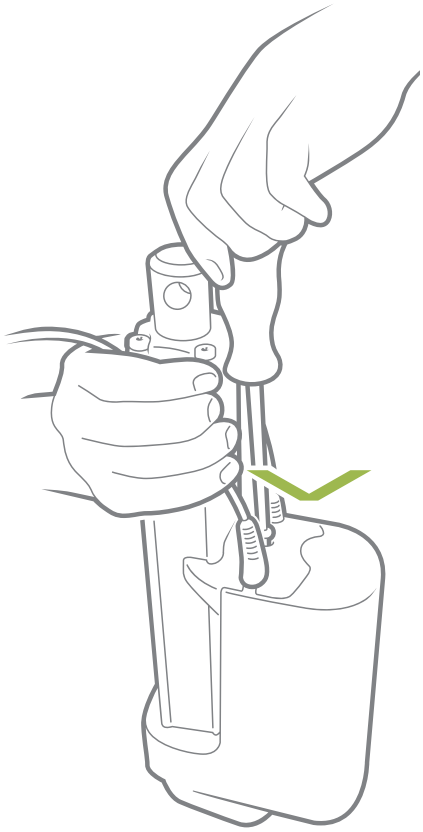
Mounting of cables



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



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



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

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.

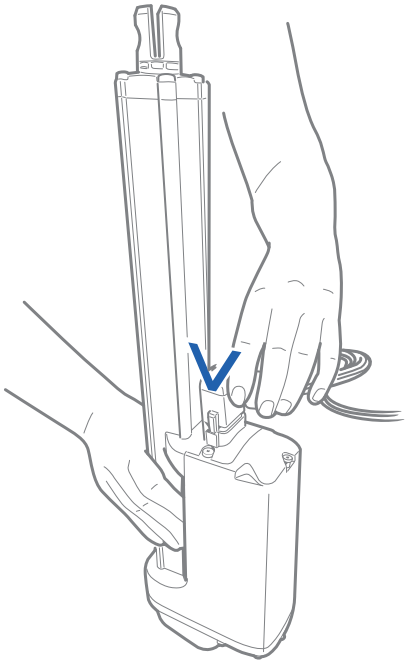
Cut off the tinned end if you connect the cable with screws. The tinned end is only to be used when a soldered connection is made.

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.
Do not lift the actuator by the cables.

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

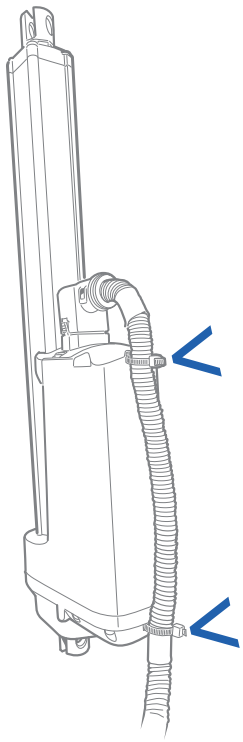
NOT valid for ATEX cables, please refer to the ATEX section for correct cable mounting on ATEX actuators.

Mounting of cable with Off-highway



1) Plug in the cable.

An audible "Click" confirms a correct mounting



2) Secure the cable with cable-ties to the two anchors

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

Off-highway connection to Actuator Connect™

When connecting the actuator to Actuator Connect™ it is imperative to follow these instructions.

Power supply connection:

The actuator has to be powered with 12 Volt DC

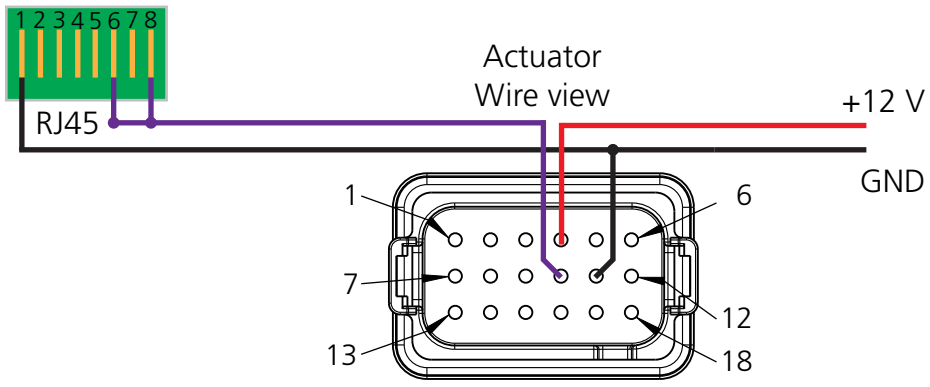
Positive is connected to pin 4 at the actuator

GND is connected to pin 11 at the actuator

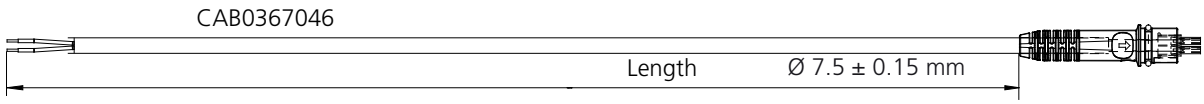
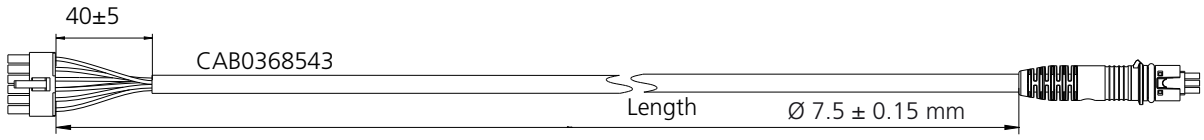
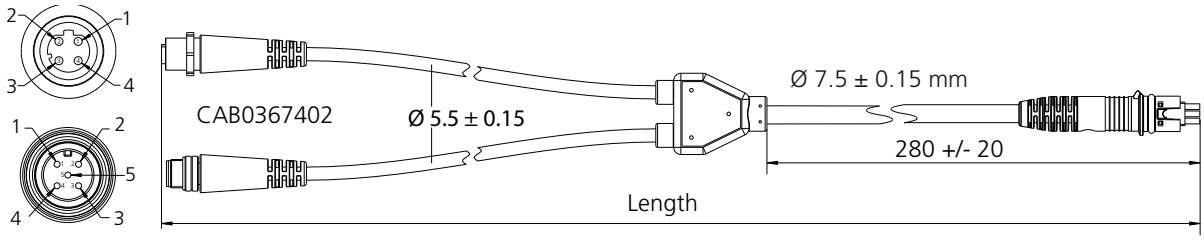
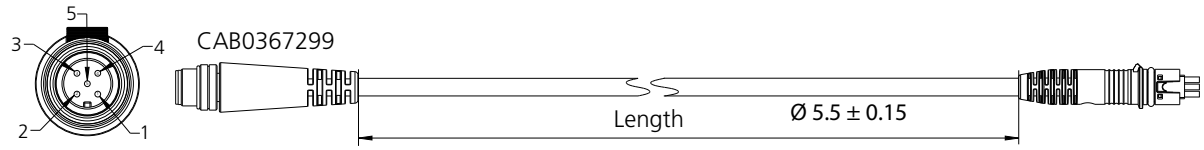
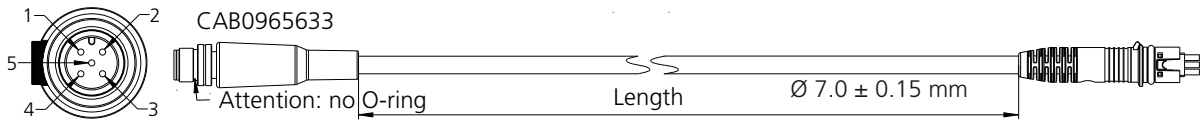
RJ45:

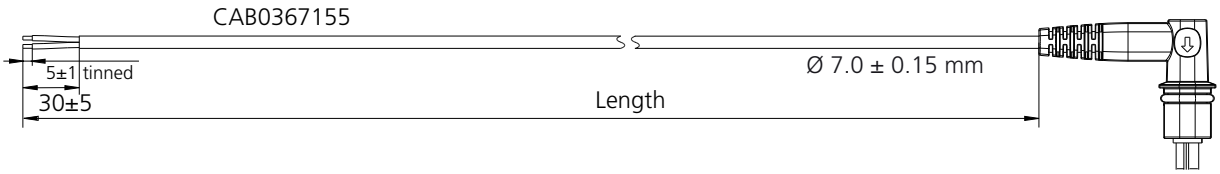
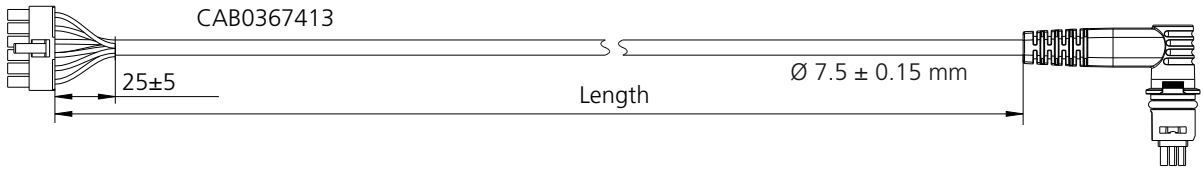
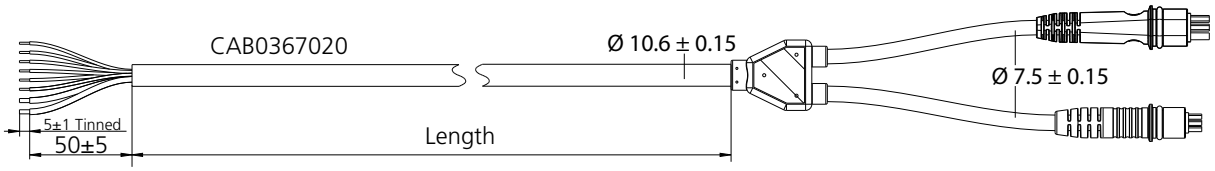
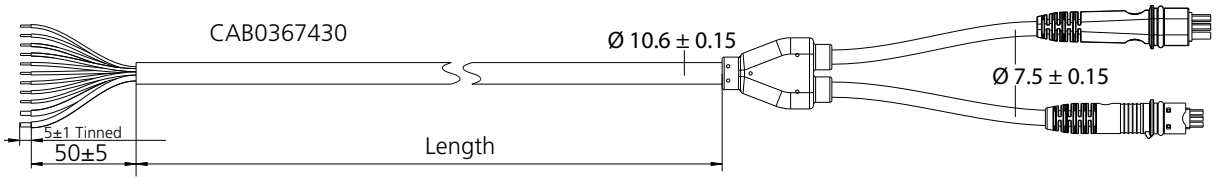
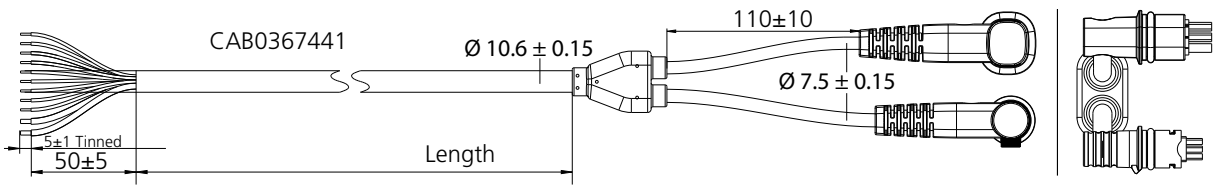
Pin 1 at the RJ45 plug is Ground and has to be interconnected to GND on pin 11 at the actuator

Pin 6 and 8 at the RJ45 plug is communication and both has to be connected to pin 10 at the actuator:



Cables

Cable P/N Table					
Option	**Cable type**	**# Wires**	**mm²**	**Length in mm**	**LINAK P/N**
S	Power cable	2	2.0	1,500	CAB0367046-1500
S	Power cable	2	2.0	5,000	CAB0367046-5000
S	Power cable	2	2.0	10,000	CAB0367046-10000
					
S	Straight signal cable	6	0.5	1,500	CAB0367049-1500
S	Straight signal cable	6	0.5	5,000	CAB0367049-5000
S	Straight signal cable	6	0.5	10,000	CAB0367049-10000
S	Straight signal cable	9	0.5	1,500	CAB0368543-1500
S	Straight signal cable	9	0.5	5,000	CAB0368543-5000
S	Straight signal cable	9	0.5	10,000	CAB0368543-10000
					
S	Ethernet connection cable	9	0.5	600	CAB0367402
					
S	IO-Link connection cable	5	0.5	600	CAB0367299
					
S	Modbus RTU connection	5	0.5	1000	CAB0965633-1000
					

Cable P/N Table					
Option	**Cable type**	**# Wires**	**mm²**	**Length in mm**	**LINAK P/N**
A	Angled power cable	2	2.0	1,500	CAB0367155-1500
					
A	Angled signal cable	9	0.5	1,500	CAB0367413-1500
					
Y	Straight Y-cable Power and Signal	2 6	2.0 0.5	1,500	CAB0367020-1500
Y	Straight Y-cable Power and Signal	2 6	2.0 0.5	5,000	CAB0367020-5000
Y	Straight Y-cable Power and Signal	2 6	2.0 0.5	10,000	CAB0367020-10000
					
Y	Straight Y-cable Power and Signal	2 9	2.0 0.5	1,500	CAB0367430-1500
Y	Straight Y-cable Power and Signal	2 9	2.0 0.5	5,000	CAB0367430-5000
Y	Straight Y-cable Power and Signal	2 9	2.0 0.5	10,000	CAB0367430-10000
					
V	Angled Y-cable Power and Signal	2 9	2.0 0.5	1,500	CAB0367440-1500
					

Power cable dimensions

LINAK® P/N 0367046

Colour	Outer dimensions	Core mm²	AWG*	Pin
Blue	Ø2.8 mm	2.0	14	1
Brown	Ø2.8 mm	2.0	14	2

6-pin Signal cable dimensions

LINAK P/N 0367049

Colour	Outer dimensions	Core mm²	AWG*	Pin
Black	Ø1.5 mm	0.5	20	1
Red	Ø1.5 mm	0.5	20	2
White	Ø1.5 mm	0.5	20	3
Violet	Ø1.5 mm	0.5	20	4
Yellow	Ø1.5 mm	0.5	20	5
Green	Ø1.5 mm	0.5	20	6

9-pin Signal cable dimensions

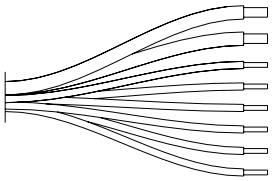
LINAK P/N 0368543

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

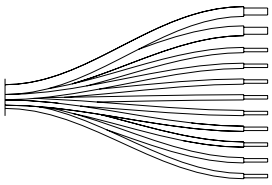
*AWG: American Wire Gauge

Y-cable dimensions

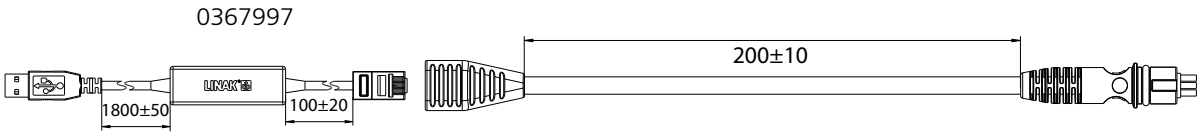
LINAK® P/N 0367020

Colour	Outer dimensions	Core mm²	AWG	Pin	
Blue	Ø2.8 mm	2.0	14	1	
Brown	Ø2.8 mm	2.0	14	2	
Black	Ø1.5 mm	0.5	20	3	
Red	Ø1.5 mm	0.5	20	4	
White	Ø1.5 mm	0.5	20	5	
Violet	Ø1.5 mm	0.5	20	6	
Yellow	Ø1.5 mm	0.5	20	7	
Green	Ø1.5 mm	0.5	20	8	

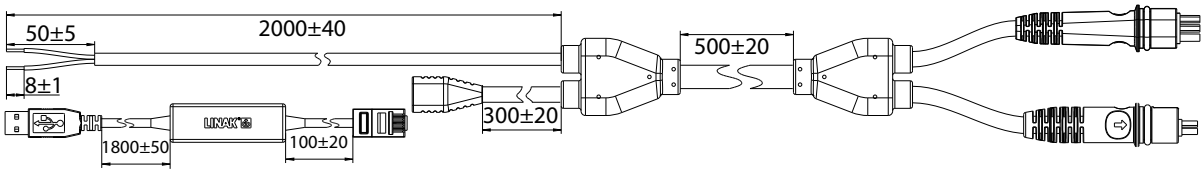
LINAK® P/N 0367430

Colour	Outer dimensions	Core mm²	AWG	Pin	
Blue	Ø2.8 mm	2.0	14	1	
Brown	Ø2.8 mm	2.0	14	2	
Orange	Ø1.5 mm	0.5	20	3	
Yellow	Ø1.5 mm	0.5	20	4	
Green	Ø1.5 mm	0.5	20	5	
Black	Ø1.5 mm	0.5	20	6	
Red	Ø1.5 mm	0.5	20	7	
Light Blue	Ø1.5 mm	0.5	20	8	
Violet	Ø1.5 mm	0.5	20	9	
White	Ø1.5 mm	0.5	20	10	
Grey	Ø1.5 mm	0.5	20	-	

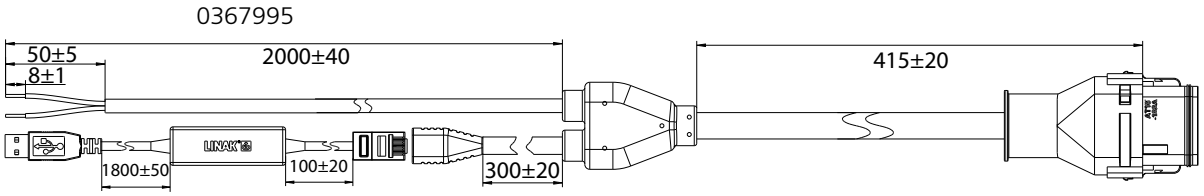
BusLink and Actuator Connect cables

BusLink cable kits					
Platform		**Connection**	**Includes**	**Colour**	**Article no.**
07 08 16* 17* 18*	CAN SAE J1939 CANopen LIN bus CAN SAE J1939 CANopen	Power and USB-A	Adapter and USB2Lin cable	Green	0367997
0367997  					

* Utilises BusLink cable -but is configured and monitored with Actuator Connect®.

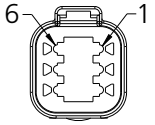
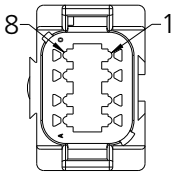
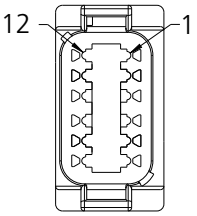
Actuator Connect™ cable kits					
Platform		**Connection**	**Includes**	**Colour**	**Article no.**
B3 C3 F3 B7 B8 0B A7 A8 2E 0E 14 4E	I/O Basic I/O Customised I/O Full CAN SAE J1939 CANopen IO-Link CAN SAE J1939 CANopen EtherNet/IP Modbus TCP/IP Modbus RTU PROFINET	Power and USB-A	Adapter and USB2Lin cable	Grey	CAB0367996
0367996  					
C6 D6 E6	LIN bus Off-highway CAN SAE J1939 Off-highway CANopen Off-highway	Power and USB-A	Adapter and USB2Lin cable	Grey	0367995

Actuator Connect™ cable kits				
Platform	**Connection**	**Includes**	**Colour**	**Article no.**



Latest versions of both BusLink® and Actuator Connect® can be downloaded at the LINAK/TECHLINE page.

Plugs

Plug type	Deutsch
2-pin	DTP04-xP
6-pin	 DT04-xP-CO15
8-pin	 DT04-xP-CO15
12-pin	 DT04-xP-CE02

Manual hand crank

The manual Hand Crank can be used in the case of a power failure -it 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 hand crank turn:				
Spindle type:	**8 mm**	**12 mm**	**16 mm**	**20 mm**
Gear F:	-	11 mm	14 mm	18 mm
Gear G:	-	6 mm	8 mm	10 mm
Gear H:	3 mm	4 mm	5 mm	7 mm
Gear E:	-	-	-	27 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
  Use your hand to turn the crank. Do not use power tools!
- After using the hand crank, the ingress protection will be less than IP66 once the plug is removed
- Move the actuator to its starting position after using the crank
  Failing to do so can damage the actuator and/or the application it is used for

Environmental tests – Climatic

Test	Specification	Comment
Cold Test	EN 60068-2-1 (Ab)	Storage at low temperature: Temperature: -40 °C Duration: 72 h Not connected Tested at room temperature.
	EN 60068-2-1 (Ad)	Storage at low temperature: Temperature: -30 °C Duration: 2 h Actuator is not activated/connected. Tested at low temperature.
Dry Heat	EN 60068-2-2 (Bb)	Storage at high temperature: Temperature: +90 °C Duration: 72 h Actuator is not activated/connected. Tested at room temperature Storage at high temperature: Temperature: +70 °C Duration: 1,000 h Actuator is not activated/connected Tested at high temperature.
	EN 60068-2-2 (Bd)	Operating at high temperature: Temperature: +60 °C Int. max. 17 % Duration:700 h Actuator is activated Tested at high temperature.
Change of Temperature	EN 60068-2-14 (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.
	EN 60068-2-14 (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 pr. 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.

Test	Specification	Comment
Damp Heat	EN 60068-2-30 (Db)	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.
	EN 60068-2-3 (Ca)	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 Mist	EN 60068-2-52 (Kb)	Salt spray test: Salt solution: 5 % sodium chloride (NaCl) 4 spraying periods, each of 2 hours. Humidity storage 7 days after each. Actuator not activated/connected. Exposure time: 500 hours
Degrees of Protection	EN 60529 – IP66	IP6X - Dust: Dust-tight, No ingress of dust. Actuator is not activated. IPX6 – Water: Ingress of water in quantities causing harmful effects is not allowed. Duration: 100 litres pr. minute in 3 minutes Actuator is not activated. IPX6 –Connected actuator: Actuator is driving out and in for 3 min. 100 (l/min) jet of water is placed at the wiper ring for 3 (min). IPX6 –Connected actuator and push 6,800 [N] Actuator is driving out and in for 3 min. and Push 6,800 [N] at the end-pos. 100 (l/min.) jet of water is placed at the wiper ring for 3 min.
	DIN40050 – IP69K	High pressure cleaner: Water temperature: +80 °C Water pressure: 80 bar Spray angle: 45 ° Spray distance: 100 mm Duration: From any direction 10 seconds of spraying followed by 10 seconds rest. Actuator is not activated. Ingress of water in quantities causing harmful effects is not allowed.
	DUNK test	The actuator has been warmed up to 115 °C for 20 hours. After this it is cooled down in 20 °C salt water. Cooling time: 5 minutes Opened for checking salt deposit and water.
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.

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	EN 60068-2-36 (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 5-25 Hz: Amplitude = 3.3 mm pp Frequency 25-200 Hz: Acceleration 4 g Number of directions: 3 (X-Z-Y) Duration: 2 hours in each direction. Actuator is not activated.
Bump	EN 60068-2-29 (Eb)	Bump test: Level: 40 g Duration: 6 milliseconds Number of bumps: 500 shocks in each of 6 directions. Actuator is not connected.
Shock	EN 60068-2-27 (Ea)	Shock test: Level: 100 g Duration: 6 milliseconds Number of bumps: 3 shocks in each of 6 directions. Actuator is not connected.

Environmental tests - Electrical

Test	Specification	Comment
Emission	EN 61000-6-4	Level is within limits for the motor
Automotive Transients	ISO 7637	Load dump test only accepted on motor power connection.
IECEx / ATEX (Ex)	EN 60079-0:2012 EN 60079-31:2014	This Ex certification allows the actuator to be mounted in Ex dust areas: II 2D Ex tb IIIC T135 °C Db Tamb -25 °C to +65 °C

Environmental tests – Climatic - LA36 Off-highway

Test	Specification	Comment
Cold Test	EN 60068-2-1 (Ab)	Storage at low temperature: Temperature: -55 °C Duration: 72 h Actuator is not activated/connected Tested at room temperature.
	EN 60068-2-1 (Ad)	Operating at low temperature: Temperature: -40 °C Duration: 16 h Actuator is not activated/connected. Tested at low temperature.
Dry Heat	EN 60068-2-2 (Bb)	Storage at high temperature: Temperature: +105 °C Duration: 72 h Actuator is not activated/connected. Tested at room temperature
		Storage at high temperature: Temperature: +70 °C Duration: 1000 h Actuator is not activated/connected Tested at high temperature.
	EN 60068-2-2 (Bd)	Operating at high temperature: Temperature: +60 °C Int. max. 17 % Duration:700 h Actuator is activated Tested at high temperature.
Change of Temperature	EN 60068-2-14 (Na)	Rapid change of temperature: High temperature: +105 °C in 60 minutes. Low temperature: -40 °C in 60 minutes. Transition time: <10 seconds Duration: 117 cycles Actuator is not activated/connected. Tested at room temperature.
	EN 60068-2-14 (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 pr. 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.

Test	Specification	Comment
Damp Heat	EN 60068-2-30 (Db)	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.
	EN 60068-2-3 (Ca)	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.
	EN 600068-2-78	Temp 40 °C Relative Humidity 95% Test Duration 168 Hours Actuator is not activated/connected. DUT orientation: Normal operating orientation
Salt Mist	ISO 9227	Continously salt spray test: Salt solution: 5 % sodium chloride (NaCl) Actuator activated/connected. Exposure time: 500 hours
Degrees of Protection	EN 60529 – IP54	IP5X - Dust: Dust-tight, No ingress of dust. Actuator is not connected IPX4 – Water: Ingress of water in quantities causing harmful effects is not allowed. Duration: 100 litres pr. minute in 3 minutes Actuator is not connected
	EN 60529 – IP66	IPX6 –Connected actuator: Actuator is driving out and in for 3 min. 100 (l/min) jet of water is placed at the wiper ring for 3 (min). IPX6 –Connected actuator and push 6800 [N] Actuator is preheated to 85 °C driving out and in for 3 min. and Push 6800 [N] at the end-pos. 100 (l/min.) jet of water (15 °C) is placed at the wiper ring for 3 min.
	ISO 20653 – IP6KX	Category : 1 (air pressure reduction) Dust medium : Talcum Air pressure : 2 kPa (20 mbar) below normal air pressure Duration : 8 hours.
	ISO 20653 – IPX9K	High pressure cleaner: Water temperature: +90 °C Water pressure: 350 bar Flowrate: 15L/min Spray angle: 360 ° Spray distance: 200 mm Duration: From any direction continously in 300 seconds Actuator is connected. Ingress of water in quantities causing harmful effects is not allowed.

Test	Specification	Comment		
	ISO 16750	The actuator has been warmed up to 85 °C for 8 hours. After this it is cooled down in 00 °C salt water. Cooling time: 120 minutes Repeated 5 times and weight recorded after each cycle. Opened for check of residue of salt deposit and water. No weightgain, water or salt residue allowed.		
Chemical test	Chemicals:	Explanation regarding chemical (poss. incl. source of supply and/or trade name):	Test temp °C:	Test duration:
	Diesel fuel	EN 590	85	22 h
	'Bio' diesel fuel	EN 14214	85	22 h
	Engine oil	Multigrade oil SAE OW40, API SL / C	85	22 h
	Transmission fluid	ATF Dexron III'	85	22 h
	Hydraulic fluid	DIN 51 524-3 (HVLP ISO VG 46)	85	22 h
	Grease	DIN 51 502 (KP2K-30)	85	22 h
	Anti-freeze 50 % (1:1)	Ethylene glycol (C2H602) - Water mixture	85	22 h
	Urea Nitrogen saturated solution	ISO 22241-1; Urea NOx "ad blue" e.g. P3 Solvclean AK (manufactured by Henkel)	85	22 h
	Cold cleaner	E.g. P3 Solvclean AK (by Henkel)	RT	22 h
	Contact spary	E.g. WD 40	85	22 h
	Ammonium hydroxide	20% diluted water-based solution	RT	22 h
	Liquid lime 10 % (Super- Cal)	Lime fertiliser, 10% solution; can be obtained from seed and fertiliser traders	RT	22 h
	NPK Fertilizer (NPK 16-4-12) saturated	Nitrogen (5-9%), phosphorus (5-9%) potassium (5-9%) portions can be obtained from seed and fertiliser traders e.g. COMPO 14361/14354, PhytoGreen NPK 8-8-6 or similar.	RT	22 h

Environmental tests - Mechanical - LA36 Off-highway

Test	Specification	Comment
Free Fall	EN 60068-2-31	Free fall from all sides: Height of fall: 0.45 meter onto concrete Actuator not activated/connected.
Vibration	EN 60068-2-64	Random vibration: Test: 5.9 g RMS 10-2,000 Hz Actuator is connected for monitoring during the test Duration: 32 hours in each direction (x,y and z).
Shock	EN 60068-2-27 (Ea)	Shock test: Level: 51 g Duration: 6 milliseconds Number of bumps: 10 shocks in each of 6 directions. Actuator is connected for monitoring during the test

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