PHOENIX MECANO

EN Assembly Instructions

Electric cylinder LD1000C

B.017 977
Version 1.8

Contents

1 LD1000C Installation Declaration

within the meaning of the Machinery Directive 2006/42/EC, Annex II, 1.B for incomplete machines.

The Manufacturer:

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

confirms that the product named therein

Product designation:	*LD1000C*
Type designation:	*LD1000C*
Trade name:	*LD1000C*
Function:	*Electromotive extension and retraction of the pushrod for creation of linear motion*

meets the requirements for an **incomplete machine** according to the Machinery Directive 2006/42/EC.

The following essential requirements of the Machinery Directive 2006/42/EC according to Annex I have been 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.
It is also declared herewith that the special technical documentation according to Annex VII Part B has been compiled.

It is expressly stated that the **incomplete machine** complies with all applicable provisions of the following EC guidelines:

2011/65/EU	Directive 2011/65/EU of the European Parliament and the Council dd. 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment
IEC 61000	IEC 61000-6-2:2016, EN 61000-6-2:2019, IEC 61000-6-4:2018, EN 61000-6-4:2007+A1:2011

Phoenix Mecano Solutions AG undertakes to submit technical documentation for the incomplete machine upon substantiated request of the national competent bodies in electronic format.

A person established within the Community and authorised to draw up the relevant technical documentation:

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

Setting into operation is forbidden until it is established that the machine, into which this incomplete machine is installed, complies with the provisions of the EC Directive 2006/42/EC.

It must comply with the CE guidelines prior to marketing, including with regard to documentation.

Stein am Rhein / 18.06.2019		Timo Fluck Technical supervision
Mechanical components (place/date)	(signature)	(identification of the signatory)

2 General notes on these assembly instructions

These assembly instructions are only applicable for the electric cylinder described and intended as documentation for the manufacturer of the final product, into which this incomplete machine will be installed.

We herewith particularly emphasize that the operating instruction containing description of all functions and safety notes for the final product must be compiled for the end customer by the manufacturer of the final product.
This also applies to the installation into a machine. The machine manufacturer is responsible for the respective safety equipment, inspections, documentation and monitoring of pinch and shear points that may potentially arise.

This assembly instructions help

- avoid hazards
- and downtime,
- and guarantee and/or extend the lifetime of the product.

Hazard warnings, safety recommendations and data in these assembly instructions shall be adhered to with no exception.

The assembly instructions must be read and used by each person, who works with the product.

Setting into operation is forbidden until it is established that the machine complies with the provisions of the EC Guidelines 2006/42/EC (Machinery Directive). It must comply with the CE guidelines prior to marketing, including with regard to documentation.

We expressly draw the attention of the re-user of this incomplete machine / partial machine / machine part to the duty of extension and complementation of this documentation. In particular, a CE Declaration of Conformity must be drawn up by the re-user in the case of fitting or mounting of electric elements and/or drives, as this declaration of incorporation was expressly drawn up for the partly completed machinery as such and automatically loses its validity when integrated/installed in a machine.

3 Liability / warranty

3.1 Liability

Phoenix Mecano Solutions AG assumes no liability for damages or impairments resulting from structural modifications by a third party or modifications of the safety devices of this electric cylinder. Phoenix Mecano Solutions AG assumes no responsibility for the spare parts that have not been tested and authorised by Phoenix Mecano Solutions AG.
Otherwise, the EC Installation Declaration becomes void.

The safety-related devices must be regularly tested for operability, damage and integrity.

We reserve the right to make technical modifications of the electric cylinder and changes of its assembly instructions.

Advertising materials, product leaflets on sales activities, public statements or similar notices may not be taken as basis for suitability and quality of the product, for which purpose a detailed technical advice is strongly recommended. No claims can be asserted against Phoenix Mecano Solutions AG as to availability of previous versions or adjustments to the current version of the electric cylinder.

In case of any inquiries please specify the type plate data.

Our address:

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

Tel.: +41 (0)52 742 75 00
Fax: +41 (0)52 742 75 90

3.2 Product monitoring

Phoenix Mecano Solutions AG offers products with highest possible technical level, adapted to the latest safety standards. Inform us please immediately of any recurrent failures or malfunctions.

3.3 Language of the operating instructions

The original version of these assembly instructions was drawn up in the EU official language (German) of the manufacturer of this incomplete machine. Translations into other languages are translations of the original version subject to the legal requirements of the machinery directive.

3.4 Copyright

4 Use / operating personnel

4.1 Intended use

The electric cylinder shall be used exclusively for the adjustment of the guided components or other comparable adjustment tasks. The electric cylinder may not be used in potentially explosive atmosphere as well as in direct contact with food, pharmaceutical or cosmetic products. Catalogue information, content of these assembly instructions and/or conditions specified in the order must be taken into account. The values specified in these assembly instructions are maximum values and may not be exceeded.

4.2 Unintended use

“Unintended use” means that the information given in section 4.1 *Intended use* is not being observed. Unintended use and improper handling, as well as operating, installing or handling this electric cylinder by untrained personnel may result in hazards to the personnel. Moving persons and animals with this electric cylinder, for example, is an example of an unintended use and is forbidden. Phoenix Mecano Solutions AG is released of liability and general operating licence of this electric cylinder becomes void in case of unintended use.

4.3 Reasonably foreseeable misuse

- Overloading the device by exceeding the weight or duty cycle
- Use in the environments outside the specified IP protection class
- Use in the environment with high humidity > dew point
- Use in the premises with potentially explosive atmosphere as defined in ATEX Directive
- Operating in damage to the mains supply, housing, motor cable, manual switch or other control lines (SPS, PC, etc.) → Attention: Accessories (power supply, manual switch, etc.) have protection class IP40
- Use when incompletely assembled or insufficiently fixed
- Stroking out (moving up to a stop)
- Use in applications with lateral forces and torques
- Hazards caused by the lack of consideration of different states and fault conditions, such as the de-energized state.

4.4 Who may use, install and operate this electric cylinder?

Individuals, who have fully read and understood the assembly instructions, may use, install and operate this electric cylinder. The responsibilities associated with handling this electric cylinder must be clearly defined and observed.

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

- Offshore applications
- Aircraft and other flying devices
- Nuclear power stations / nuclear energy
- Potentially explosive service locations
- Service locations at high altitudes (from 2000 m above sea level) without further assessment and practical tests

5 Safety

5.1 Safety instructions

Phoenix Mecano Solutions AG has constructed this electric cylinder according to the current state of the art and existing safety regulations. However, if the electric cylinder is misused and/or operated in the manner inconsistent with the intended use or if the safety instructions are not observed, this may result in hazards to personnel and property. Competent handling guarantees high performance and availability of the electric cylinder. Faults or conditions, which may impair the safety, must be rectified immediately.

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

This includes:

- understanding the safety instructions in the text, and
- being familiar with the configuration and functioning of various options of operation and application.

The electric cylinder may only be used, installed and operated by the designated, trained personnel. Any works on and with the electric cylinder may only be carried out according to this instruction. This instruction needs therefore be kept safe and close at hand in the vicinity of the electric cylinder.

The general, national or operational safety instructions shall be observed. Responsibilities for the use, installation and operation of this electric cylinder must be unequivocally stipulated and observed so that no unclear situation may arise with regard to safety aspects. Before every commissioning, the user must ensure that no persons or objects remain in the danger area of the electric cylinder. The user may only operate the electric cylinder if it is in a faultless condition. Any change must be immediately reported to the nearest person responsible.

5.2 Special safety instructions

- Any works with the electric cylinder may only be carried out according to this instruction.
- The device may only be opened (installed / dismantled) by authorised specialist personnel. In case of any defect of the electric cylinder, we recommend to contact the manufacturer and/or send this electric cylinder for repair.
- Power supply must be disconnected before installation, dismantling, maintenance or troubleshooting.
- The re-user must prevent pinching between guiding tube and the front suspension by means of design.
- A proper installation of the supply lines prevents the hazards posed by this application.
- Only use original accessories and spare parts.
- The re-user must prevent potential damages caused by the failure of the end position switch-off or nut breakage by means of design.
- The electric cylinder may not be exposed to lateral forces or torques exceeding the specified values.
- Loss of connection between the thrust rod and guiding tube in case of a tensile load must be prevented by means of design. It means that, especially with suspended loads, additional safety devices (e.g.: cable, chain, etc.) must be affixed!
- During maintenance, only original parts must be used and installed by trained specialist personnel.
- For safety reasons, unauthorised modifications, repairs or changes of the electric cylinder are prohibited.
- The performance data of this electric cylinder determined by Phoenix Mecano Solutions AG may not be exceeded (see 6.6 *Performance diagram*).
- The type plate must remain legible. The data must be retrievable without effort at any time.
- Safety-relevant hazard signs identify danger areas on the product.
- Safety-relevant devices must be tested for operability, damage and integrity on a regular basis, at least once a year.
- In case of an overhead installation of the electric cylinder, the fastened loads must be secured onsite against dropping. The danger area under the application must be marked in the documentation of the final product.
- The electric cylinder must immediately be put out of operation if the mains cable and/or supply line is damaged.

5.3 Safety signs

Warning and mandatory actions signs are the safety symbols which warn of risk or hazard.
Data of these assembly instructions regarding special hazards or situations with electric cylinder must be complied with, while non-observance increases the risk of an accident.

The "General mandatory action sign" indicates the necessity to exercise caution.
Data marked with this sign in these assembly instructions require your particular attention.
These contain important information on functions, settings and procedures.
Failure to observe may lead to personal injuries, disturbances of the electric cylinder or the environment.

6 Product information

6.1 Mode of operation

The electric cylinder serves for adjustment of the guided components or other similar adjustment tasks. It is driven by a low voltage motor.

6.1.1 Variants of power supply

Power supply 12 / 24 / *48 VDC

*on inquiry

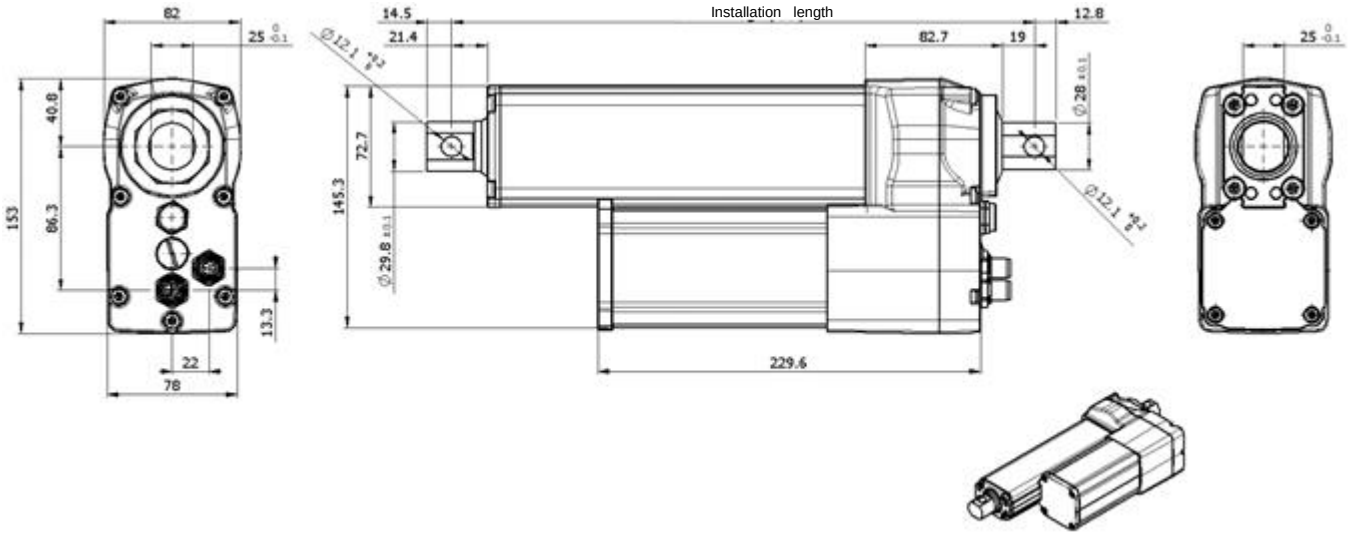
6.1.2 Variants of force / speed

There are the following basic configurations in terms of force / travel speed of the electric cylinder PMZ1000:

			C variant	
Executions	**Push force**	**Pull force**	**No-load@24VDC**	**Rated load@24VDC**
Version I	F=10,000 N push	F=10,000 N pull	9 mm/s	≤ 8 mm/s
Version II	F= 4,000 N push	F= 4,000 N pull	22 mm/s	≤ 19 mm/s
Version III	F= 2,000 N push	F= 2,000 N pull	29 mm/s	≤ 27 mm/s
Version IV*	F= 500 N push	F= 500 N pull	156 mm/s	≤ 148 mm/s

The provided data were determined under optimum conditions and may differ as a result of friction loss, temperature changes or external disturbances.
Drives with "C-Variant" have an internal regulation system, in order to be able to keep the speeds almost constant even in different load cases. It is also possible to set any desired speeds in the range between standstill and nominal speed by means of software.
*Not every constellation (depending on stroke length) available. Other variants are possible in special versions.

6.2 Dimensions of geometry

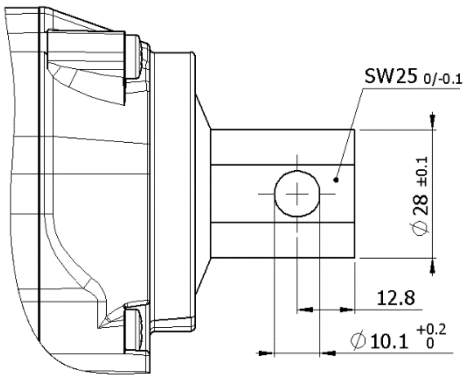


SCALE 1 : 5

6.3 Variants of suspension

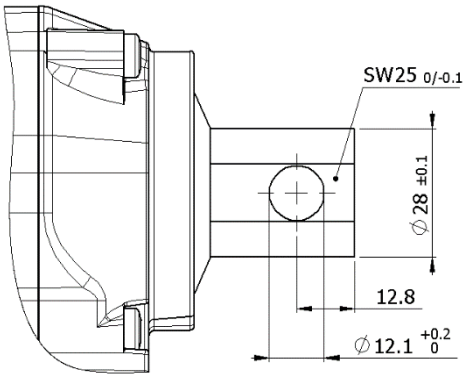
Variants of rear suspension:

Variant 1 – 4:



Variant	Angle	Dimension
1	0°	Ø10.1 +0.2 0
2	45°	
3	90°	
4	135°	

Variant 5 – 8:



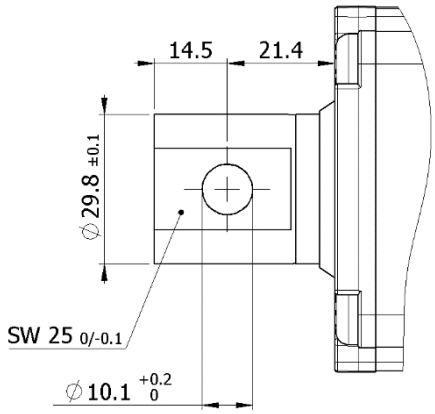
Variant	Angle	Dimension
5	0°	Ø12.1 +0.2 0
6	45°	
7	90°	
8	135°	

Variant 1 – 4 is only available up to 5,000 N.

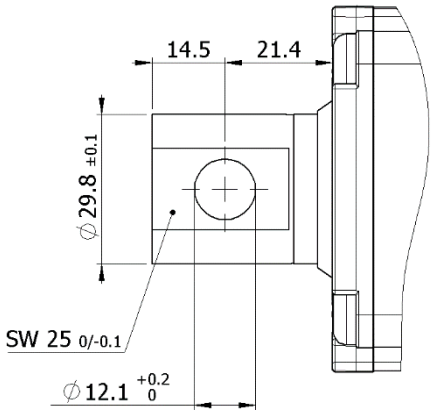
			
0°	**45°**	**90°**	**135°**

Variants of front suspension:

Variant 1:

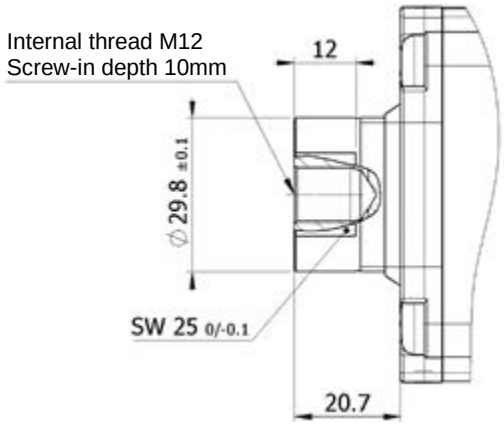


Variant 2:

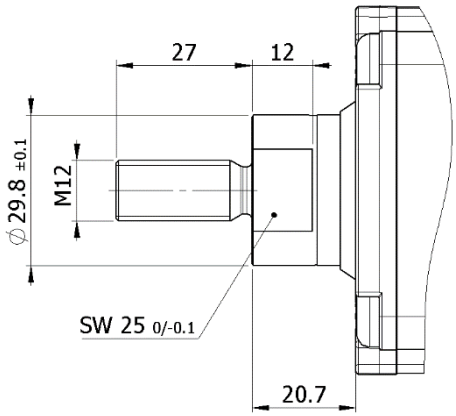


Variant 1 is only available up to 5‘000 N.

Variant 3:



Variant 4:



6.4 Technical data

Stroke length	Up to 1000 mm
Dimension A (installation dimension)	Stroke less than 400 mm = stroke + 200 mm Stroke equal or greater than 400 mm = stroke + 250 mm (±0.5mm)
Standard stroke lengths	100; 150; 200; 250; 300; 350; 400; 500; 600; 700; 800; 900 und 1000 mm
Special stroke lengths / installation lengths	Customisation possible on request
Mounting position	any desired, without cross forces
Lifting force	500 – 10,000 N pull / push (depending on gear ratio and spindle pitch)
Lifting speed	5 – 156 mm/s (depending on load / spindle)
Protection class	IP 69k static (≙ IP 65 dynamic)
Operating voltage	12 VDC (± 20%)** 24 VDC (± 10%)** 36* VDC (± 10%)** 48* VDC (± 10%)**
Ambient storage temperature	–40 °C to +85 °C
Ambient operating temperature	–20 °C to +65 °C
Self-locking	Yes (except 500N-variant and special-variants)
Stroke tube guide	Slide bearing
Operating mode / duty cycle	On-time 30 % Int.3 min./ 7 min. (with rated load and ambient operating temperature +5°C to +40°C)
Maintenance	maintenance-free
Colour	black powder coated / other colours on request
Electrical connection	M12, M12 Signal (see Chapter 8)
Control options	Manual switch / PLC (see Chapter 8)

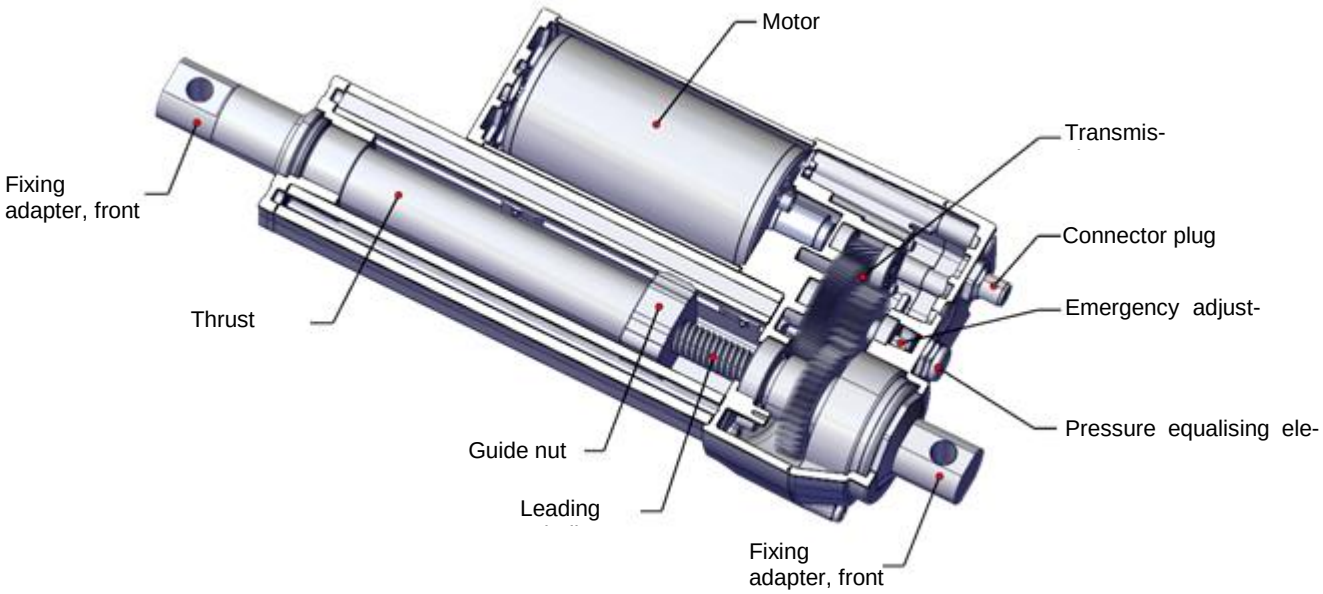
* available upon request

** Measured current at room temperature and nominal voltage

Passed verification:	
DIN EN 60529 IPX9	Schutzartprüfung nach DIN EN 60529 auf IPX9 (Wasserschutz – Abschnitt 14.2.9) a. Statisch „mit einem Blindstopfen am Motorraum“ b. Statisch „mit einem Druckausgleichselement am Motorraum“
DIN EN 60529 IP6X	Schutzartprüfung nach DIN EN 60529 auf IP6X (Staubschutz – Abschnitt 13.4 / 13.6) Ausführung: Statisch „mit einem Druckausgleichselement am Motorraum“
DIN EN ISO 9227 NSS	Salzsprühnebelprüfung nach DIN EN ISO 9227 NSS (Prüfdauer: 96 h) Ausführung: Statisch „mit einem Druckausgleichselement am Motorraum“
Temperaturwechsel	Temperaturwechseltest -40°C bis +85°C, 18 Zyklen über 144h Vorkonditionierung und Ermittlung der Widerstandsfähigkeit gegen Temperaturwechsel
Klima	Klimatest +25°C bis +55°C, Luftfeuchte 80 – 100%, 4 Zyklen über 96h Nachweis der Funktionsfähigkeit
Trockene Wärme	Trockene Wärme +105°C über 10 Tage Nachweis der Widerstandsfähigkeit bei hohen Temperaturen

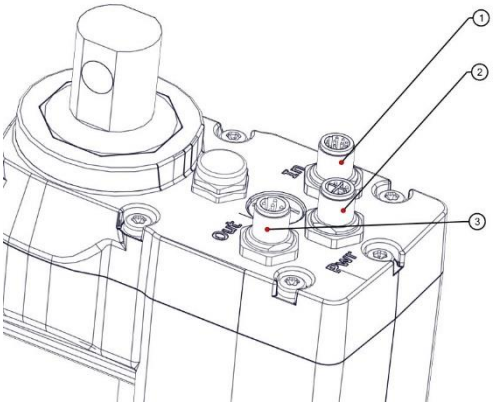
IEC 60601-1-2:2014 **EN 60601-1-2:2015**	Medizinische elektrische Geräte - Teil 1-2 Medical electrical equipment - Part 1-2
IEC61000-4-3:2006+A1:2007+A2:2010 **EN 61000-4-3:2006+A1:2008+A2:2010**	Elektromagnetische Verträglichkeit (EMV) - Teil 4-3 Electromagnetic compatibility (EMC) - Part 4-3
IEC 61000-4-4:2012 **EN 61000-4-4: 2012**	Elektromagnetische Verträglichkeit (EMV) - Teil 4-4 Electromagnetic compatibility (EMC) - Part 4-4
IEC 61000-4-2:2008 **EN 61000-4-2:2009**	Elektromagnetische Verträglichkeit (EMV) - Teil 4-2 Electromagnetic compatibility (EMC) - Part 4-2
IEC 61000-4-5:2014+A1:2017 **EN 61000-4-5:2014+A1:2017**	Elektromagnetische Verträglichkeit (EMV) - Teil 4-5 Electromagnetic compatibility (EMC) - Part 4-5
CISPR 11:2015+A1:2016 **EN 55011:2016+A1:2017**	Industrielle, wissenschaftliche und medizinische Geräte Industrial, scientific and medical equipment

6.5 Overview diagram of the electric cylinder

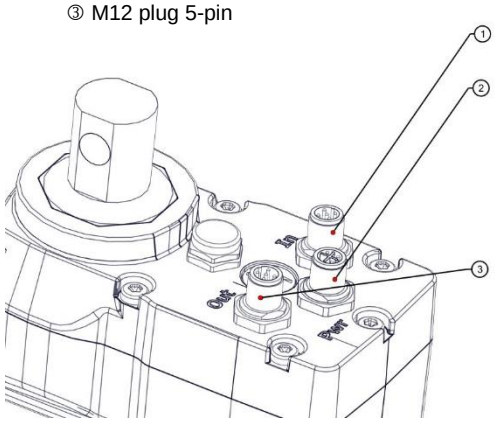


6.6 Plugs/connectors option overview

Master:
① M12 plug 12-pin
② M12 plug 3-pin
③ M12 plug 5-pin

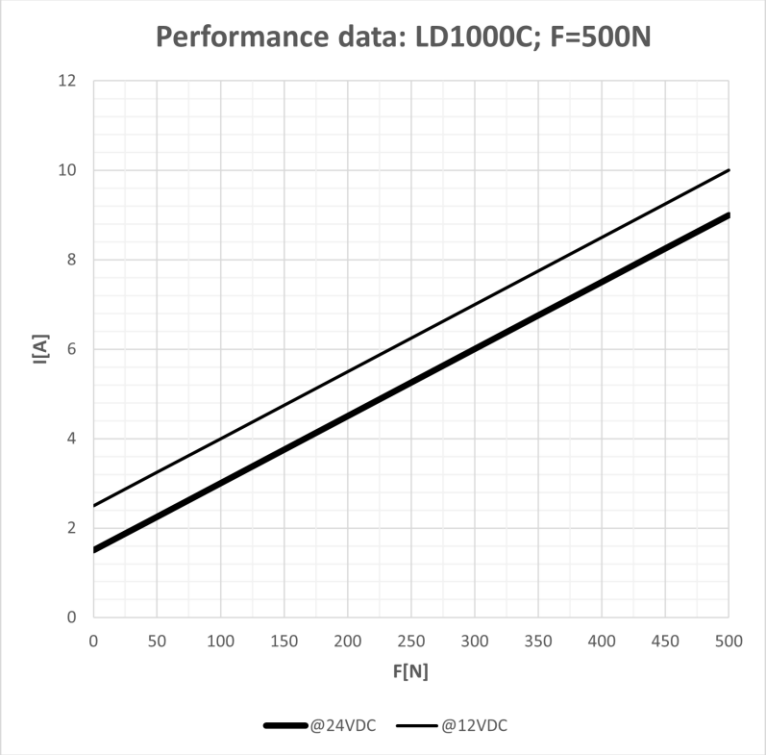


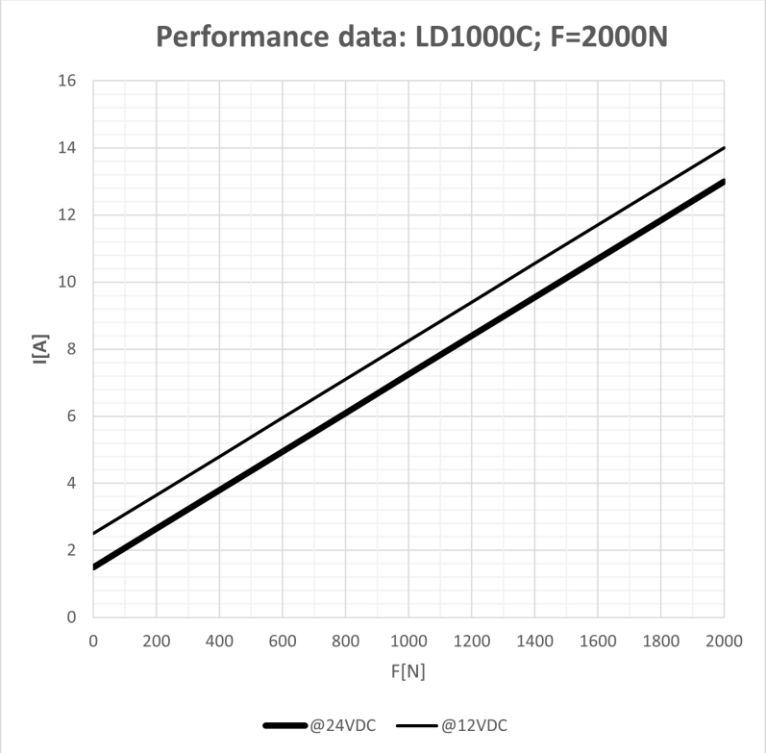
Slave:
① M12 plug 5-pin
② M12 plug 3-pin
③ M12 plug 5-pin

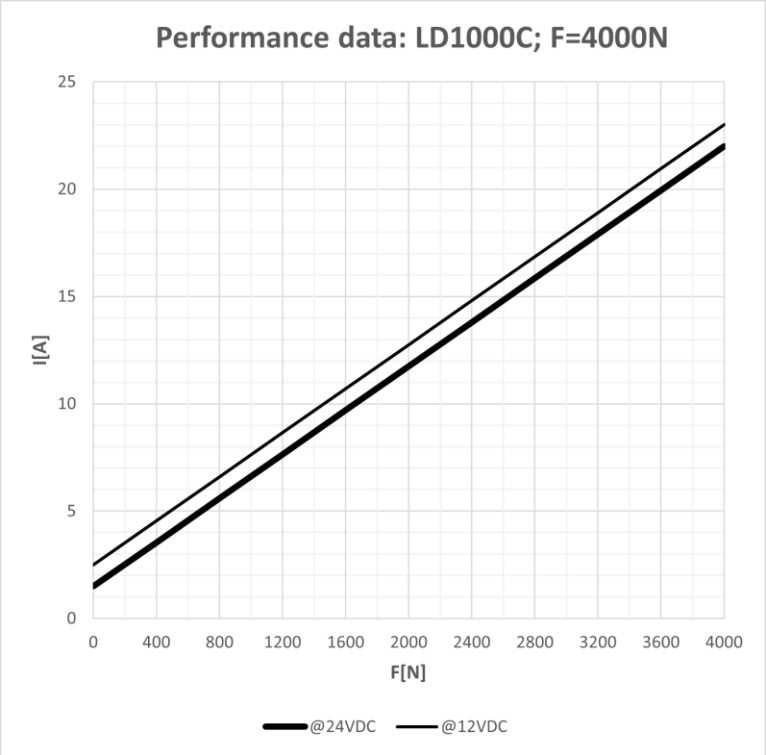


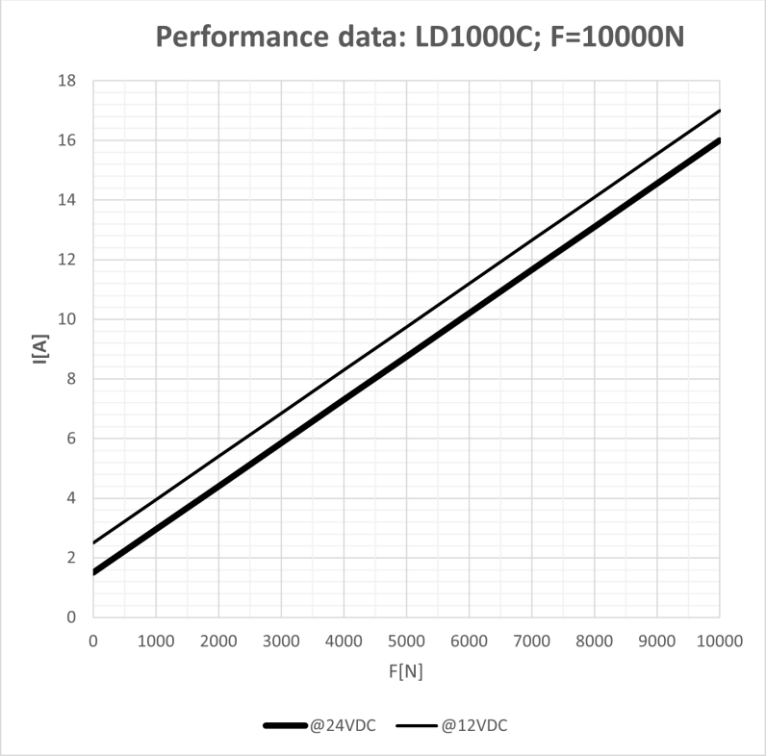
6.7 Performance charts

6.7.1 Current consumption

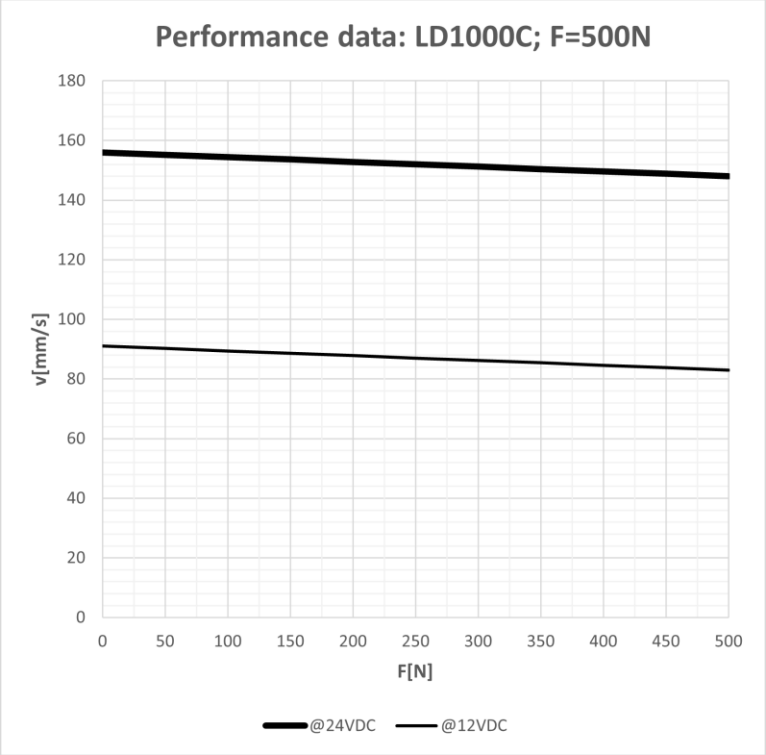


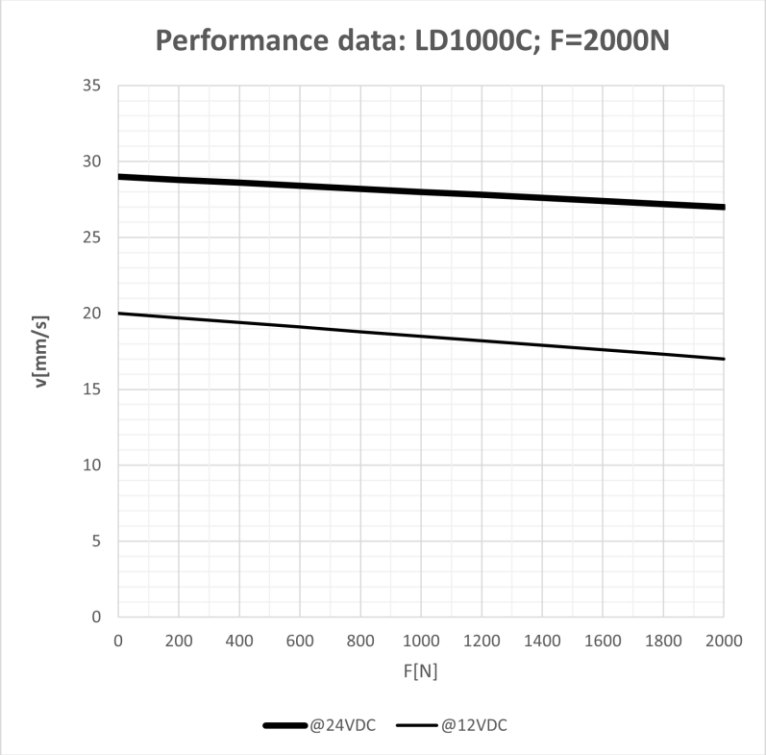


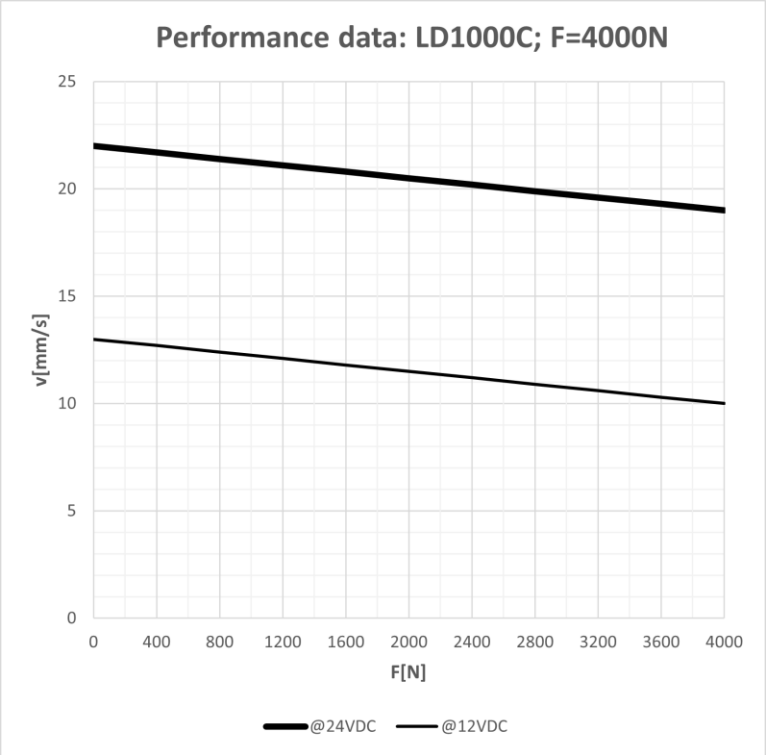

Performance data: LD1000C; F=4000N
I[A]
F[N]
0
5
10
15
20
25
0
400
800
1200
1600
2000
2400
2800
3200
3600
4000
@24VDC
@12VDC

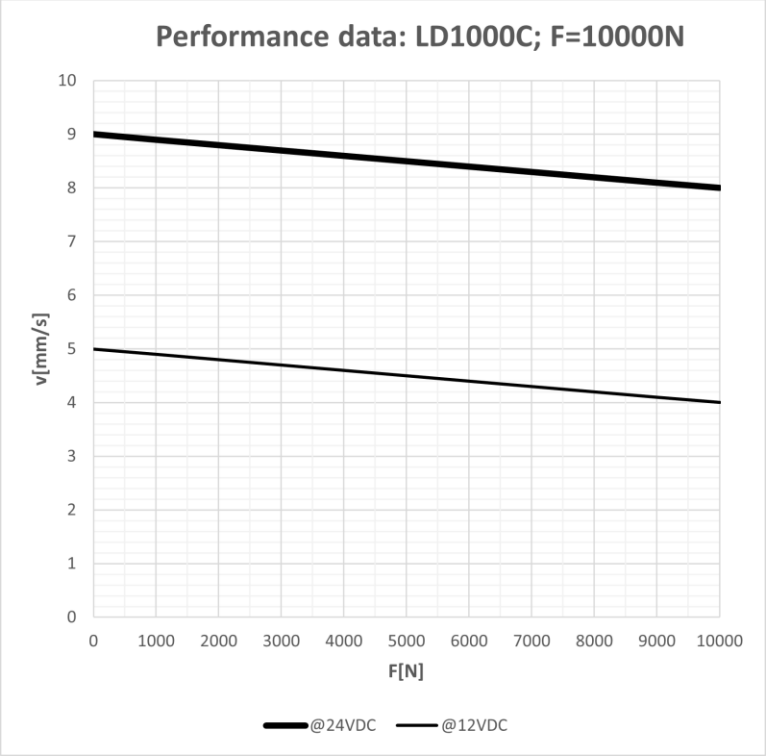

Performance data: LD1000C; F=10000N
I[A]
F[N]
0
2
4
6
8
10
12
14
16
18
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
@24VDC
@12VDC

6.7.2 Speed


Performance data: LD1000C; F=500N
v[mm/s]
180
160
140
120
100
80
60
40
20
0
0
50
100
150
200
250
300
350
400
450
500
F[N]
@24VDC
@12VDC


Performance data: LD1000C; F=2000N
v[mm/s]
35
30
25
20
15
10
5
0
0
200
400
600
800
1000
1200
1400
1600
1800
2000
F[N]
@24VDC
@12VDC


Performance data: LD1000C; F=4000N
v[mm/s]
25
20
15
10
5
0
0
400
800
1200
1600
2000
2400
2800
3200
3600
4000
F[N]
@24VDC
@12VDC


Performance data: LD1000C; F=10000N
v[mm/s]
10
9
8
7
6
5
4
3
2
1
0
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
F[N]
@24VDC
@12VDC

6.7.3 Weight data

Stroke [mm]	EBL [mm]	Weight [kg]
100	300	5.7
150	350	6
200	400	6.4
250	450	6.7
300	500	7
350	550	7.3
400	650	8
500	750	8.6
600	850	9.3
700	950	9.9
800	1050	10.6
900	1150	11.2
1000	1250	11.8

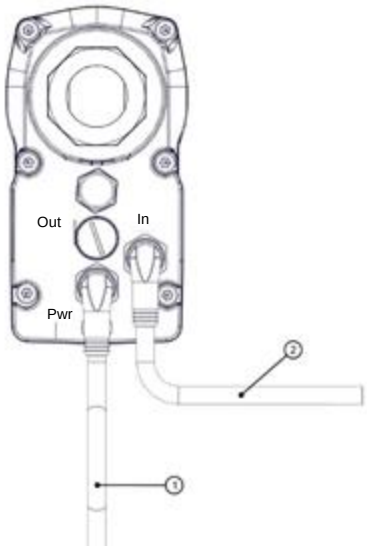
*The given weight data can vary slightly due to different attachment parts (customer specific).

6.8 Initial commissioning

6.8.1 Single drives

Please read the complete document before commissioning the electric drives!

Please connect the electric cylinder as shown in the following diagram. First connect the cable plug ①(3-pin / power supply) to the device installation plug on the drive with the inscription "Pwr".
Then insert the cable connecting plug ② (12-pin / control, signals, etc.) in the device installation plug with the designation "In".



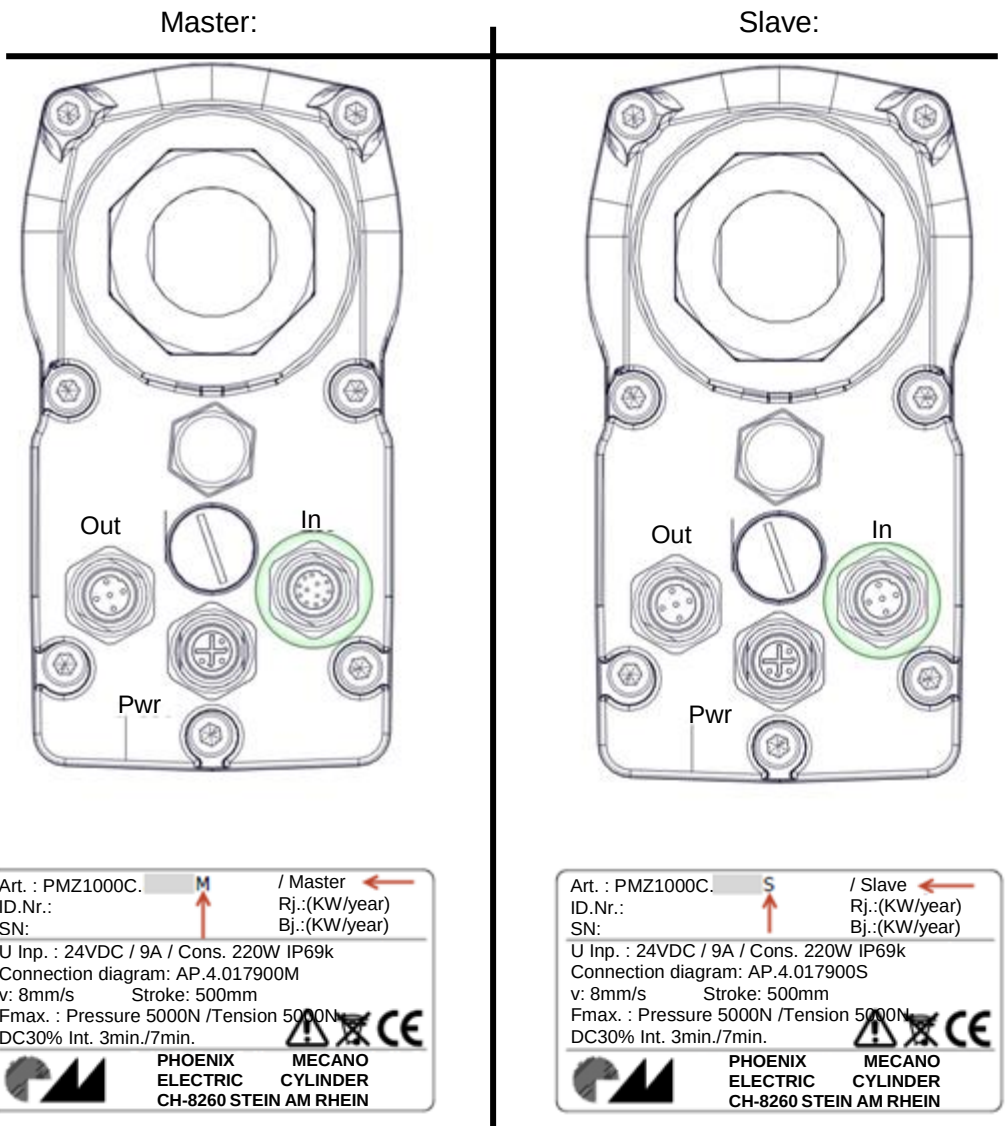
Screw the union fittings on the plugs fingertight.

Connect the connector lead with your control system and the stabilized power supply according to the connection diagram (see Chapter 8). Before connecting, always verify the deenergized status of the control system and the power supply unit. Make sure that no short circuit can occur between the stranded conductors and that they have no contact with conductive surfaces. This could permanently damage the cylinder.

6.8.2 Synchronous system

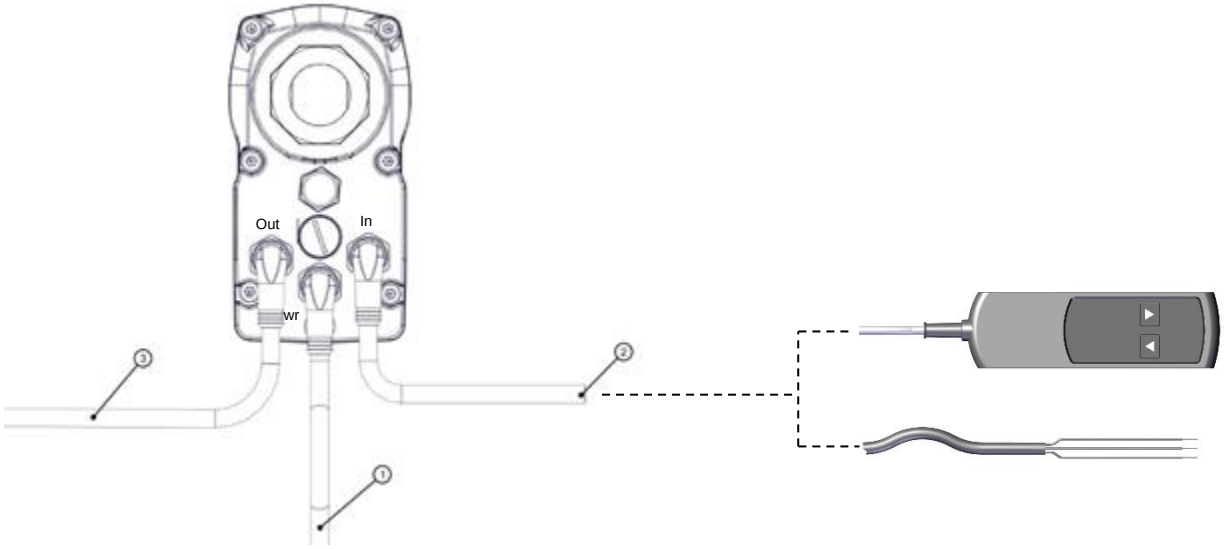
Please read the complete document before commissioning the electric drives!

A synchronous system always consists of a master drive and one or more slave drives.
The distinction between "Master" and "Slave" is made very easily via the corresponding marking on the type plates, or visually via the different device connectors:



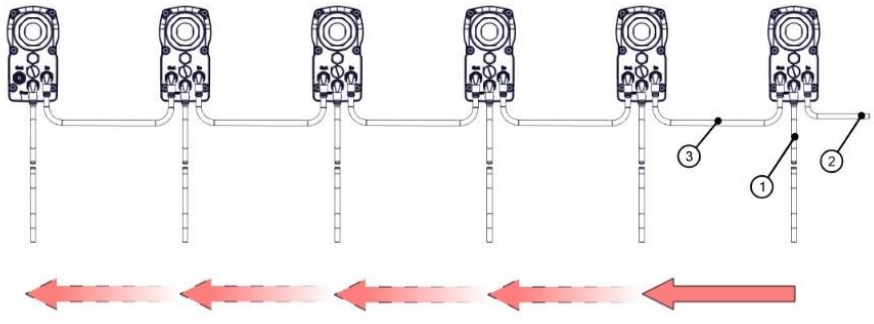
.

Please connect the electric cylinder as shown in the following diagram. First connect the cable plug ①(3-pin / power supply) to the device installation plug on the drive with the inscription "Pwr".
Then insert the cable connecting plug ② (12-pin / open cable end for control, signals, etc.) in the device installation plug with the designation "In". If you have ordered a manual switch, please insert its connecting plug in the device installation plug with the designation "In".
After that, please insert a connecting plug of the communication cable ③ (connector on both sides / connection cable for communication) in the device installation plug with the designation "Out".



Screw the union fittings on the plugs fingertight.

Now connect the communication cable inserted in the device installation plug "Out" of the first drive to the device installation plug "In" of the next drive (no star-shaped wiring allowed!).
Proceed in this manner until all "slaves" of the synchronous system are connected to each other:



Connect the connector lead with your control system and the stabilized power supply according to the connection diagram (see Chapter 8). Before connecting, always verify the deenergized status of the control system and the power supply unit. Make sure that no short circuit can occur between the stranded conductors and that they have no contact with conductive surfaces. This could permanently damage the cylinder.

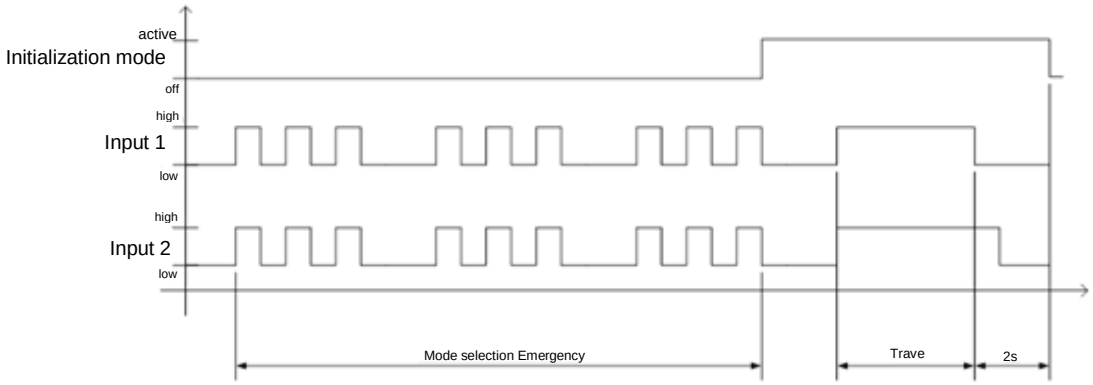
6.9 Operating modes

6.9.1 Initialization mode

The activation pattern for the initialization mode is shown in the following figure. Input 1 and 2 must be actuated simultaneously nine times within 6s for activation. All actuations which have an actuation deviation of less than 200ms are considered simultaneous. After the mode has been activated, initialization can be executed by another simultaneous and continuous activation of inputs 1 and 2. All cylinders are readdressed in this mode and homing is performed (by default unless explicitly described otherwise). All drives therefore move to limit switch S2 (retracted) and then the current position 0.0mm is set for all drives. It is possible to stop and restart as often as desired within the mode. The mode is exited automatically if the time period exceeds 2s without joint activation of inputs 1 and 2.

A BUS terminating resistor does not have to be manually set on the last system participant (end slave) in LD1000C series drives from Phoenix Mecano Solutions AG - this is done fully automatically.

It must be ensured that no synchronous travel is executed during the initialization run. Each cylinder runs independently.



6.9.2 Normal operation

The operational system can be controlled via the inputs (manual switch or customer's control system). The inputs must always be set individually and not simultaneously for normal operation. Inputs 1 and 2 are assigned to move to the respective maximum position by default. The cylinder stops automatically when the end or configured target position is reached. The pin assignment and interface specifications can be found in the corresponding connection diagram (see Chapter A starting on page 37).

Caution: Verify the direction of travel and positions in a safe environment prior to installation.

After an input has been set, the cylinder will move to the stored target position (max. end positions) at the stored speed, if it is not already at this position. The drive can be stopped at any position by releasing the hand switch button, or by interrupting the corresponding input signal. A slight latency between setting and the start of travel is normal. Small position adjustment runs of individual cylinders can also take place before the run in the case of a synchronous system.

Caution: Do not exceed the specified duty cycle. This may result in damage to the cylinder.

6.9.3 Adjustment mode

Normal operation is blocked if the position lag (maximum permissible position deviation between the participants in a synchronous system) is exceeded. The adjustment mode moves the slaves to the position of the master at a reduced speed to enable normal operation again. This involves non-synchronized individual runs of the slaves with a relevant position deviation to the master. A safety risk assessment must be carried out before an adjustment run (no obstacles or danger of personal injury).

Caution: Exceeding the position lag is an indication of uneven load distribution, missing compensation elements, blockages, bad supply voltage connection, etc.

Simultaneous actuation within 200ms of input 1 and 2 for more than 20s The adjustment mode begins after 20s. An interruption of the actuation of one or both inputs stops the movement immediately. Activation must be executed again for a restart.

6.9.4 Emergency operation mode

Under certain circumstances, individual drives or synchro systems may not respond and therefore cannot be moved. Possible causes include:

- Power supply is no longer available (cable break, power supply unit defect, battery defect, etc.).
- The internal control electronics installed in the electric cylinder are damaged.
- External influences.
- Defect of a drive in a synchronous system.
- This list is not exhaustive, as there many possible causes of error.

Drives of the LD1000C series offer the option of software-controlled emergency operation, in order to be able to remove a defective drive from an existing application or, for example, to move an application to a safe end position in the event of a power failure. However, this only works if an operating voltage is present and the DC motor in the drive is functional.

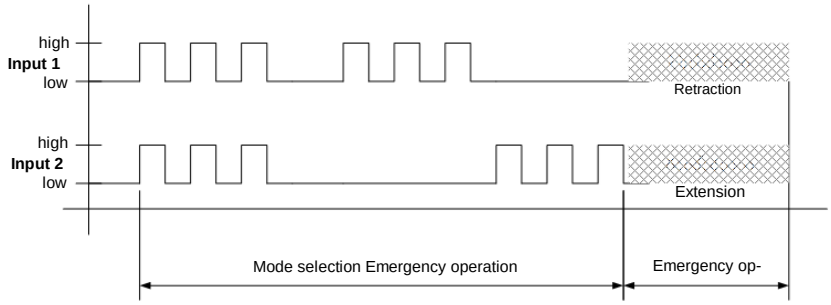
This emergency operation mode is not available if there is a defect in the master drive (defect in the integrated control electronics) – in this case, please proceed as described in Chap. 6.9.5 (Mechanical emergency adjustment) or contact the manufacturer!

The "adjustment mode" mentioned above requires all slave drives to communicate with the master and have no permanent / recurring errors. The "emergency operation" mode ignores missing / defective slave drives. The "emergency operation" mode is used to move the functional participants in the system one last time, in order to be able to replace a defective drive. Please note that the defective participants no longer move and must therefore be mechanically decoupled beforehand!

Extreme caution is absolutely necessary, as ALL safety functions are deactivated!
The user is responsible for securing attached loads or attachment parts, so that no personal injury or property damage can occur during manual emergency adjustment!

Emergency operation to move an incomplete system without synchronization:

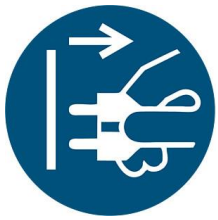
The activation pattern for emergency operation is shown in the following figure. For activation, input 1 and 2 must be actuated simultaneously three times, then input 1 three times and then input 2 three times. A drive or a synchronous system (retract or extend) can subsequently be moved to a safe position. All actuations which have an actuation deviation of less than 200ms are considered simultaneous.
The mode is exited automatically if the time period exceeds 2s without activation of inputs 1 or 2.



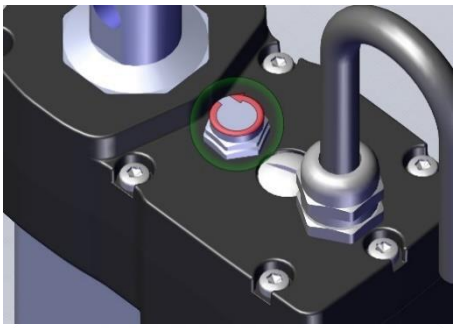
6.9.5 Emergency mechanical adjustment

If no operating voltage is not available or the internally installed control electronics appear to be defective, drives of the LD1000C series offer the possibility of mechanical EMERGENCY adjustment.

Please proceed as follows:

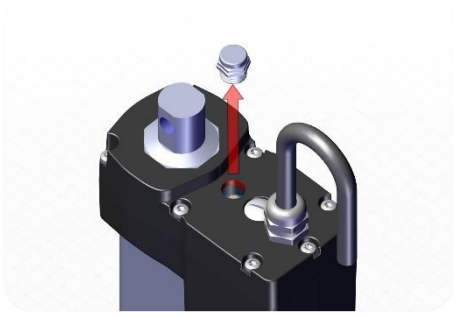


You must first ensure that the power supply is disconnected and automatic restart is ruled out!

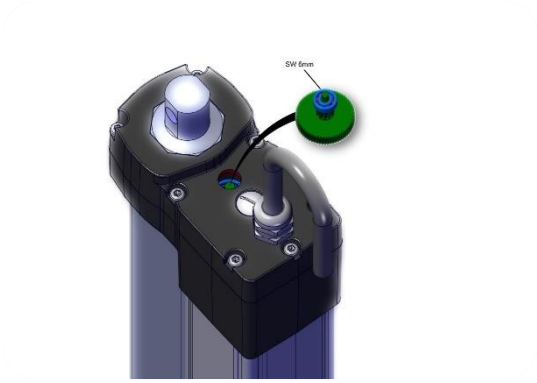


Remove the pressure equalizing element with a 19 mm open-end / ring spanner.

Please ensure that there is NO LONGER any IP-protection on the electric cylinder with the disassembled pressure equalizing element!

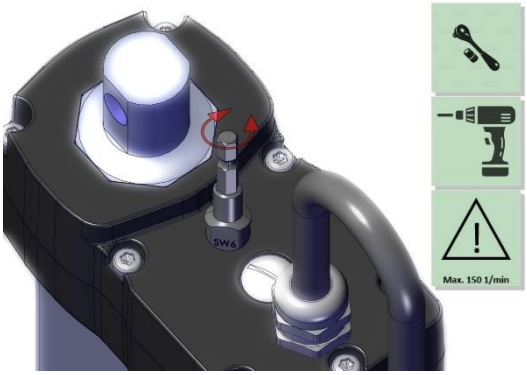


Take off the pressure equalizing element and stow it away safely:



A transmission gear with a pressed-on deep-groove ball bearing and a hexagonal pin (SW 6 mm) can be seen in the opening:

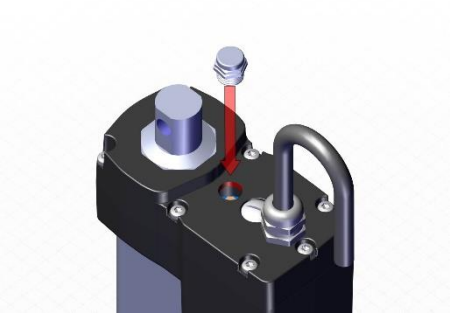
Put on a standard socket wrench (plug-in bolt 6 mm).



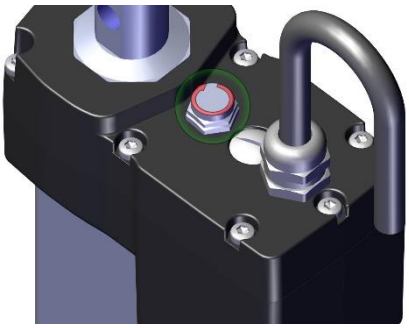
A standard ratchet or cordless screwdriver can be used to help adjust the drive (pushrod is driven in or out).

Please ensure that a maximum speed of rotation of **150 1/min** is NOT exceeded!
Exceedance would drive the motor to strongly so that it would work as a generator and induce voltage in the built-in control system. This would brake the motor and in some circumstances cause electronic components to “come to life” on the control print.

By repeatedly measuring the installation length with a standard tape measure or folding rule, make sure that the end-positions (**retracted = installation length** and **extended = installation length + stroke length**) are NOT exceeded (Table: 6.7.3)!



After you have released the drive from the application and removed it, take off the socket wrench again (nut) and screw on the pressure equalizing element again.



Hand tighten the pressure equalizing element back on using an open-end / ring spanner.

The cylinders will be wrongly positioned after the adjustment. If the cause of the EMERGENCY mechanical adjustment was a power supply outage and it can be assumed that the drive(s) will continue to be fully functional, the "initialization mode" should be executed. All cylinders are readdressed in this mode and homing is performed (by default unless explicitly described otherwise). All drives therefore move to limit switch S2 (retracted) and then the current position 0.0mm is set for all drives.
If the cause was one or more defective drives, please shut down the plant/application and contact the manufacturer.
Both the EMERGENCY operation mode and the EMERGENCY mechanical adjustment are **NOT** normal operating modes! They are only used for the purpose of bringing a system, application, machine, etc. to a safe position, in order to rectify the previous faults or to replace the defective drives!
Please note that the initialization mode must **ALWAYS** be executed after replacing/adding participants in a synchronous system! This ensures that the addressing is error-free and the terminating resistor is set at the last participant of the system. Malfunctions and damage to the drives cannot be ruled out if this instruction is not followed.

7 Life phases

7.1 Electric cylinder scope of delivery

The electric cylinder is delivered as an individual component. The power supply unit, manual switch and accessories are not included in the scope of delivery (unless explicitly ordered).

7.2 Transport and storage

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

Commissioning damaged electric cylinders is forbidden.

The ambient conditions for the storage of the electric cylinder are prescribed as follows:

- air must not contain oils
- contact with solvent-based paints must be avoided
- lowest / highest ambient temperature: -40 °C to +85 °C
- air pressure: from 700 to 1060 hPa

Divergent ambient factors must be approved by Phoenix Mecano Solutions AG.

7.3 Important information on installation and commissioning

It is essential that you note and follow the following instructions Otherwise persons can be injured or the electric cylinder and/or other components damaged.

- It is essential to implement an emergency stop onsite, which could interrupt reliably the operating voltage in the event of a failure or malfunction of the incomplete machine!
- This electric cylinder may not be modified or provided with additional holes.
- After setting up and commissioning, it is essential that the plug of the power supply is freely accessible.
- The electric cylinder must not be moved to "Stop". Risk of mechanical damage.
- The electric cylinder may not be opened.
- The user must ensure that there is no danger when the power supply is active.
- Pinch and shear points must be avoided in the design of the applications with this electric cylinder. These must be secured and marked correspondingly.
- Automatic start-up of the electric cylinder caused by a defect is to be stopped immediately by disconnecting the power supply (see Emergency stop).
- If the supply line is damaged, the electric cylinder must be taken out of operation immediately.
- The pushrod with suspension must be secured against twisting. Non-observance leads to the adjustment of the stroke end position.
- Do not provide tolerance compensations by unscrewing the pushrod. No safe connection → Danger of death!
- The electric cylinder has not been designed for continuous operation. The number of starts per hour determined for your application may not be exceeded (note the information on the type plate).

7.4 Assembly

After the receipt of the electric cylinder, check the device for any damage. The electric cylinder is supplied ready for operation with internal control / regulation.

The installation of the PMZ1000 consists in fixing the electric cylinder using the rear and front suspensions. (here, note your special suspension variants; see 6.3 “Variants of suspension“)
The cross-holes of the two suspensions measure 12.1 ±0.1 mm or 10.1 ±0.1 mm as standard (depending on the version ordered). The fastening bolts are not included in the scope of delivery. **Ø12mm bolts must be used for drives of 5000N and higher!**

The following instructions must be observed during installation:

Stroke end positions and the installation length are set with the pushrod. The pushrod is not secured against twisting. This means that a turning (rotation) of the pushrod - or the fixed swivel head - is equal to an adjustment of the end positions!

Caution: The attachment points for installation of the electric cylinder must be aligned flawlessly to ensure the safe and flawless operation!

Action of lateral forces on the pushrod must be excluded!

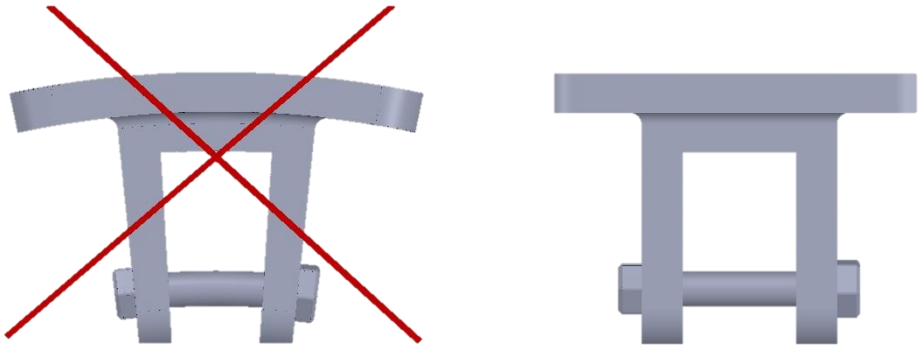
- When a swivel head or clevis is used/assembled, the head must be correctly locked using the lock nut supplied.
- A test or trial run must be performed.

Non-compliance with this procedure will cause damage to the electric cylinder!
This nullifies the guarantee!

The installation positions of the components must ensure that pinch and shear points are avoided, particularly taking into consideration any future applications.
Make sure to exclude the tripping hazard by proper and safe laying of the supply lines / cables!

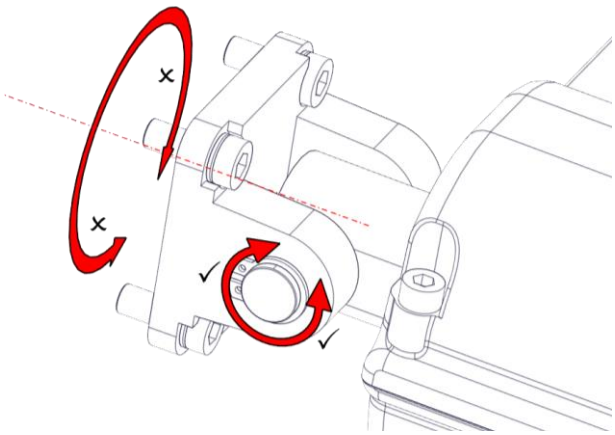
It is very important to ensure that the mounted electric cylinder can move freely in the attachment points / that the electric cylinder is neither strained nor buckled. Improper assembly and any emergency situation associated with it would damage the drive and prevent it from operating smoothly!

- The assembly bolts or fastening screws (no shoulder set screws) must be available in the correct size (pay attention to the hole diameter of the cylinder uptakes).
- The bolts and nuts must be manufactured of high-quality steel (for example, 10.8). There may not be any threads on the nuts in the rear uptake nor at the piston rod eye.
- The screws and nuts must be tightened tight enough that they cannot come loose.
- However, do not use too high a torque on the screws in the rear uptake since otherwise the uptakes will be unnecessarily strained.

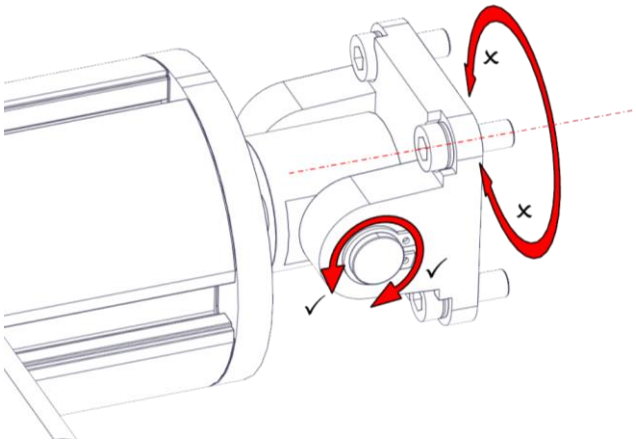


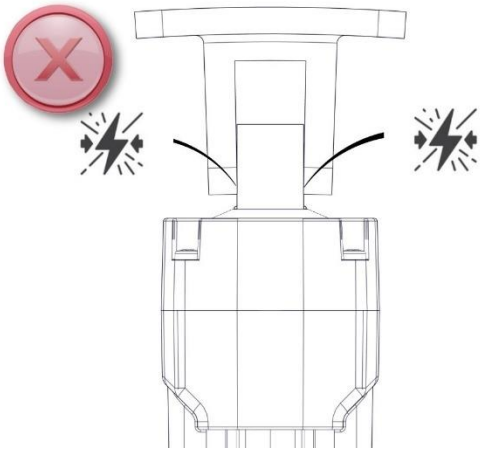
7.4.1 Installation procedure

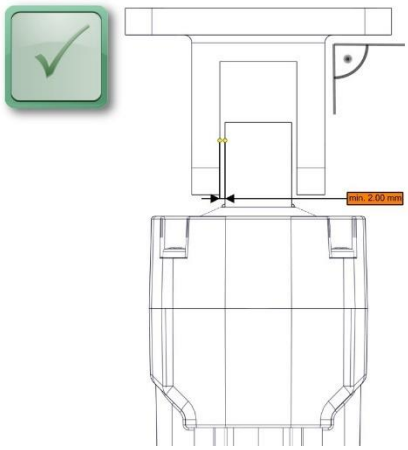
1. Hang the rear suspension onto the counterpart piece.
Caution: It should not be possible to rotate the counterpart piece. It must be possible to rotate the electric cylinder in the direction of the arrow (see figure).



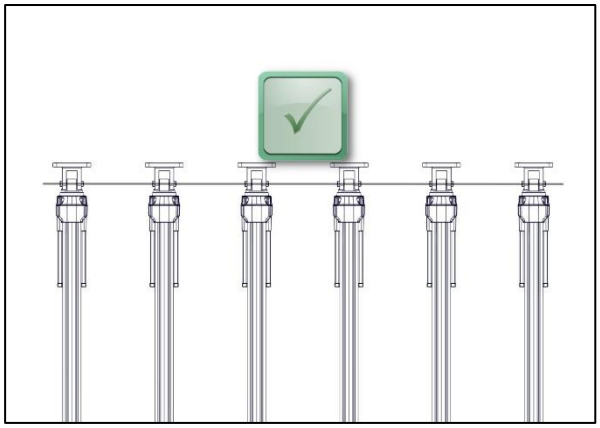
2. Fix the suspension at the front.
Caution: It should not be possible to rotate the counterpart piece. It must be possible to rotate the electric cylinder in the direction of the arrow (see figure).

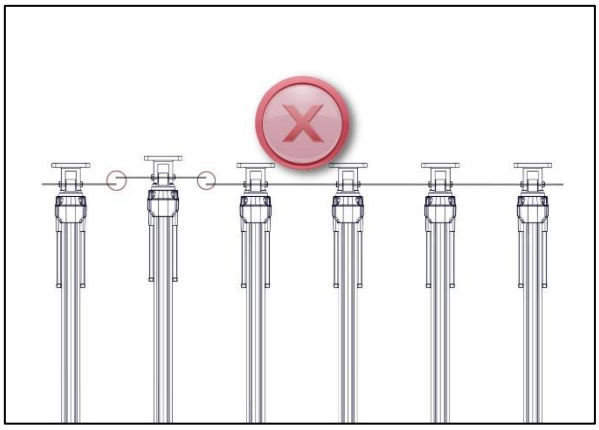




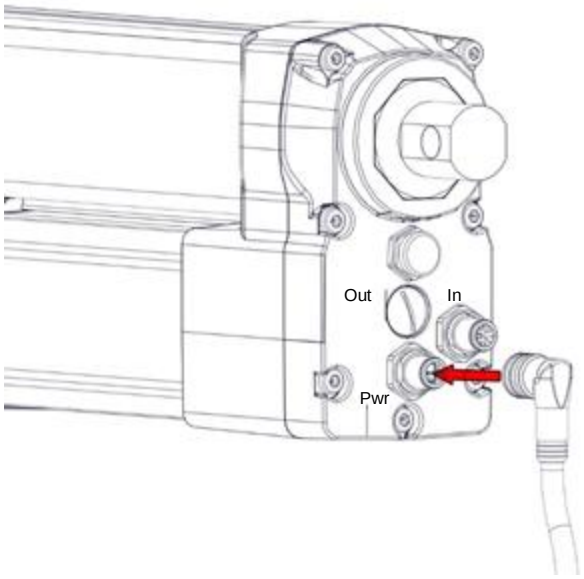


3. **When mounting a synchronous system, please pay special attention to ensuring that the respective mounting points of the individual drives of a system are precisely aligned - distortions and associated damage to the electric cylinders due to inadmissible lateral forces or torques would be the direct consequence if this is neglected! If this is not the case due to a specific application, the corresponding tolerance compensation options must be provided or retrofitted by the customer.**





4. Connect to the appropriate power supply.
Attention: do not connect with reverse polarity (pay attention to connection diagrams in chapter A from page 37)!



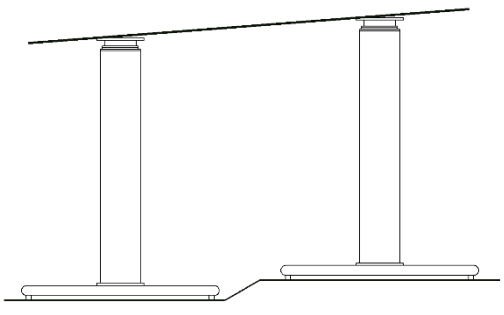
5. Perform test run / initial run without load and check operability of the system (see chapter 6.8).

7.4.2 Synchronous operation of electric cylinders and lifting columns

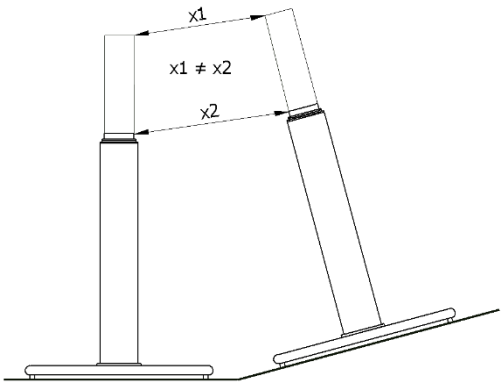
You will find graphical representations of the lifting columns in the following chapters (up to and including chapter 7.4.7). The specifications and notes apply equally to electric cylinders and lifting columns, with the difference that low lateral loads are permissible for lifting columns but **completely prohibited** for electric cylinders, i.e. additional guide elements are necessary! For ease of reference, electric cylinders and lifting columns are collectively referred to as "displacement units" in these chapters.
In the ideal case, two or more displacement units are positioned parallel to each other and move up and down synchronously.
In reality, however, there are many factors which do not allow this simple approach. Manufacturing tolerances are unavoidable in the production of the displacement units and your attachment parts. In the worst case, the tolerances of different parts can add up and lead to distortions and damage.

7.4.3 Different heights

A rigid connection forces the displacement units up to a common height. The displacement units distort if the load / connecting plate is screwed tight.
As a result, the running characteristics can deteriorate and the service life is reduced. The cause of different heights is an uneven floor in most cases. The height of the base plate of the displacement units should therefore be adjustable. However, it is also possible that the displacement units have different heights when they are moved together owing to manufacturing tolerances.

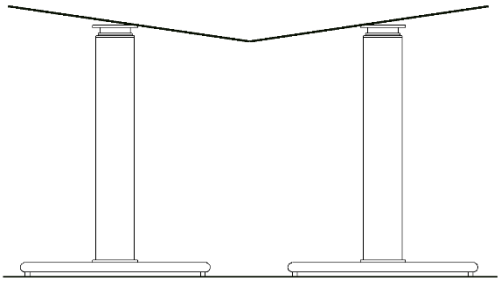


7.4.4 Parallel alignment



If the displacement units are not parallel to each other, the distance between the upper attachment points changes during travel. However, a rigid connection keeps this distance constant. As a result, considerable forces act on the displacement units, which can be damaged thereby.
The displacement units should also be precisely aligned in this case. Uneven floors can be leveled with the aid of an adjustable base plate.

7.4.5 Crooked connecting plates

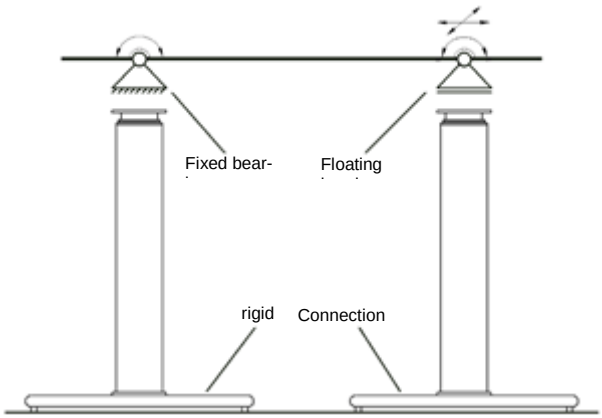


If the weight/connecting plate does not lie flat on the displacement units, the synchro system will be distorted during screwing. This results in undesirable lateral forces which stress the guides of the displacement units. Please ensure that the components are processed correctly.

Use an RK SyncFlex adjuster plate to compensate for height differences between two or more displacement units, or ensure that the height difference is compensated for before initial startup by attaching appropriate compensation elements. Please refer to the current product catalogue for information on the application and technical data of this item.

7.4.6 The ideal set-up

In a synchro system, the positions should be controlled during travel in such a way that all displacement units have exactly the same height at all times. This is not possible in practice because a controller must first detect a control deviation before it can eliminate it. For the synchro system, this means that a deviation from an ideal synchronous travel must always be allowed.



Particular requirements are therefore placed on the connections between the load / connecting plate and displacement units. Ideally, the design allows some room for movement.

The displacement units usually stand on heavy base plates. These guarantee the stability of the construction. The connections between the base plate and the displacement units do not allow linear and rotary movements. They can therefore be called rigid connections, even if the base plates are not connected to each other. Movability must therefore be provided at the upper connection of the load / connecting plate.

Owing to the control deviation, slight height differences must be able to be compensated for by the design. It therefore makes sense if the connection between the displacement units and the load / connection plate can pivot slightly, or the load / connection plate has the requisite flexibility.

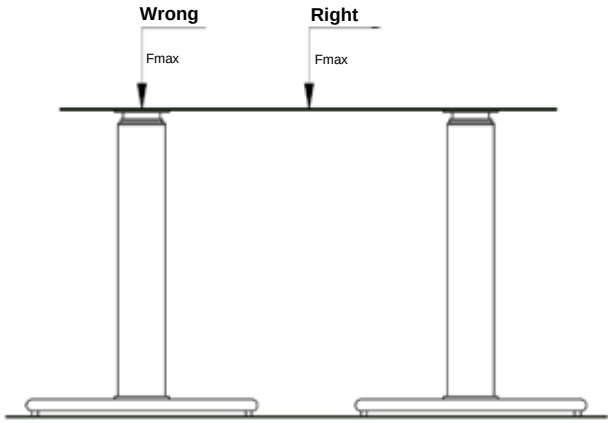
Avoid countersunk screws for fastening the load / connecting plate. These center themselves in the drill holes when screwed tight. The screw channels will be distorted or even destroyed if the hole pattern of the load / connecting plate is not an exact match for that of the displacement units. It is better if the drill holes are slightly larger than the fastening screws. Inaccuracies in the hole pattern can thereby be compensated for.

If the displacement units are not exactly parallel, the upper distance between them may change. For this reason, only one displacement unit may be fixed (fixed bearing) and all others should have a floating support at the load / connection level (floating bearing). This ensures that no distortions can occur during travel.

The greater the distance between the displacement units, the better the travel characteristics. Control deviations have a greater effect if the displacement units are close together. The load / connecting plate has an unstable effect during travel. If the distance increases, the effect decreases.

7.4.7 Load distribution

A small example: You build a table with four displacement units. Each displacement unit can carry 1000N. Therefore, the displacement units may carry a total load of
Fmax = 4000 N (incl. table top, etc.), provided that the load is symmetrically located in the center of the table. If you move the load to a corner of the table, then the lifting column under this corner must carry almost the entire 4000N. This would inevitably lead to overloading. Please pay attention not only to the total load, but also to the load of the individual displacement units when planning your application.



7.5 Maintenance

The electric cylinder is basically maintenance-free, but is not wear-free.

Faulty functioning, excessive play of the movable parts or unusual sounds generated by the electric cylinder can be the signs of wear.

Worn parts of the product must only be replaced by the manufacturer. The electric cylinder must be sent to the manufacturer for these works. In the case of wear without replacement of the worn product parts, the safety of the product cannot be guaranteed.

Any works with the electric cylinder may only be carried out according to this instruction . The device may only be opened by authorised and trained specialist personnel.

In case of any defect of the drive, we recommend to contact the manufacturer and/or send this electric cylinder for repair.

- When working on electric circuits or elements, these must first be disconnected from the supply to prevent the risk of injury.
- For safety reasons, unauthorised modifications or changes of the electric cylinder are prohibited .
- Safety-related devices must be tested on a regular basis depending on the frequency of use, however at least once a year for integrity and operability.

7.6 Cleaning

You can clean the manual switch and the external surface of the electric cylinder profile using a lint-free, clean cloth.

Solvent-based cleaners attack and can damage the material.
Caution: Protection class of the manual switch is not IP69K, but IP40, and therefore may not be washed using the high-pressure cleaner and exposed to moisture, which would immediately lead to damage!

7.7 Disposal and return

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

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

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

In the European Economic Area, the disposal of the product is governed by the EU Directive 2002/95/EC or the relevant national legislation.

A Connection plans

On the following pages you can view the available connection plans.

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

Each connection plan starts with "AP.4." followed by a number with at least six digits. ➔ Example: AP.4.000000. The number of the connection plan can be found on the type plate, as well as on the specification sheet.

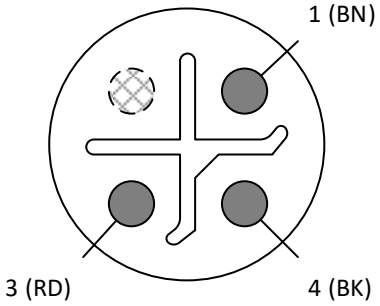
PHOENIX MECANO

Connection AP.4.017886

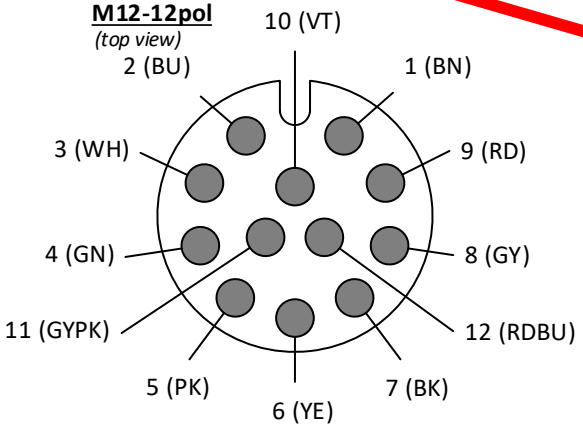
Not recommended for new projects

Pin assignment

M12power
(top view)



M12-12pol
(top view)

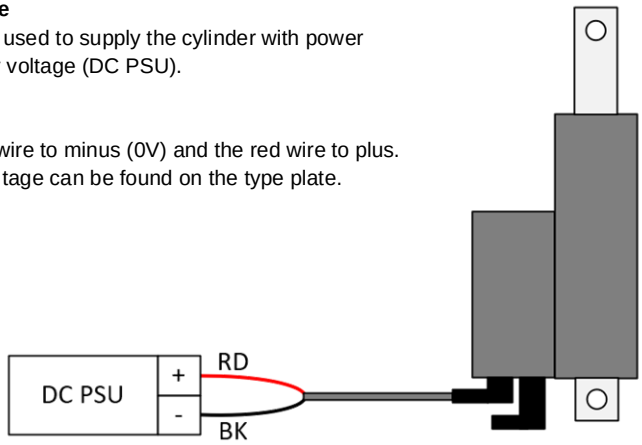


Pin assignment M12power (3-pin)

***** Supply voltage *****

Pwr

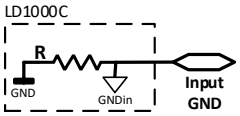
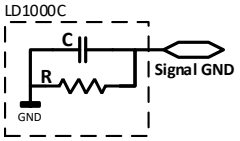
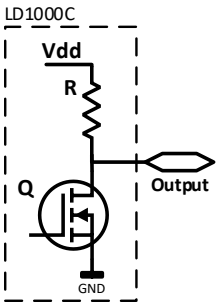
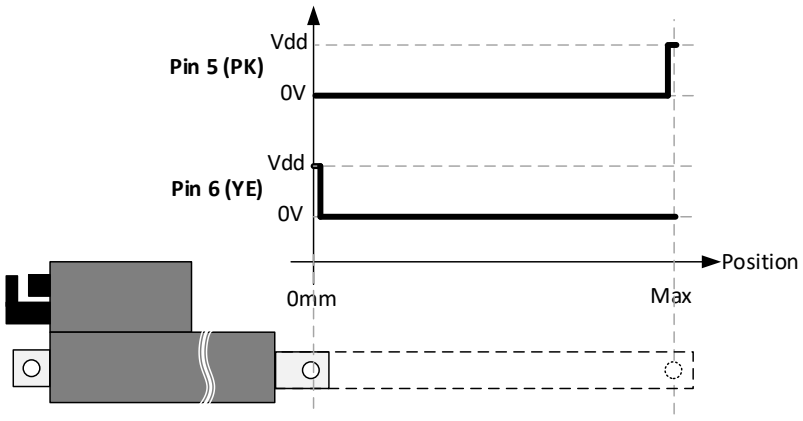
Pin	*Description*	
Pin 1 Brown (BN)	**Do not connect**	**V C supply voltage** The power cable is used to supply the cylinder with power from the DC supply voltage (DC PSU). **Connection** Connect the black wire to minus (0V) and the red wire to plus. The permissible voltage can be found on the type plate.
Pin 3 Red (RD)	**DC power supply**	
Pin 4 Black (BK)		



Pin assignment M12 Signal (12-pin)

*** Communication & control plug ***

In

Pin	*Description*	
Pin 1 Brown (BN)	**Input GND** Common zero potential of the inputs (see pin 9-11). Connecting this wire is recommended at input voltage levels below 5V. Therefore, the voltage drop on the negative wire (M12power, pin 4) has an nearly insignificant impact on the input signal. Connection of this wire to a control unit galvanically isolated from the LD1000 supply voltage (M12power) is required.	
Pin 2 Blue (BU)	**Signal GND**	**CAN communication interface** Interface for control, query, update and parameterization of the cylinder. Signal GND is capacitively and ohmically coupled with the GND of the cylinder to avoid critical cross currents. **Note:** Ensure an identical GND potential for all CAN BUS nodes. 
Pin 3 White (WH)	**CAN high**	
Pin 4 Green (GN)	**CAN low**	
Pin 5 Pink (PK)	**Output 4**	**Digital outputs** The actuator indicates when the retracted and extended end positions have been reached with a separate pin each. The output is designed for switching small loads such as relays, magnetic valves or signal lamps. The internal resistor R is connected to the cylinder supply voltage Vdd (e.g. 24V) and allows for example the direct operation of common signal LEDs without separate series resistor. **Specification** • **R** = 2.4k Ω • **V_{DS}** = 0…30 V_{DC} • **I_{DS}** = 0…300m A **Definition** • **Output 3** Retracted • **Output 4** Extended 
Pin 6 Yellow (YE)	**Output 3**	

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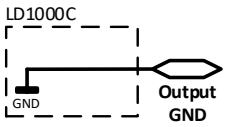
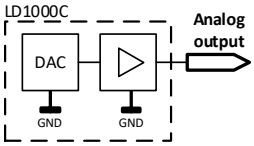
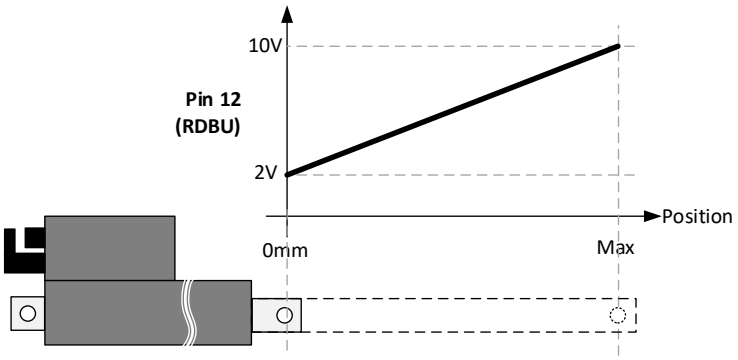
Pin 7 Black (BK)	**Output GND (digital)** Common zero potential of the outputs (see pin 5 and 6). Do not connect the wire to the minus of the cylinder supply voltage (see M12power, pin 4). The cylinder could be damaged by the cross currents that can occur. This line is necessary only if the control unit has a galvanically isolated supply to the cylinder. 	
Pin 8 Grey (GY)	**Output GND (analog)** Common zero potential of the analog outputs. The common zero potential is connected with low resistance to the minus of the supply voltage. A low-resistance connection of the stranded wire to the negative of the supply voltage is not permitted, as this may damage the cylinder.	

Pin 9
Red (RD)
	Input 3	**Digital Inputs**
		The digital inputs allow you to extend and retract the actuator, as well as to select other operating modes (see assembly instructions).
		
		For an active control, connect the inputs to the cylinder voltage, for example. The low "high" level also allows control with a 3.3V controller.
		
		<u>Configuration</u>
		• **[Input 1]** Retract
		• **[Input 2]** Extend
		• **[Input 3]** No function defined
		
		<u>Specification</u>
		• U = 0 … 30Vdc*
		• Level definition
		  ○ **[high]** ≥ 3V*
		  ○ **[low]** < 0.8V*
		• Typical current consumption per input: 5mA
		
		*Reference to "Input GND"

Pin 10 Violet (VT)	**Input 2**	
Pin 11 Gray-Pink (GYPK)	**Input 1**	

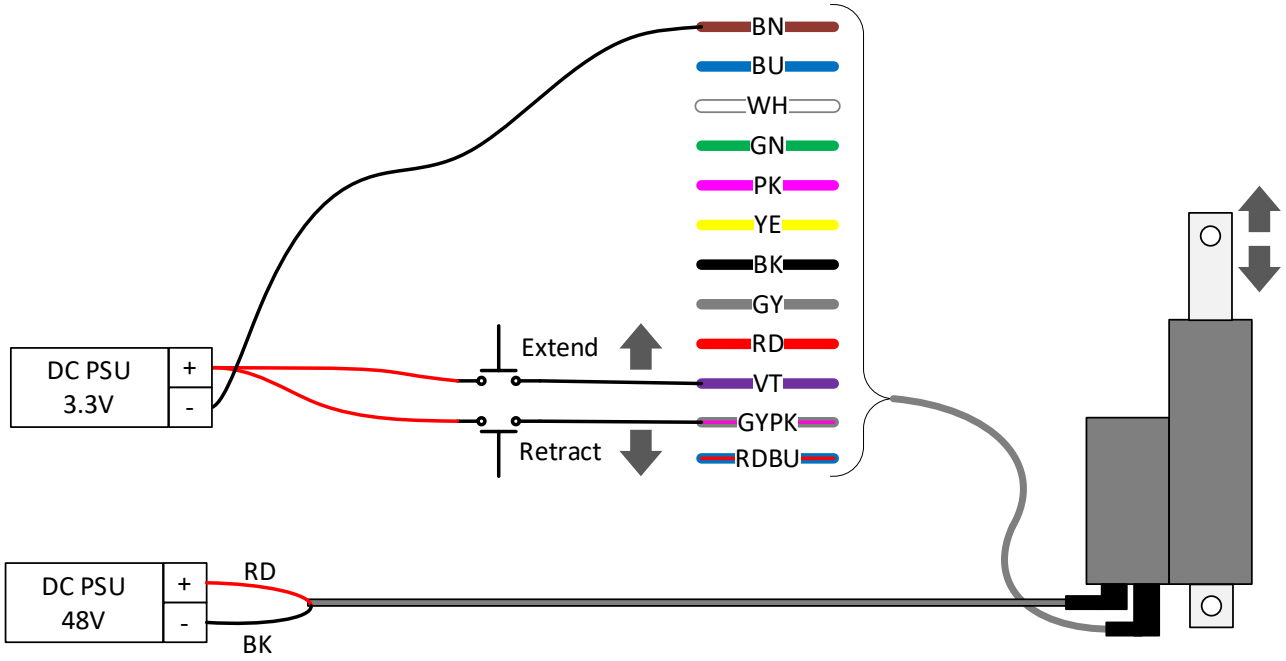
Continued on next page

Continued from previous page

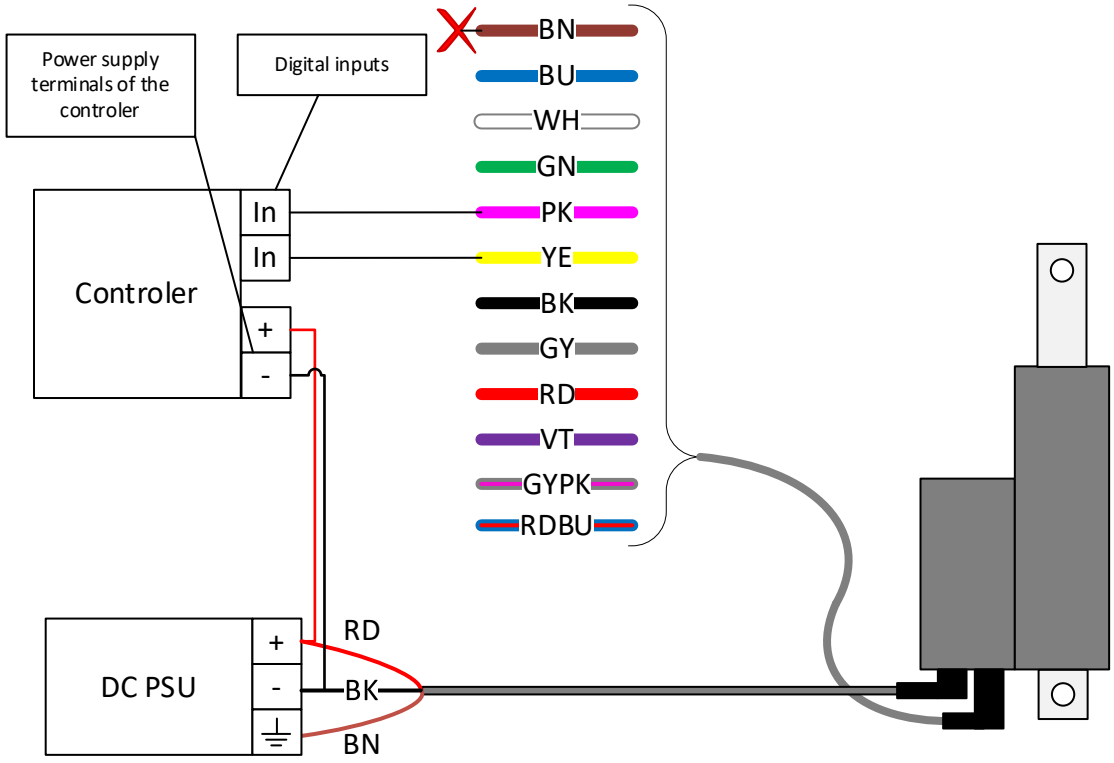
Pin 12 Red-Blue (RDBU)	**Output analog** (Position of the actor) The LD1000C generates a linear output voltage depending on the current position. Specification • Load R_L ≥ 1k Ω Output level for 12V cylinder • **[0.5V*]** Retracted position • **[4.5V*]** Extended position Output level for 24V cylinder • **[2V*]** Retracted position • **[10V*]** Extended position   *Reference to "Output GND"

Example

Connection example – drive – active

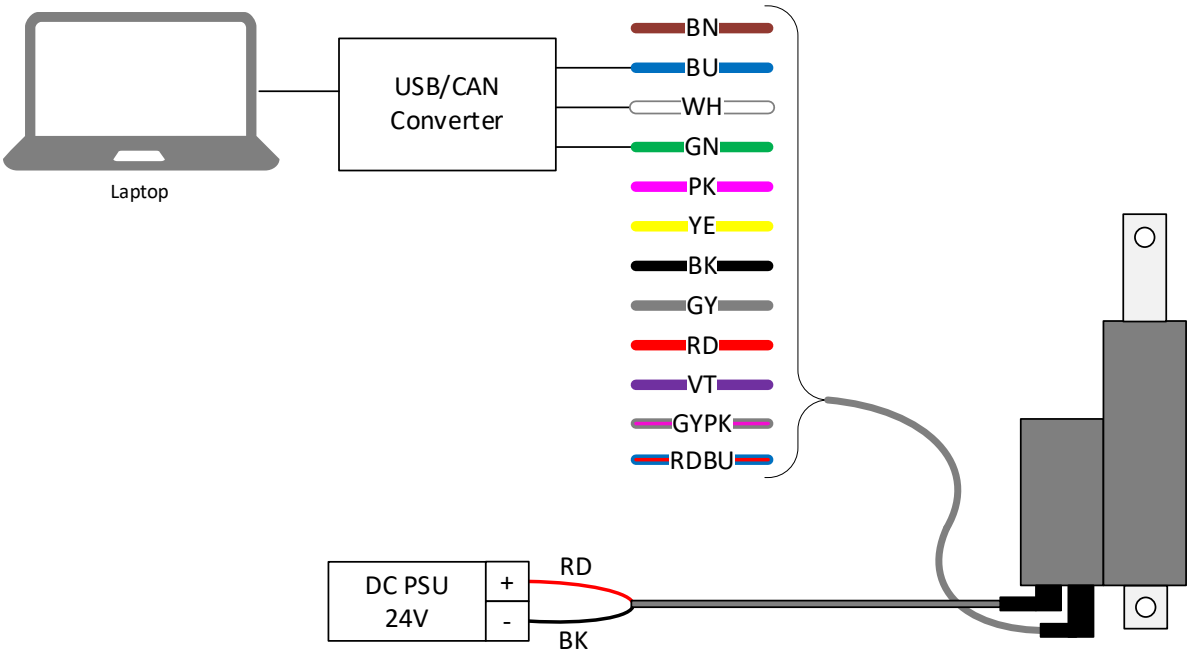


Connection example – Feedback signal

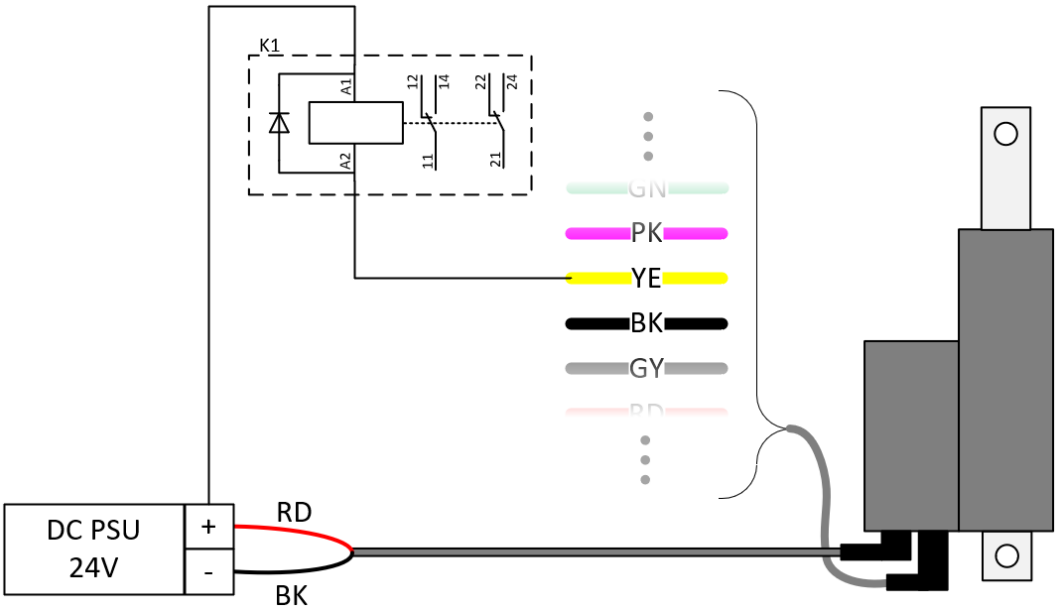


Note: The figure shows a usual application in which the control unit is connected to a central GND (minus), as is also the cylinder. The brown wire (GND) of the 12-pole cable is not allowed to be connected in this constellation.

Connection example – CAN



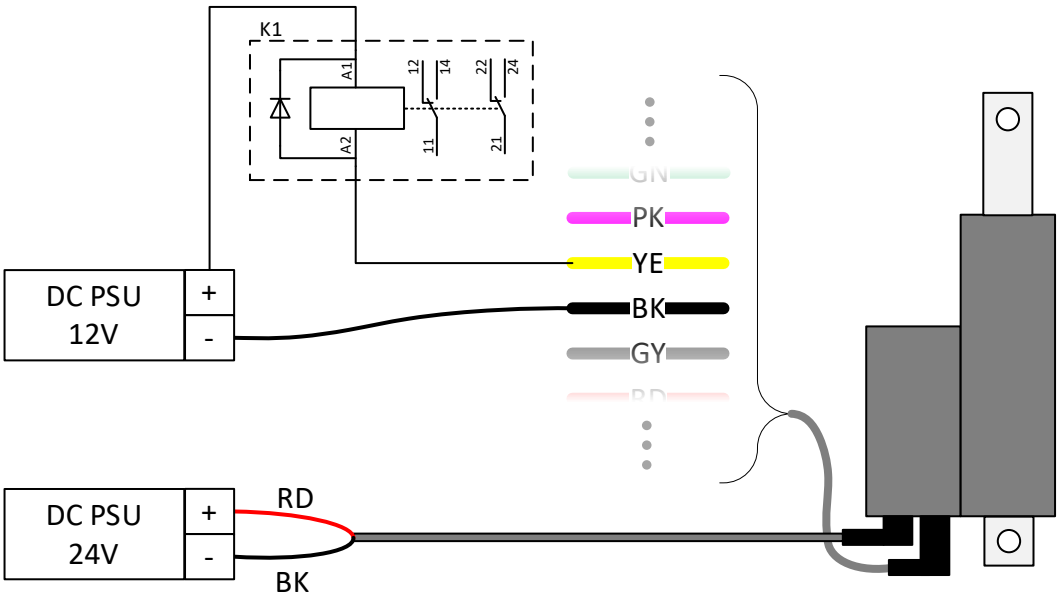
Connection example – Switch a relay



K1: Relay with integrated free-wheeling diode (Wago, 788-312)

Note: For a better overview, only one relay is shown at output 3.

Connection example – Relay with two galvanic isolated power supply units

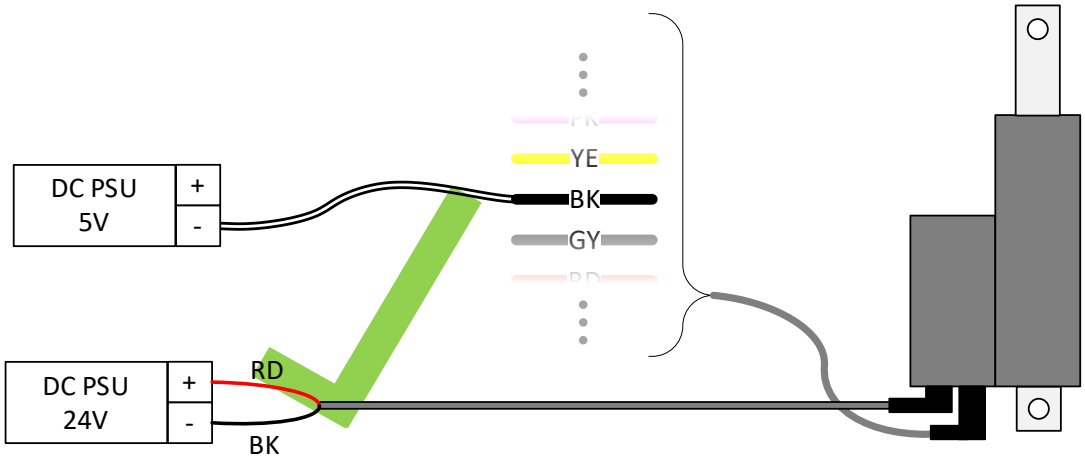


K1: Relay with integrated free-wheeling diode (Wago, 788-312)

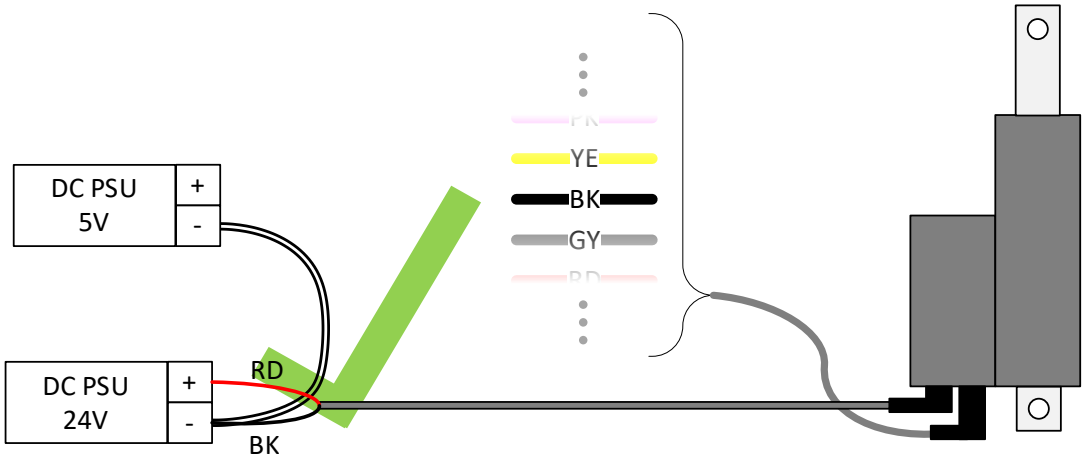
Note: For a better overview, only one relay is shown at output 3.

Output Ground (GND) Concepts

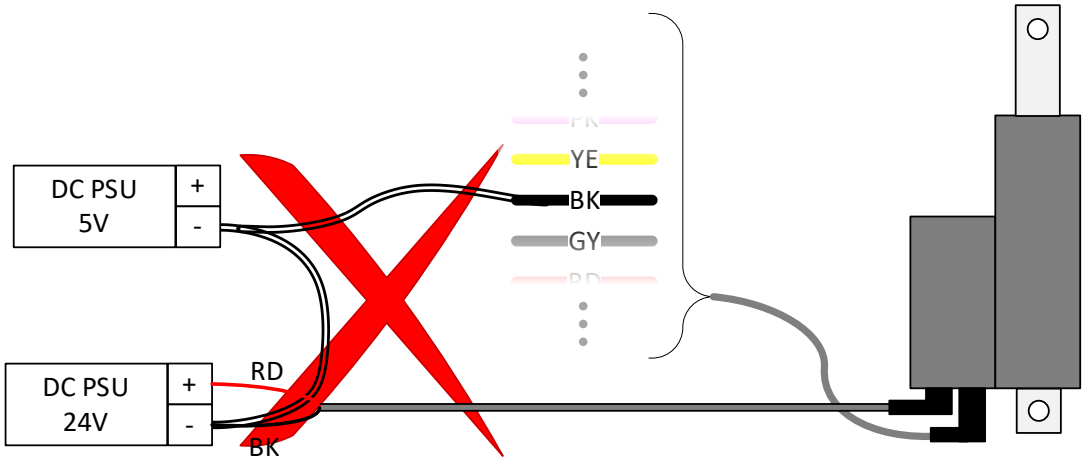
GND concept with two separate power supplies



GND concept with two power supplies and common GND

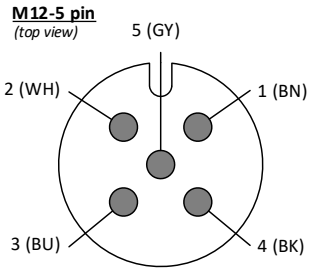


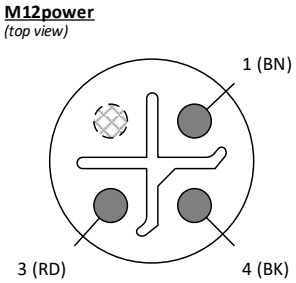
GND concept not permitted

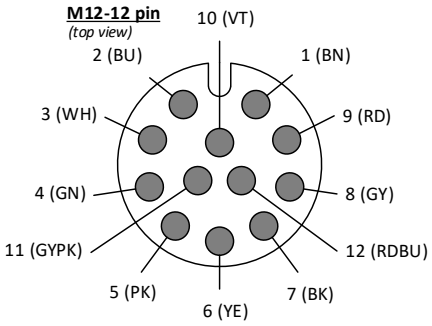


Connection AP.4.017900M (M=Master)

Pin assignment





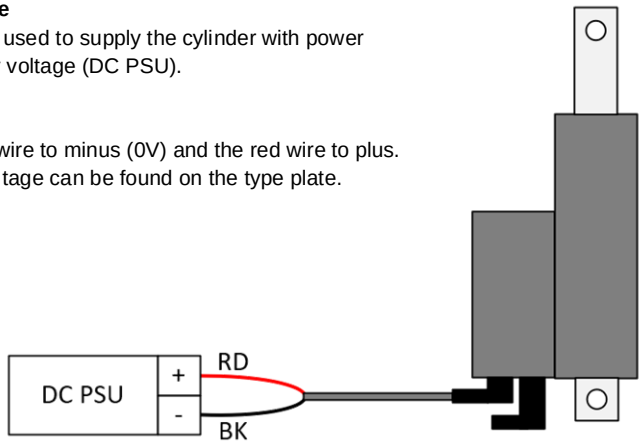


Pin assignment M12power (3-pin)

***** Supply voltage *****

Pwr

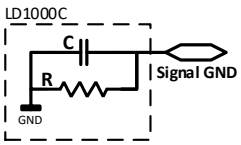
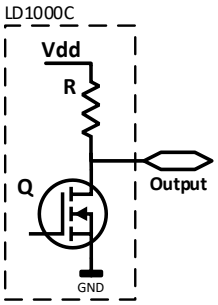
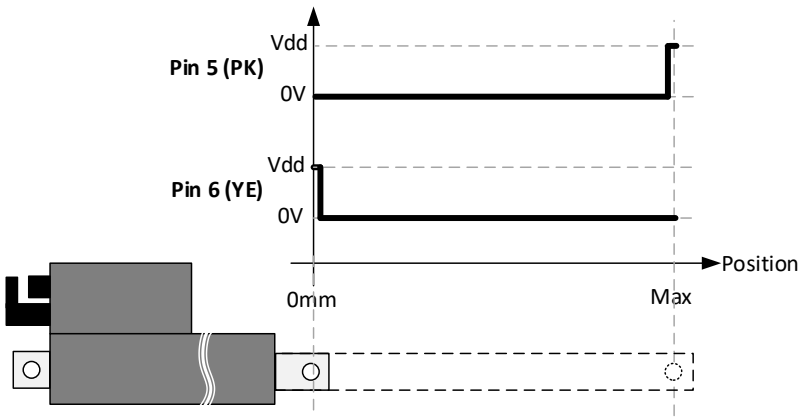
Pin	*Description*	
Pin 1 Brown (BN)	**Do not connect**	**V C supply voltage** The power cable is used to supply the cylinder with power from the DC supply voltage (DC PSU). **Connection** Connect the black wire to minus (0V) and the red wire to plus. The permissible voltage can be found on the type plate.
Pin 3 Red (RD)	**DC power supply**	
Pin 4 Black (BK)		



Pin assignment M12 Signal (12-pin)

*** Communication & control plug ***

In

Pin	*Description*	
Pin 1 Brown (BN)	**Voltage output** Fused supply voltage for switching the digital inputs on this plug. Any other use is not permitted.	
Pin 2 Blue (BU)	**Signal GND**	**CAN communication interface** Interface for control, query, update, and parameterization of the linear drive. Signal GND is capacitively and ohmically coupled with the GND of the cylinder to avoid critical cross currents. **Note:** Ensure an identical GND potential for all CAN BUS nodes. 
Pin 3 White (WH)	**CAN high**	
Pin 4 Green (GN)	**CAN low**	
Pin 5 Pink (PK)	**Output 4**	**Digital outputs** The linear drive indicates when the retracted and extended end positions have been reached with a separate pin each. The output is designed for switching small loads such as relays, magnetic valves, or signal lamps. The internal resistor R is connected to the linear drive supply voltage Vdd (e.g. 24V) and allows for example the direct operation of common signal LEDs without separate series resistor. **Specification** • **R** = 2.4k Ω • **V_{DS}** = 0…30 V_{DC} • **I_{DS}** = 0…300m A **Definition** • **Output 3** Retracted • **Output 4** Extended 
Pin 6 Yellow (YE)	**Output 3**	

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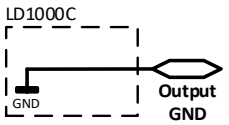
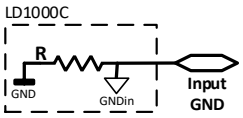
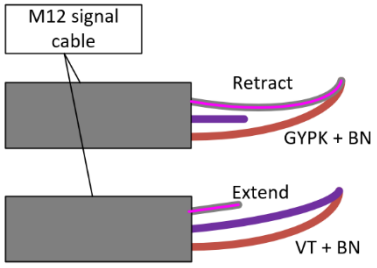
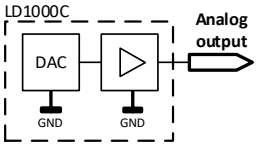
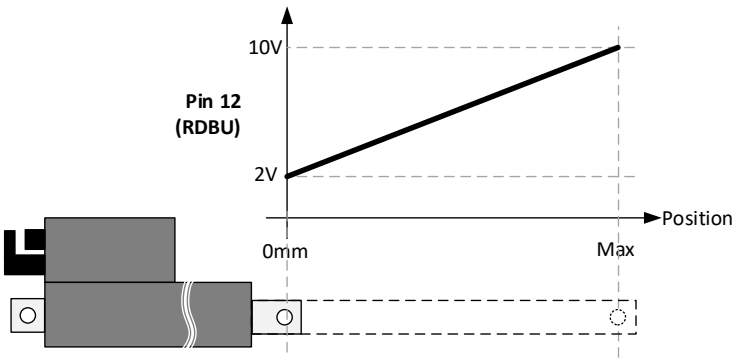
Pin 7 Black (BK)	**Output GND** Common zero potential of the outputs (see pin 5 and 6). Do not connect the wire to the minus of the linear drive supply voltage (see M12power, pin 4). The linear drive could be damaged by the cross currents that can occur. This line is necessary only if the control unit has a galvanically isolated supply to the linear drive. 	
Pin 8 Grey (GY)	**Input GND** Common zero potential of the inputs. Connecting this wire is recommended at input voltage levels below 5V. Therefore, the voltage drop on the negative wire (M12power, pin 4) has an nearly insignificant impact on the input signal. Connection of this wire to a control unit galvanically isolated from the LD1000 supply voltage (M12power) is required. 	

Pin 9
Red (RD)
	Input 3	**Digital Inputs**
		The digital inputs allow you to extend and retract the actuator, as well as to select other operating modes (see assembly instructions).
		
		The linear drive allows passive and active control. For passive control, connect the brown wire (pin 1) to the corresponding input (see diagram opposite). This can be done, for example, via a manual switch (accessory), pushbutton or relay contacts.
		
		 
		
		In the case of active control, connect the inputs to the cylin linear drive der voltage, for example. The low "high" level also allows control with a 3.3V controller.
		
		<u>Configuration</u>
		• **[Input 1]** Retract
		• **[Input 2]** Extend
		• **[Input 3]** No function defined
		
		<u>Other operating modes (see assembly instructions)</u>
		• Initialization mode
		• Adjusting mode
		• Emergency operation mode
		
		<u>Specification</u>
		• U = 0 … 30Vdc*
		• Level definition
		  ○ **[high]** ≥ 3V*
		  ○ **[low]** < 0.8V*
		• Typical current consumption per input: 5mA
		
		*Reference to "Input GND"

Pin 10 Violet (VT)	**Input 2**	
Pin 11 Gray-Pink (GYPK)	**Input 1**	

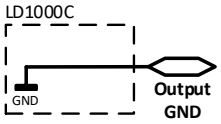
Continued on next page

Continued from previous page	
Pin 12 Red-Blue (RDBU)	**Output analog** (Position of the actor) The LD1000C generates a linear output voltage depending on the current position. Specification • Load R_L ≥ 1k Ω Output level for 12V cylinder • **[0.5V*]** Retracted position • **[4.5V*]** Extended position Output level for 24V cylinder • **[2V*]** Retracted position • **[10V*]** Extended position   *Reference to "Output GND"

Pin assignment M12 Signal (5-pin) - OUT

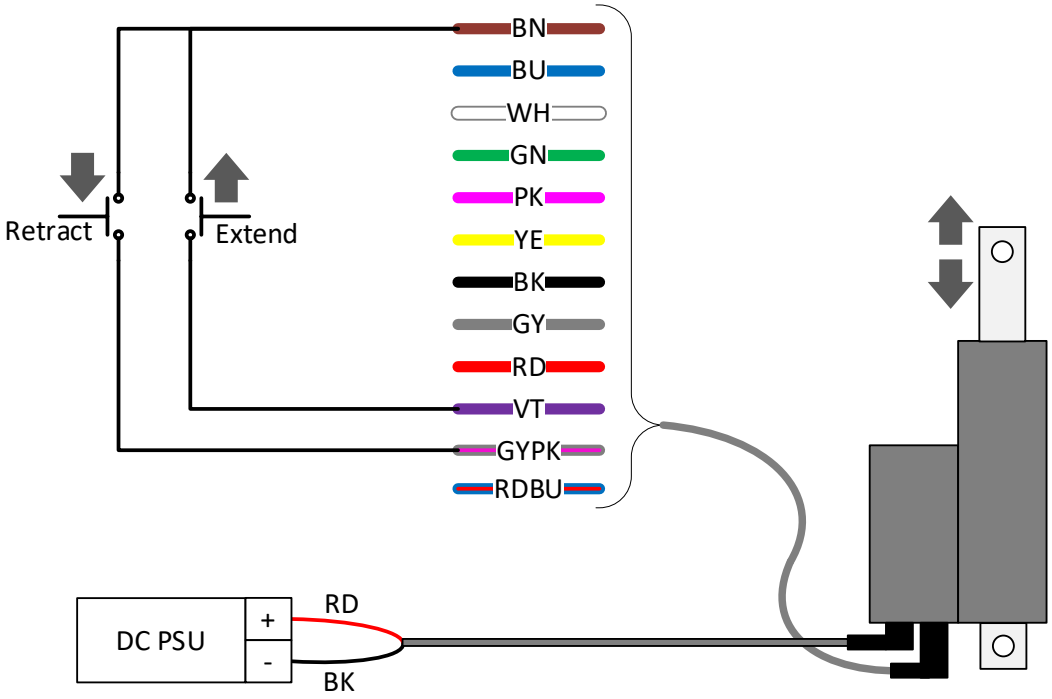
*** Communication plug (internal) – Slave ***

OUT

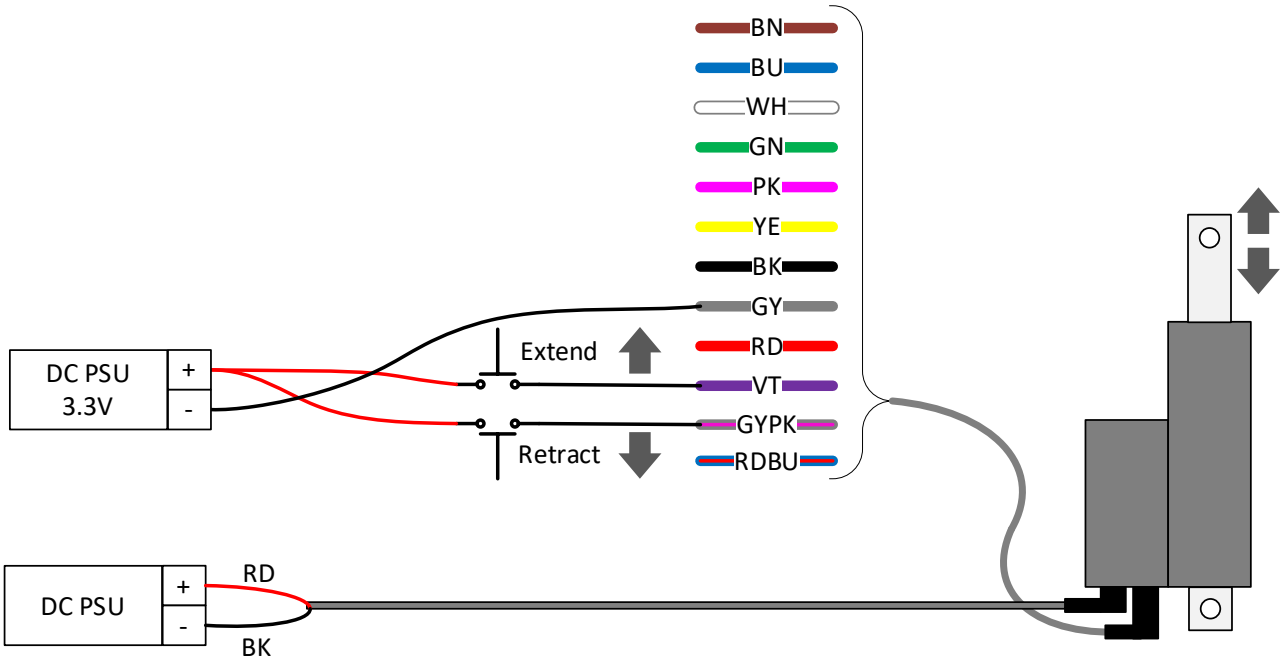
Pin	*Description*	
Pin 1 Brown (BN)	**CAN low**	**CAN communication interface** Interface for control, query, update and parameterization of the cylinder.
Pin 2 White (WH)	**CAN high**	
Pin 3 Blue (BU)	**Do not connect** Internal signals.	
Pin 4 Black (BK)		
Pin 5 Grey (GY)	**Output GND** Common zero potential of the outputs. You can connect this wire with the “input GND” of the next slave 	
Note: All five pins of this connector are to be connected direct and complete with all five pins to the connector IN of the next slave.		

Example

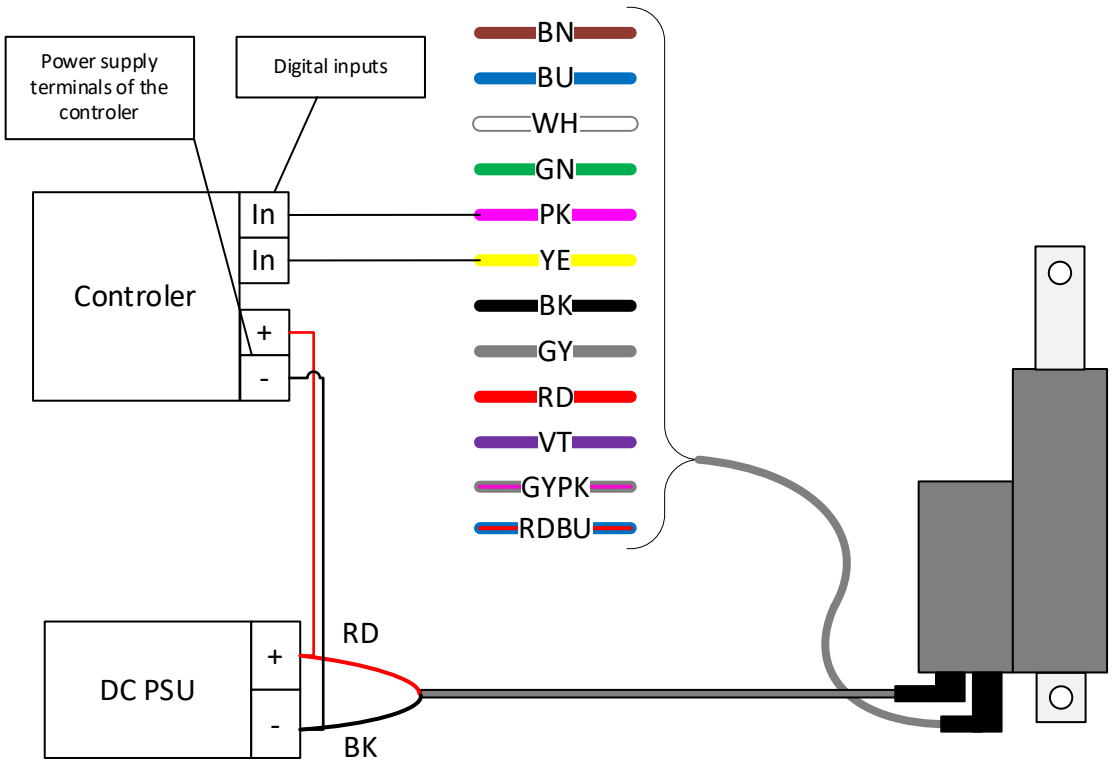
Connection example – drive – passive



Connection example – drive – active

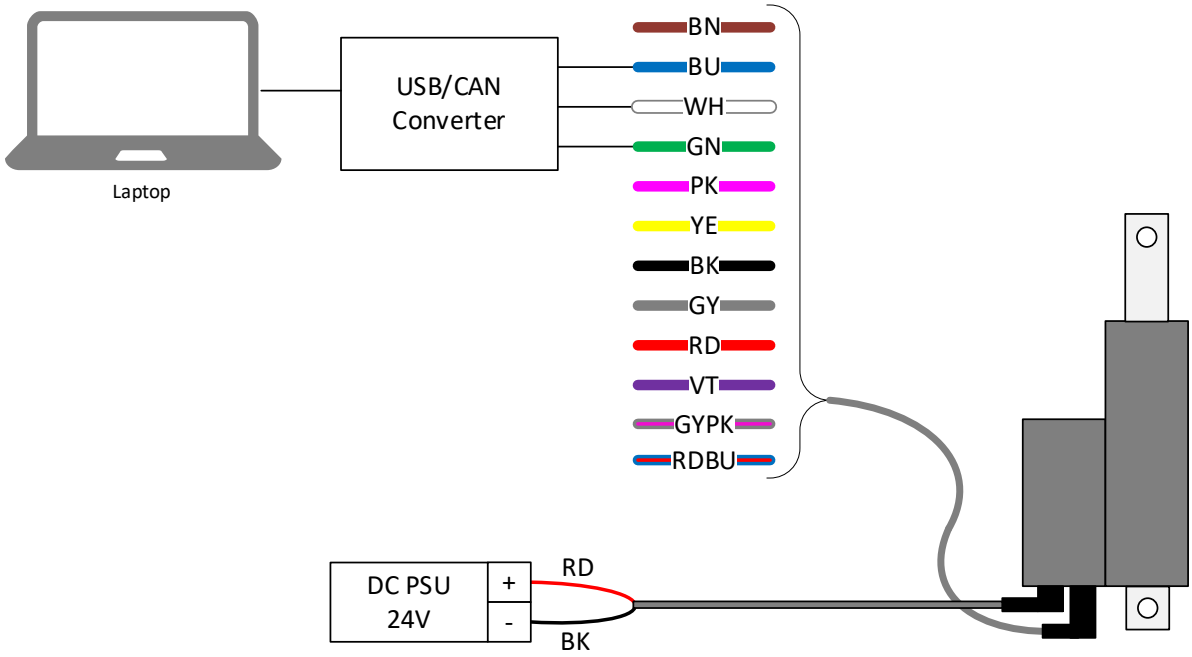


Connection example – Feedback signal

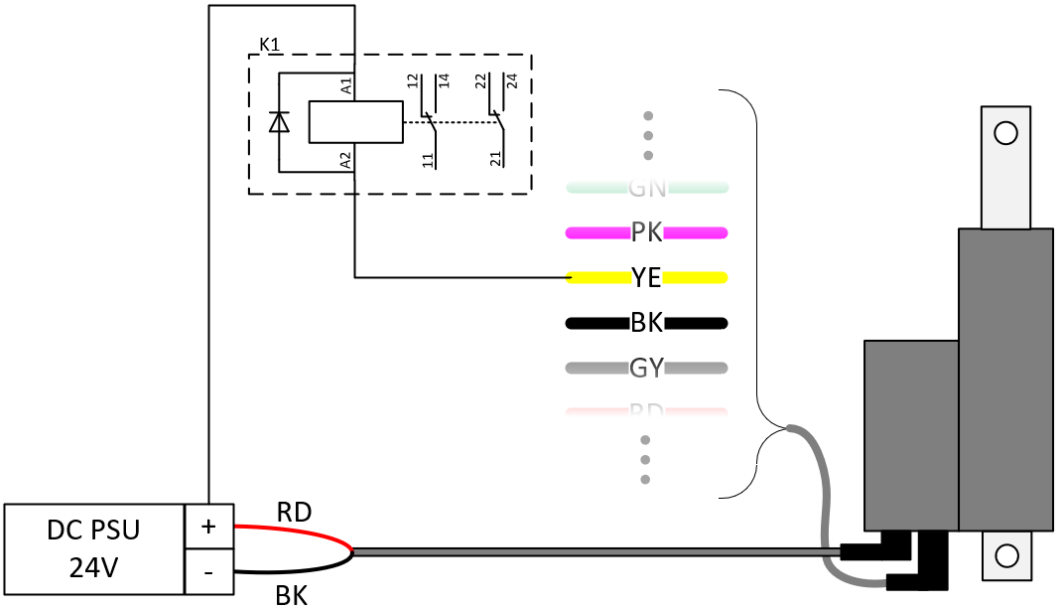


Note: The figure shows a usual application in which the control unit is connected to a central GND (minus), as is also the cylinder.

Connection example – CAN



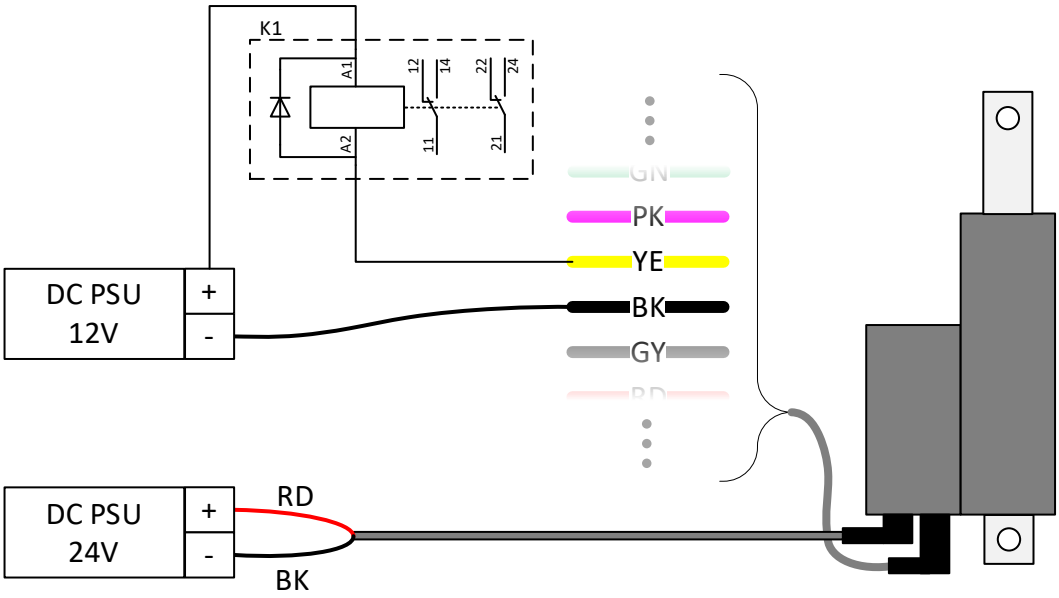
Connection example – Switch a relay



K1: Relay with integrated free-wheeling diode (Wago, 788-312)

Note: For a better overview, only one relay is shown at output 3.

Connection example – Relay with two galvanic isolated power supply units

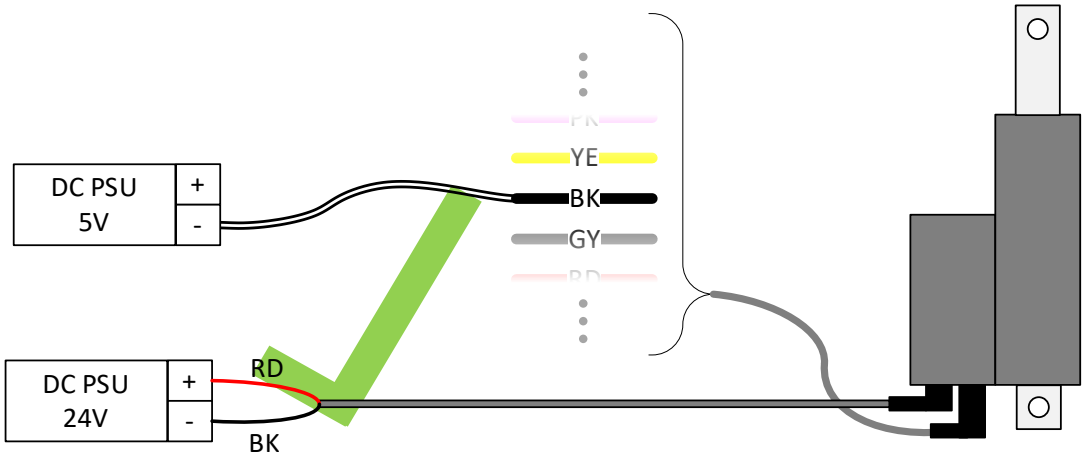


K1: Relay with integrated free-wheeling diode (Wago, 788-312)

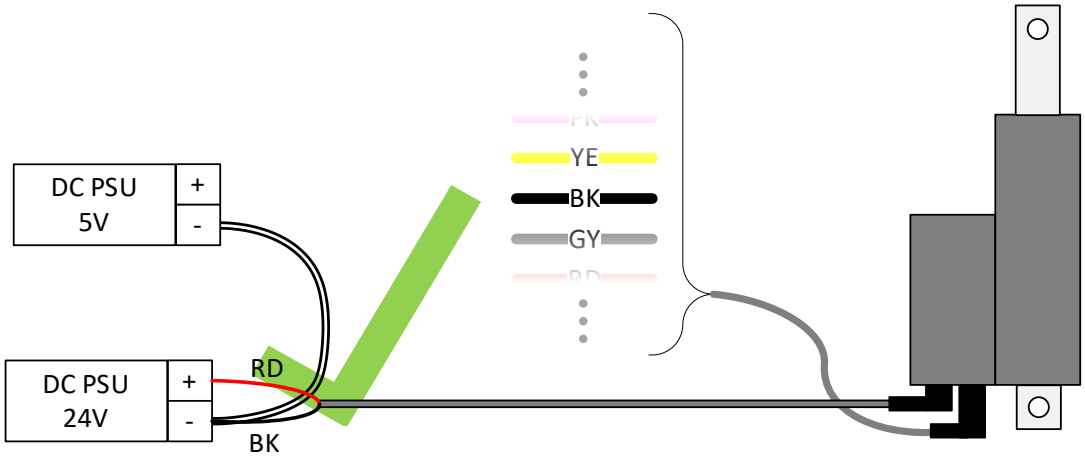
Note: For a better overview, only one relay is shown at output 3.

Output Ground (GND) Concepts

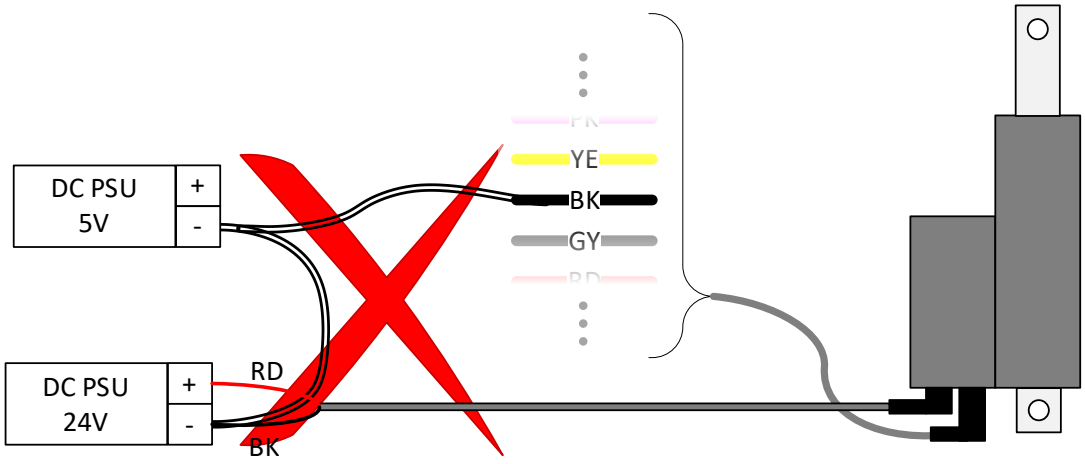
GND concept with two separate power supplies



GND concept with two power supplies and common GND

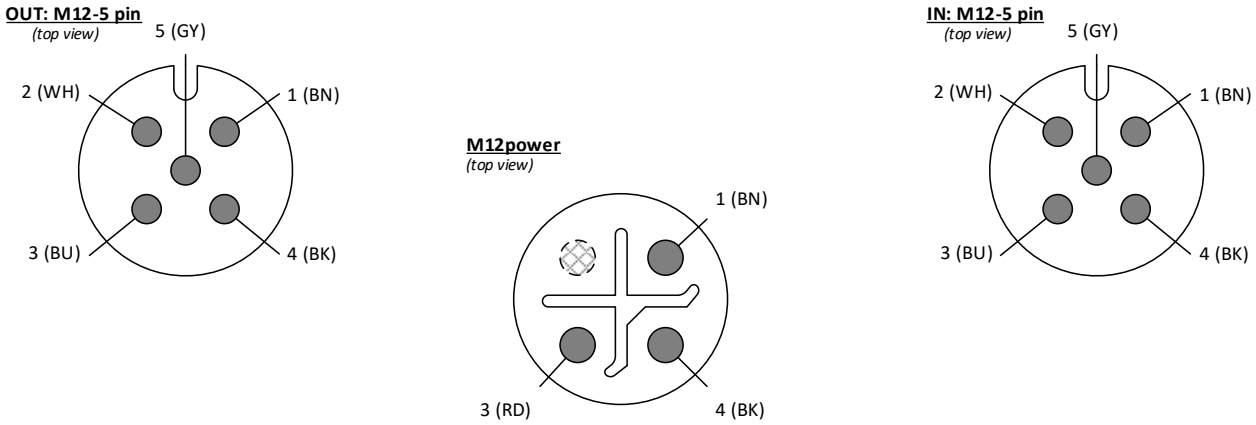


GND concept not permitted



Connection AP.4.017900S (S=Slave)

Pin assignment

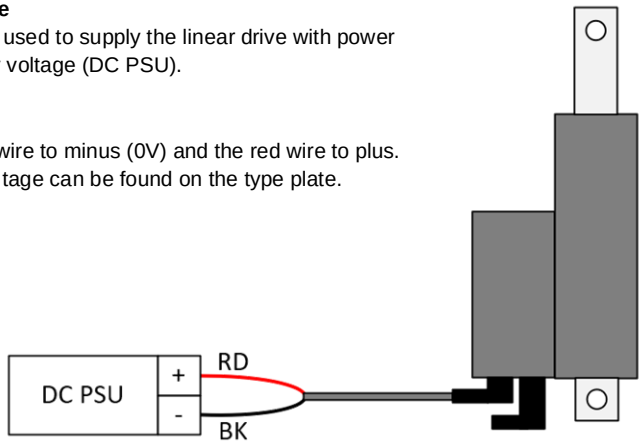


Pin assignment M12power (3-pin)

***** Supply voltage *****

Pwr

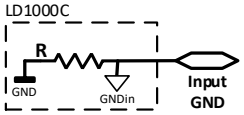
Pin	*Description*	
Pin 1 Brown (BN)	**Do not connect**	**V C supply voltage** The power cable is used to supply the linear drive with power from the DC supply voltage (DC PSU). **Connection** Connect the black wire to minus (0V) and the red wire to plus. The permissible voltage can be found on the type plate.
Pin 3 Red (RD)	**DC power supply**	
Pin 4 Black (BK)		



Pin assignment M12 (5-pin) - IN

*** Communication plug (internal) ***

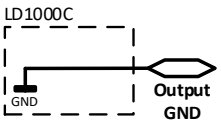
IN

Pin	*Description*	
Pin 1 Brown (BN)	**CAN low**	**CAN communication interface** Interface for control, query, update, and parameterization of the linear drive.
Pin 2 White (WH)	**CAN high**	
Pin 3 Blue (BU)	**Do not connect** Internal signals.	
Pin 4 Black (BK)		
Pin 5 Grey (GY)	**Input GND** Common zero potential of the inputs. You can connect this wire with **Output GND** of the master or slave. **Note:** Ensure an identical GND potential for all CAN BUS nodes.	
Note: Connect this connector direct and complete with all five pins to the output connector (OUT) of the previous master or slave.		

Pin assignment M12 Signal (5-pin) - OUT

*** Communication plug (internal) – Slave ***

OUT

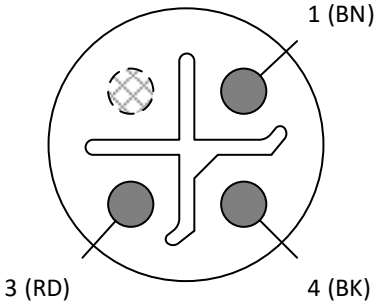
Pin	*Description*	
Pin 1 Brown (BN)	**CAN low**	**CAN communication interface** Interface for control, query, update, and parameterization of the linear drive.
Pin 2 White (WH)	**CAN high**	
Pin 3 Blue (BU)	**Do not connect** Internal signals.	
Pin 4 Black (BK)		
Pin 5 Grey (GY)	**Output GND** Common zero potential of the outputs. You can connect this wire with the **Input GND** of the next slave. **Note:** Ensure an identical GND potential for all CAN BUS nodes.	
Note: All five pins of this connector are to be connected direct and complete with all five pins to the connector IN of the next slave.		

Note: After each new cabling of a synchronization system, first perform an initialization (see installation instructions).

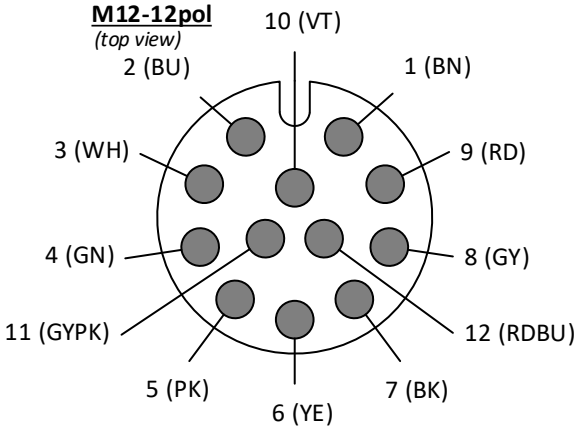
Connection AP.4.017901

Pin assignment

M12power
(top view)



M12-12pol
(top view)

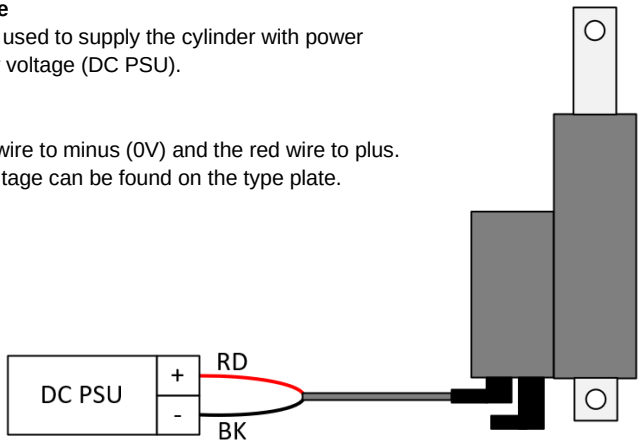


Pin assignment M12power (3-pin)

***** Supply voltage *****

Pwr

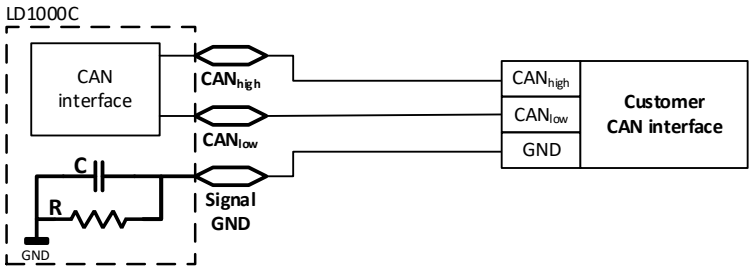
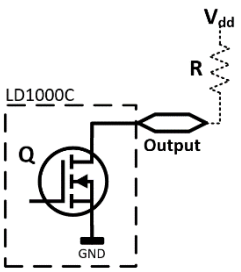
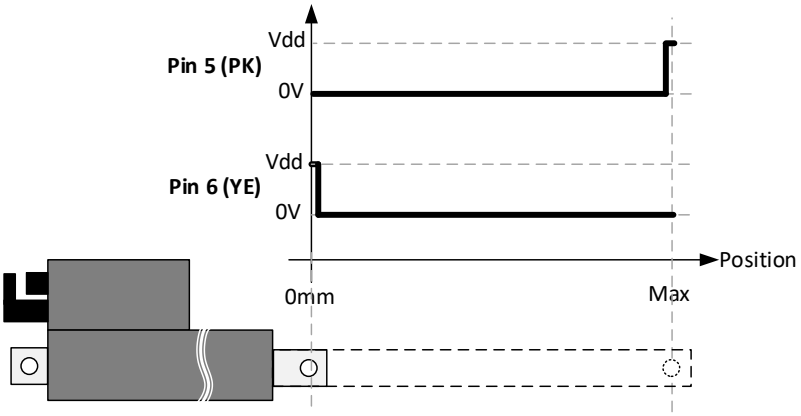
Pin	*Description*	
Pin 1 Brown (BN)	**Do not connect**	**V C supply voltage** The power cable is used to supply the cylinder with power from the DC supply voltage (DC PSU). **Connection** Connect the black wire to minus (0V) and the red wire to plus. The permissible voltage can be found on the type plate.
Pin 3 Red (RD)	**DC power supply**	
Pin 4 Black (BK)		



Pin assignment M12 Signal (12-pin)

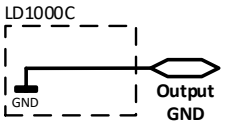
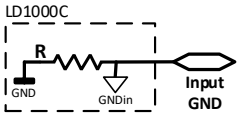
*** Communication & control plug ***

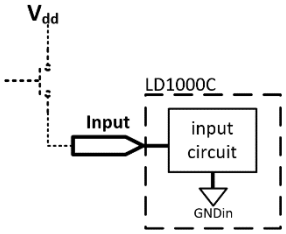
In

Pin	*Description*	
Pin 1 Brown (BN)	**Not connected** Leave unconnected	
Pin 2 Blue (BU)	**Signal GND**	**CAN communication interface** Interface for control, query, update and parameterization of the cylinder. Signal GND is capacitively and ohmically coupled with the GND of the cylinder to avoid critical cross currents. **Note:** Ensure an identical GND potential for all CAN BUS nodes. 
Pin 3 White (WH)	**CAN high**	
Pin 4 Green (GN)	**CAN low**	
Pin 5 Pink (PK)	**Output 4**	**Digital outputs** The actuator indicates when the retracted and extended end positions have been reached with a separate pin each. The outputs do not generate an active voltage. They are designed as electronic switches (MOSFET) against the reference potential (minus / GND). This allows you to realize the output with any voltage. **Specification** • **V_{DS}** = 0…30 V_{DC} • **I_{DS}** = 0…300m A **Definition** • **Output 3** Retracted • **Output 4** Extended  
Pin 6 Yellow (YE)	**Output 3**	

Continued on next page

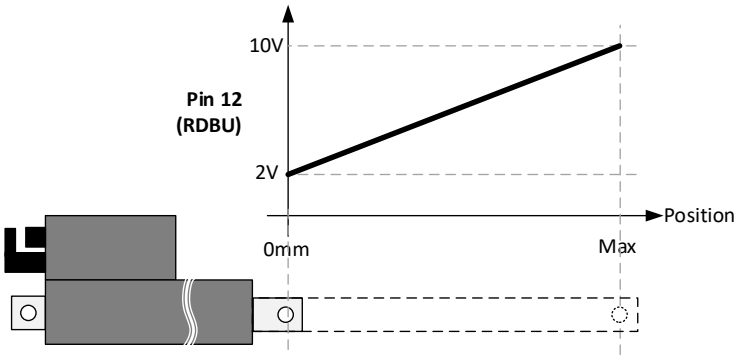
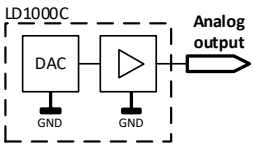
Continued from previous page

Pin 7 Black (BK)	**Output GND** Common zero potential of the outputs (see pin 5 and 6). Do not connect the wire to the minus of the cylinder supply voltage (see M12power, pin 4). The cylinder could be damaged by the cross currents that can occur. This line is necessary only if the control unit has a galvanically isolated supply to the cylinder. 	
Pin 8 Grey (GY)	**Input GND** Common zero potential of the inputs. Connecting this wire is recommended at input voltage levels below 5V. Therefore, the voltage drop on the negative wire (M12power, pin 4) has an nearly insignificant impact on the input signal. Connection of this wire to a control unit galvanically isolated from the LD1000 supply voltage (M12power) is required. 	

Pin 9
Red (RD)
	Input 3	**Digital Inputs**
		The digital inputs enable the extension and retraction of the linear drive. The very low voltage threshold of the inputs allows direct control by a controller with 3.3V logic. A control with 24V is also permissible.
		
		The inputs have a reference potential ohmically coupled by the linear drive. A connection of the "Input GND" to the reference potential of the voltage source (minus / GND) is obligatory.
		
		<u>Configuration</u>
		• **[Input 1]** Retract
		• **[Input 2]** Extend
		• **[Input 3]** No function defined
		
		 
		
		<u>Specification</u>
		• U = 0 … 30Vdc*
		• Level definition
		  ○ **[high]** ≥ 3V*
		  ○ **[low]** < 0.8V*
		• Typical current consumption per input: 5mA
		
		*Reference to "Input GND"

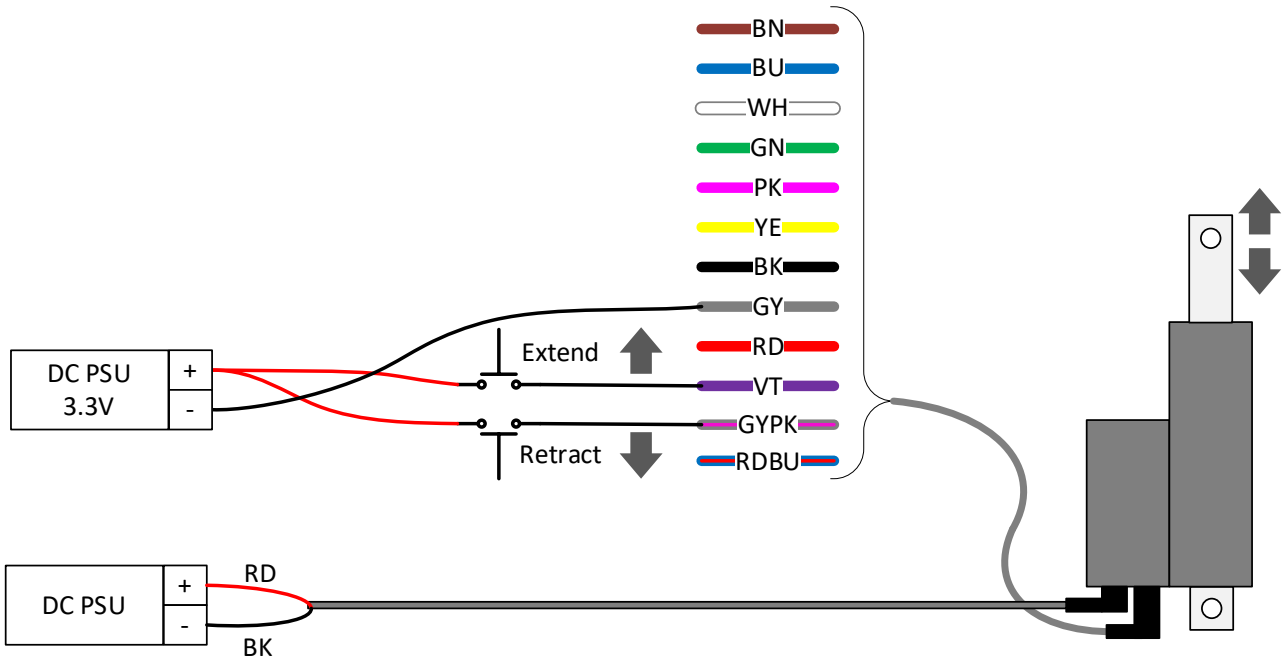
Pin 10 Violet (VT)	**Input 2**	
Pin 11 Gray-Pink (GYPK)	**Input 1**	

Continued on next page

Continued from previous page	
Pin 12 Red-Blue (RDBU)	**Output analog** (Position of the actor) The LD1000C generates a linear output voltage depending on the current position. Specification • Load R_L ≥ 1k Ω • Retracted 2 V* • Extended 10 V*   *Reference to "Output GND"

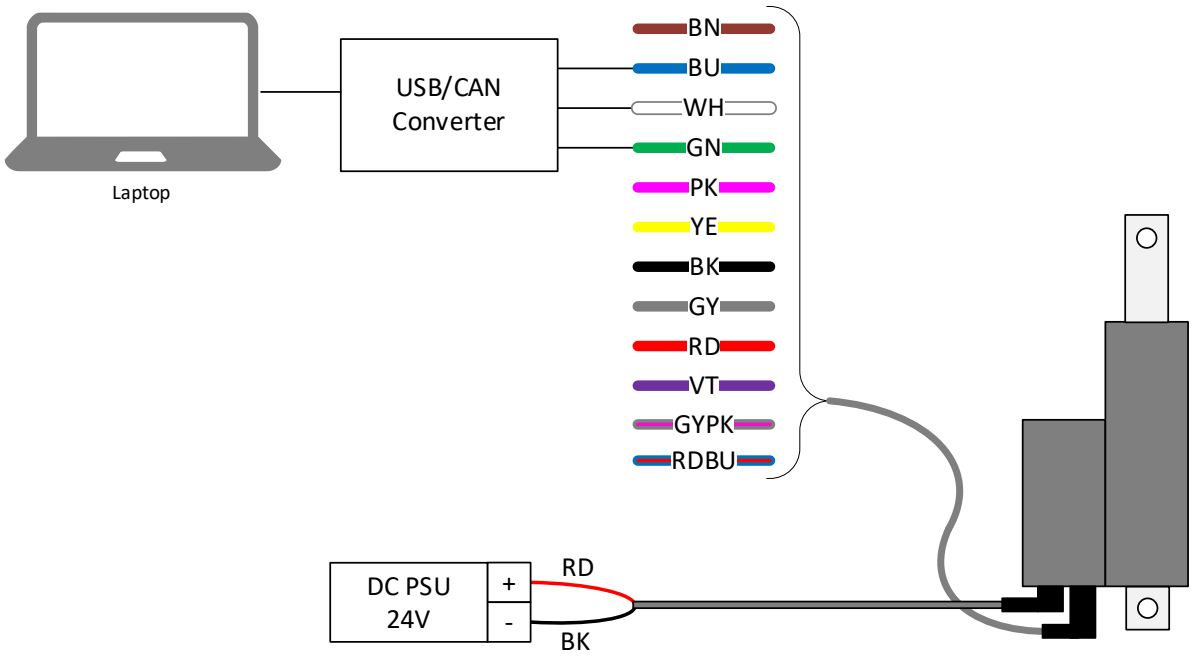
Example

Connection example – drive

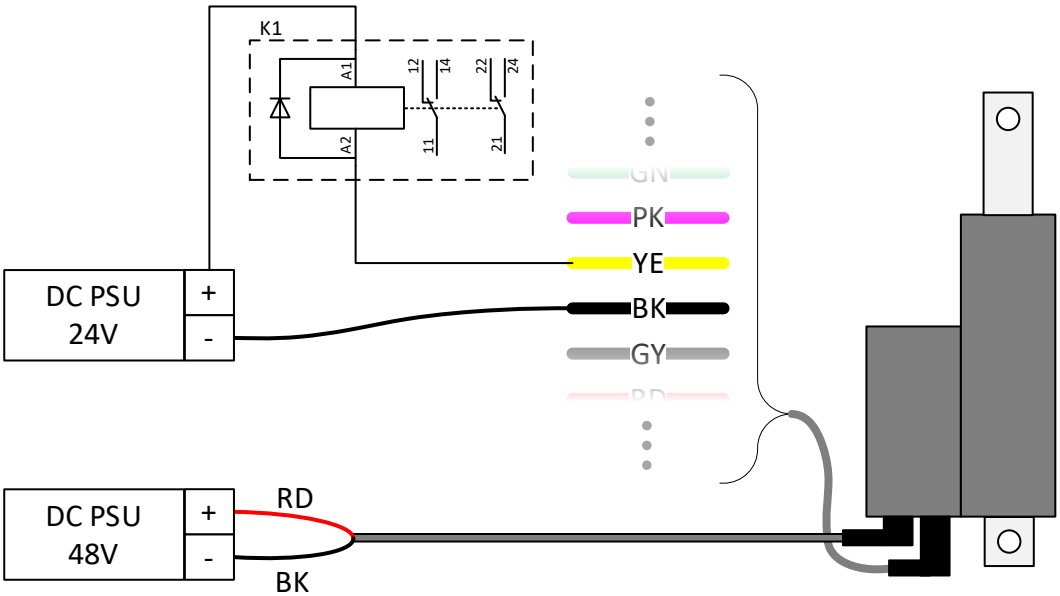


Warning: 48V on the inputs is not allowed and will damage the linear drive.

Connection example – CAN



Connection example – Relay with two galvanic isolated power supply units

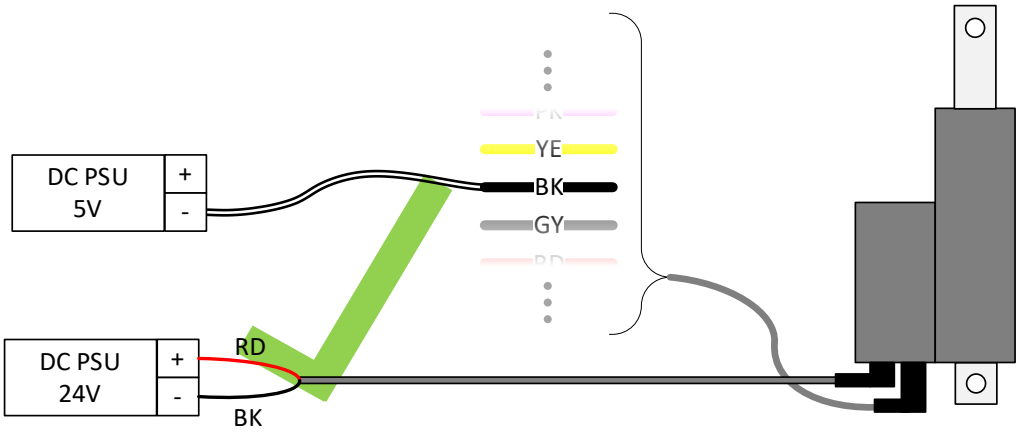


K1: Relay with integrated free-wheeling diode (Wago, 788-312)

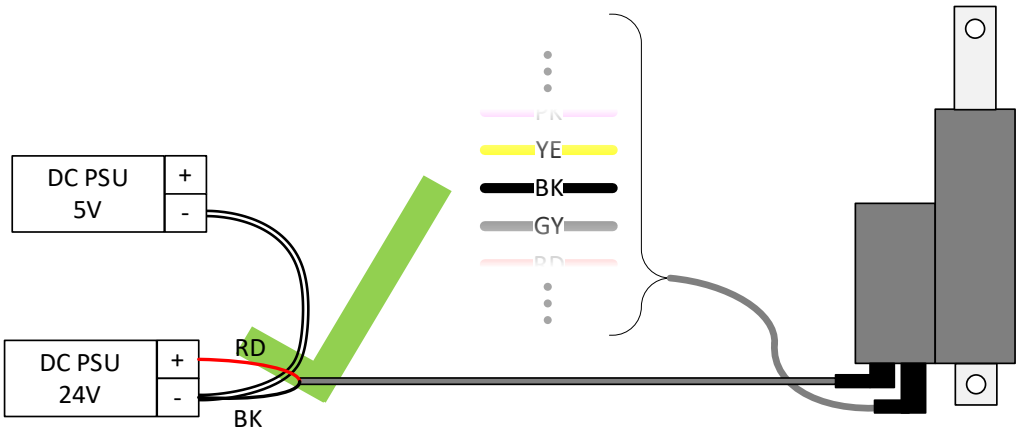
Note: For a better overview, only one relay is shown at output 3.

Output Ground (GND) Concepts

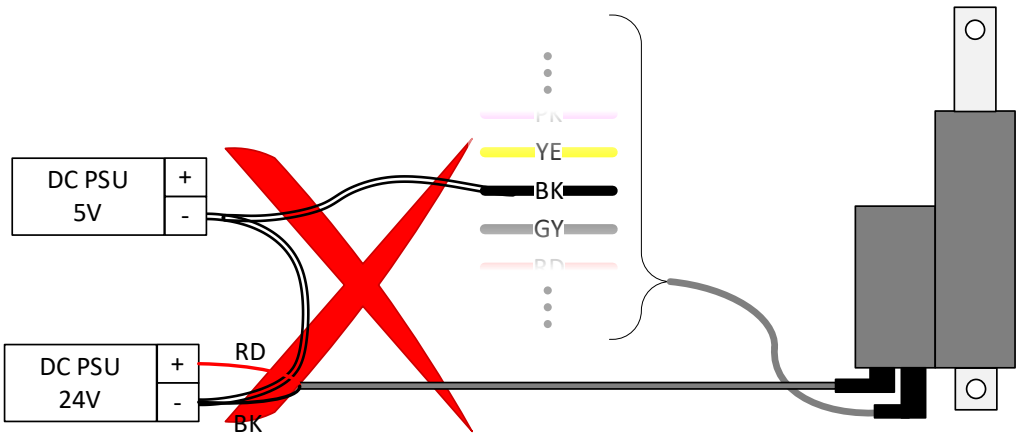
GND concept with two separate power supplies



GND concept with two power supplies and common GND



GND concept not permitted

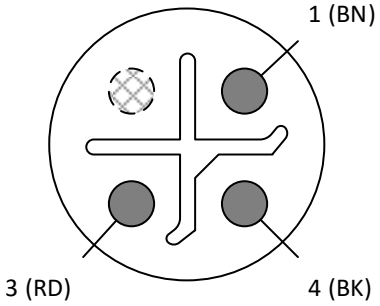


Note: The motor currents flowing via the stranded wire BK can damage the linear drive. Always ensure a GND concept in which no cross currents can flow.

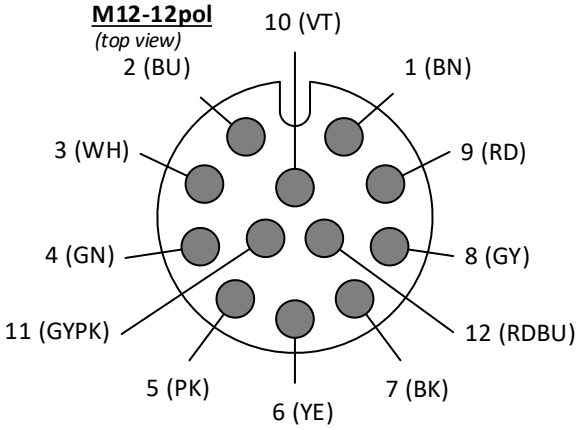
Connection AP.4.017910

Pin assignment

M12power
(top view)



M12-12pol
(top view)

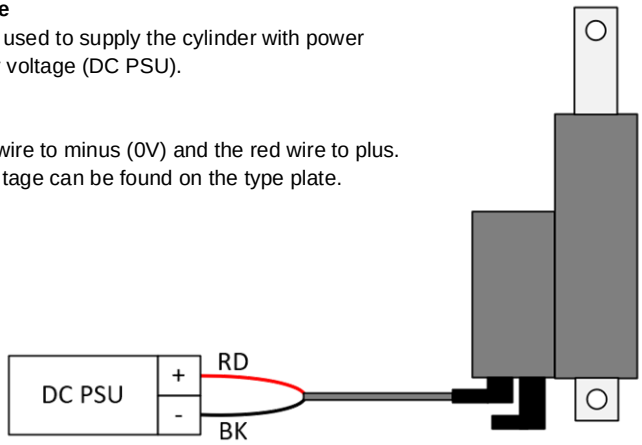


Pin assignment M12power (3-pin)

***** Supply voltage *****

Pwr

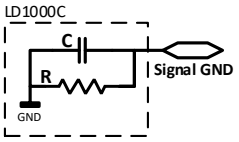
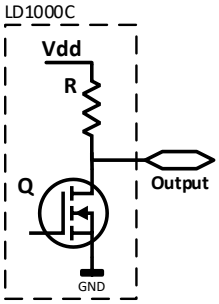
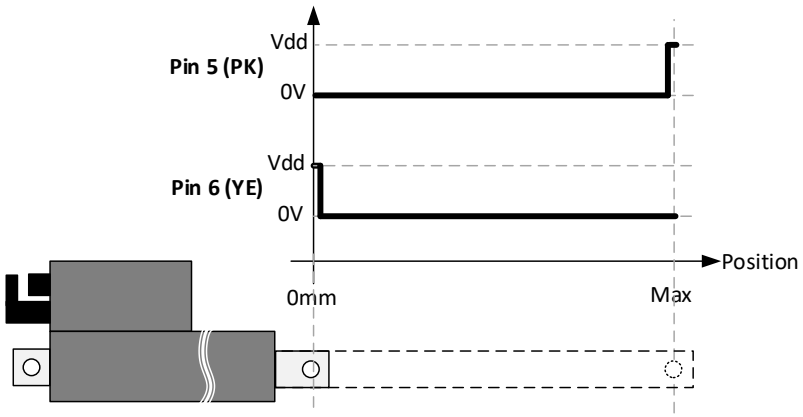
Pin	*Description*	
Pin 1 Brown (BN)	**Do not connect**	**V C supply voltage** The power cable is used to supply the cylinder with power from the DC supply voltage (DC PSU). **Connection** Connect the black wire to minus (0V) and the red wire to plus. The permissible voltage can be found on the type plate.
Pin 3 Red (RD)	**DC power supply**	
Pin 4 Black (BK)		



Pin assignment M12 Signal (12-pin)

*** Communication & control plug ***

In

Pin	*Description*	
Pin 1 Brown (BN)	**Voltage output** Fused supply voltage for switching the digital inputs on this plug. Any other use is not permitted.	
Pin 2 Blue (BU)	**Signal GND**	**CAN communication interface** Interface for control, query, update and parameterization of the cylinder. Signal GND is capacitively and ohmically coupled with the GND of the cylinder to avoid critical cross currents. **Note:** Ensure an identical GND potential for all CAN BUS nodes. 
Pin 3 White (WH)	**CAN high**	
Pin 4 Green (GN)	**CAN low**	
Pin 5 Pink (PK)	**Output 4**	**Digital outputs** The actuator indicates when the retracted and extended end positions have been reached with a separate pin each. The output is designed for switching small loads such as relays, magnetic valves or signal lamps. The internal resistor R is connected to the cylinder supply voltage Vdd (e.g. 24V) and allows for example the direct operation of common signal LEDs without separate series resistor. **Specification** • **R** = 2.4k Ω • **V_{DS}** = 0…30 V_{DC} • **I_{DS}** = 0…300m A **Definition** • **Output 3** Retracted • **Output 4** Extended 
Pin 6 Yellow (YE)	**Output 3**	

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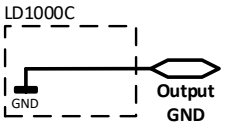
Pin 7
Black (BK)

Output GND
Common zero potential of the outputs (see pin 5 and 6).

Do not connect the wire to the minus of the cylinder supply voltage (see M12power, pin 4). The cylinder could be damaged by the cross currents that can occur.

This line is necessary only if the control unit has a galvanically isolated supply to the cylinder.

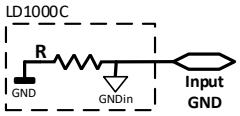


Pin 8
Grey (GY)

Input GND
Common zero potential of the inputs.

Connecting this wire is recommended at input voltage levels below 5V. Therefore, the voltage drop on the negative wire (M12power, pin 4) has an nearly insignificant impact on the input signal.

Connection of this wire to a control unit galvanically isolated from the LD1000 supply voltage (M12power) is required.

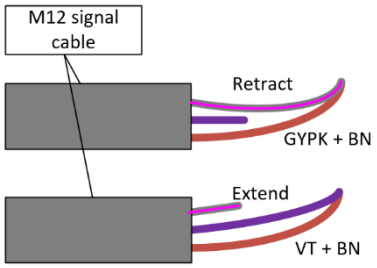


Pin 9
Red (RD)

Input 3

Digital Inputs
The digital inputs allow you to extend and retract the actuator, as well as to select other operating modes (see assembly instructions).

The actuator allows passive and active control. For passive control, connect the brown wire (pin 1) to the corresponding input (see diagram opposite). This can be done, for example, via a manual switch (accessory), pushbutton or relay contacts.



In the case of active control, connect the inputs to the cylinder voltage, for example. The low "high" level also allows control with a 3.3V controller.

Pin 10
Violet (VT)

Input 2

Pin 11
Gray-Pink
(GYPK)

Input 1

Configuration

- **[Input 1]** Retract
- **[Input 2]** Extend
- **[Input 3]** No function defined

Specification

- U = 0 … 30Vdc*
- Level definition
  - **[high]** ≥ 3V*
  - **[low]** < 0.8V*
- Typical current consumption per input: 5mA

*Reference to "Input GND"

Continued on next page

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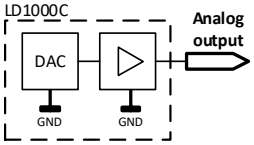
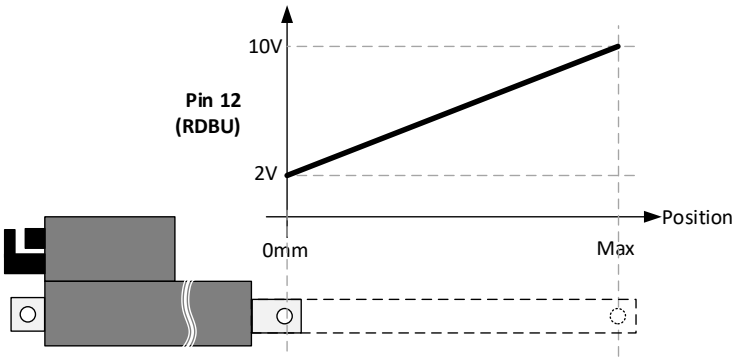
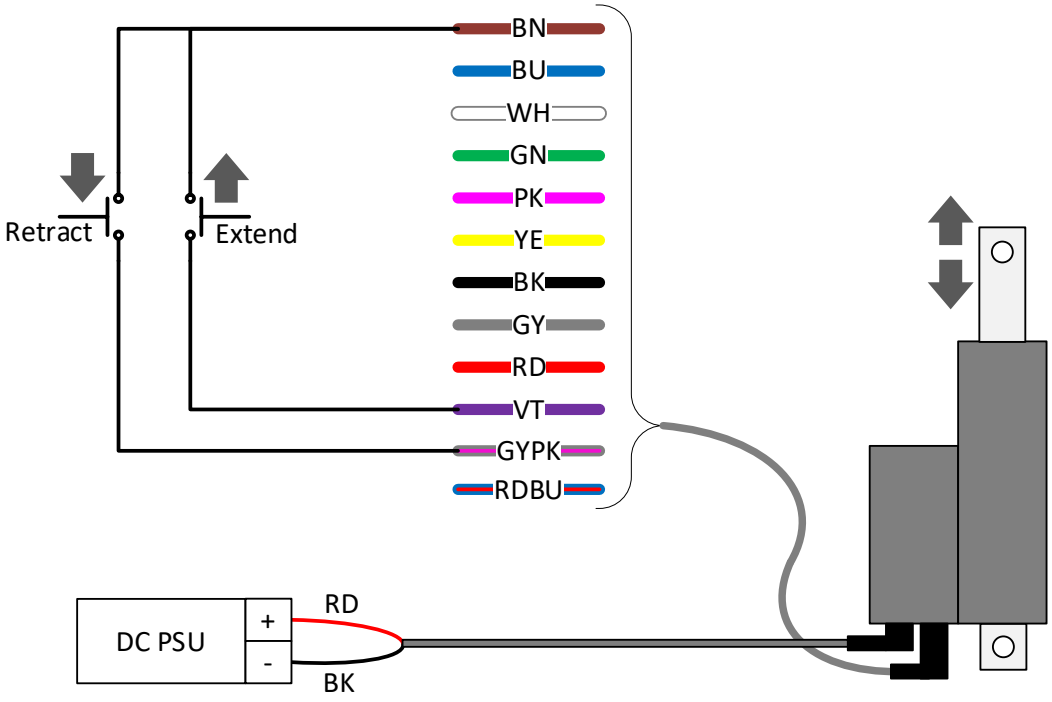
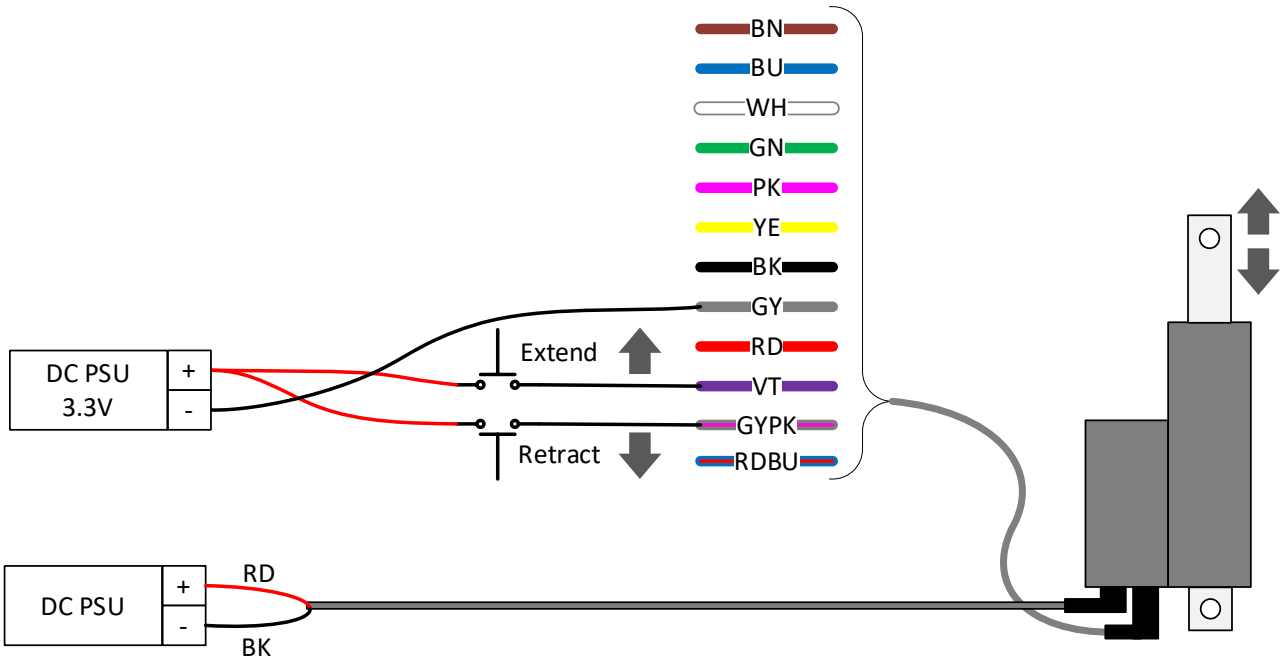
Pin 12 Red-Blue (RDBU)	**Output analog** (Position of the actor) The LD1000C generates a linear output voltage depending on the current position. Specification • Load R_L ≥ 1k Ω Output level for 12V cylinder • **[0.5V*]** Retracted position • **[4.5V*]** Extended position Output level for 24V cylinder • **[2V*]** Retracted position • **[10V*]** Extended position   *Reference to "Output GND"

Example

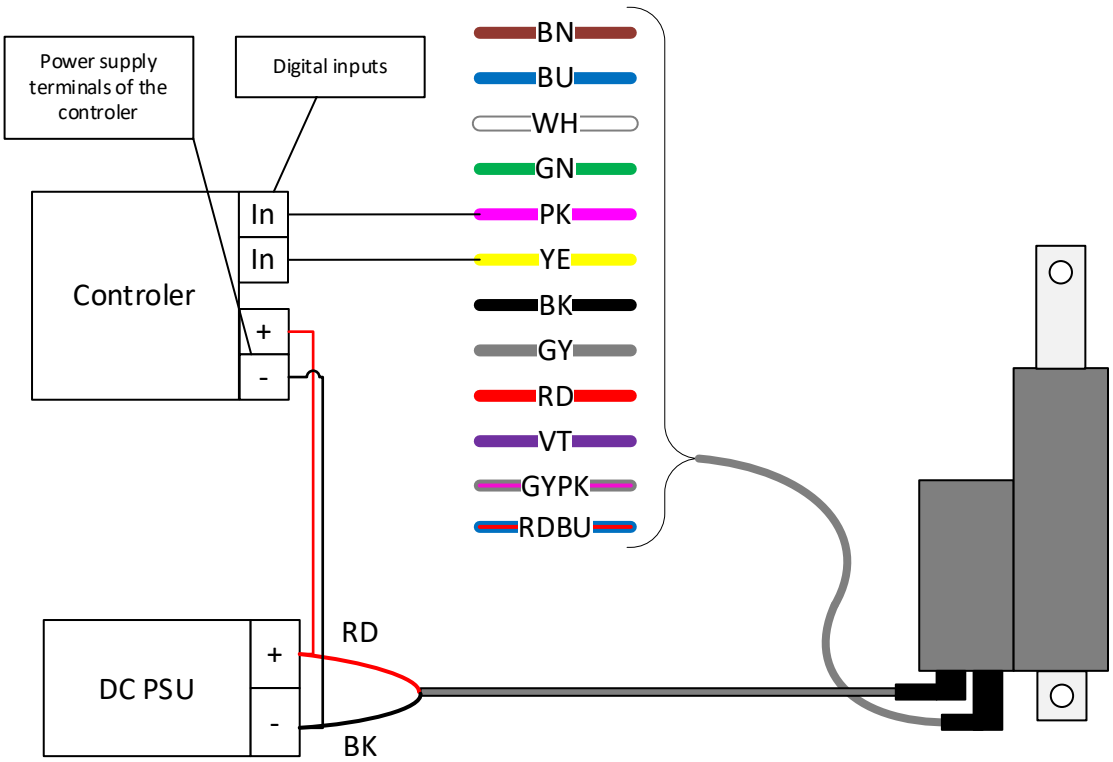
Connection example – drive – passive



Connection example – drive – active

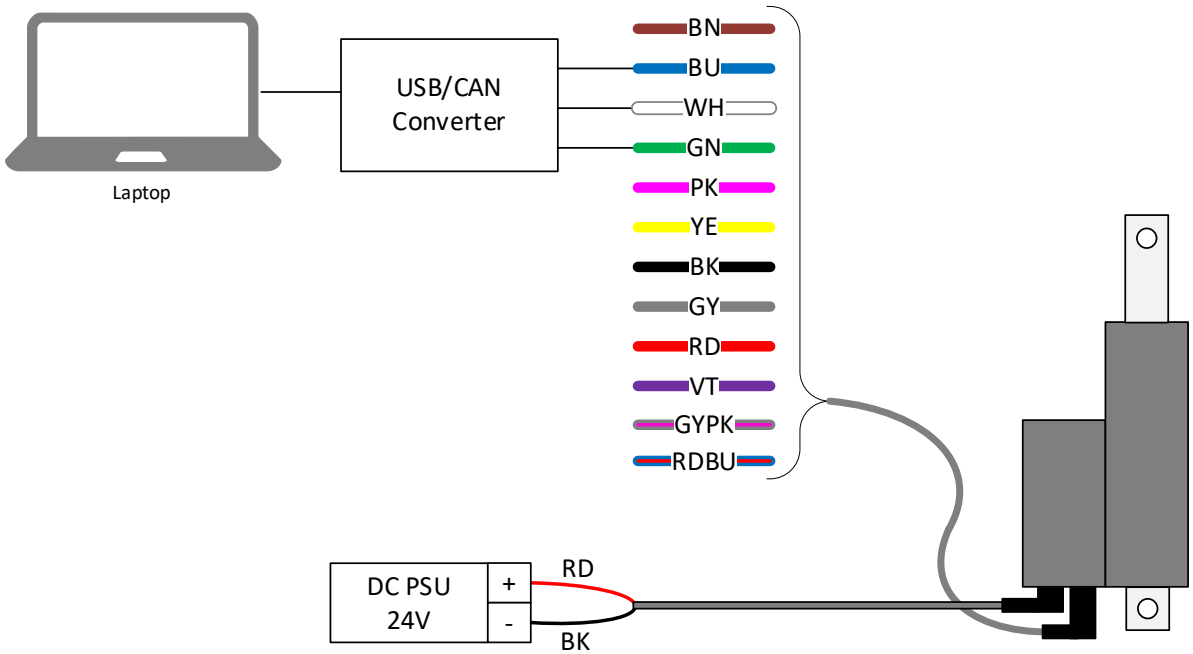


Connection example – Feedback signal

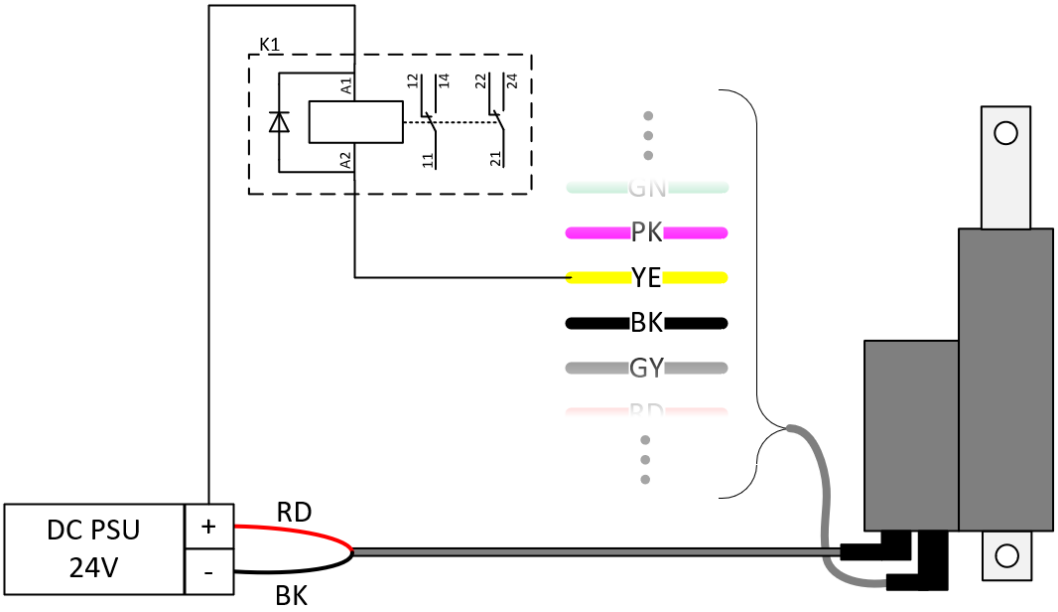


Note: The figure shows a usual application in which the control unit is connected to a central GND (minus), as is also the cylinder.

Connection example – CAN



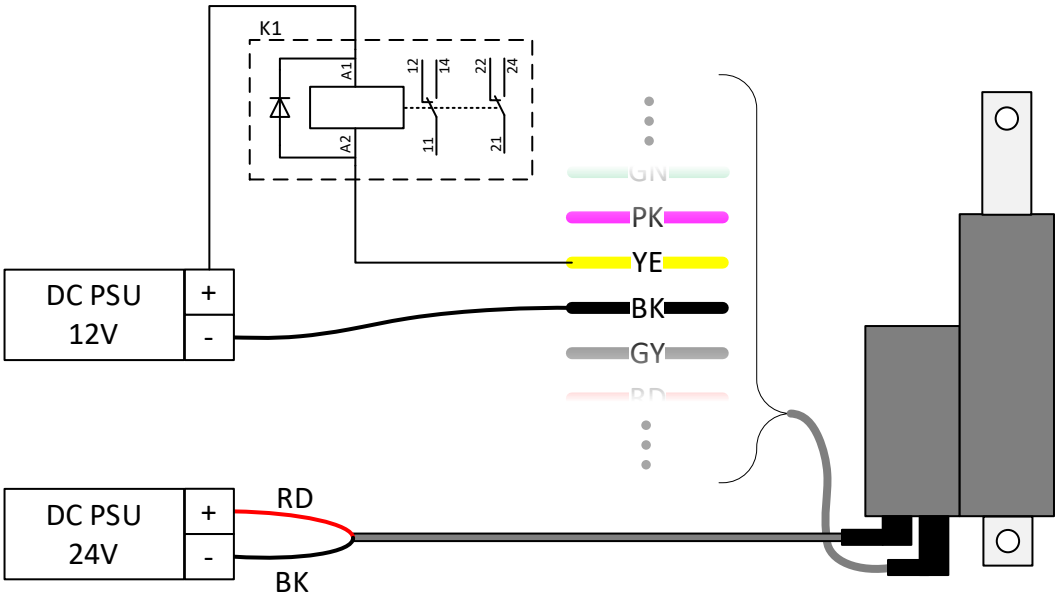
Connection example – Switch a relay



K1: Relay with integrated free-wheeling diode (Wago, 788-312)

Note: For a better overview, only one relay is shown at output 3.

Connection example – Relay with two galvanic isolated power supply units

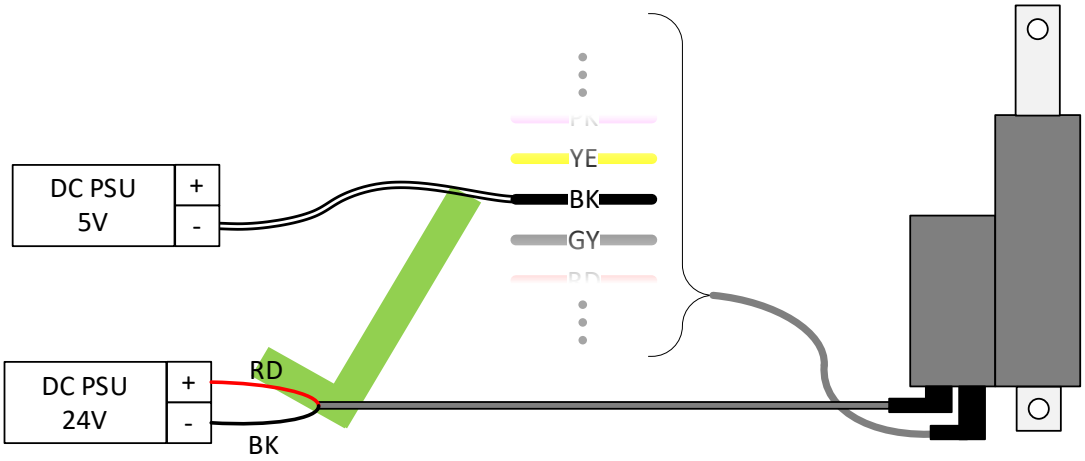


K1: Relay with integrated free-wheeling diode (Wago, 788-312)

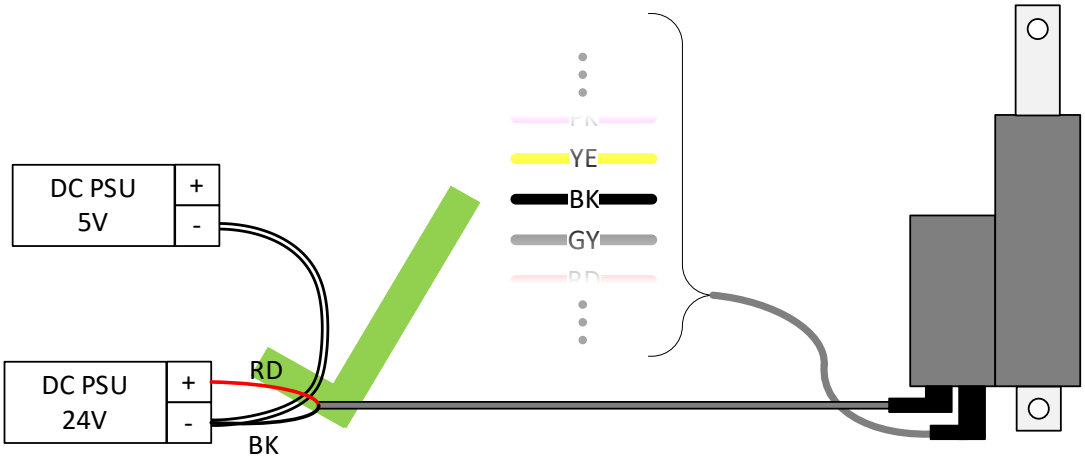
Note: For a better overview, only one relay is shown at output 3.

Output Ground (GND) Concepts

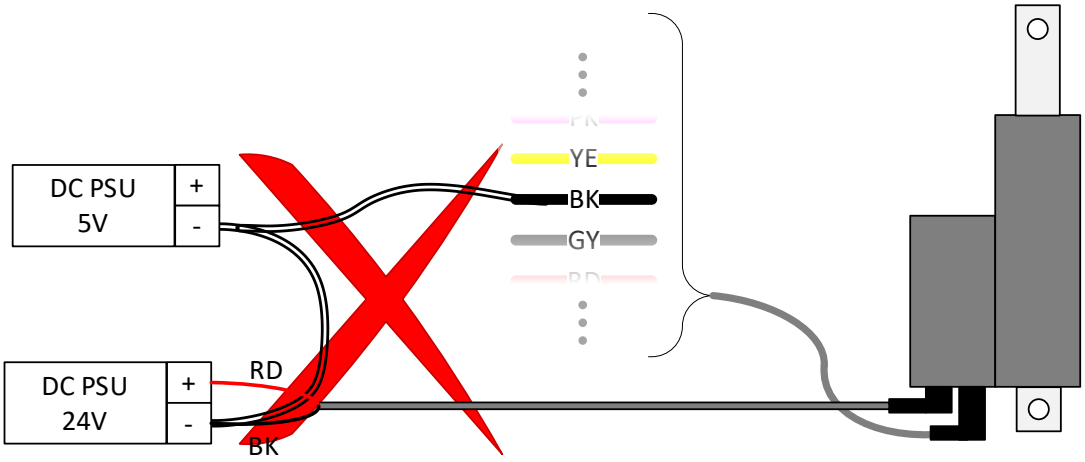
GND concept with two separate power supplies



GND concept with two power supplies and common GND



GND concept not permitted

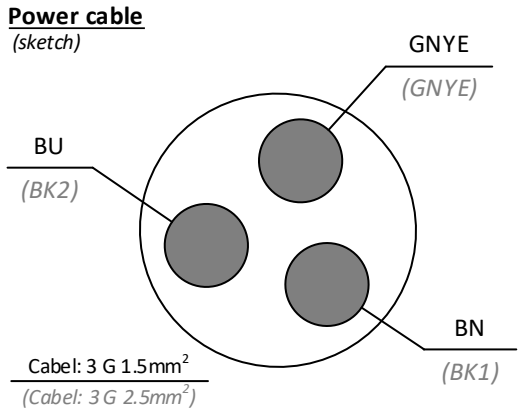


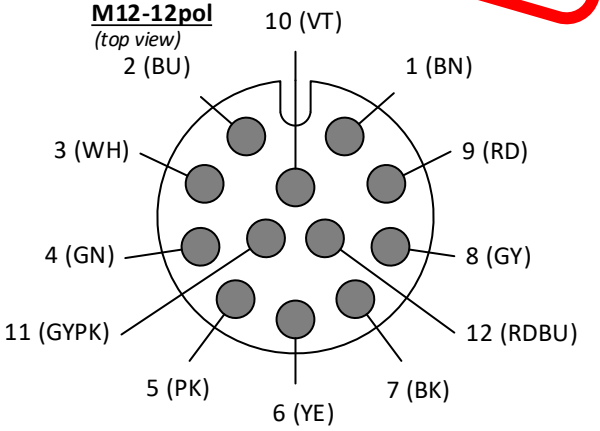
PHOENIX MECANO

Connection AP.4.017913

Not recommended for new projects

Pin / wire assignment



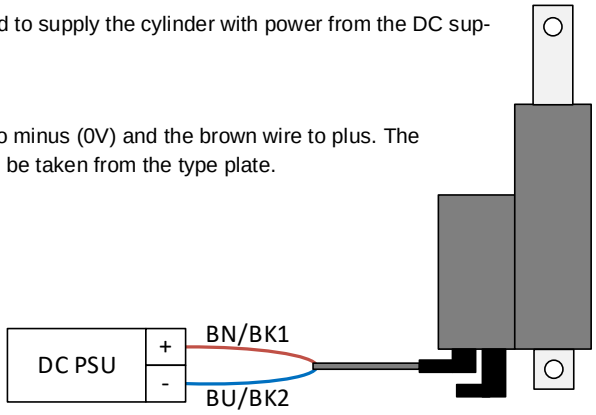


Plug or wire version

Wire assignment power (3-pole)

***** Supply voltage *****

Pwr

Pin	*Description*	
1.5mm²: **Green-Yellow** (GNYE) 2.5mm²: **Green-Yellow** (GNYE)	**Do not connect**	**V C supply voltage** The power cable is used to supply the cylinder with power from the DC supply voltage (DC PSU). **Wiring with 1.5mm²** Connect the blue wire to minus (0V) and the brown wire to plus. The permissible voltage can be taken from the type plate.  **Wiring with 2.5mm²** Connect black wire 2 (BK2) to minus (0V) and black wire 1 (BK1) to plus. The permissible voltage can be taken from the type plate. **Attention** Incorrect connection can cause permanent damage to the actuator!
1.5mm²: **Brown** (BN) 2.5mm²: **Black 1** (BK1)	**DC power supply**	
1.5mm²: **Blue** (BU) 2.5mm²: **Black 2** (BK2)		

Pin assignment M12 / wire assignment Signal (12-pole)

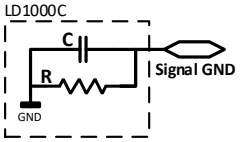
***** Communication & control wire *****

In

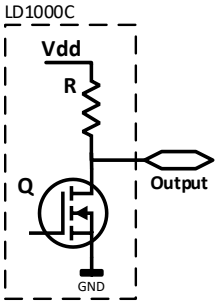
<table>
<tr><th>Pin</th><th colspan="2">Description</th></tr>
<tr><td>Pin 1
Brown (BN)</td><td colspan="2">Voltage output
Fused supply voltage for switching the digital inputs on this plug. Any other use is not permitted.</td></tr>
<tr><td>Pin 2
Blue (BU)</td><td>Signal GND</td><td rowspan="3">CAN communication interface
Interface for control, query, update and parameterization of the cylinder.

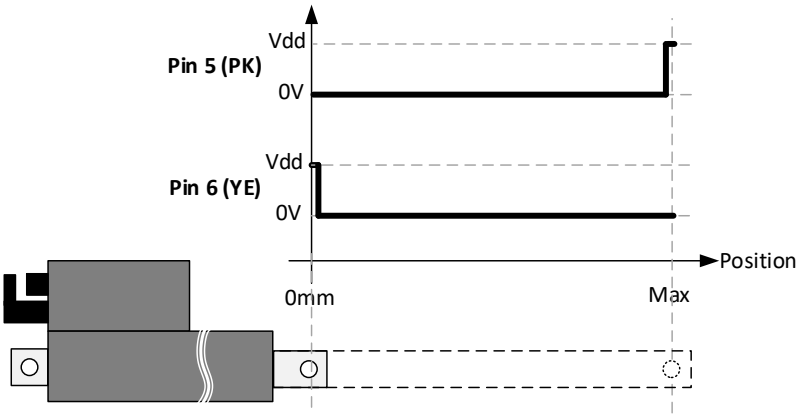
Signal GND is capacitively and ohmically coupled with the GND of the cylinder to avoid critical cross currents.

Note: Ensure an identical GND potential for all CAN BUS nodes.

 
</td></tr>
<tr><td>Pin 3
White (WH)</td><td>CAN high</td></tr>
<tr><td>Pin 4
Green (GN)</td><td>CAN low</td></tr>
<tr><td>Pin 5
Pink (PK)</td><td>Output 4</td><td rowspan="2">Digital outputs
The actuator indicates when the retracted and extended end positions have been reached with a separate pin each.
The output is designed for switching small loads such as relays, magnetic valves or signal lamps. The internal resistor R is connected to the cylinder supply voltage Vdd (e.g. 24V) and allows for example the direct operation of common signal LEDs without separate series resistor.
Specification
• R = 2.4k Ω
• V_{DS} = 0…30 V_{DC}
• I_{DS} = 0…300m A

Definition
• Output 3 Retracted
• Output 4 Extended

 
</td></tr>
<tr><td>Pin 6
Yellow (YE)</td><td>Output 3</td></tr>
<tr><td colspan="3">Continued on next page</td></tr>
</table>

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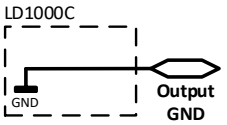
Pin 7
Black (BK)

Output GND
Common zero potential of the outputs (see pin 5 and 6).

Do not connect the wire to the minus of the cylinder supply voltage (see M12power, pin 4). The cylinder could be damaged by the cross currents that can occur.

This line is necessary only if the control unit has a galvanically isolated supply to the cylinder.

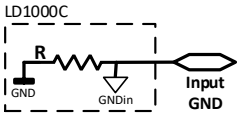


Pin 8
Grey (GY)

Input GND
Common zero potential of the inputs.

Connecting this wire is recommended at input voltage levels below 5V. Therefore, the voltage drop on the negative wire (M12power, pin 4) has an nearly insignificant impact on the input signal.

Connection of this wire to a control unit galvanically isolated from the LD1000 supply voltage (M12power) is required.

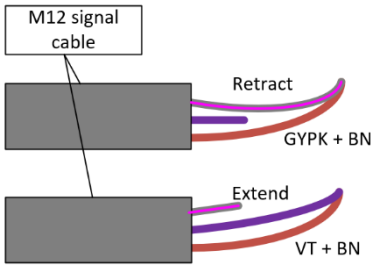


Pin 9
Red (RD)

Input 3

Digital Inputs
The digital inputs allow you to extend and retract the actuator, as well as to select other operating modes (see assembly instructions).

The actuator allows passive and active control. For passive control, connect the brown wire (pin 1) to the corresponding input (see diagram opposite). This can be done, for example, via a manual switch (accessory), pushbutton or relay contacts.



In the case of active control, connect the inputs to the cylinder voltage, for example. The low "high" level also allows control with a 3.3V controller.

Pin 10
Violet (VT)

Input 2

Pin 11
Gray-Pink
(GYPK)

Input 1

Configuration

- **[Input 1]** Retract
- **[Input 2]** Extend
- **[Input 3]** No function defined

Specification

- U = 0 … 30Vdc*
- Level definition
  - **[high]** ≥ 3V*
  - **[low]** < 0.8V*
- Typical current consumption per input: 5mA

*Reference to "Input GND"

Continued on next page

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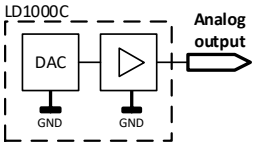
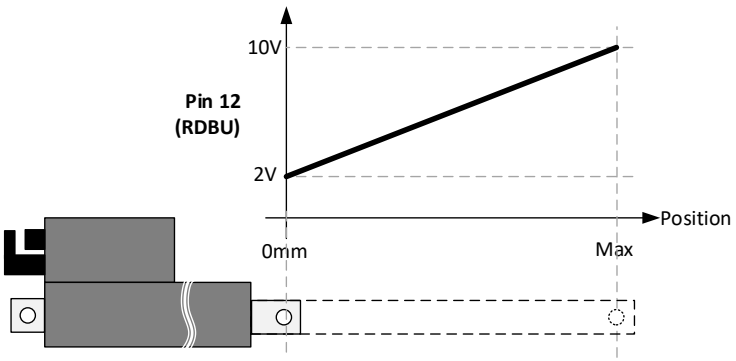
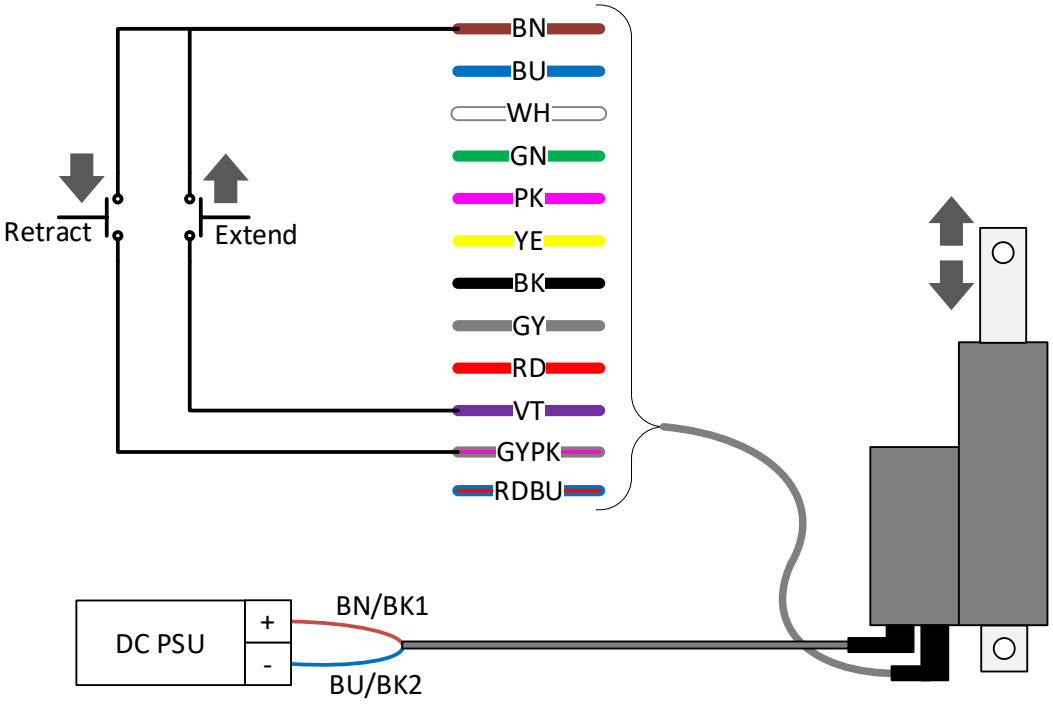
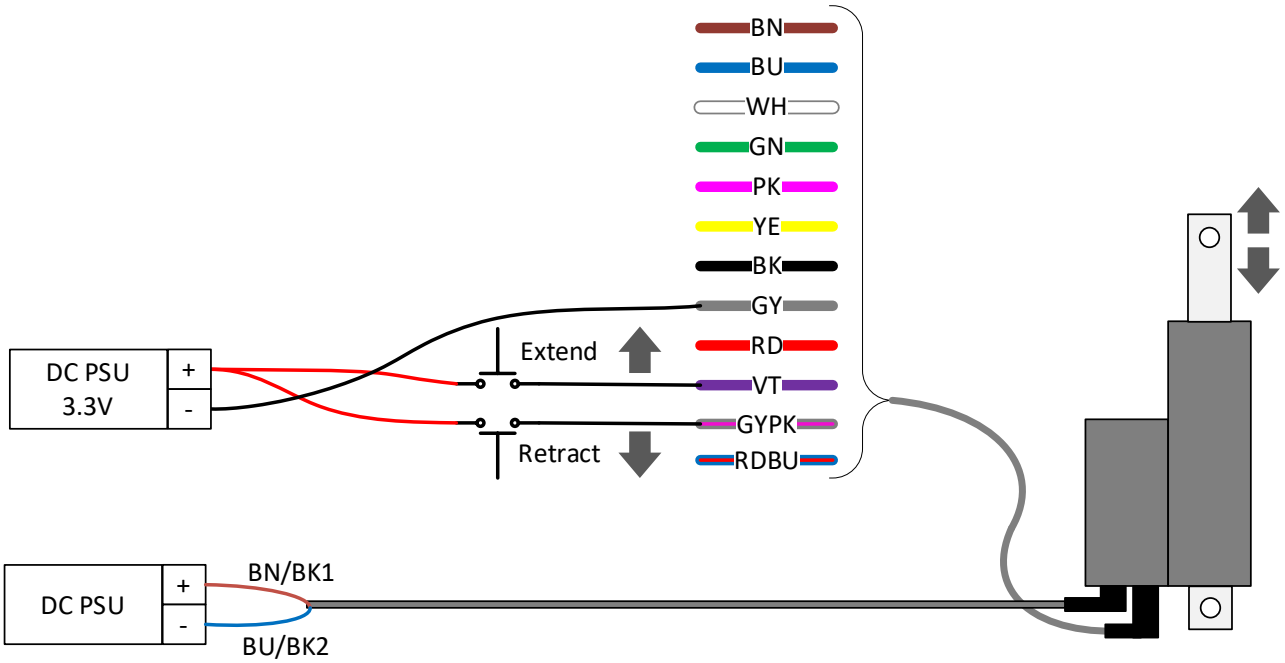
Pin 12 Red-Blue (RDBU)	**Output analog** (Position of the actor) The LD1000C generates a linear output voltage depending on the current position. Specification • Load R_L ≥ 1k Ω Output level for 12V cylinder • **[0.5V*]** Retracted position • **[4.5V*]** Extended position Output level for 24V cylinder • **[2V*]** Retracted position • **[10V*]** Extended position   *Reference to "Output GND"

Example

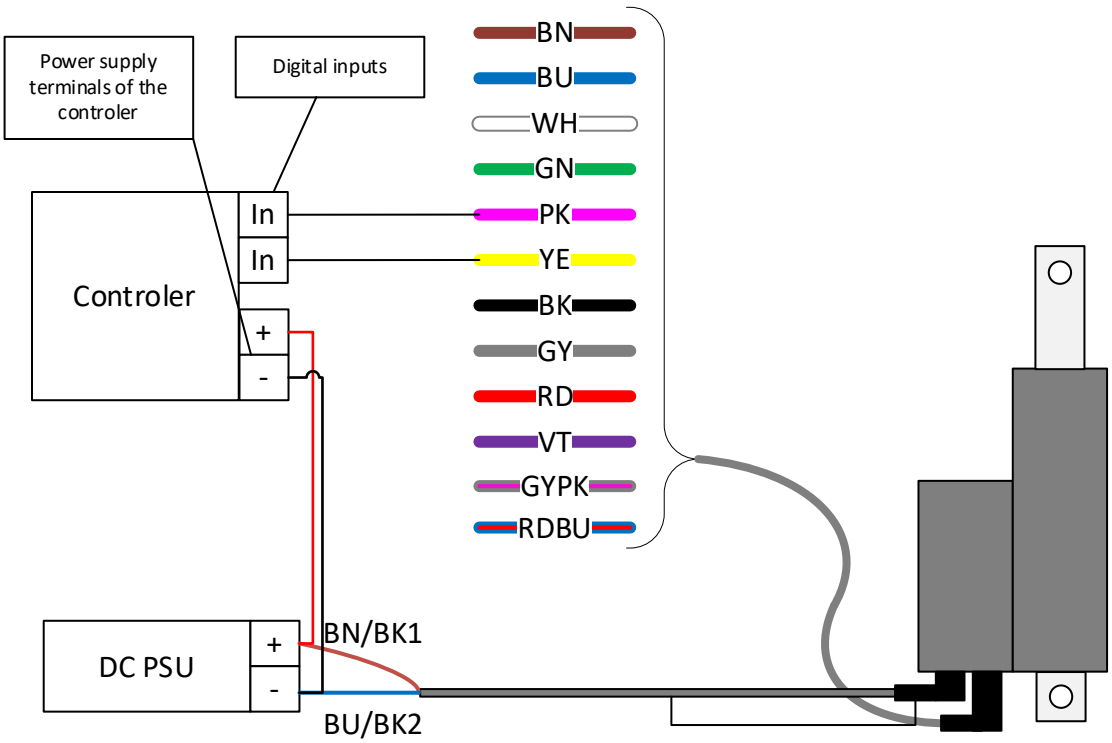
Connection example – drive – passive



Connection example – drive – active

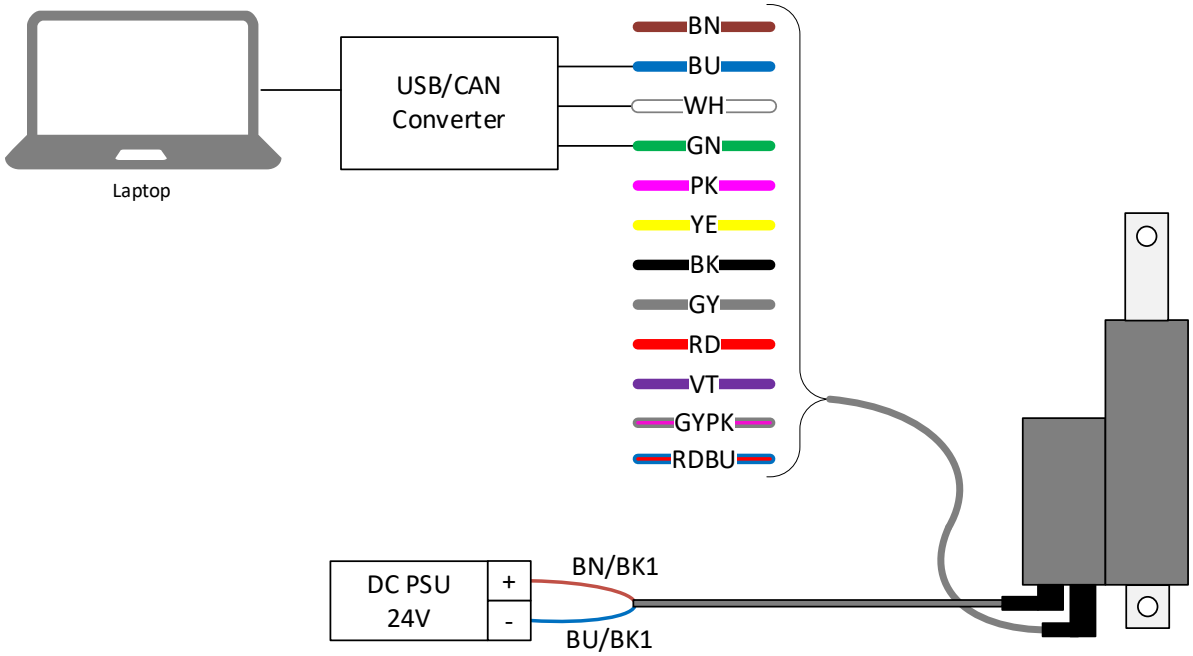


Connection example – Feedback signal

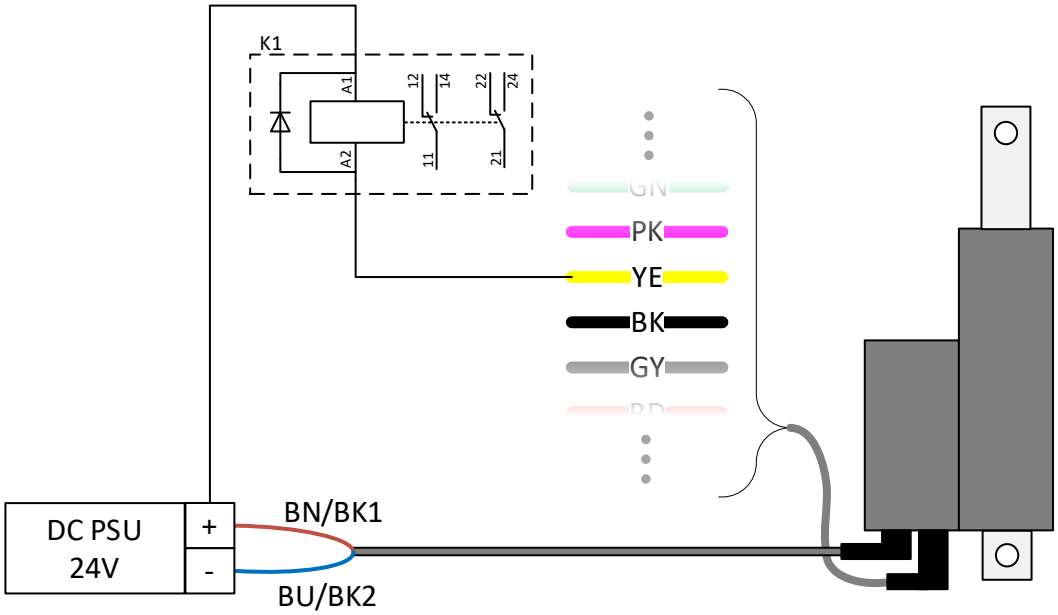


Note: The figure shows a usual application in which the control unit is connected to a central GND (minus), as is also the cylinder.

Connection example – CAN



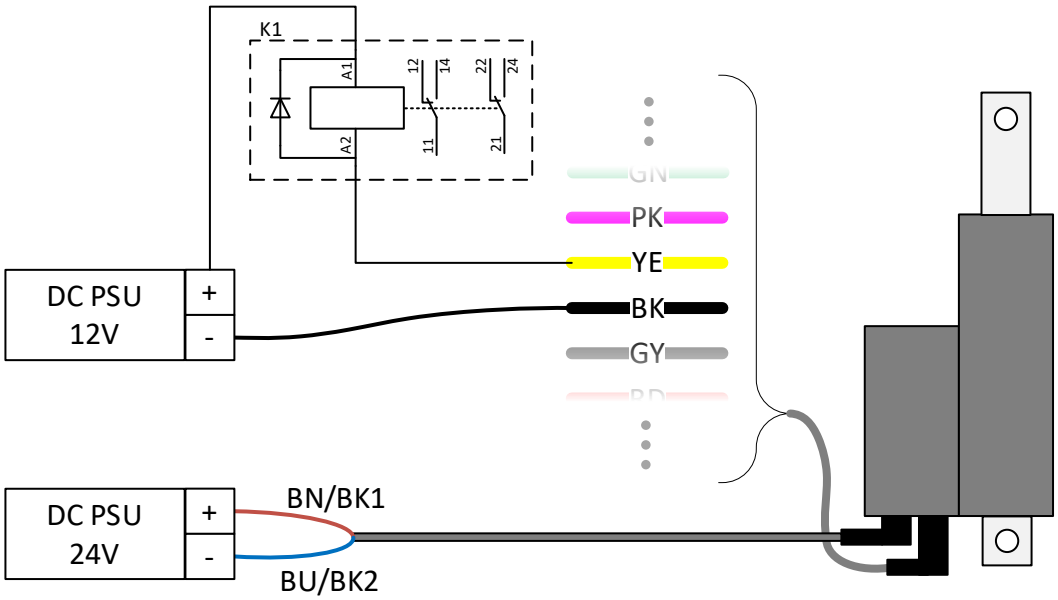
Connection example – Switch a relay



K1: Relay with integrated free-wheeling diode (Wago, 788-312)

Note: For a better overview, only one relay is shown at output 3.

Connection example – Relay with two galvanic isolated power supply units



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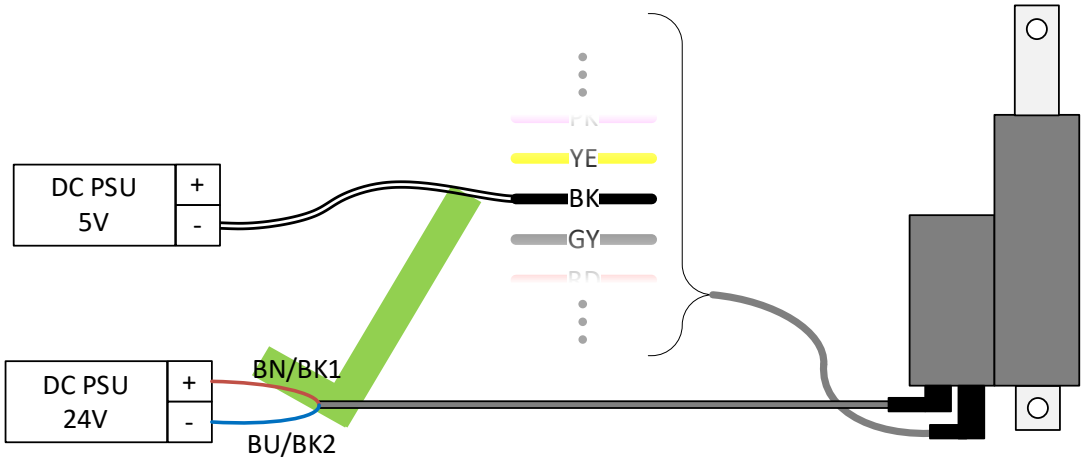
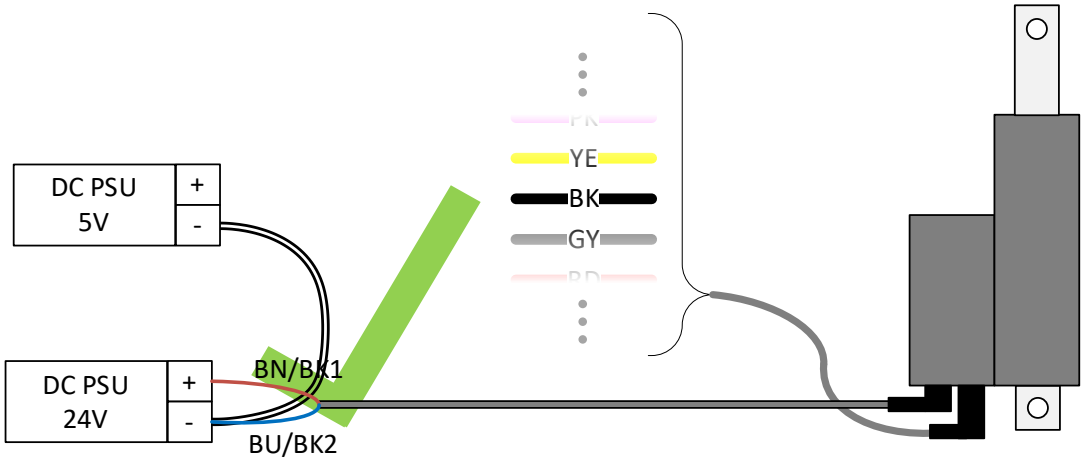
Note: For a better overview, only one relay is shown at output 3.

Output Ground (GND) Concepts

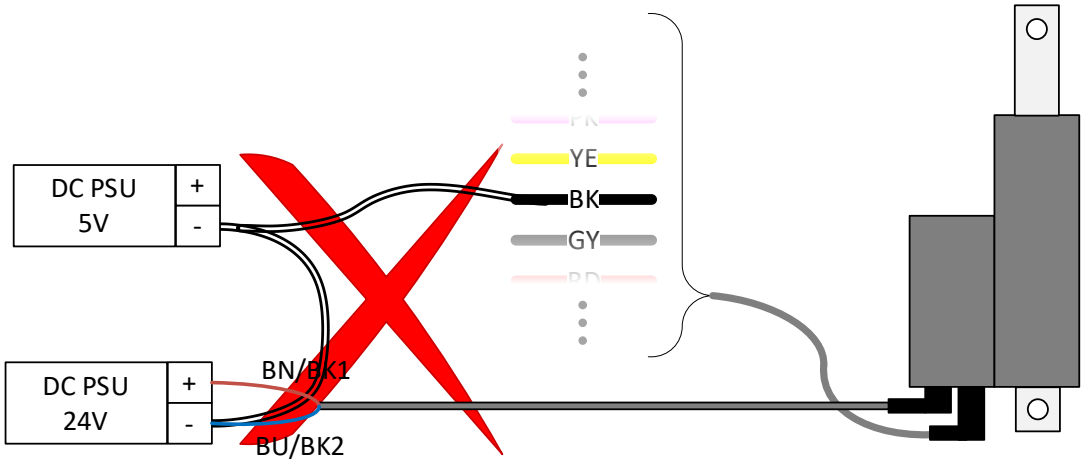
GND concept with two separate power supplies



GND concept with two power supplies and common GND

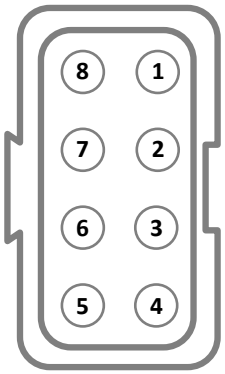


GND concept not permitted



Connection plan AP.4.018886

Pin assignment



Contacts

Pin 1 & 2: Amphenol AT60-16-0122 (Nickel)

Pin 3 – 8: Amphenol AT60-16-0822 (Nickel)

Amphenol AT04-08PB

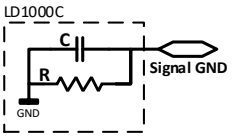
(Front view)

Pin assignment Amphenol AT04-08PB

AT04-08PB

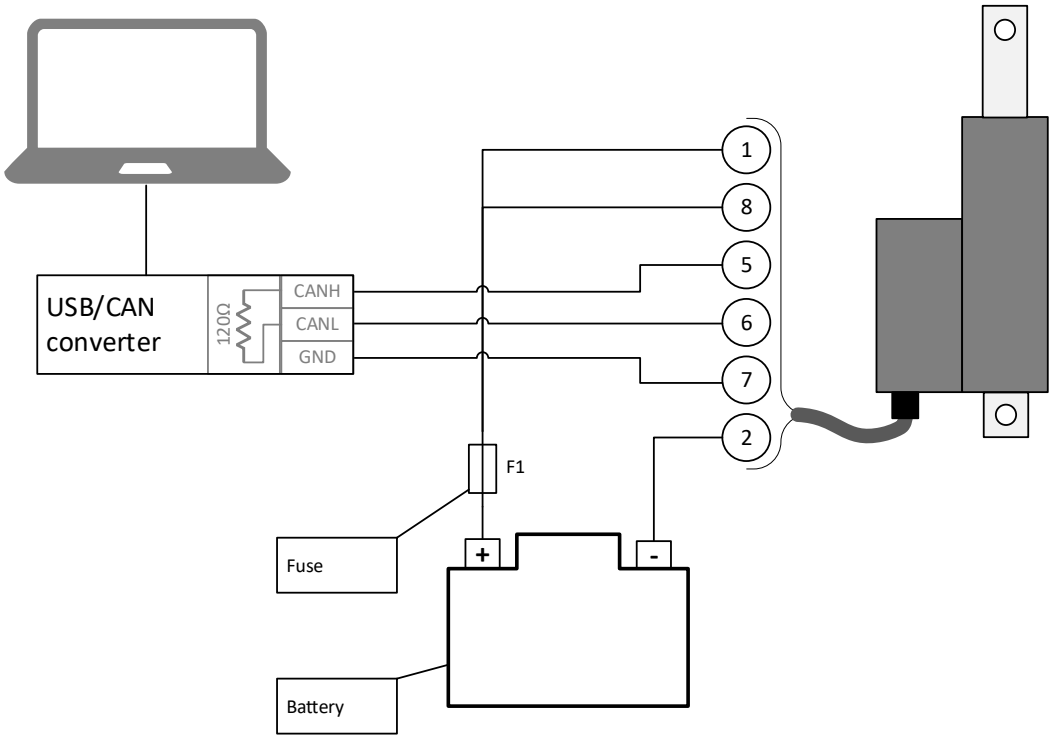
Pin	*Description*	
Pin 1 Brown (BN)	**Power supply motor**	Positive supply voltage for the motor. The voltage can be switched off at standstill. **Note:** Switching off the voltage while driving is not permitted.
Pin 2 Blue (BU)	**Power supply ground/minus**	Common ground cable for the supply voltage of the motor and the controller.

Pin 3
Gray (GY)
	Input 1 (Manual IN)	**Digital inputs**
		
		<u>Standard configuration</u>
		• **[Input 1]** Retract
		• **[Input 2]** Extend
		
		<u>Specification</u>
		• U = 0 … 30Vdc
		• Level definition
		  ○ **[high]** ≥ 3V*
		  ○ **[low]** < 0.8V*
		• Typical current consumption per input: 5mA
		
		*Reference to the internal „Power supply ground/minus“

Pin 4 Yellow (YE)	**Input 2 (Manual OUT)**	
Pin 5 White (WH)	**CAN high**	**CAN communication interface** Interface for control, query, update, and parameterization of the linear drive. Signal GND is capacitively and ohmically coupled with the GND of the linear drive. **Note:** Ensure an identical GND potential for all CAN BUS nodes. 
Pin 6 Green (GN)	**CAN low**	
Pin 7 Black (BK)	**Signal GND**	
Pin 8 Red (RD)	**Power supply electronic**	Supply voltage for the controller and the communication interface. **Note:** Switching off the voltage while driving is not permitted.

Example

Connection Example - CAN



Warning: The two power supplies “Power supply motor” and “Power supply electronic” must be activated before a drive command and cannot be deactivated during the drive.

Connection example – drive – active