PHOENIX MECANO

EN Assembly instructions

Electric cylinder LD600E

Electric cylinder LD600P

B.018 210
Version 1.1

Contents

1 Declaration of incorporation

1.1 Declaration of incorporation LD600E and LD600P

within the meaning of the Machinery Directive 2006/42/EC, Annex II, 1.B for partly completed machinery

Manufacturer:

Phoenix Mecano Solutions AG
Hofwisenstrasse 6
CH-8260 Stein am Rhein

confirms that the named product

Product description:	*LD600E, LD600P*
Type designation:	*LD600E, LD600P*
Trade name:	*L6000E, LD600P*
Function:	*Electric motorised extension/retraction of the push tube to generate a linear motion*

fulfils the requirements of **partly completed machinery** in accordance with the EC Machinery Directive 2006/42/EC.

The following essential requirements of the Machinery Directive 2006/42/EC according to Annex I are applied and fulfilled:

1.1.5.; 1.3.2.; 1.3.3.; 1.3.4.; 1.3.7.; 1.5.1.; 4.1.2.1.; 4.1.2.3.

Furthermore, it is declared that the specific technical documentation has been prepared in accordance with Annex VII Part B.

It is explicitly declared that the **partly completed machinery** complies with all relevant provisions of the following EC Directives:

2011/65/EU	Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of use of certain hazardous substances in electrical and electronic equipment
IEC 60601-1-2:2014	Medical electrical equipment - Part 1-2: General specifications for safety including the essential performance characteristics - supplementary standard: Electromagnetic disturbances - requirements and tests (IEC 60601-1-2:2014); German version EN 60601-1-2:2015

Phoenix Mecano Solutions AG undertakes to transmit the technical documentation for the partly completed machinery to the national authorities in electronic form upon justified request.

Commissioning is prohibited until the machine into which this partly completed machinery is installed complies with the provisions of EC Directive 2006/42/EC.

Before being placed on the market, it must comply with the CE guidelines, which includes the documentation as well.

2 General information

2.1 Notes on these installation instructions

These assembly instructions are only valid for the electric cylinders described and are intended as documentation for the manufacturer of the end product into which this partly completed machinery is integrated.

We expressly point out that the manufacturer of the end product must prepare operating instructions for the end customer, which contain all functions and hazard warnings of the end product.

These installation instructions also apply to the installation of the product in a machine. The machine manufacturer is responsible for the corresponding safety equipment, inspections, monitoring of any crushing and shearing points that may occur and documentation.

These installation instructions will help you,

- avoid dangers,
- prevent downtime,
- and ensure or increase the service life of this product.

Hazard warnings, safety regulations and the information in these installation instructions must be observed without exception.

The installation instructions must be read and applied by every person who works with the product.

Commissioning is prohibited until the machine in which the electric cylinder is installed complies with the provisions of EC Directive 2006/42/EC (Machinery Directive). Before being placed on the market, it must comply with the CE guidelines, which includes the documentation as well.

We expressly draw the attention of the subsequent user of this partly completed machinery/sub-machine/machine parts to the obligation to extend and complete this documentation. A CE declaration of conformity must be drawn up by the subsequent user, particularly when installing or attaching electrical elements and/or drives, as this declaration of incorporation was expressly drawn up for the partly completed machinery itself and automatically loses its validity when integrated/installed in a machine.

3 Liability/Warranty

3.1 Liability

Phoenix Mecano Solutions AG accepts no liability for damage or impairment resulting from structural changes by third parties or changes to the protective devices on this electric cylinder. Phoenix Mecano Solutions AG accepts no liability for spare parts that have not been tested and approved by Phoenix Mecano Solutions AG. The EC Declaration of Incorporation will otherwise become invalid.

Safety-relevant equipment must be checked regularly for function, damage and completeness.

We reserve the right to make technical changes to the electric cylinder and changes to these installation instructions.

Advertising, product brochures for sales activities, public statements or similar announcements must not be used as a basis for the suitability and quality of the product, detailed technical advice is therefore expressly recommended. Claims against Phoenix Mecano Solutions AG for the availability of previous versions or adaptations to the current version are not recognised.
Version status of the electric cylinder cannot be claimed.

If you have any questions, please refer to the information on the type plate.

Our address:

Phoenix Mecano Solutions AG
Hofwisenstrasse 6
CH-8260 Stein am Rhein

Phone: +41 (52) 742 75 00
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3.2 Product monitoring

Phoenix Mecano Solutions AG offers you products at the highest technical level, adapted to the latest safety standards. Please inform us immediately of any repeated failures or malfunctions.

3.3 Language of the operating instructions

The original version of these assembly instructions was written in the official EU language of Phoenix Mecano Solutions AG for this partly completed machinery. Translations into other languages are translations of the original version; the legal requirements of the Machinery Directive apply.

3.4 Copyright

4 Use/operating personnel

4.1 Intended use

The electric cylinder is to be used exclusively for the adjustment of guided components or other comparable adjustment tasks. The electric cylinder must not be used in potentially explosive atmospheres or in direct contact with food, pharmaceutical or cosmetic products. Catalogue specifications, the contents of these installation instructions and/or conditions stipulated in the engagement must be observed. The values specified in these installation instructions are maximum values and must not be exceeded.

4.2 Non-intended use

“Improper use" is deemed to have occurred if the product is used contrary to the information given in chapter 4.1 *Intended use*. If this electric cylinder is not used as intended, handled improperly or if it is used, installed or handled by untrained personnel, it may pose a risk to personnel. Moving persons and animals with this electric cylinder, as an example of improper use, is prohibited. Improper use invalidates the liability of Phoenix Mecano Solutions AG and the general operating licence for this electric cylinder.

4.3 Reasonably foreseeable misuse

- Overloading the device due to excessive forces and loads.
- Use in applications with laterally acting forces and moments.
- Non-observance of the self-locking information.
- Mechanical non-protection of suspended loads.
- Load in case of inadequate mounting or inadequate fixing.
- Drive to blockage (stop).
- Impermissible twisting of the drive shaft or the front suspension.
- Failure to observe the performance data on the type plate.
- Failure to tighten or incorrect tightening of the central screw of the limit switch unit.
- Opening the drive cover and penetrating the housing interior with tools or limbs (exception: actuation of the adjustment opening cap for proper adjustment of the limit switch unit using an Allen key).
- Overlooking or non-observance of resulting pinch, shear, pull-in and catch spots between the fixing points of the drive or the overall application.
- Improper storage or transport of the product. This results in hazards, such as tripping, falling, slipping or similar.
- Operation in the event of damage to the mains supply cable, housing, motor cable, manual switch or other control cables (PLC, PC, etc.). Attention: Accessories (power supply unit, hand switch, etc.) may have protection classes other than IP69k (even lower).
- Exceeding the maximum permissible operating time.
- Use in environments outside the specified IP protection class.
- Use in environments with high humidity or unfavourable dew points.
- Use in spaces with potentially explosive atmospheres in accordance with the ATEX (Atmospheres Explosibles) directive.

4.4 Who is authorised to use, install and operate this electric cylinder?

Persons who have read and understood the installation instructions in full are authorised to use, install and operate this electric cylinder. The responsibilities for handling this electric cylinder must be clearly defined and adhered to.

Drives from Phoenix Mecano Solutions AG are not suitable for the following applications:

- Offshore applications
- Aeroplanes and other aircraft
- Nuclear power plants/nuclear power
- Potentially explosive locations
- High-altitude locations (from 2,000 metres above sea level) without additional observation and practical tests

5 Security

5.1 Safety instructions

Phoenix Mecano Solutions AG has built this electric cylinder in accordance with the current state of the art and existing safety regulations. Nevertheless, this electric cylinder can pose a risk to persons and property if it is used improperly or not in accordance with its intended use or if the safety instructions are not observed. Expert operation ensures high performance and availability of the electric cylinder. Faults or conditions that may impair safety must be rectified immediately.

Every person involved in the installation, use or operation of this electric cylinder must have read and understood the installation instructions.

This includes

- understanding the safety instructions in the text
- and getting to know the arrangement and function of the various operating and usage options described in this document.

The electric cylinders may only be used, installed or operated by trained personnel designated for this purpose. All work on and with the electric cylinder may only be carried out in accordance with these instructions. It is therefore essential that these instructions are kept close to the electric cylinder so that they are always easily accessible, but must be protected.

The general, national or company safety regulations must be observed. The responsibilities for the use, installation and operation of this electric cylinder must be clearly regulated and adhered to so that no unclear competences arise in terms of safety. Before each start-up, the user must ensure that there are no persons or objects in the danger zone of the electric cylinder. The user may only operate the electric cylinder if it is in perfect condition. Any change must be reported immediately to the next responsible person.

5.2 Special safety instructions

- All work with the electric cylinder must be carried out in accordance with these instructions only.
- The electric cylinder may only be opened, installed or removed by authorised specialist personnel. If the electric cylinder is defective, we recommend contacting the manufacturer or sending the electric cylinder in for repair.
- The performance data specified by Phoenix Mecano Solutions AG for these electric cylinders must not be exceeded (see type plate & performance diagrams).
- The type plate must remain legible. The data must be retrievable at any time and without effort.
- Danger symbols used for safety purposes indicate danger areas on the product.
- Proper installation of supply lines prevents this application from posing a hazard.
- If the mains cable and/or supply line are damaged, the electric cylinder must be taken out of service immediately.
- The power source must be disconnected before assembly, disassembly, maintenance or troubleshooting. The mechanical load must also be mechanically secured during this work.
- If the electric cylinder is installed overhead, fixed loads must be secured against falling. The danger zone below the application must be labelled in the documentation of the end product.
- Under tensile load, the design must prevent the drive shaft and the guide tube from coming apart. This means that additional safety devices (e.g. wire rope, chain, etc.) must be fitted, especially for suspended loads!
- Possible damage due to failure of the end position cut-off or bolt breakage must be prevented by the subsequent user.
- Crushing between the guide tube and the front suspension must be prevented by the user.
- Lateral forces or torques must not act on the electric cylinder or must not be higher than specified.
- Only original spare parts may be used for maintenance, which may only be installed by trained specialist personnel.
- Unauthorised modifications or changes to the electric cylinder are not permitted for safety reasons.
- Safety-relevant equipment must be checked regularly, at least once a year, for function, damage and completeness.
- Only use original accessories and intended compatible spare parts.
- Only use the tools and torques described for adjusting the limit switch unit.
- Do not insert tools or objects into the limit switch adjustment opening that are not intended for this purpose.

- The emergency adjustment provided may only be used in the event of a power failure. After using the emergency adjustment, the cylinder must be removed from the application. The function of the limit switches must then be ensured immediately in a load-free state. If the limit switches no longer function properly, the drive must be returned to the manufacturer immediately for readjustment.

5.3 Safety sign

These warning and mandatory signs are safety signs that warn of risk or danger.
Information in these installation instructions regarding special hazards or situations on the electric cylinder must be observed; failure to do so increases the risk of accidents.

The "General Mandatory Sign" indicates to act attentively.
Please pay particular attention to the marked information in these installation instructions.
You will receive important information on functions, settings and procedures.
Non-observance can lead to personal injury, faults in the electric cylinder or the environment.

6 Product information

6.1 Functionality

The electric cylinders are used to adjust guided components or other similar adjustment tasks. They are driven by a brush-operated low-voltage motor. The rotational movement is converted into a translational movement with the aid of a gearbox and a spindle, which results in a stroke variation. The resulting forces and speeds of the electric cylinder are directly dependent on the torques and speeds acting on the motor.

6.1.1 Variants of the power supply

The following power supply variants are available for this product:
12 VDC/24 VDC

6.1.2 Variants of force/speed

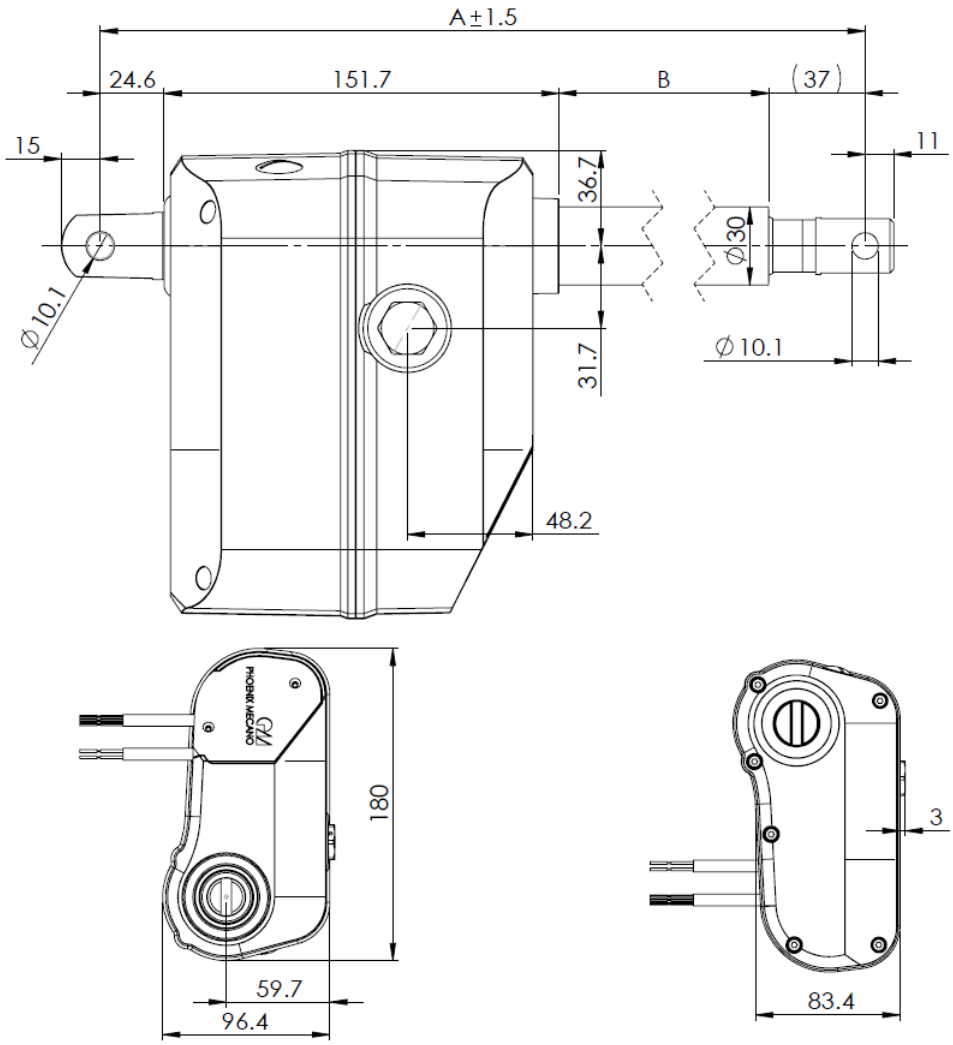
With regard to the force/speed of the LD600E/LD600P electric cylinders, the following different basic versions are available:

Basic cylinder variant	LD600E/LD600P		
Force in N	Push & pull 2,000	Push & pull 4,000	Push/pull 6,000/4,000
Self-locking up to force in N	Push & pull 1,900	Push & pull 3,600	Push/pull 6,000/4,000
Idle speed in mm/sec (12V)	19	12	6
Nominal speed in mm/sec (12V)	15	10	5
Idle speed in mm/sec (24V)	18	12	6
Nominal speed in mm/sec (24V-M)	15	10	5

The specified values were determined under optimum conditions and may change due to friction losses, temperature changes or external interference.

6.2 Dimensions of the geometry

The following technical drawings and the associated table show the standardbasicdimensions and the relationship between the stroke and the retracted installation dimension of the drive:



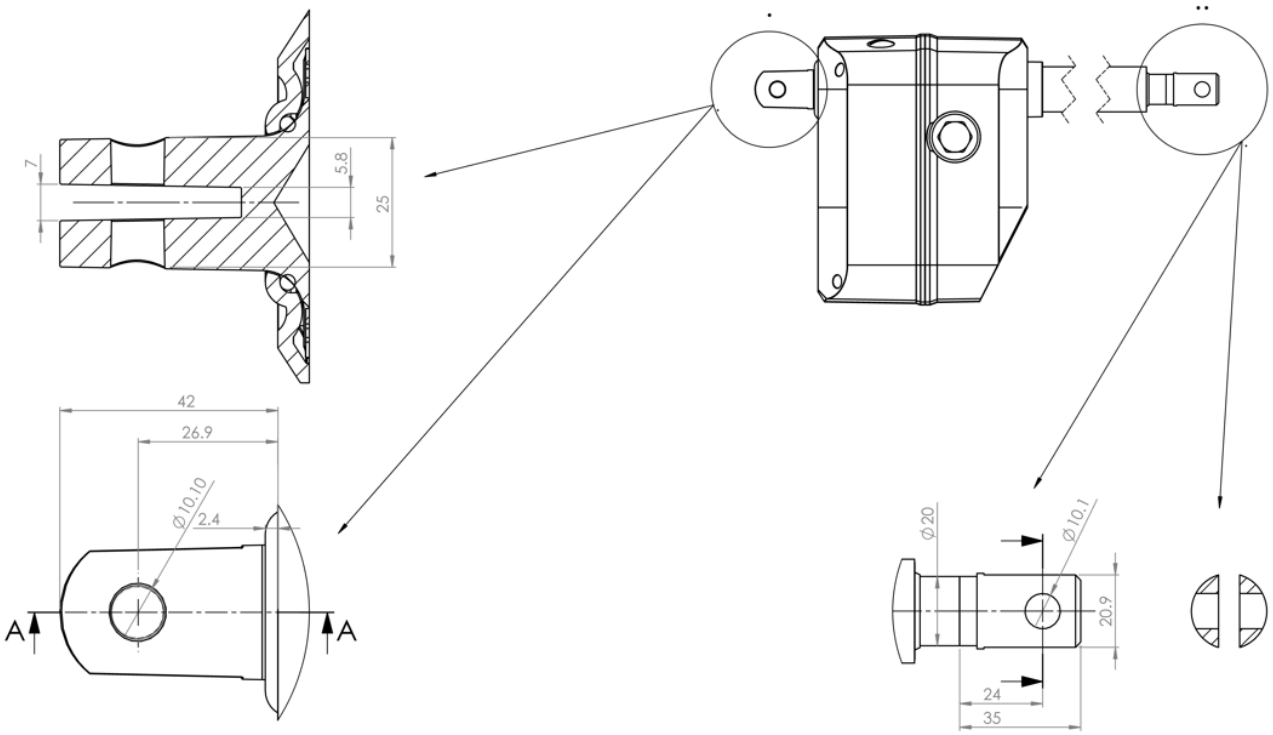
Hublänge (mm)	100	150	200	250	300	350	400	500	600
Mass A(mm)	300	350	400	450	500	550	600	700	800
Mass B(mm)	87	137	187	237	287	337	387	487	587

When extended, the drive is extended by the lengthof the stroke (installation dimension when extended) due to the displacement of the drive shaft and the front suspension. When installing the drive, care must be exercised to ensure that the suspended loads are secured against falling when retracted or extended.

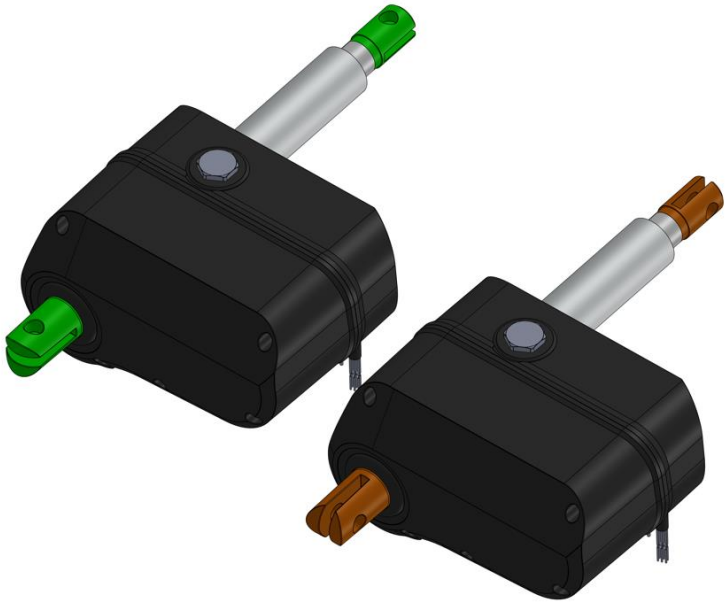
Designs with deviations from the drawing shown, for example in the case of project adaptations, are possible. The binding values can always be found in the respective specification sheet.

6.3 Suspension variants

The drive is installed in the application structure by means of two connecting components, the front and rear suspension. The following suspension variants are currently planned:



The standard suspensions can be supplied in two basic orientations, 0° and 90°, as shown in the following illustration:



To ensure that the drive can operate without tension and without the effect of torques, it is important that the mounting bores are aligned in the same way. Chapters 7.5 from page 19 describe the points that must be observed when installing the drive.

Remark: Customised suspensions are possible.

6.4 Technical data

Stroke length	Up to 600 mm
Installation length (EBL)	Stroke + 200 mm (±1.5 mm)
Standard stroke lengths	100; 150; 200; 250; 300; 350; 400; 500, 550 and 600 mm
Special stroke lengths/installation lengths	Customised on request
Installation position	any, without lateral forces
Lifting force	2,000N, 4,000 or 6,000N/4,000N (push/pull) (depending on gear ratio and spindle pitch)
Self-locking	F = 6,000 N: up to 6,000 N F = 4,000 N: up to 3,600 N** F = 2,000 N: up to 1,900 N**
Speed at nominal load	5 - 15 mm/s (depending on load/spindle)
Idle speed	up to 19 mm/s
Alignment of the front and rear suspensions	0°, 90°, special orientation*
Protection class	IP69k static(≙ IP65 dynamic)
Operating voltage	12 VDC 24 VDC
Ambient temperature	-30 °C to +80 °C
Operating temperature	-25 °C to +60 °C
Lifting tube guide	Plain bearing
Operating mode	ED 10 % interval 2 min. / 18 min. (at nominal load and operating ambient temperature +10°C to +30°C)
Maintenance	maintenance-free
Colour	black powder-coated/anodised other colours on request
Electrical connection	Cable (free cable end)
Control options	See connection diagram
Feedback	optional

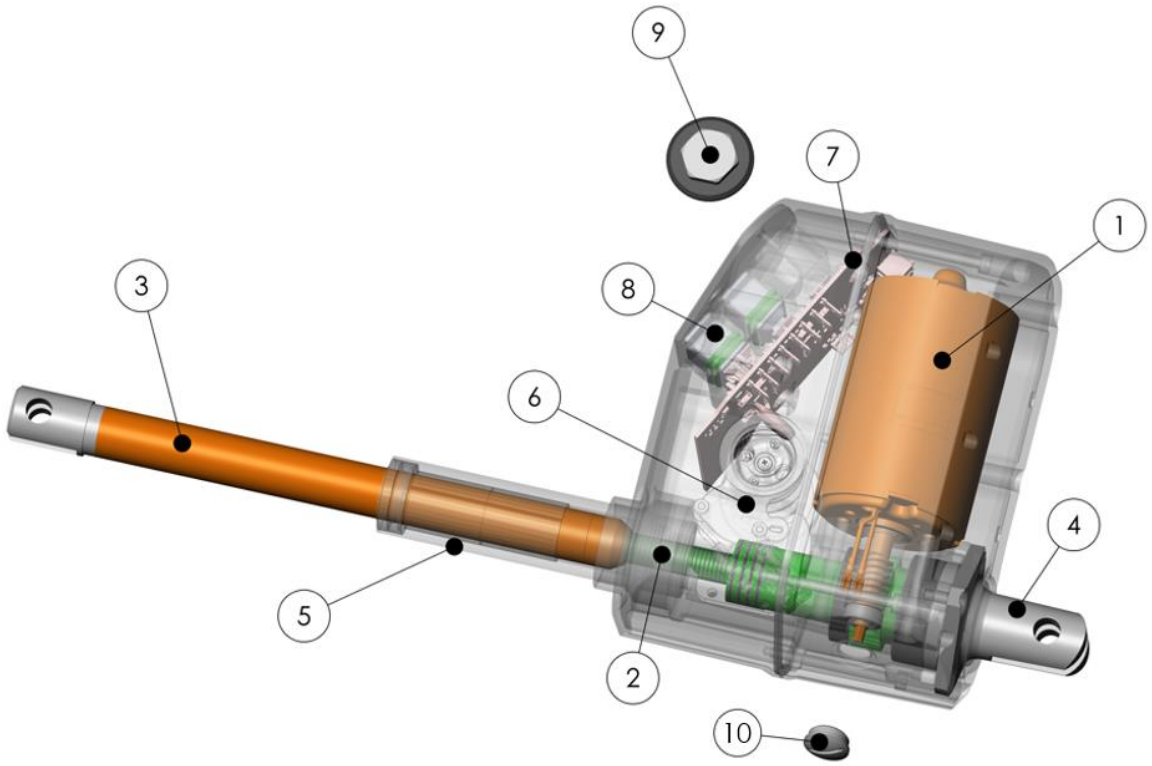
* Availability on request

** measured at room temperature

Completed examinations:

DIN EN IEC 61000-6-2: 2019-11	Electromagnetic compatibility (EMC) - Part 6-2 Generic standards - Interference immunity for industrial areas
DIN EN IEC 61000-6-4: 2020-09	Electromagnetic compatibility (EMC) - Part 6-4 Generic standards - Interference emission for industrial areas

6.5 Overview image of the electric cylinder

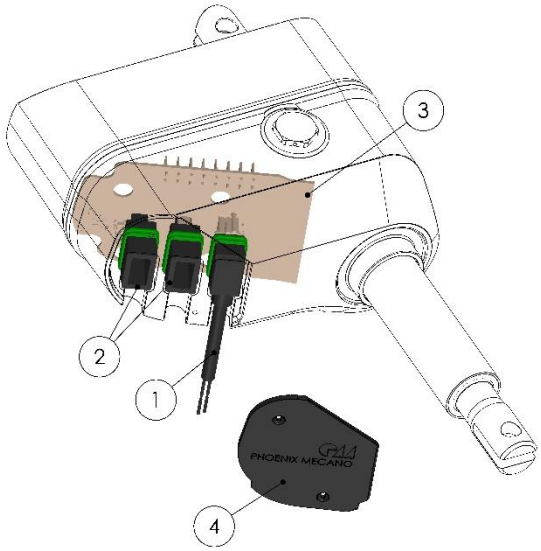


① Motor with screw
② Spindle with worm wheel
③ Drive shaft with suspension
④ Rear suspension
⑤ Guide tube
⑥ Limit switch adjustment
⑦ Control board
⑧ Plug with FKE**
⑨ Adjustment opening cap with DAE*
⑩ Emergency adjustment opening

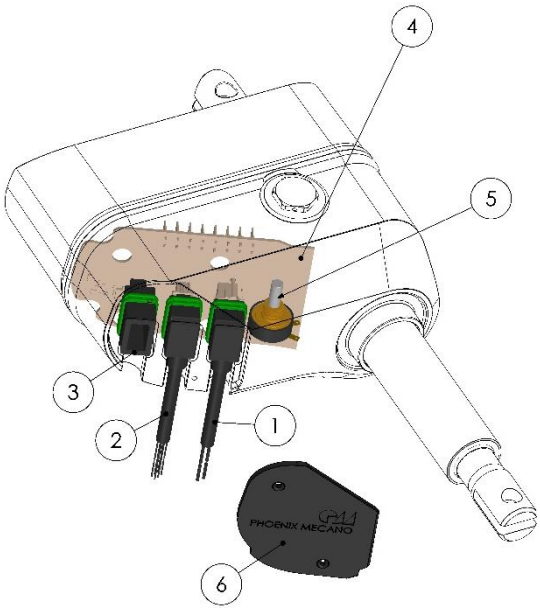
*DAE - Pressure equalisation element
**FKE - Free cable end

6.6 Overview of plug / connection options

The LD600E has two different cable assignments. These depend on the potentiometer option of the drive. The cables are each fitted with a matching plug at one end, the second end is always designed as an open cable end. Cable lengths of up to 5 metres are available as standard.



Variant without potentiometer:
(AP.4.018517)
① Power cable
② Dummy plug
③ Control board
④ Cable cover

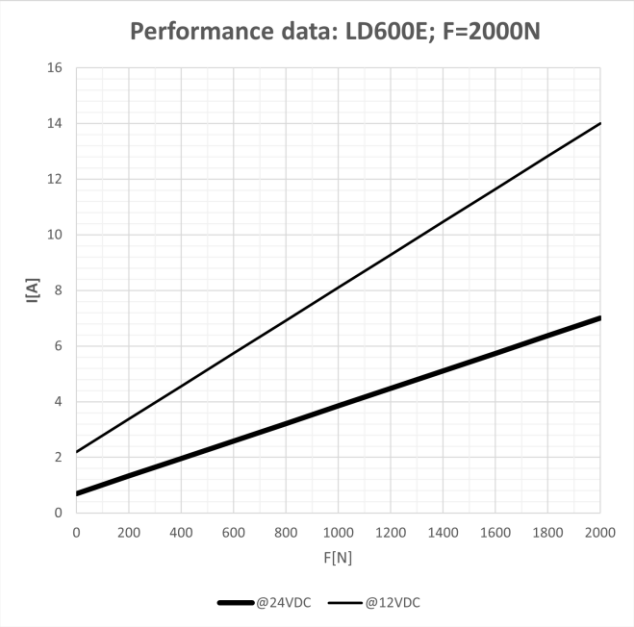


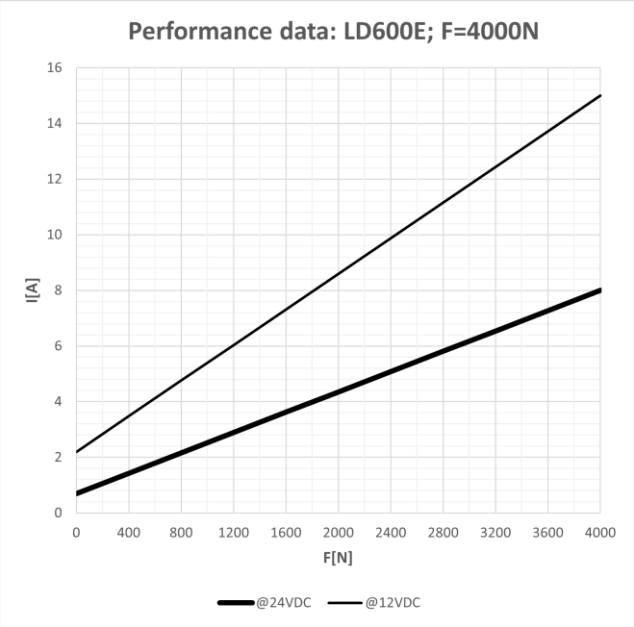
Variant with potentiometer:
(AP.4.018518 / AP.4.018519)
① Power cable
② Signalling cable
③ Dummy connector
④ Control board
⑤ Potentiometer
⑥ Cable cover

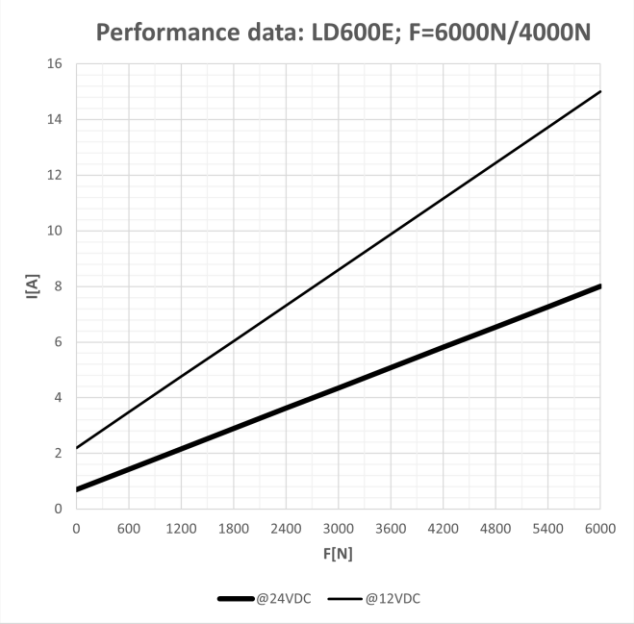
6.7 Performance diagrams

6.7.1 Power consumption

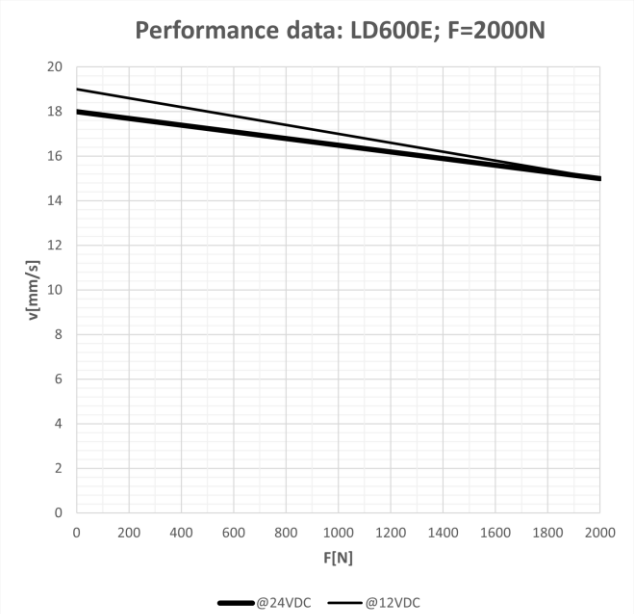
The following diagrams show the relationship between current and force for the individual variants:

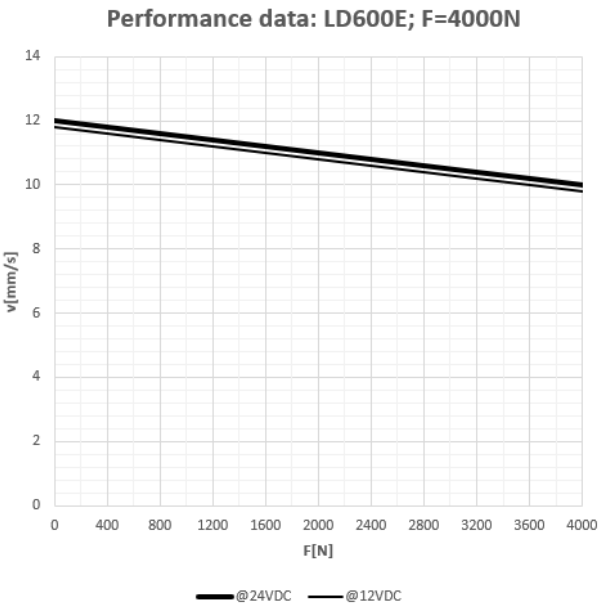


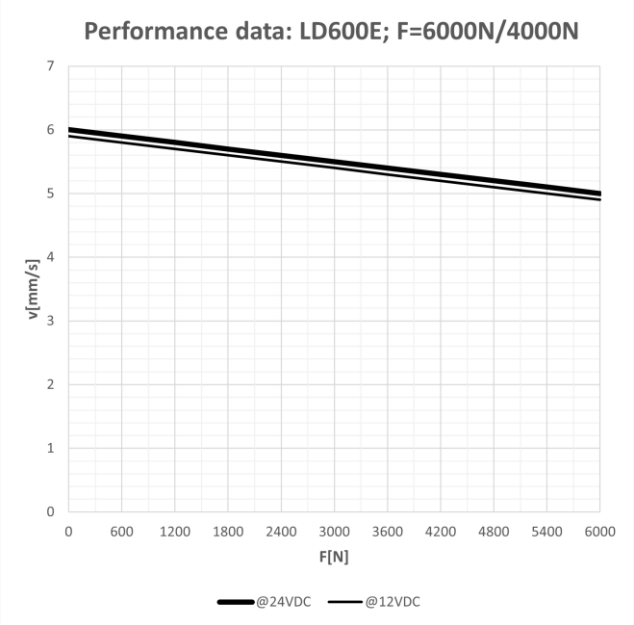




6.7.2 Speeds


Performance data: LD600E; F=2000N
v[mm/s]
F[N]
@24VDC
@12VDC


Performance data: LD600E; F=4000N
v[mm/s]
F[N]
@24VDC
@12VDC


Performance data: LD600E; F=6000N/4000N
v[mm/s]
F[N]
@24VDC
@12VDC

6.7.3 Weight specifications

Stroke [mm]	EBL [mm]	Weight [kg]
100	300	3.2
150	350	3.4
200	400	3.6
250	450	3.8
300	500	4
350	550	4.2
400	650	4.4
500	750	4.6
600	850	4.8

Remark: The specified weights may vary slightly due to different attachments (customised).

7 Life phases

7.1 Scope of delivery of the electric cylinders

The electric cylinder is supplied ready for operation as a single component. Power supply unit and handset or accessories are not included in the scope of delivery.

7.2 Transport and storage

The product must be checked by suitable personnel for visible and functional damage. Damage caused by transport and storage must be reported immediately to the person responsible and to Phoenix Mecano Solutions AG.

The commissioning of damaged electric cylinders is prohibited.

Ambient conditions specified for the storage of electric cylinders:

- no oily air
- Contact with solvent-based paints must be avoided,
- lowest / highest ambient temperature: -30 °C to +80 °C
- Air pressure: from 700 hPa to 1,060 hPa

Deviating environmental influences must be approved by Phoenix Mecano Solutions AG.

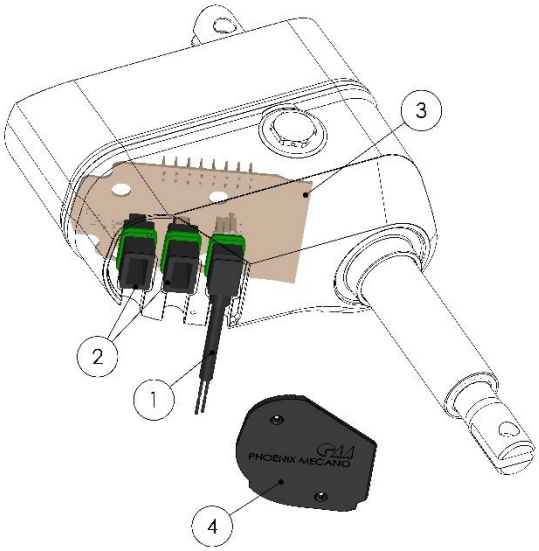
7.3 Important notes on installation and commissioning

It is essential that you observe and follow the following instructions. Otherwise, persons may be injured or the electric cylinder or other components may be damaged.

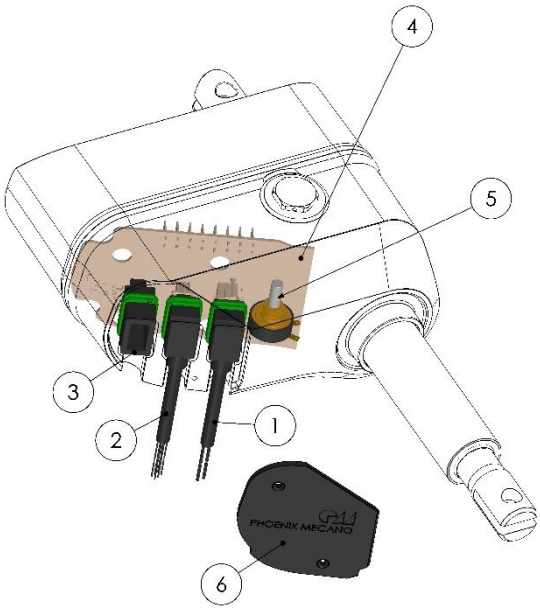
- An EMERGENCY STOP circuit must be provided on site, which reliably interrupts the operating voltage in the event of a failure or malfunction of the partly completed machinery!
- This electric cylinder must not be provided with additional bores.
- After installation and commissioning, the power supply plug must always be freely accessible.
- The electric cylinder must not be run on "block". Risk of mechanical damage.
- The electric cylinder may only be opened to adjust the limit switch unit. Once this has been done, it must be closed again immediately. Ensure that the flat gasket is correctly installed, all screws of the unit are correctly tightened and the adjustment opening cap is hand-tightened.
- The user must ensure that there is no danger when the power supply is active.
- When designing applications with this electric cylinder, care must be taken to avoid crushing and shearing points. These must be secured and labelled accordingly.
- Any self-starting of the electric cylinder due to a defect must be stopped immediately by switching off the power supply (for EMERGENCY STOP, see above).
- If the supply cable is damaged, the electric cylinder must be taken out of service immediately.
- The drive shaft is secured against twisting at the factory by a red safety strap.
- The drive shaft with suspension must also be secured against twisting when installed. Failure to observe this will result in the stroke end positions being adjusted.
- The electric cylinder is not designed for continuous operation. The switching frequency per hour specified for your application must not be exceeded.
- The user must determine and verify the suitability of the electric cylinder before installation.

7.4 First commissioning

The drive is supplied including pre-assembled accessory cables.



Variant without potentiometer:
① Power cable
② Dummy plug
③ Control board
④ Cable cover



Variant with potentiometer:
① Power cable
② Signal cable
③ Dummy connector
④ Control board
⑤ Potentiometer
⑥ Cable cover

Connect the connecting wires to your control unit and the stabilised power supply in accordance with the wiring diagram (see appendix chapter 0 from page 30). Always verify that the control unit and the power supply unit are de-energised (dead) before connecting them. Ensure that there can be no short circuit between the strands and that they are not in contact with conductive surfaces. This could permanently damage the cylinder.

7.5 Assembly

After receiving the electric cylinder, check the appliance for any damage. The electric cylinder is supplied ready for use without a power supply unit.

The installation, i.e. the fixing of the electric cylinder, is carried out using a rear suspension and a front suspension. Note your specific suspension variant here; see chapter 6.3 "Suspension variants" on page 11.

The following instructions must be observed during installation:

The stroke end positions are set using the drive shaft. The drive shaft is not secured against twisting. This means that turning (rotating) the drive shaft - or the fixed rod end - results in an adjustment of the end positions! The two suspensions must therefore always be installed in the target structure in the position set by the factory.

Attention: To ensure safe and trouble-free operation, the mounting points for installing the electric cylinder must be perfectly aligned!

Lateral forces on the drive shaft are not permitted!

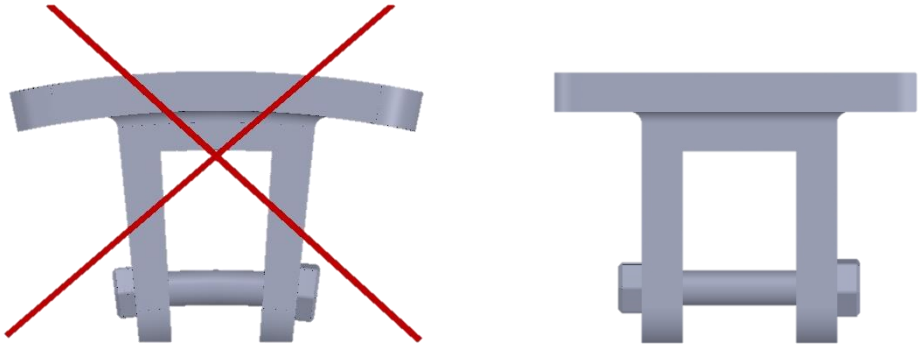
- When using/installing a rod end or clevis, ensure that the heads are correctly locked with the nut included in the scope of delivery.
- Carry out a test or trial run.

Failure to comply with this procedure will result in damage to the electric cylinder!
The warranty expires!

With regard to the installation position of the components, care must be taken to avoid crushing and shearing points, particularly with regard to the subsequent application.
Take care to avoid tripping hazards by installing the supply lines/cables properly and safely / Avoid supply lines!

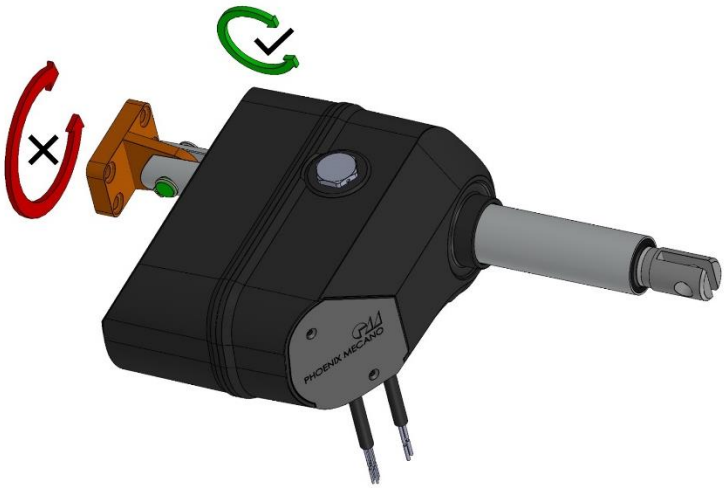
It is essential to ensure that the attached electric cylinder can move freely in the mounting points and that the electric cylinder is neither distorted nor bent. Incorrect installation and the associated forced position would damage the drive and prevent it from functioning properly!

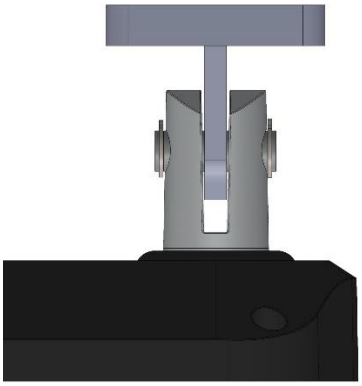
- The mounting bolts or fixing screws (not shoulder bolts) must be the correct size (observe the bore diameter of the cylinder mounts).
- Auxiliary components for the connection, such as bolts and nuts, must be made of high-quality steel (e.g. 10.8). There must be no threads on the bolt in the rear mount or on the piston rod eye.
- Screws and nuts must be tightened so that they cannot come loose.
- However, do not use too high a tightening torque for the screws on the rear and front mounts, otherwise the mounts will be unnecessarily stressed:



7.5.1 Assembly process

1. Hang the rear suspension on the "counterpart".
Attention: The counterpart must not be rotatable (red arrow). The electric cylinder must be able to rotate in the direction of the green arrow (see diagram). Always ensure that there is sufficient play in the suspension slot to prevent jamming.

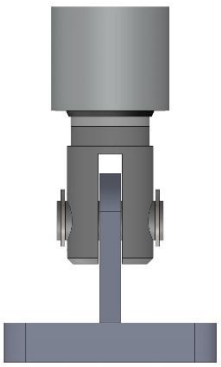




2. Remove the safety tape.

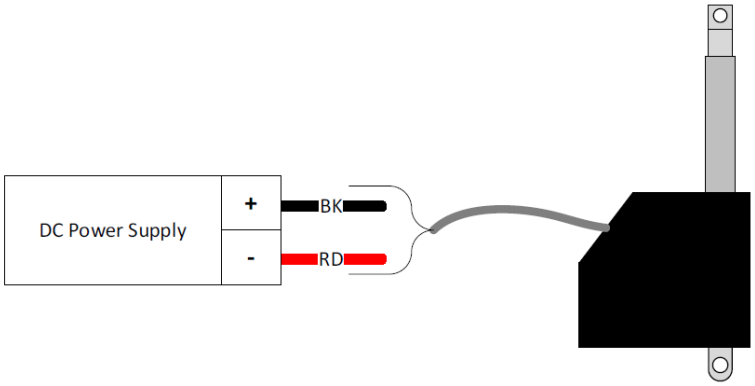
The drive shaft must not be twisted.

3. Attach the "front" suspension.
Attention: The counterpart must not be rotatable (red arrow). The electric cylinder must be mounted so that it can rotate in the direction of the arrow (see diagram). Always ensure that there is sufficient play in the suspension slot to prevent jamming.

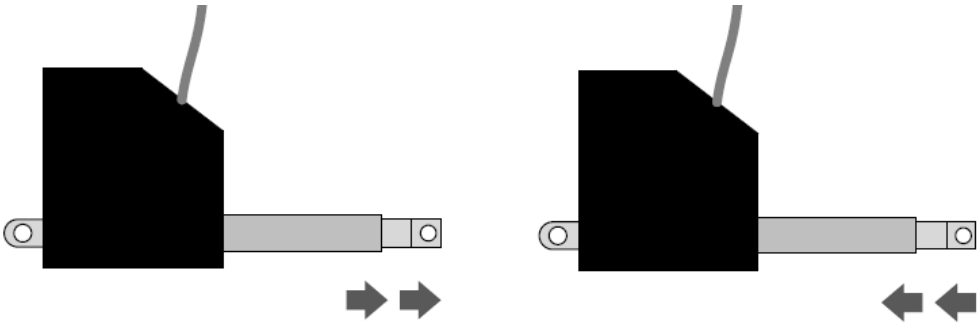


Attention: As the drive saft is not secured against rotation, the push rod eye must not be rotated! Ensure that the factory-set alignment of the suspensions to each other is not changed. Turning the drive shaft causes an immediate mechanical adjustment of the drive.

4. Connect the connecting wires of the pre-assembled cables to your control unit and the stabilised power supply in accordance with the wiring diagram (see chapter 0 from page 30). Always verify that the control unit and the power supply unit are de-energised (dead) before connecting them. Ensure that there can be no short circuit between the strands and that they are not in contact with conductive surfaces. This could permanently damage the cylinder.



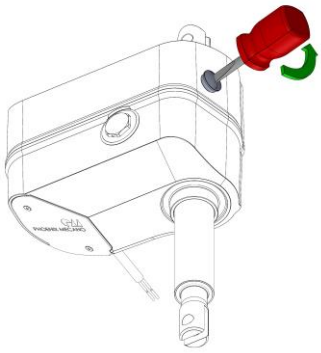
5. Carry out a test drive/first drive without load and check the system for functionality. The control can be viewed in the corresponding wiring diagram (see chapter 0 from page 30) .



7.5.2 Mechanical emergency adjustment

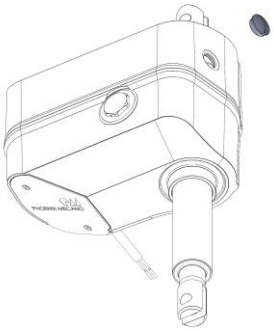
Attention: Please read this chapter completely before you start!

Firstly, it must be ensured that the power supply is disconnected and that it cannot be switched on again by the user!

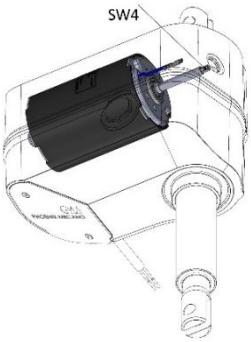


Remove the dummy plug with a screwdriver.

Please note that electric cylinders with removed blanking plugs are NO longer IP-protected!

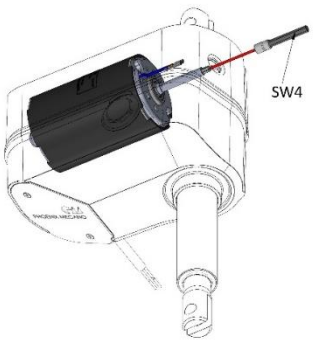


Remove the dummy plug and stow it away safely.

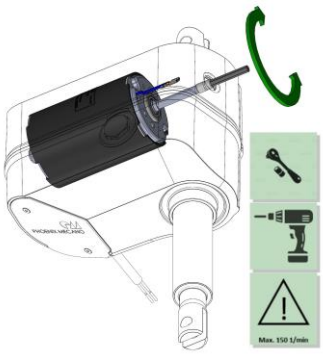


The motor shaft with pressed-on deep groove ball bearing and a hexagon pin (SW 4mm) is visible in the opening.

Fit a

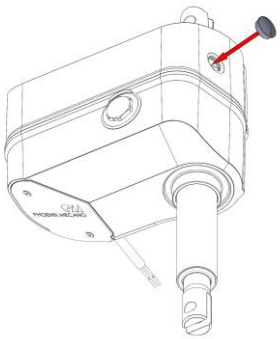


standard socket spanner (4 mm socket).

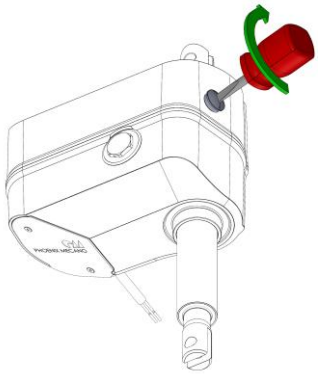


A standard ratchet or cordless screwdriver can be used to adjust the drive (drive shaft is extended or retracted).

Please ensure that a maximum rotation speed of **150 1 rpm** is NOT exceeded! Exceeding this limit would drive the motor too strongly, causing it to act as a generator and induce a voltage in the internal control unit. This would slow down the motor and possibly cause electronic components on the control board to "wake up".
Measure the installation length several times with a standard tape measure or folding rule to ensure that the end positions**(retracted = installation length** and **extended = installation length + stroke length**) are NOT exceeded (see table in chapter 0 on page 17)!



Once you have removed the drive from the application, remove the socket spanner (nut) and screw the blind plug back on.



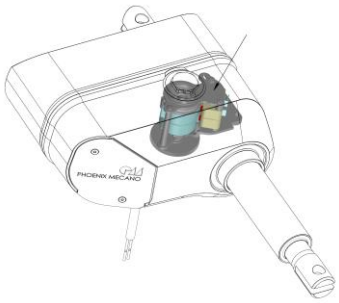
Tighten the blind plug again **hand-tight** using the open-ended/ring spanner.

If the cause was a defective drive, please shut down the system/application and contact the manufacturer.

Mechanical EMERGENCY adjustment is **NOT** a normal operating mode! Its sole purpose is to bring a system, an application, a machine, etc. into a safe mode in order to rectify previous faults or replace defective drives!

7.6 Setting the end position switch-off

Attention: Please read this chapter completely before you start!

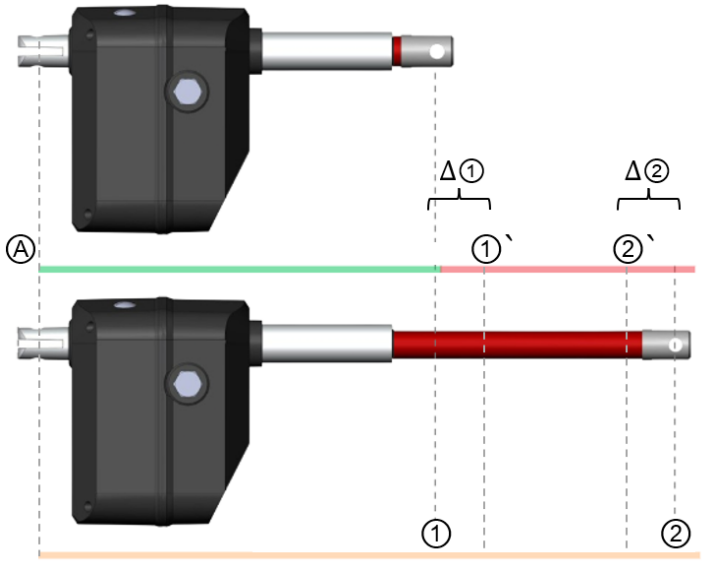


This product has an adjustable limit switch unit with which the extended and retracted end position (stroke length) of the drive can be adjusted.

The settings described here may only be made in a load-free state. Therefore, always remove the drive from your application to carry out the adjustment work. When carrying out any adjustment work in the dismantled state, always ensure that the fork head or front suspension is prevented from rotating, as otherwise the drive can become misaligned and, in the worst case, even be destroyed.

7.6.1 Electric drive to reference position & preparation

This work step must be carried out in the dismantled state and without load. Move the drive electrically to the corresponding reference position in preparation for the following setting ①` or ②`. The setting dimension corresponds to the distance Ⓐ①`or Ⓐ②`.



①	Lower target dimension to be set	②	Upper nominal dimension to be set
①`	Lower reference position	②`	Upper reference position
Δ①	Lower reference deviation	Δ②	Upper reference deviation

The reference position is located immediately before the desired end position is reached. It is offset by the reference deviation Δ① or Δ②. To set the rear end position, move the operator to the lower reference position ①`. Similarly, to set the upper end position, move the drive to the upper reference position ②`. The following table provides the respective reference deviations as a function of force and stroke in the as-delivered state:

F in N	Hub in mm (Auslieferungszustand)	Δ① in mm	Δ② in mm
Druck & Zug 2000	100...200	+2	-1
	201...400	+3	-2
	401...600	+9	-6
Druck & Zug 4000	100...133	+1	-1
	134...266	+2	-2
	267...600	+6	-6
Druck / Zug 6000 /4000	100..133	+2	-1
	134...400	+5	-4

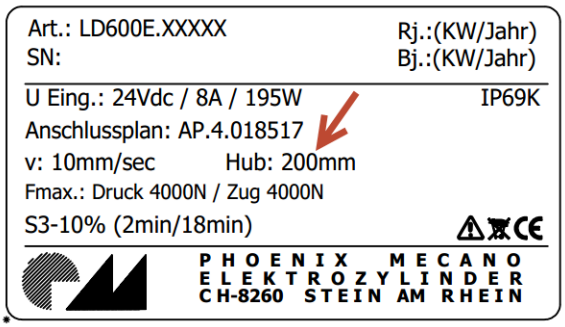
The respective reference position can then be determined using the corresponding reference deviation Δ① or Δ② in relation to the target dimension ① or ② to be set.

$lower\ reference\ position$ ①` = ① + Δ①

$upper\ reference\ position$ ②` = ② + Δ②

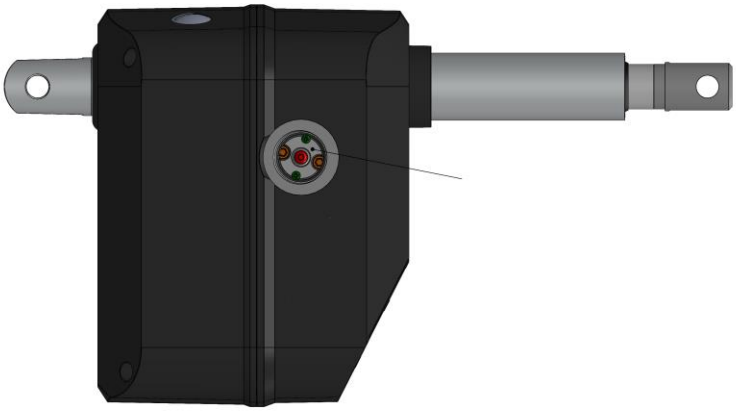
To read out the values, please refer to the type label for the stroke in the as-delivered state.

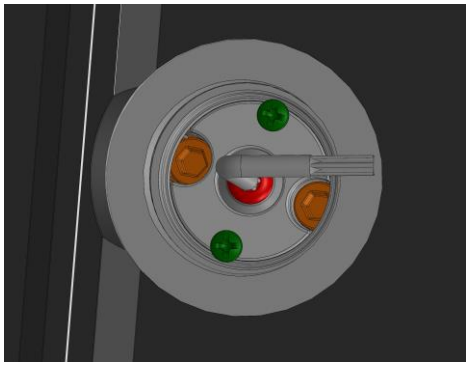
There is a risk of confusion between the currently set stroke and the stroke as delivered.
The stroke in the as-delivered state must be identiiied on the type plate. The following illustration shows an example with a stroke of 200 mm as delivered:



Disconnect all electrical inlet lines after reaching the reference position. The settings must be made in a de-energised state. In this state, the drive's adjustment opening cap can be removed. To open, use a standard open-end spanner and turn the adjustment opening cap clockwise:

Remove the adjustment opening cap and the flat gasket marked in green and stow the components away safely. The adjustable limit switch unit is now visible under the adjustment opening cap.





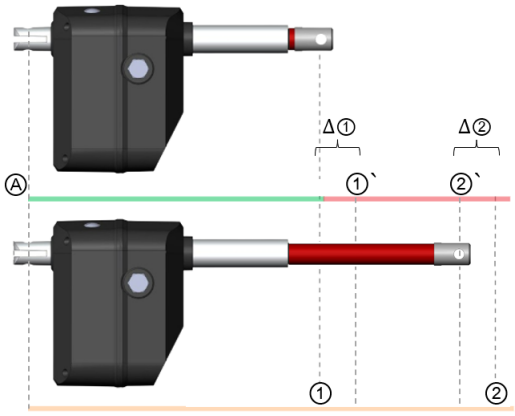
In preparation for the following adjustment work to unlock the unit, ONLY loosen the central screw shown in red by turning it anti-clockwise by approx. half a turn. The screws marked in green must NOT be tampered with. Destruction of the drive is the direct consequence.

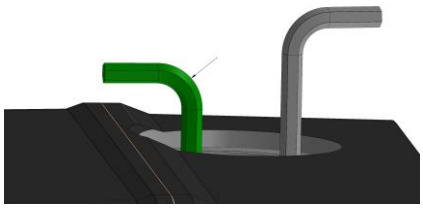
7.6.2 Setting the front end position

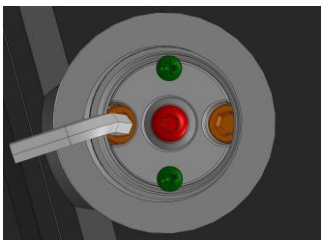
The working torques that apply specifically to this work step are described below.
These must not be exceeded under any circumstances.

- Tightening torque for the centre screw (shown in red) = 0.25 Nm
- Maximum torque on the planet during adjustment = 0.25 Nm

The drive is in the upper reference position ②`at the start of this operation.
The centre screw shown in red is loosened. Now insert a standard Allen key with width across flats SW3 into the drive of the lower planet.
The lower planet can be determined by briefly placing the tool on it (the Allen key shown in green is lower).

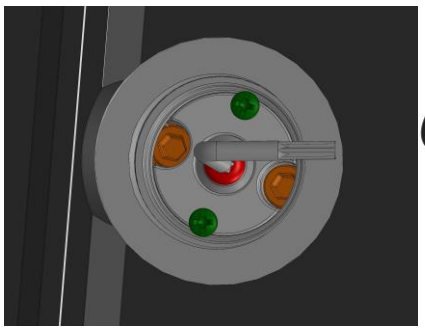


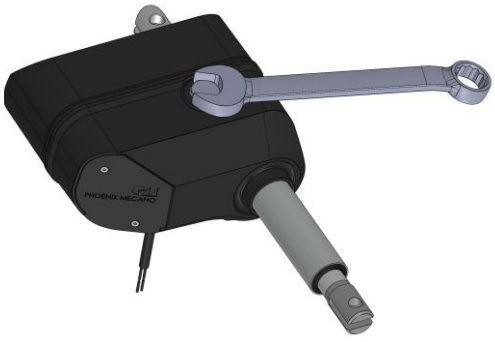




Now turn the planet carefully (maximum torque on the planet during adjustment = 0.25 Nm) in a clockwise direction until you hear an audible click from the switch. Avoid the occurrence of high torques during adjustment. The limit switch is now set. In this state, pull the spanner as straight as possible out of the unit without turning the planet any further.

Finally, tighten the central screw (red) of the limit switch unit to a tightening torque of 0.25 Nm and fit the adjustment opening cap including the flat seal. Tighten the adjustment opening cap hand-tight using an open-end spanner. The drive is now put back into operation electrically. In this state, move the operator to both end positions and measure the installation dimensions (retracted, extended).





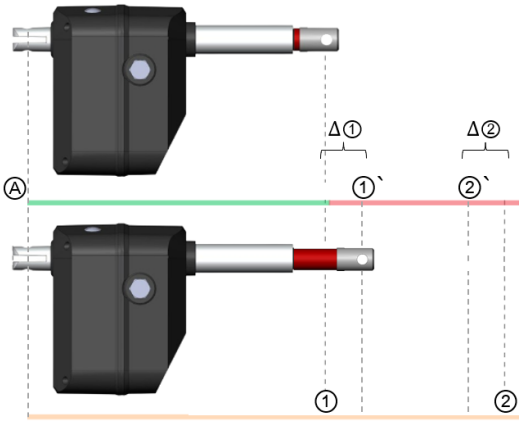
To undo the settings made in this chapter, repeat the procedure and carefully turn the Allen key anti-clockwise. Always ensure that the specified torques are not exceeded.

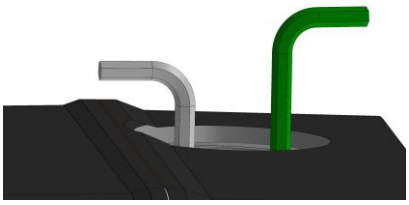
7.6.3 Setting the rear end position

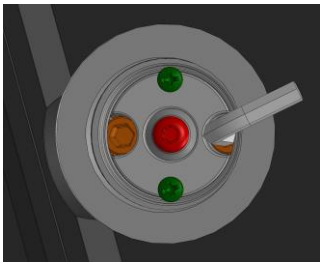
The working torques that apply specifically to this work step are described below.
These must not be exceeded under any circumstances.

- Tightening torque for the centre screw (shown in red) = 0.25 Nm
- Maximum torque on the planet during adjustment = 0.15 Nm

The drive is in the upper reference position ①`at the start of this operation.
The centre screw shown in red is loosened. Now insert a commercially available Allen key with width across flats SW3 into the drive of the higher planet. The higher planet can be determined by briefly positioning the tool (the Allen key shown in green is positioned higher).

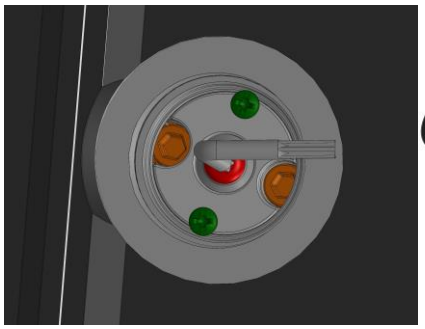


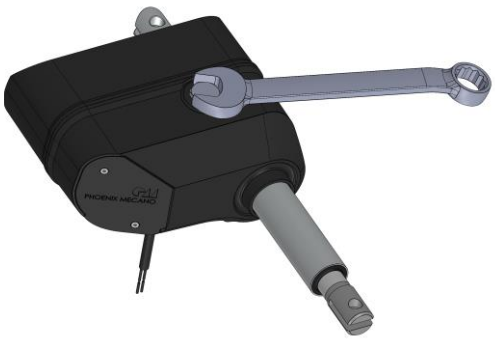




Now turn the planet carefully (maximum torque on the planet during adjustment = 0.15 Nm) anti-clockwise until you hear an audible click from the switch. Avoid the occurrence of high torques during adjustment. The limit switch is now set. In this state, pull the spanner as straight as possible out of the unit without turning the planet any further.

Finally, tighten the centre screw (red) of the limit switch unit to a tightening torque of 0.25 Nm and fit the adjustment opening cap including the flat gasket. Tighten the adjustment opening cap hand-tight using an open-end spanner. The drive is now put back into operation electrically. In this state, move the operator to both end positions and measure the installation dimensions (retracted, extended).





To undo the settings made in this chapter, repeat the procedure and carefully turn the Allen key clockwise. Always ensure that the specified torques are not exceeded.

7.7 Maintenance

In principle, the electric cylinder is maintenance-free; however, it is not wear-free.

Possible wear can be recognised by faulty function, increased play in the moving parts or unusual noises emanating from the electric cylinder.

Worn product parts are replaced by the manufacturer. The electric cylinder must be sent to the manufacturer for this work. If worn product parts are worn and not replaced, the safety of the product may no longer be guaranteed.

All work with the electric cylinder must be carried out in accordance with these instructions only. The device may only be opened by authorised and trained specialist personnel.

If the drive is defective, we recommend contacting the manufacturer or sending the electric cylinder in for repair.

- When working on the electrical system or electrical components, they must be de-energised beforehand to prevent the risk of injury.
- Unauthorised modifications or changes to the electric cylinder are not permitted for safety reasons.
- Safety-relevant equipment must be checked regularly, i.e. at least once a year depending on the frequency of use, to ensure that it is complete and functioning properly.

7.8 Cleaning

You can clean the hand control and outer profile surfaces of the electric cylinder with a lint-free, clean cloth.

Solvent-based cleaners attack the material and can damage it.
Attention: Accessories such as hand switches do not have protection class IP69K, but IP40 and must therefore not be washed with a high-pressure cleaner or exposed to moisture - damage would be the immediate consequence!

7.9 Disposal and return

The electric cylinder must either be disposed of in accordance with the applicable guidelines and regulations or returned to the manufacturer.

The manufacturer reserves the right to charge a fee for the disposal of these drives.

The electric cylinder contains electronic components, cables, metals, plastics, etc. and must be disposed of in accordance with the applicable environmental regulations of the respective country.

In Europe, the disposal of the product is subject to EU Directive 2002/95/EC or the respective national legislation.

8 Appendix: Wiring diagrams

You can view the available connection diagrams on the following pages.

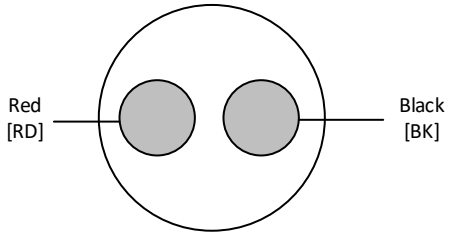
General explanation: A connection diagram defines the connectors/cables, their assignment, as well as part of the specification and the available functions. As a rule, various connection examples are also shown to provide you with the best possible planning support.

Each connection diagram begins with "AP.4.", followed by a number of at least six digits. ➔ Example: AP.4.000000. The number of the wiring diagram can be found on the type plate and on the specification sheet.

Connection plan AP.4.018517

Cable

(sketch)



Cabel (2pol)

***** Power cable *****

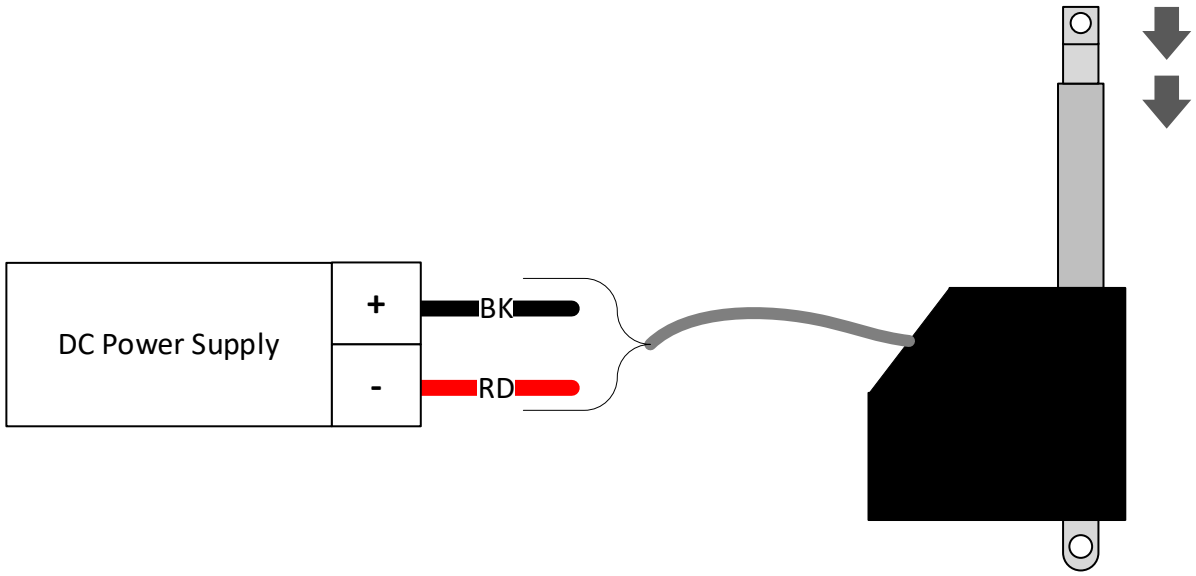
2.5mm² (AWG14): RD, BK

wire	*description*
Red (RD)	**Motor** The actuator can be extended and retracted with the red and black stranded wires. Please refer to the nameplate for the operating voltage. **Direction** The actuator extends or retracts according to the polarity of the power supply. The actuator stops automatically at the end positions.
Black (BK)	

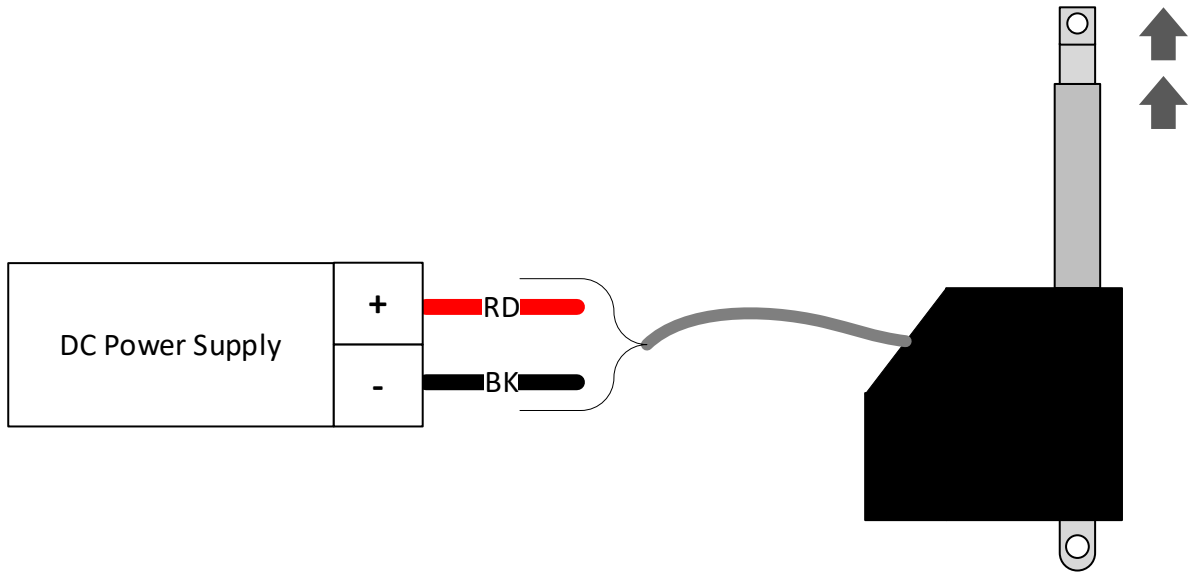
	Red	**Black**
Retract	Minus	Plus
Extend	Plus	Minus

Example

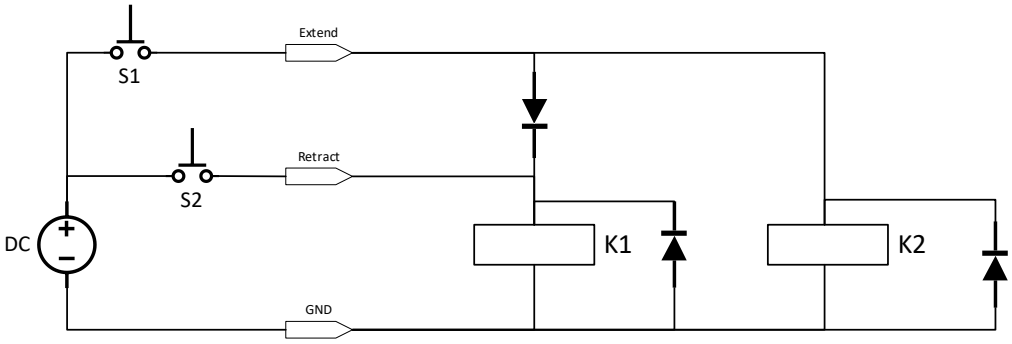
Connection example – Retract

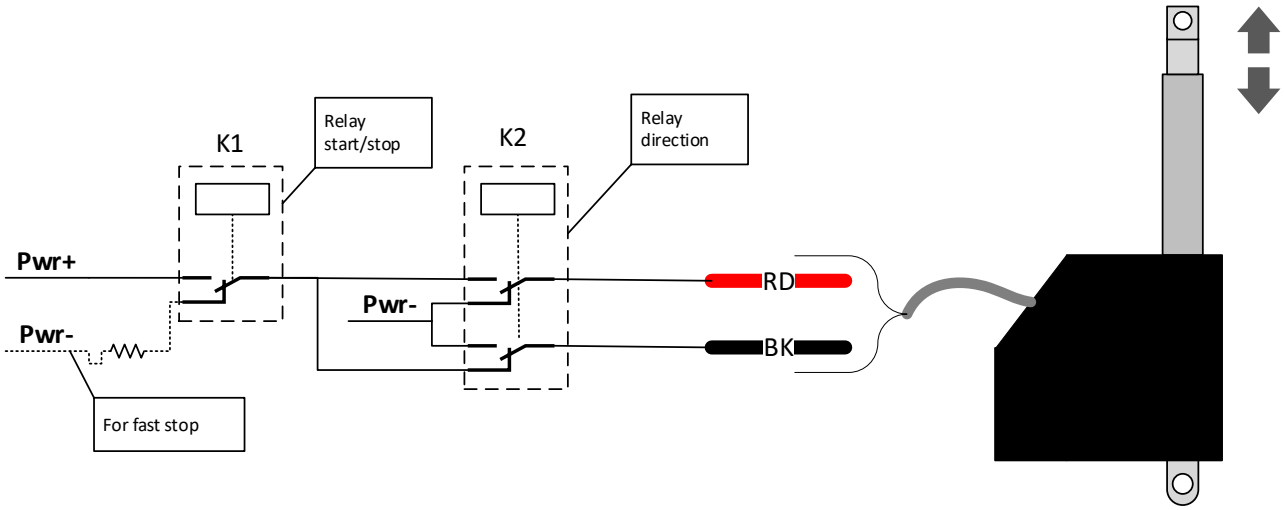


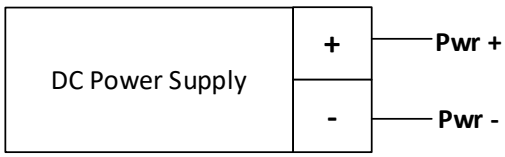
Connection example – Extend



Connection example - Relay





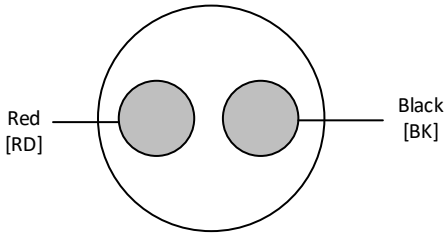


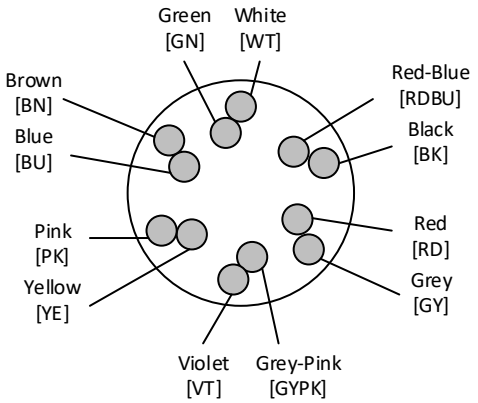
Note: Do not change the direction during travel. Always stop the travel via K1 before changing the direction with K2.

Connection AP.4.018518

Pin assignment

(sketchy representation)





Cable (2 pin)

***** Powercable *****

2.5mm² (AWG14): RD, BK

Wire	*Description*
Red (RD)	**Motor wires** The cylinder can be extended and retracted using the red and black wires. Please refer to the type plate for the voltage. **Direction** The cylinder extends or retracts according to the polarity of the power supply. The cylinder stops automatically in the end positions.
Black (BK)	

	Red	**Black**
Retract	Minus	Plus
Extend	Plus	Minus

Cable (12 pin)

***** Control cable *****

0.25mm² (AWG23): BN, BU, WH, GN, PK, YE, BK, RDBU, GY, RD, VT, GYPK

Wire	*Description*
Brown (BN)	**Do not connect** The cable is not to be connected.
Blue (BU)	
White (WH)	
Green (GN)	

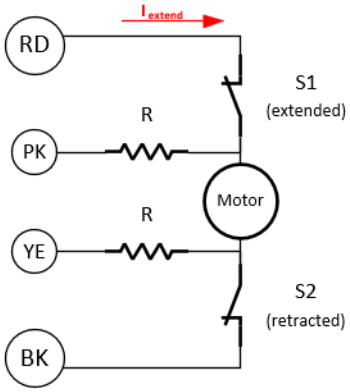
Table continues

Continuation

Pink
(PK)

End position feedback
Signal feedback that the corresponding end position has been reached.

Functional description
The motor of the cylinder is operated via the RD and BK wires. The end position feedback is provided via the PK and YE wires, which each transmit the motor voltage via the resistor R. When the end position is reached, the motor is de-energized via a limit switch S, causing the motor voltage at PK or YE to drop.

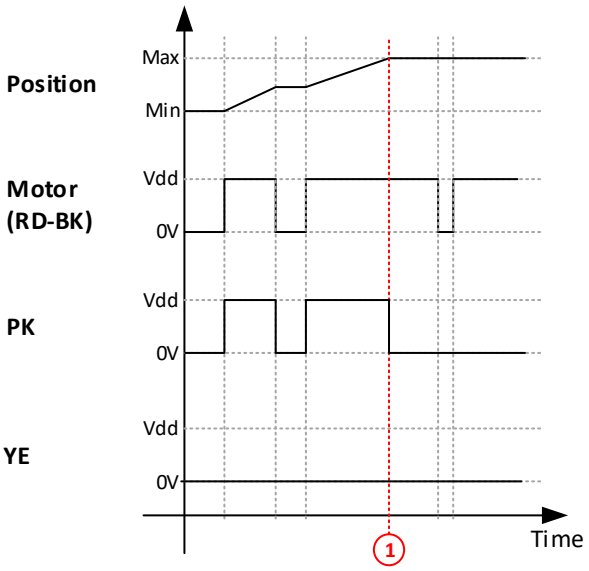


Definition

- **Pink (PK)** Extended end position
- **Yellow (YE)** Retracted end position
- **R** 1k Ω

Overview - Extending

Yellow
(YE)



Position (1): Reaching the extended end position

Black
(BK)

Do not connect
The cable is not to be connected

Table continues

Continuation

Red-Blue
(RDBU)

Mechanical potentiometer

The potentiometer generates an analog position signal over the entire stroke.

- Red: Plus (e.g. 12V)
- Gray: Minus
- Red-Blue: Output signal

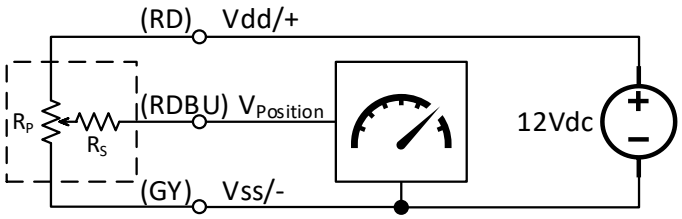
Electrical values

Potentiometer:	R_P	= 10kΩ
Series resistance:	R_S	= 1kΩ
Maximum power:	P_{tot}	= 0.1W
Maximum voltage:	Vdd-Vss	= 30V

Retracted:	1kΩ*
Extended:	11kΩ*
*Measurement reference:	Red-Blue (RDBU) against Gray (GY)

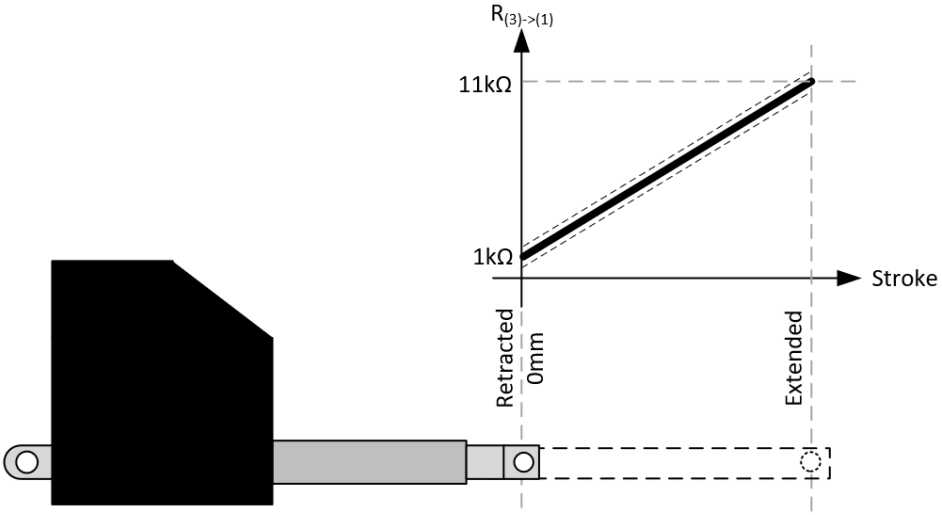
Gray
(GY)

Connection example



Position (resistance value between RDBU and GY)

Red
(RD)



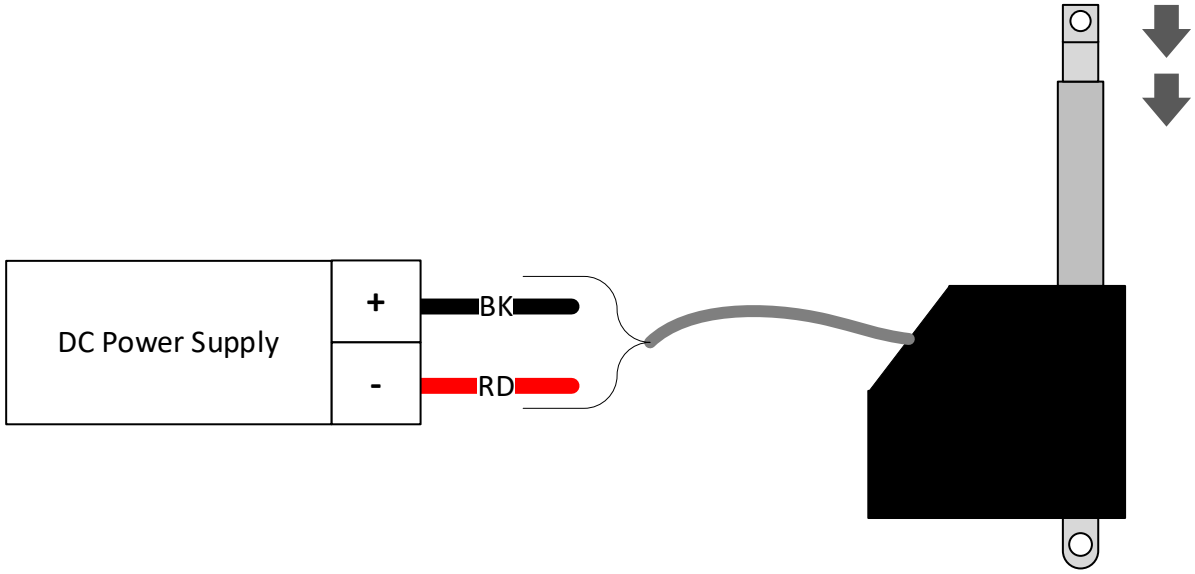
Violet
(VT)

Do not connect
The cable is not to be connected

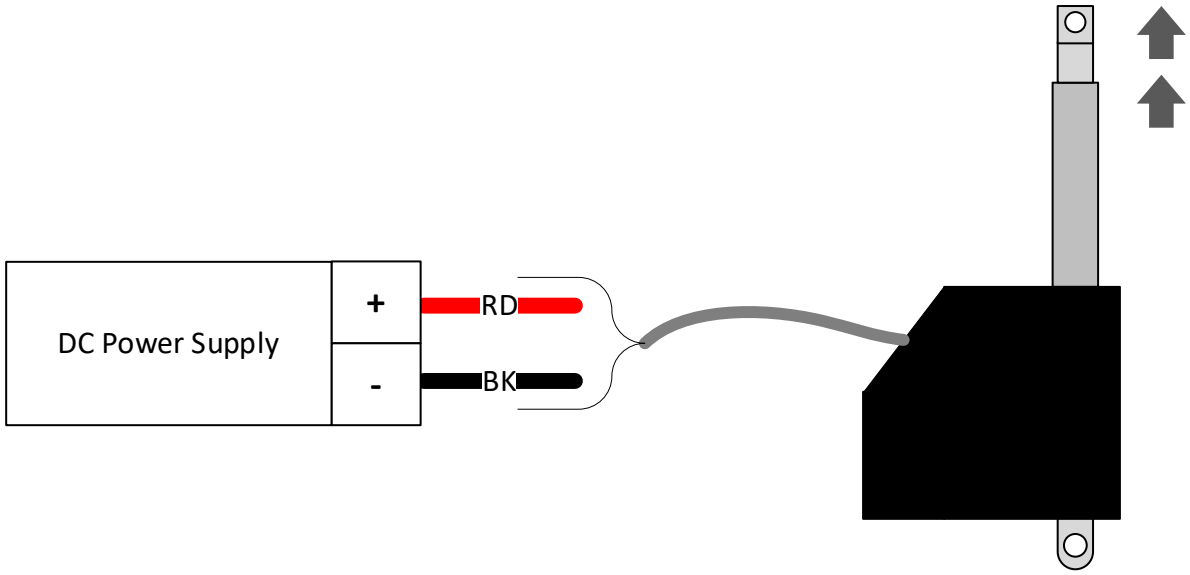
Gray-Pink
(GYPK)

Example

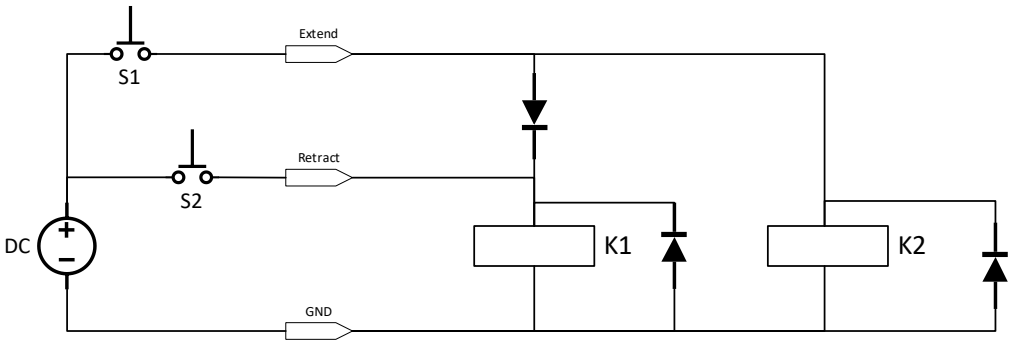
Connection example - retract

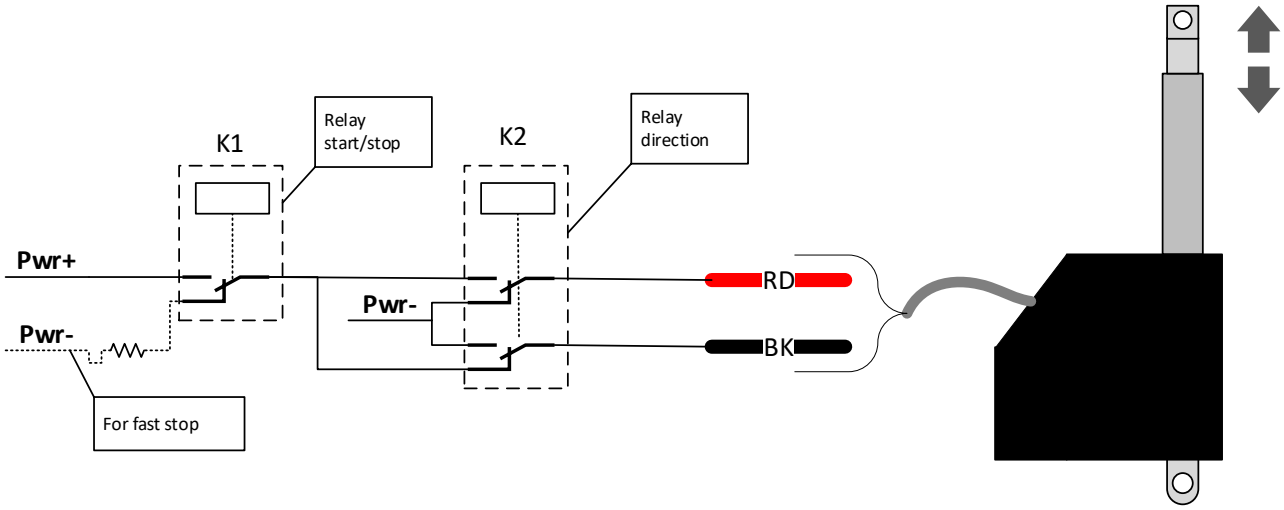


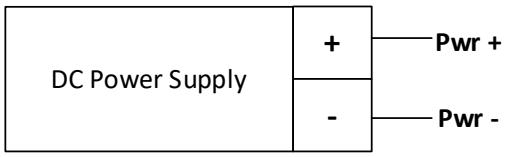
Connection example - extend



Control example - Relay





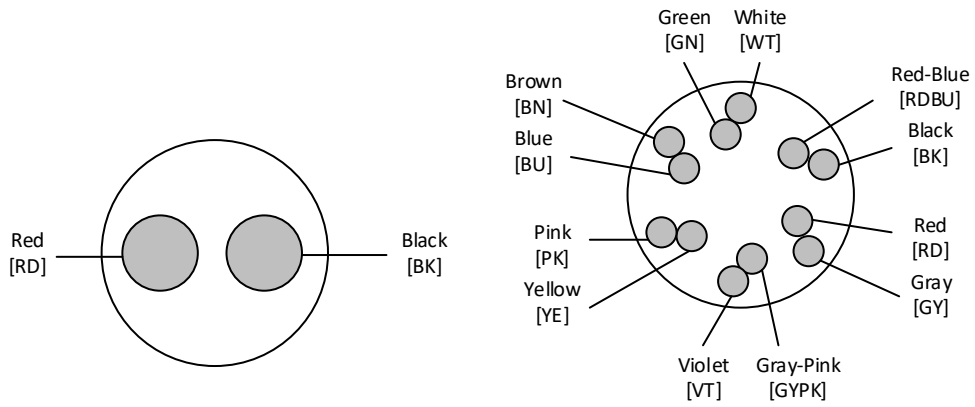


Note: Do not change direction while driving. Always stop the drive via K1 before changing direction with K2.

Connection plan AP.4.018519

Cable

(sketch)



Cable (2pol)

***** Power cable *****

2.5mm² (AWG14): RD, BK

wire	*description*
Red (RD)	**Motor** The actuator can be extended and retracted with the red and black stranded wires. Please refer to the nameplate for the operating voltage. **Direction** The actuator extends or retracts according to the polarity of the power supply. The actuator stops automatically at the end positions.
Black (BK)	

	Red	**Black**
Retract	Minus	Plus
Extend	Plus	Minus

Kabel (12pol)

*****Control cable *****

0.25mm² (AWG23): BN, BU, WH, GN, PK, YE, BK, RDBU, GY, RD, VT, GYPK

wire	*description*
Brown (BN)	**Do not connect** Leave unconnected
Blue (BU)	
White (WH)	
Green (GN)	

Continued on next page

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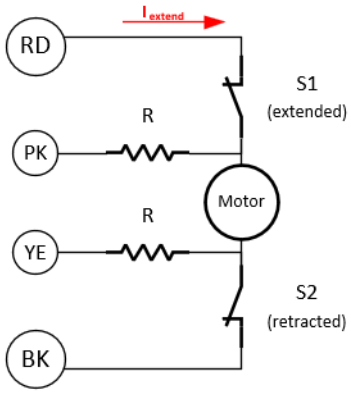
Pink
(PK)

End Position feedback
Signal feedback on reaching the corresponding end position.

Functional description

The motor of the actuator is operated via the wires RD and BK. The end position feedback is provided by the wires PK and YE, each of which is connected to the motor voltage via the resistor R. The motor is switched off by a limit switch S when the end position is reached. When the end position is reached, the motor is disconnected from the power supply via a limit switch S, which cuts the motor voltage at PK or YE.

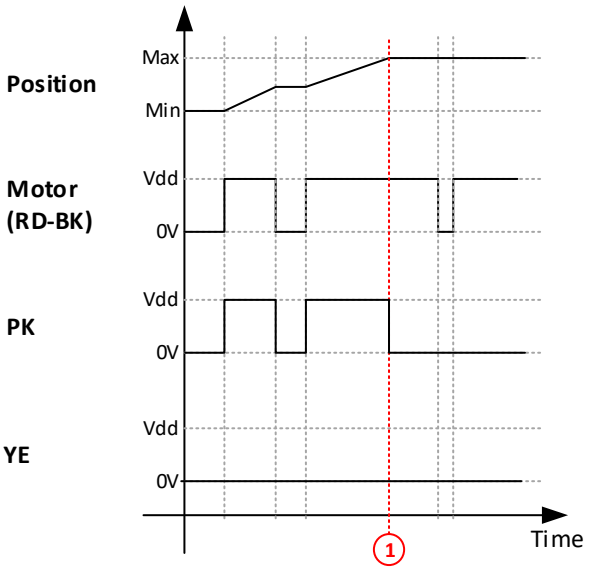


Definition

- **Pink (PK)** Extended
- **Yellow (YE)** Retracted
- **R** 1k Ω

Overview – Extend

Yellow
(YE)



Position (1): Reaching the extended end position

Black
(BK)

Do not connect
Leave unconnected

Continued on next page

Continued from previous page

Red-Blue
(RDBU)

Gray
(GY)

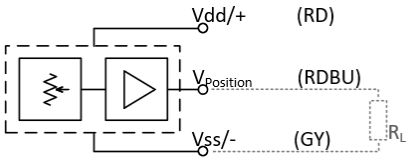
Red
(RD)

Violet
(VT)

Gray-Pink
(GYPK)

Active position feedback 0.5 - 4.5V

Depending on the set stroke, the output voltage $V_{Position}$ will generate a voltage between 0.5 and 4.5V. 0.5V corresponds to the retracted end position and 4.5V to the extended end position. By the active output voltage the influence of different loads (RL), as for example from controllers and PLC, can be almost neglected.



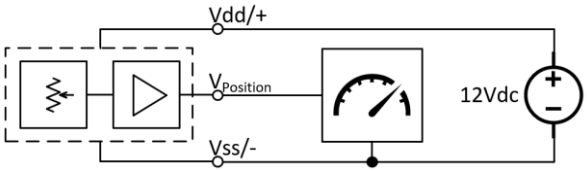
Specification

Power Supply Vdd-Vss	8 – 28 VDC
Load R_L	≥1kΩ
Retracted position $V_{Position}$	0.5 V[1,2]
Extended position $V_{Position}$	4.5 V[1,2]

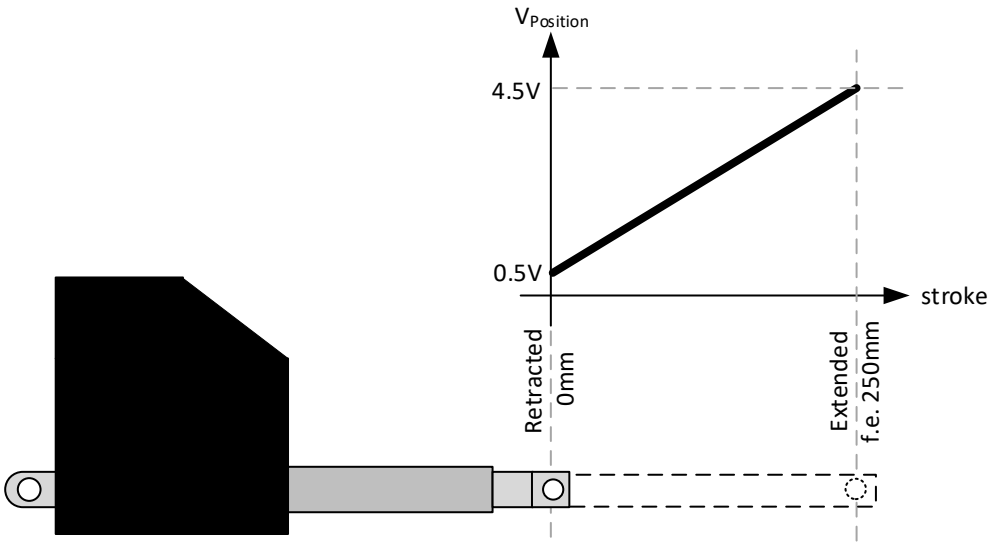
[1]With respect to Vss/-

[2]The Voltage $V_{Position}$ is adjusted to the specified stroke at the factory.

Connection example



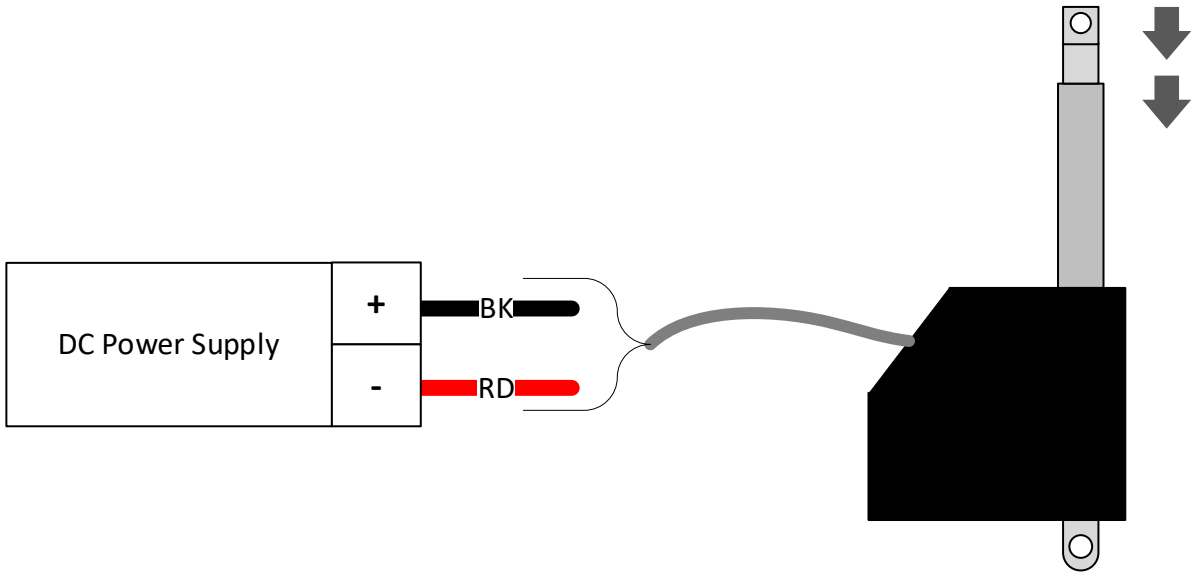
$V_{Position}$ (with respect to Vss/-)



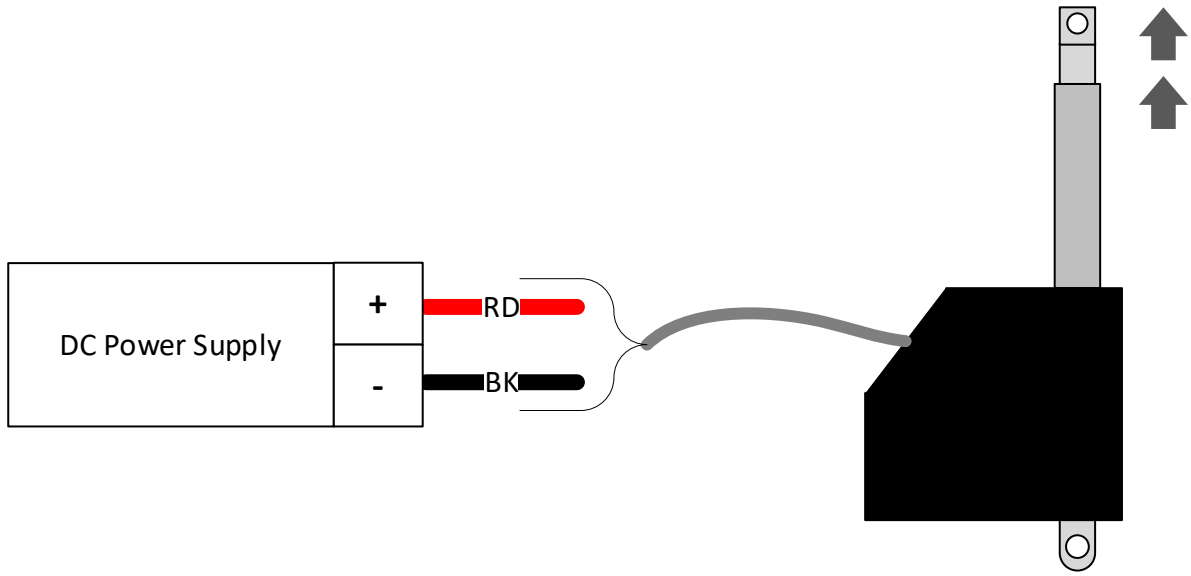
Do not connect
Leave unconnected

Example

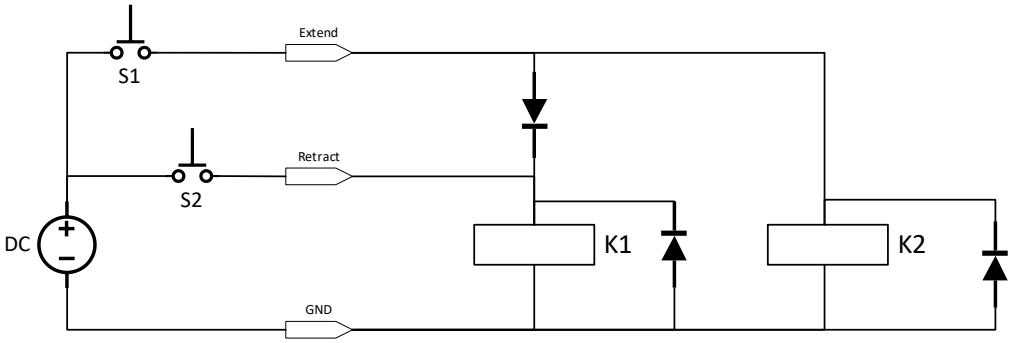
Connection example – Retract

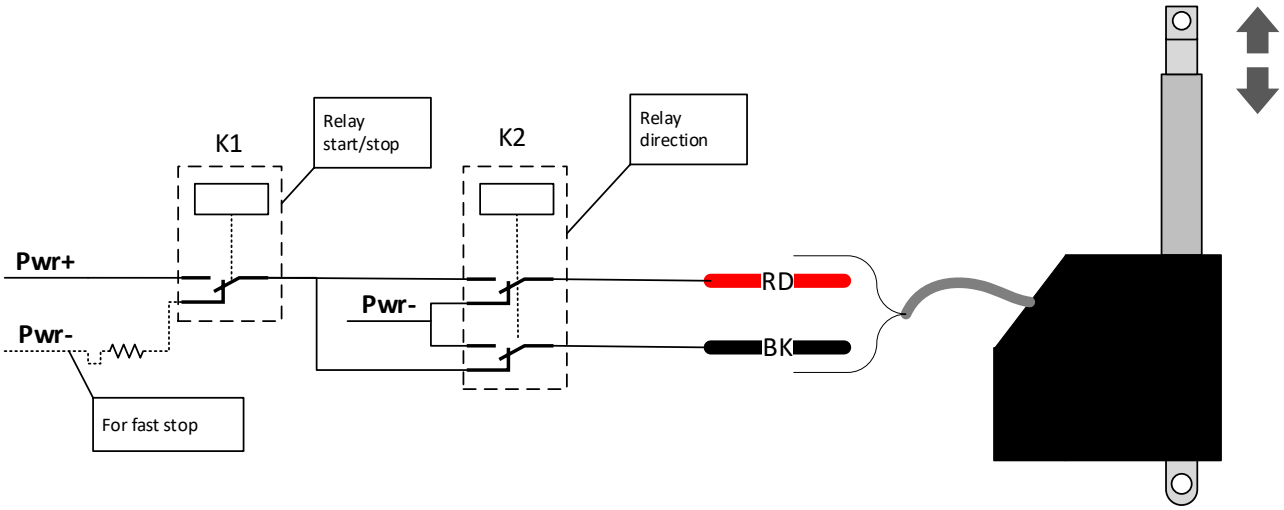


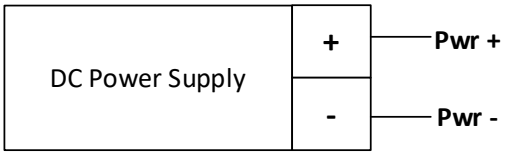
Connection example – Extend



Connection example – Relay







Note: Do not change the direction during travel. Always stop the travel via K1 before changing the direction with K2.