# Rotary loader
# DRL

## Assembly and operating manual

# Imprint



**Technical changes:**
We reserve the right to make alterations for the purpose of technical improvement.

**Document number:** 389528

**Edition:** 04-A |03/12/2018|en



Dear customer,

congratulations on choosing a SCHUNK product. By choosing SCHUNK, you have opted for the highest precision, top quality and best service.

You are going to increase the process reliability of your production and achieve best machining results – to the customer's complete satisfaction.

SCHUNK products are inspiring.

Our detailed assembly and operation manual will support you.

Do you have further questions? You may contact us at any time – even after purchase.

Kindest Regards

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Reg. No. 003496 QM08

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# Table of contents

# 1 About this manual

This instruction is an integral part of the product and contains important information for a safe and proper assembly, commissioning, operation, maintenance and help for easier trouble shooting.

Before using the product, read and note the instructions, especially the chapter "Basic safety notes".

## 1.1 Warnings

To make risks clear, the following signal words and symbols are used for safety notes.

**DANGER**

**Danger for persons.**
Non-compliance will inevitably cause irreversible injury or death.

**WARNING**

**Dangers for persons.**
Ignoring a safety note like this can lead to irreversible injury and even death.

**CAUTION**

**Dangers for persons.**
Non-observance can cause minor injuries.

***NOTICE***

**Material damage**
Information about avoiding material damage.

## 1.2 Applicable documents

- General terms of business
- Catalog data sheet of the purchased product
- Assembly and Operating manuals of the accessories

The documents listed here, can be downloaded on our homepage **www.schunk.com**

# 2 Basic safety notes

## 2.1 Intended use

This module has been designed for the reliable pivoting of workpieces or other objects.

The product is intended for installation in a machine/system. The requirements of the applicable guidelines must be observed and complied with.

The product may be used only in the context of its defined application parameters (☞ 6, Page 13).

The product is designed for industrial use.

To use this unit as intended, it is also essential to observe the technical data and installation and operation notes in this manual and to comply with the maintenance intervals.

## 2.2 Not intended use

Use which is not specified as an intended use is for instance when the product is for example used as a pressing tool, stamping tool, lifting tool, guide for tools, cutting tool, tensioning mean, boring tool.

## 2.3 Environmental and operating conditions

- Make sure, that the product may be used only in the context of its defined application parameters (☞ 6, Page 13).
- Observe Maintenance and lubrication intervals (☞ 10.1, Page 56).
- Make sure that the environment is free from splash water and vapors as well as from abrasion or processing dust. Exceptions are products that are designed especially for contaminated environments.
- Make sure that the product is not exposed to excessive vibrations and/or strokes.
- Make sure that no strong magnetic fields affect the function of the product.
  Please contact your SCHUNK contact person, if the product should be used in high magnetic fields!

## 2.4 Product safety

Dangers arise from the product, if:

- the product is not used in accordance with its intended purpose.
- the product is not installed or maintained properly.
- the safety and installation notes are not observed.

Avoid any manner of working that may interfere with the function and operational safety of the product.

Wear protective equipment.

**NOTE**
More information are contained in the relevant chapters.

### 2.4.1 Protective equipment

Provide protective equipment per EC Machinery Directive.

### 2.4.2 Constructional changes, attachments, or modifications

Additional drill holes, threads, or attachments that are not offered as accessories by SCHUNK may be attached only with permission of SCHUNK.

## 2.5 Personnel qualification

The assembly, initial commissioning, maintenance, and repair of the product may be performed only by trained specialist personnel. Every person called upon by the operator to work on the product must have read and understood the complete assembly and operating manual, especially the chapter "Basic safety notes" (☞ 2, Page 6). This applies particularly to personnel only used occasionally, such as maintenance personnel.

## 2.6 Using personal protective equipment

When using this product, observe the relevant industrial safety regulations and use the personal protective equipment (PPE) required!

- Use protective gloves, safety shoes and safety goggles.
- Observe safe distances.
- Minimal safety requirements for the use of equipment.

## 2.7 Notes on particular risks

**Generally valid:**

- Remove the energy supplies before installation, modification, maintenance, or adjustment work.
- Make sure that no residual energy remains in the system.
- Do not move parts by hand when the energy supply is connected.
- Do not reach into the open mechanism or the movement area of the unit.
- Perform maintenance, modifications, and additions outside the danger zone.
- Secure the product during all operations against uncontrolled activation.
- Take a precautionary approach by maintenance and disassembly.
- Only specially trained staff should disassemble the product.

**⚠ WARNING**

**Risk of injury from objects falling and being ejected**

- The danger zone must be surrounded by a safety fence during operation.

**⚠ WARNING**

**Risk of injury due to rotating components!**

**⚠ WARNING**

**Danger of crushing and impacts when moving the unit or attachments!**
Risk of injury due to attachments breaking or becoming loose!

**⚠ WARNING**

**Risk of injury possible due to residual energy in the attachments.**
Uncontrolled movement of individual module components possible during disassembly!

- Before removing from service, ensure that no residual energy is still in the system.

# 3 Warranty

If the product is used as intended, the warranty is valid for 24 months from the date of delivery from the production facility under the following conditions:

- Observe the mandatory maintenance and lubrication intervals
- Observe the environmental and operating conditions

Parts touching the work piece and wear parts are not part of the warranty.

# 4 Scope of delivery

The scope of delivery includes

- Rotary loader DRL 20, DRL 25 in the ordered model.
- 4x Sensors
- Accessory pack

# 5 Accessories

The following accessories, which are to be ordered separately, are available for the module:

- Sensors
- Lever control
- Energy hose mounting kit
- Angular adapter mounting kit

For information about which accessories can be used with the appropriate product version ☞ catalog.

## 5.1 Sensors

The **MMS** sensor can be used for the sensory monitoring of the position of the swivel arm during the rotary movement.

- Exact type designation of the compatible sensors see ☞ catalog.
- If you require information on sensor operation, contact your SCHUNK contact person or download information from our homepage. www.schunk.com

## 5.2 Lever control

***NOTICE***

**Damage to the rod lock due to incorrect actuation / overload!**

- The rod lock may only be triggered and unlocked when the module has been shut down or is in its waiting position.
- Observe the specifications for the static holding force. The forces occurring in a clamped condition must not exceed the holding force.
- In the event of a dynamic load or overload (e.g. drop in pressure during movement), the clamping cartridge must be checked and replaced if necessary

**⚠ WARNING**

**The rod lock is not a safety component for personal protection in the sense of the Machine Directive.**

Lock to prevent the lowering of the useful load from the waiting position in the event of a pressure loss.

| Designation | ID number |
|---|---|
| ASP-D020 rod lock | 0314767 |
| ASP-D025 rod lock | 0314764 |

## 5.3 Energy hose mounting kit

Guidance of the energy and sensor lines from the base body to the swivel arm.

Supplied parts:

- Mounting material

| Designation | ID number |
|---|---|
| Energy hose mounting kit AS-DRL 020-ES | 0314765 |
| Energy hose mounting kit AS-DRL 025-ES | 0314762 |

## 5.4 Angular adapter mounting kit

For the application of the rotary loader as a stroke/rotary actuator.

Supplied parts:

- Mounting material

| Designation | ID number |
|---|---|
| Angular adapter mounting kit AS-DRL 020-WA | 0314766 |
| Angular adapter mounting kit AS-DRL 025-WA | 0314763 |

# 6 Technical data

## 6.1 Module

| Size | DRL 020-W 090 | DRL 020-W 180 | DRL 025-W 090 | DRL 025-W 180 |
|---|---|---|---|---|
| Overall vertical stroke [mm] | 33 | | 40 | |
| Linear vertical stroke [mm] | 18 | | 20 | |
| Max. vertical stroke adjustment [mm] | 10 | | 10 | |
| Standard swivel stroke [°]* | 90 | 180 | 90 | 180 |
| Max. rotating angle adjustment per side [°] | ± 2 | | ± 2 | |
| Min. cycle time | "Cycle times / load" (☞ 6.3, Page 15) | | | |
| Max. load | "Cycle times / load" (☞ 6.3, Page 15) | | | |
| Max. number of cycles [rpm] | 63 | | 63 | |
| Noise emission [dB(A)] | | | | |
| Pressure medium | Compressed air, compressed air quality according to ISO 8573-1:7 4 4 | | | |
| Min. pressure [bar] | 3 | | 3 | |
| Max. pressure [bar] | 6 | | 5 | |
| Nominal working pressure [bar] | 6 | | 5 | |

* Any number of swivel strokes of 90° to 180° possible. Consult a SCHUNK contact person.

More technical data are included in the catalog data sheet. Whichever is the latest version.

## 6.2 Rod lock, ASP

***NOTICE***

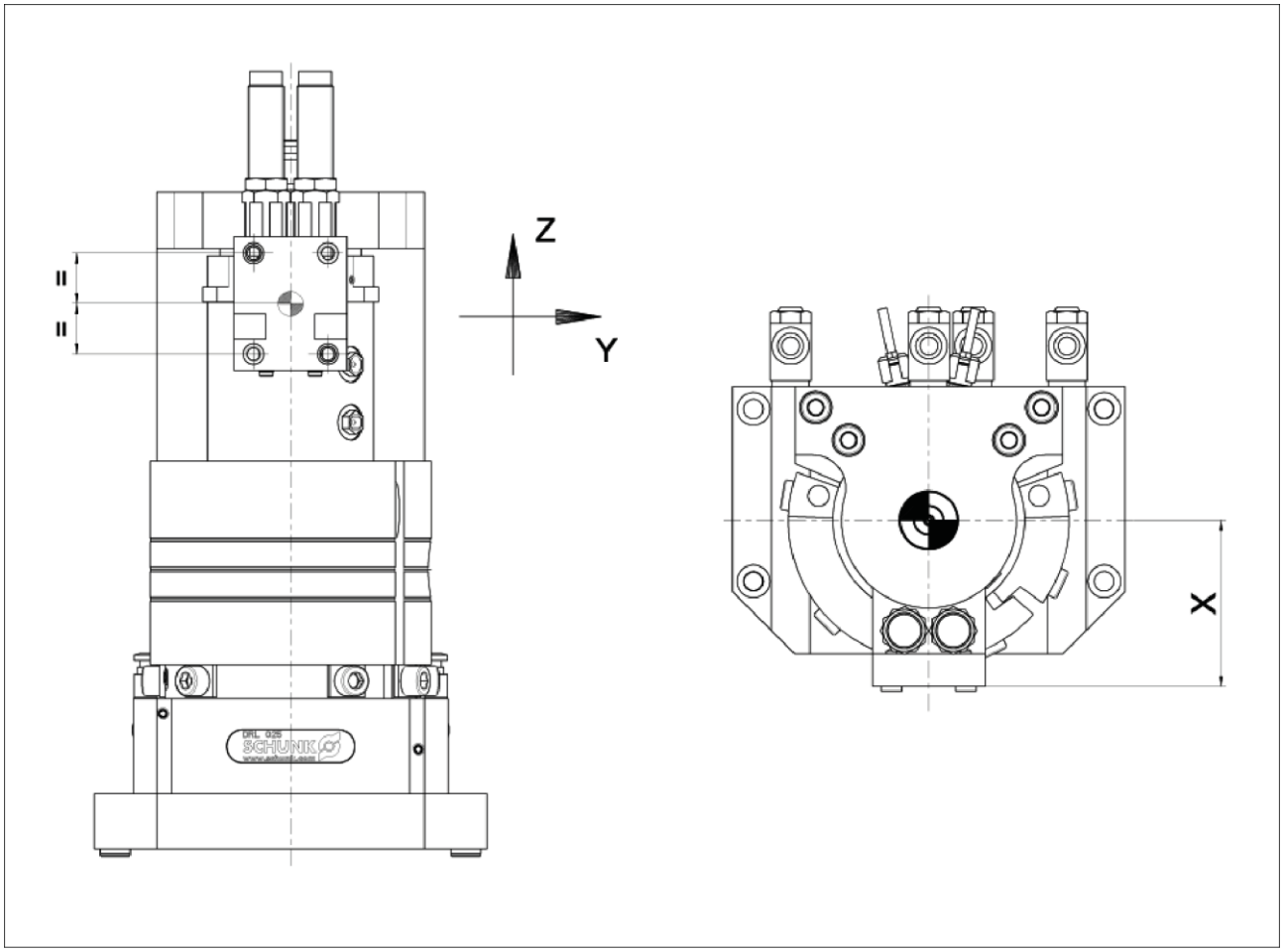
**Clamping in the operating cycle (braking) is not permitted.**
Increased wear up to total failure could be the result.

- The dynamic holding force must always be less than the static holding force.
- With the exception of a sudden pressure loss, clamping is only permitted in the waiting or end positions of the cylinder.
- If a pressure loss occurs (e.g. as a result of an emergency stop), continued use is only permitted after a subsequent functional test.

| Designation | DRL 20 | DRL 25 |
|---|---|---|
| Static holding force [N] | 80 | |
| Max. axial play of the clamping [mm] | 0.2 | |
| Min. release pressure [bar] | 3 | |
| Pneumatic connection | M5 | |

## 6.3 Cycle times / load

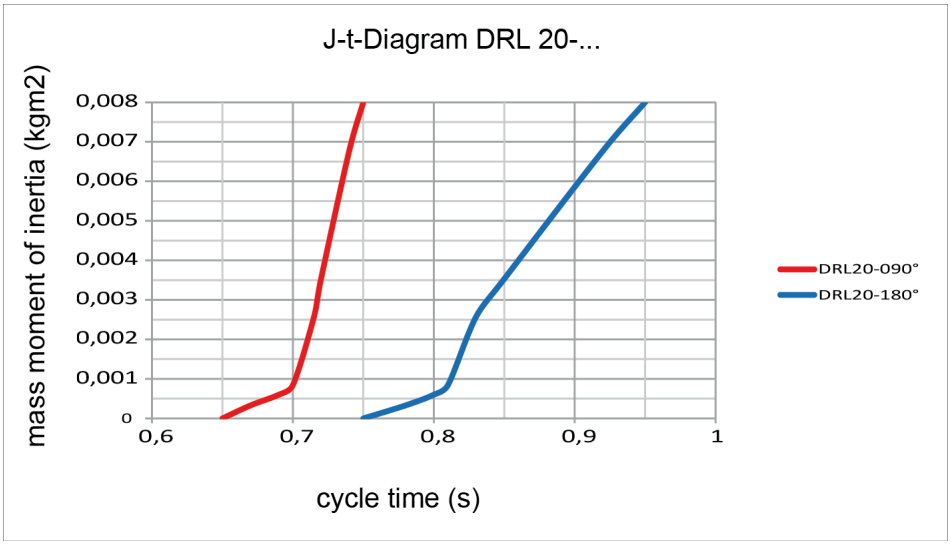
| | |
|---|---|
| | ***NOTICE*** |
| | **To determine the permissible cycle time t (the time t is specified purely as the travel time), the time for the available mass moment of inertia and the available mass must be determined using the following diagrams.**<br>• The higher value of the determined cycle time is decisive!<br>• Observe the maximum permissible number of cycles!<br>• Take into account any dwell times in the end positions for settings and measurements. |



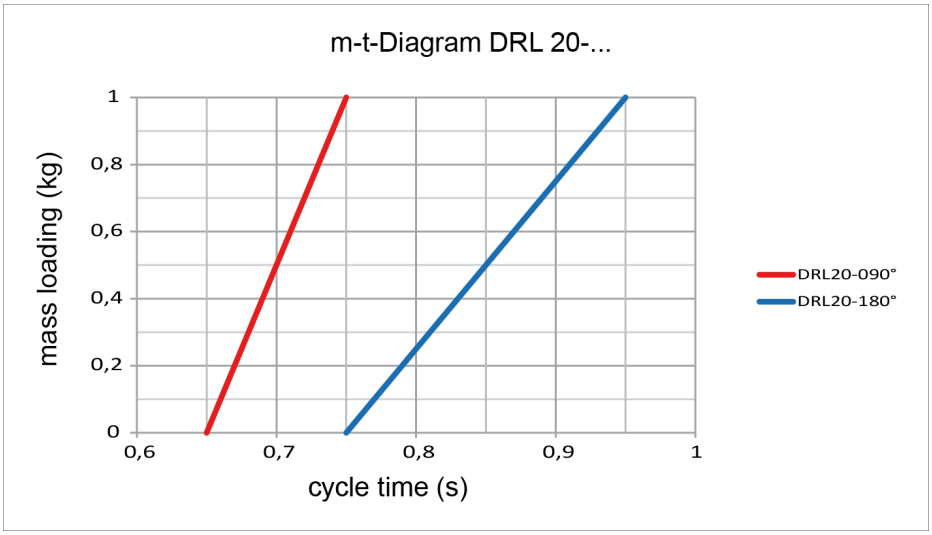

Reference point for mass moment of inertia

### 6.3.1 DRL20

Interpolate the values linearly for angles between 90° - 180°.



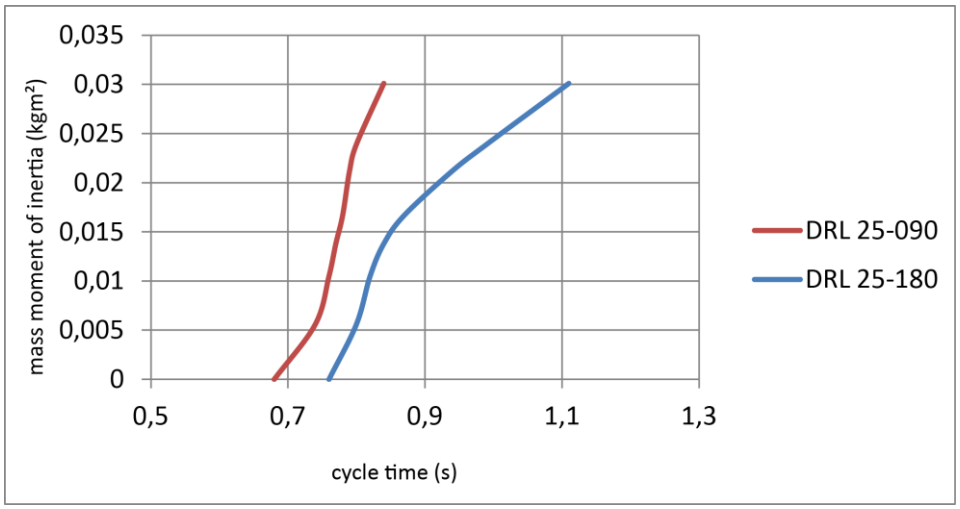

DRL20 mass moment of inertia cycle time



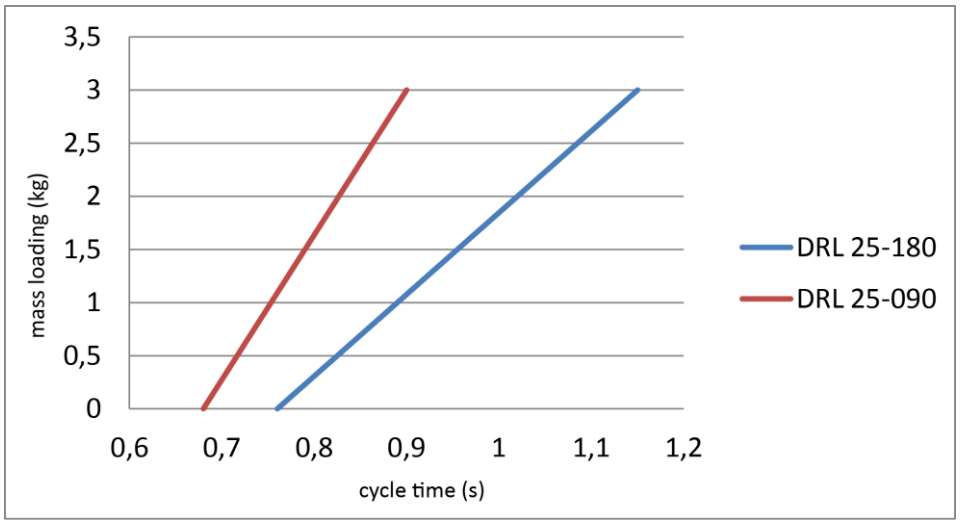

DRL20 mass cycle time

### 6.3.2 DRL25

Interpolate the values linearly for angles between 90° - 180°.

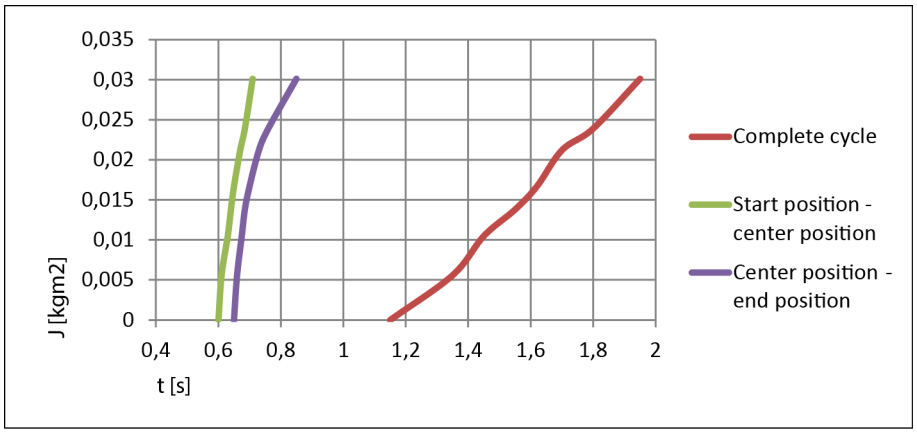



DRL025 mass moment of inertia cycle time

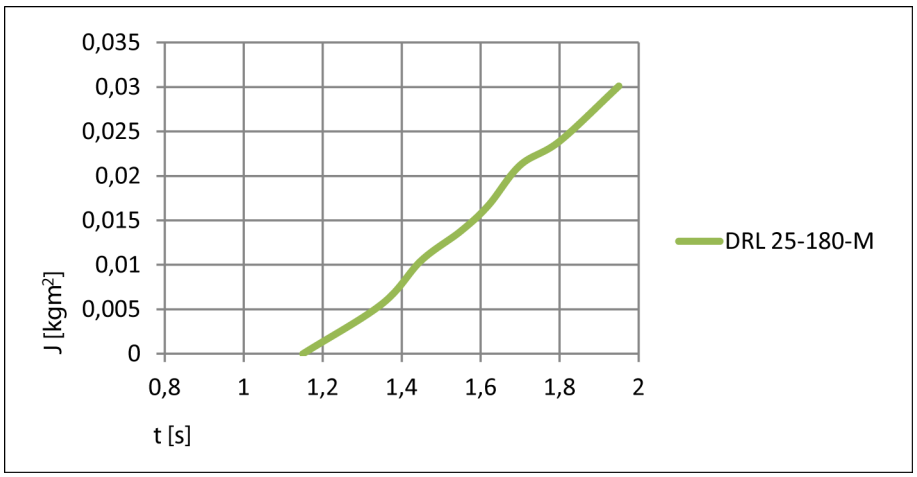



DRL025 mass cycle time

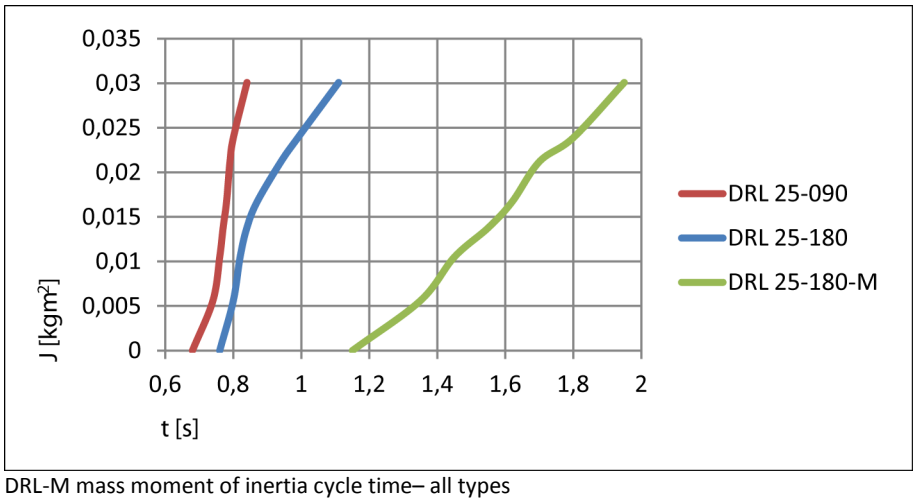
### 6.3.3 DRL-M




DRL-M mass moment of inertia cycle time – single times




DRL-M mass moment of inertia cycle time – complete cycle




DRL-M mass moment of inertia cycle time– all types

## 6.4 Valve specifications

| Designation | Value |
|---|---|
| Directional control valve | 4 x 3/2 directional control valve monostably vented |
| Nominal flow | 400 l/min |
| Switching time on | 28 ms |
| Switching time off | 8 ms |

## 6.5 Control specifications

In case of directly wiring the digital input signals to an input module of SPS, the maximal cycle time of
**5 ms** may not be exceeded. Otherwise malfunctions may occur, since the SPS cannot capture any input signals due to the high speed of the DRL.

Recommended cycle time of SPS: < 1 ms

# 7 Assembly

## 7.1 Mechanical connection

**Check the evenness of the bolting surface**

The values relate to the entire bolting surface.

Requirements for levelness of the bolting surface (Dimensions in mm)

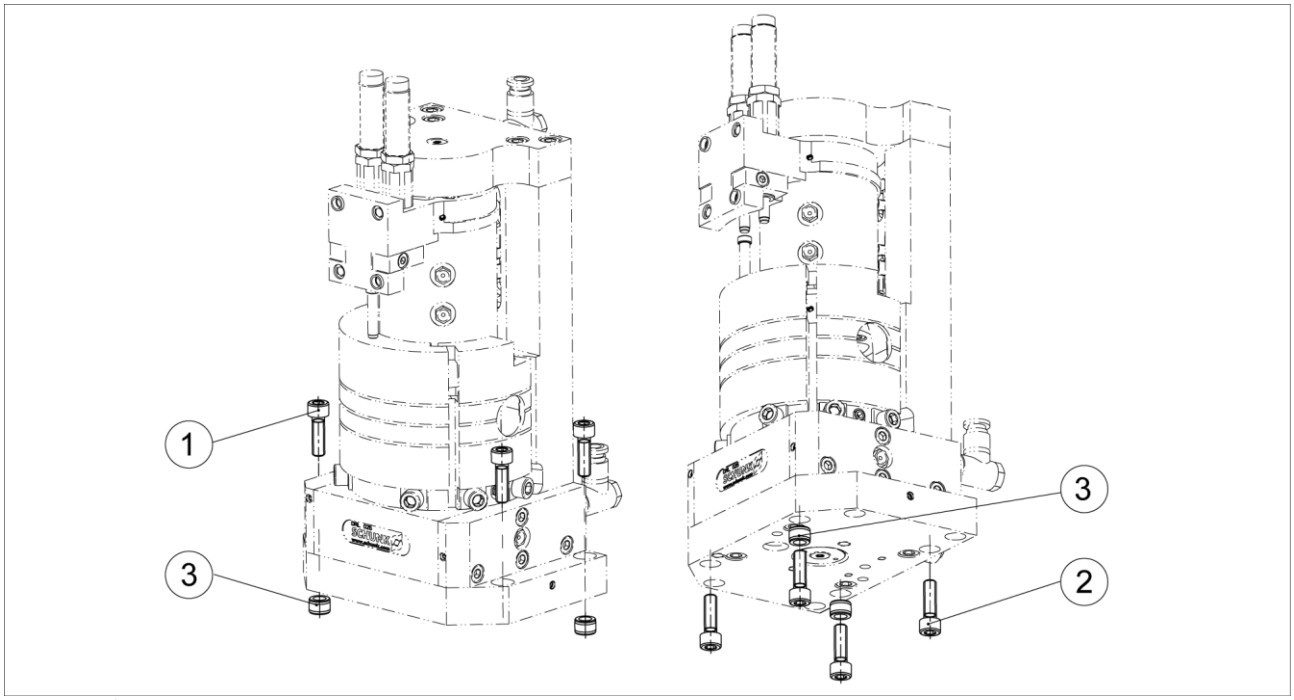
| Diameter | Permissible unevenness |
|---|---|
| < 100 | < 0.02 |
| > 100 | < 0.05 |

**Mounting the unit**

The unit is mounted on the lower base, alternatively from above or below.

The exact position and dimension of the connection geometries can be taken from the current catalog data.

Use the supplied centering elements.




Mounting the unit

Mounting material for standard module

| Item | Mounting | DRL20 | DRL25 |
|---|---|---|---|
| 1 * | Screw, ISO 4762 | M5 (4x) | M6 (4x) |
| 2 * | Screw, ISO 4762 | M6 (4x) | M6 (4x) |
| 3** | Centering sleeve | Ø 10 (2x) | Ø 10 (2x) |

* Not included in the scope of delivery, to be provided by the customer.

** Included in the scope of delivery.

## 7.2 Attachment of loads

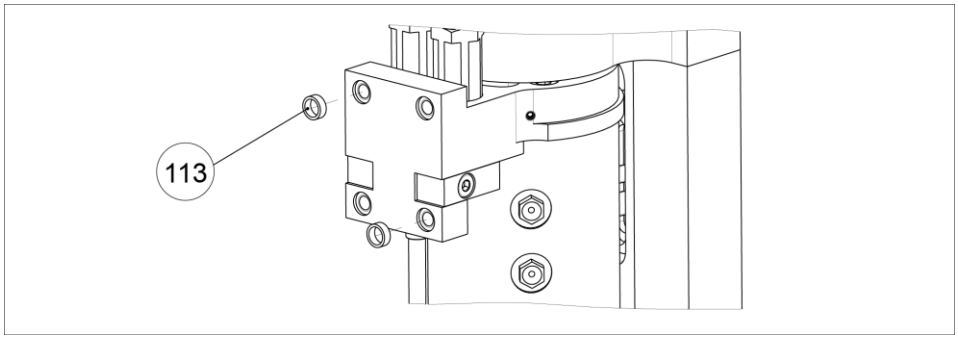
Loads are attached to the attachment face of the front side.

Further optional assembly possibilities:

- Centrally above the module (☞ 7.4.3, Page 27)
- At a right angle to the attachment face above the connection angle of the power track option (☞ 7.4.2, Page 26)

The exact position and dimension of the connection geometries can be taken from the current catalog data.

Use the supplied centering elements.




Attachment surface for loads

Centering elements for load fixation (included in the scope of delivery)

| Item | DRL20 | DRL25 |
|---|---|---|
| 113 | ZH 600 / Ø6 (2x) | ZH 700 / Ø7 (2x) |

## 7.3 Air connection

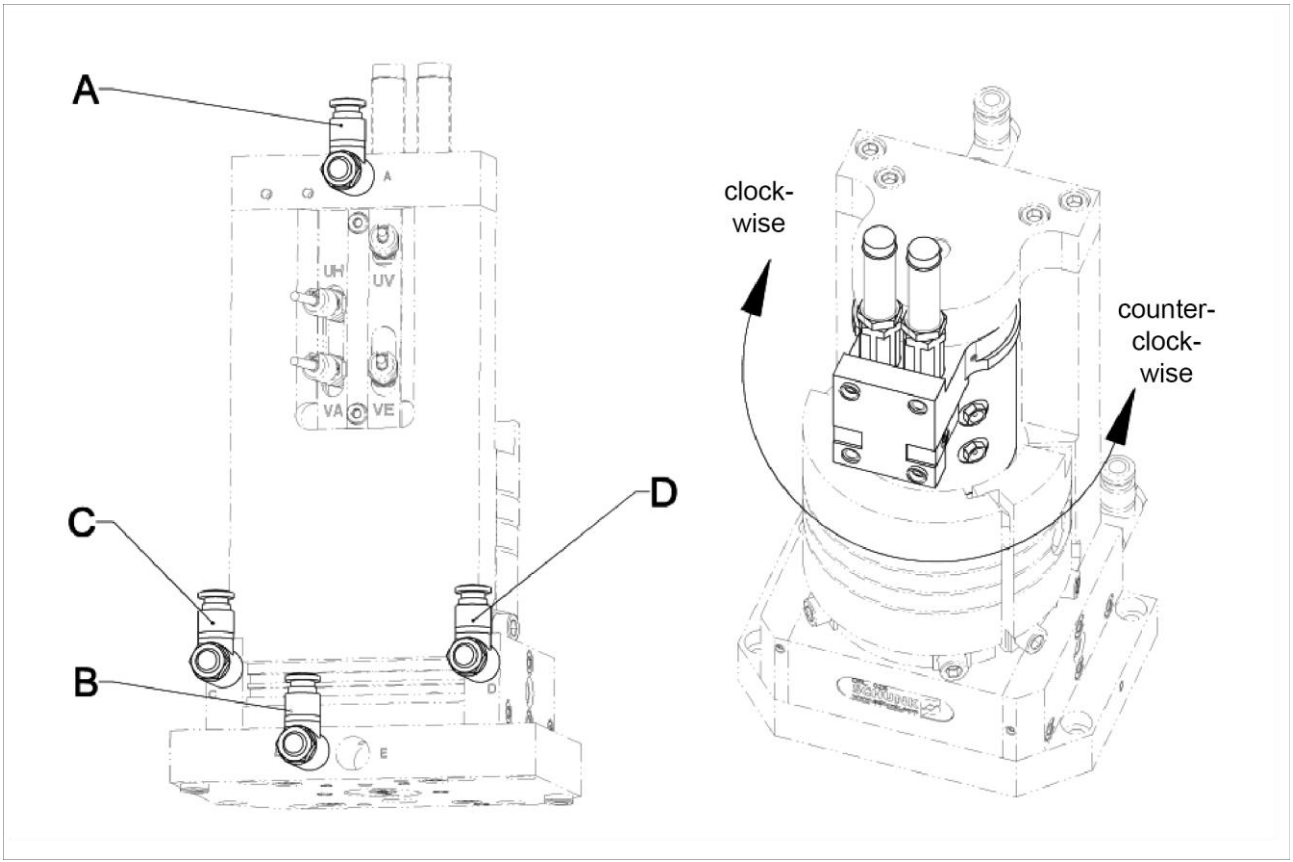
| | |
|---|---|
|  | ***NOTICE***<br>Observe the requirements for the air supply (☞ 6, Page 13). |

| | |
|---|---|
|  | ***NOTICE***<br>**Pressure medium:**<br>The unit must not under any circumstances be operated with oiled air before operation with unoiled air (washing out of factory lubrication). |

| | |
|---|---|
| | ***NOTICE*** |
| | **The length of the hoses from the valve to the unit influences the cycle time!**<br>The hose lengths are to be kept to a minimum! |

Recommended and permissible hose length for the air connection

| Hose length | Value |
|---|---|
| Maximum permissible [m] | 1.4 |
| Recommended [m] | 0.7 |

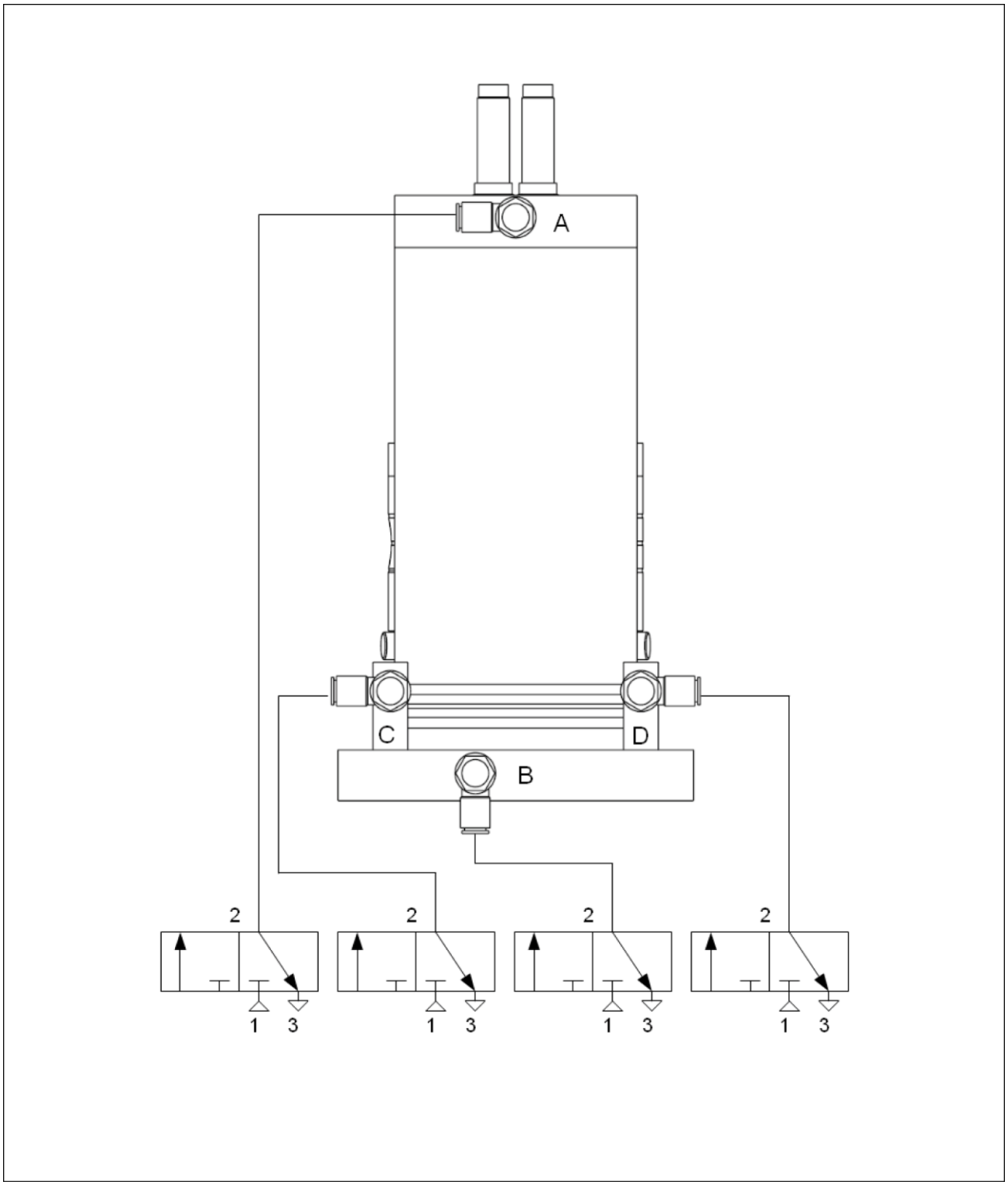



Air connections

Thread diameter of the air connections

| Item | Connection | Description | Connection | Connection $D_a$ [mm] |
|---|---|---|---|---|
| 1 | A | Lift vertical drive | Exhaust air throttle | 6 |
| 2 | B | Lower vertical drive | Exhaust air throttle | 6 |
| 3 | C | Counter-clockwise rotation | Exhaust air throttle | 6 |
| 4 | D | Clockwise rotation | Exhaust air throttle | 6 |

### 7.3.1 Pneumatic diagram



## 7.4 Assembly accessories

### 7.4.1 Rod lock (ASP) assembly option

The rod lock is supplied complete with mounting material.

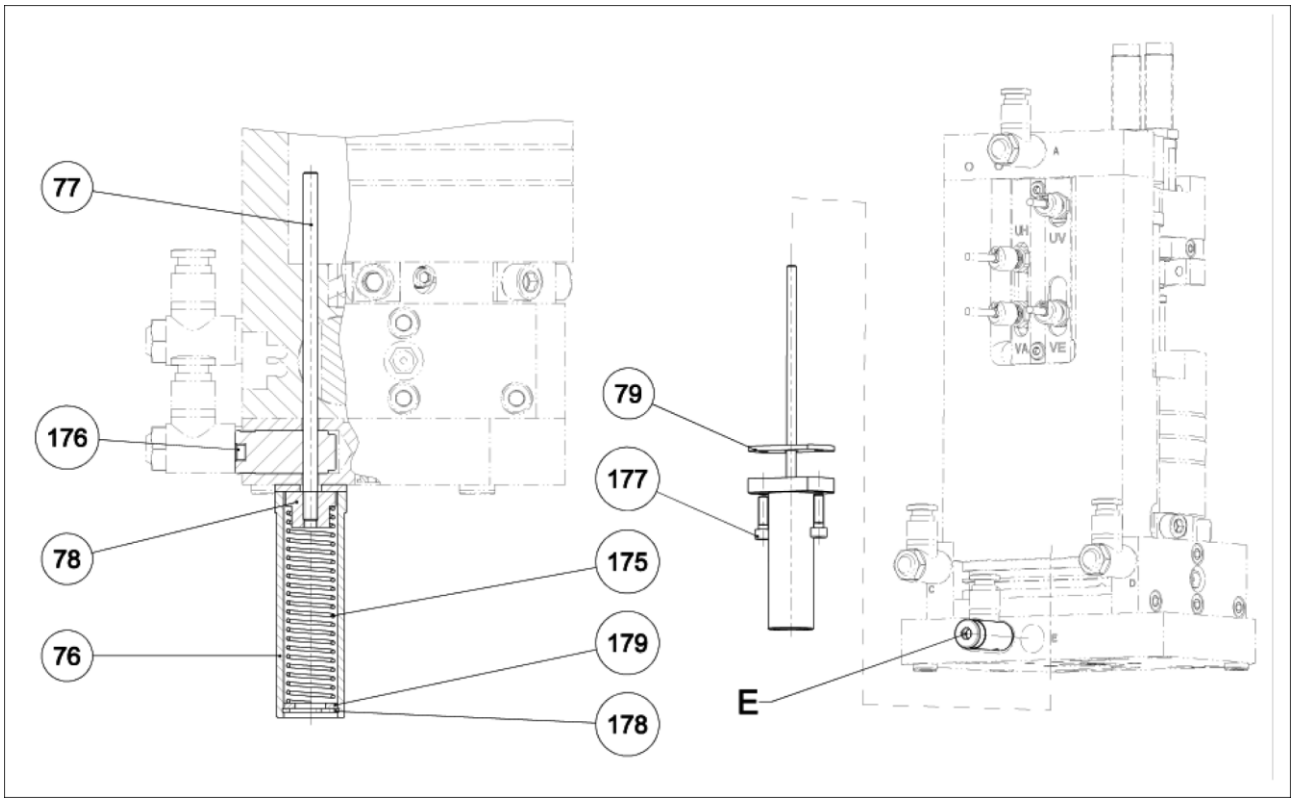
***NOTICE***

**Damage to the rod lock due to incorrect actuation / overload!**

- The rod lock may only be triggered and unlocked when the module has been shut down or is in its waiting position.
- Observe the specifications for the static holding force. The forces occurring in a clamped condition must not exceed the holding force.
- In the event of a dynamic load or overload (e.g. drop in pressure during movement), the clamping cartridge must be checked and replaced if necessary

**⚠ WARNING**

**The rod lock is not a safety component for personal protection in the sense of the Machine Directive.**




Rod lock assembly option

Rod lock assembly option

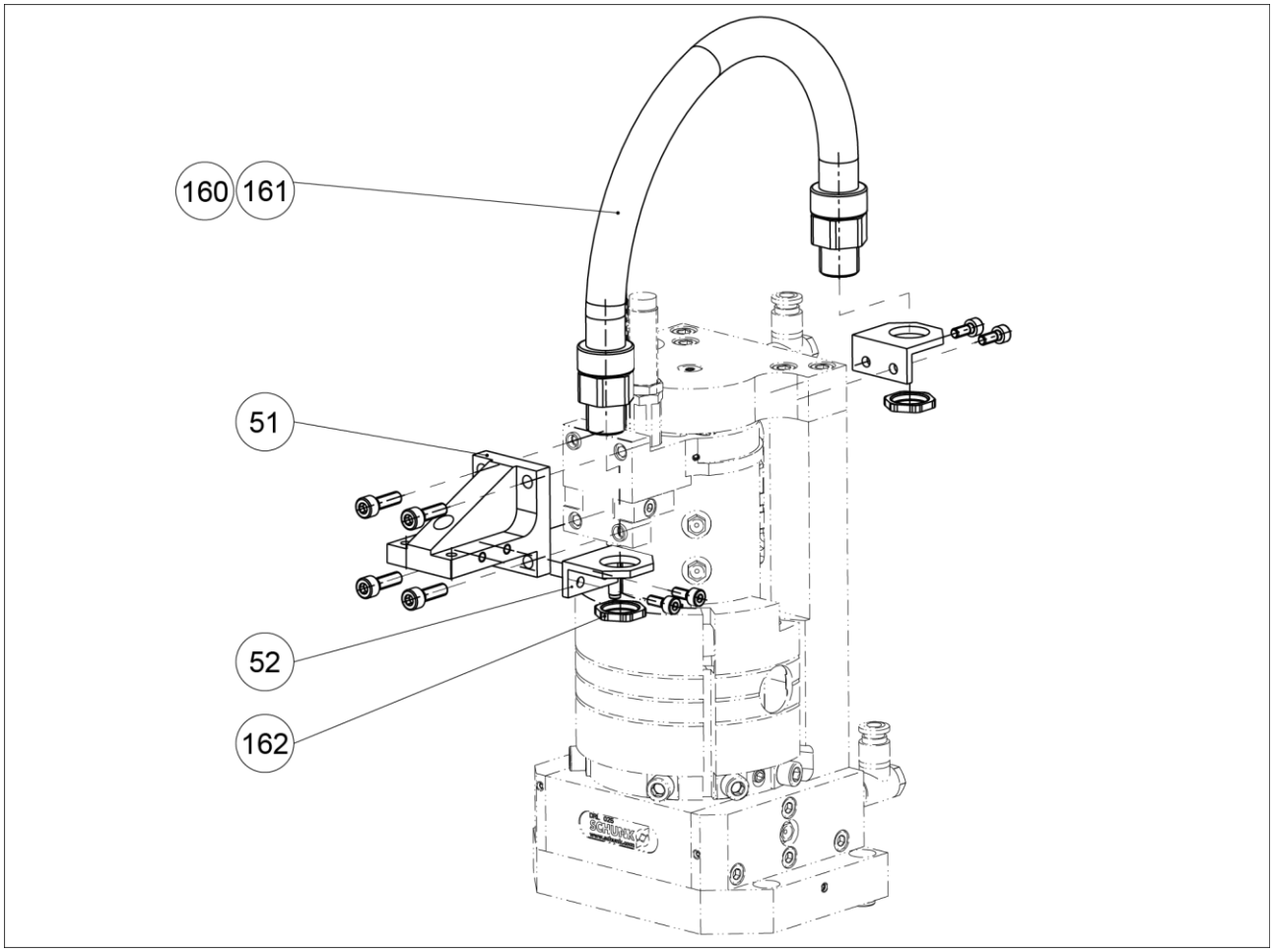
| Item | Designation | Value |
|---|---|---|
| E * | Rod lock air connection | M5 |

* Air connection must be provided by the customer.

| Item | Designation |
|---|---|
| 76 | Base body |
| 77 | Rod |
| 78 | Back stop |
| 79 | Washer |
| 175 | Spring |
| 176 | KP-4-80 locking cartridge |
| 177 | DEI 4762 screw, M4x14 |
| 178 | Safety ring, DIN 472-J 15x1 |
| 179 | Washer, DIN 433 M8 |

### 7.4.2 Power track mounting kit assembly

The power track mounting kit is supplied completely with mounting material.

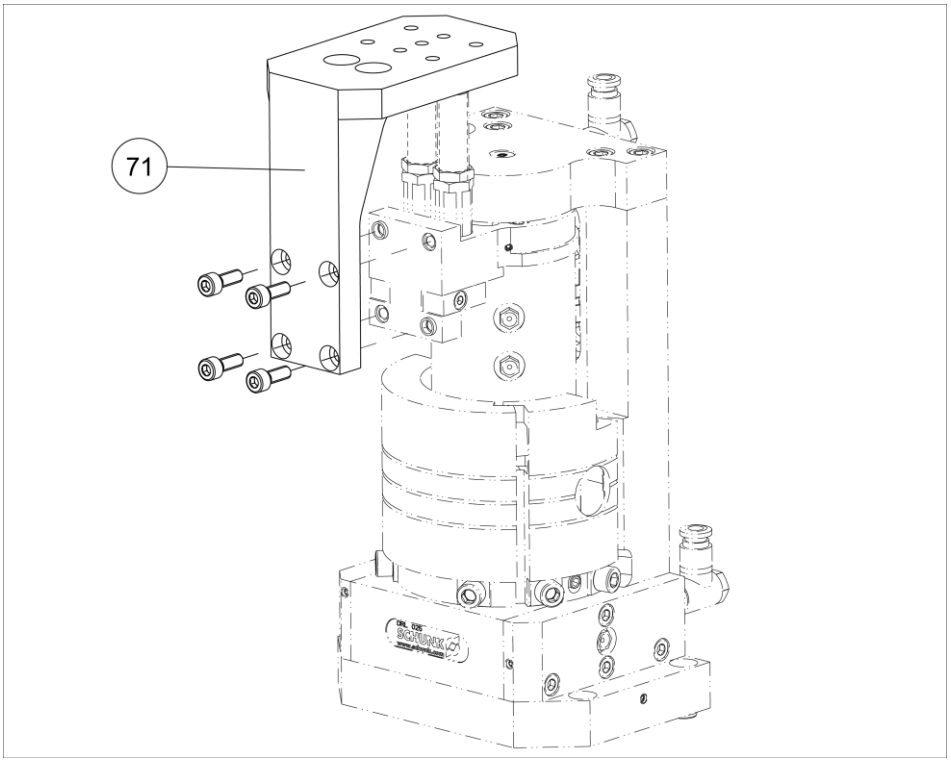



Power track assembly option

| Item | Designation |
|---|---|
| 51 | Angle |
| 52 | Holder |
| 160 | Hose fitting |
| 161 | Cable protection sleeve |
| 162 | Metal counter nut |

### 7.4.3 Angular adapter mounting kit assembly

The angular adapter is supplied completely with mounting material.




Angular adapter assembly option

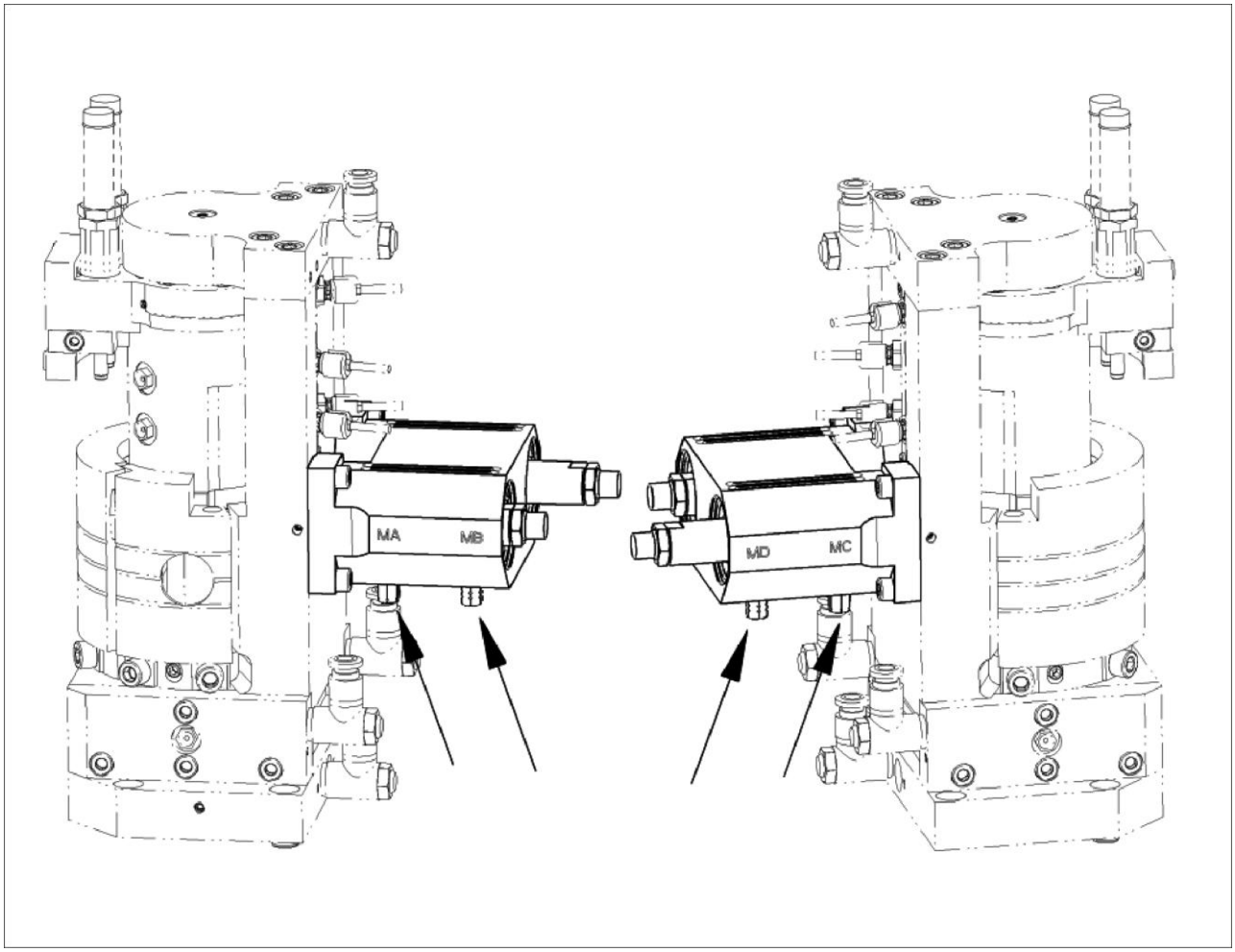
| Item | Designation |
|---|---|
| 71 | Angular adapter |

## 7.5 Optional center position

The optional center position is delivered completely mounted on the DRL. It is only possible for version DRL-W180.
The option allows the DRL025-W180 to approach a center position at 90°. This position cannot be adjusted!

### 7.5.1 Air connections

The back stop is set to the necessary stroke times by means of fixed throttles.



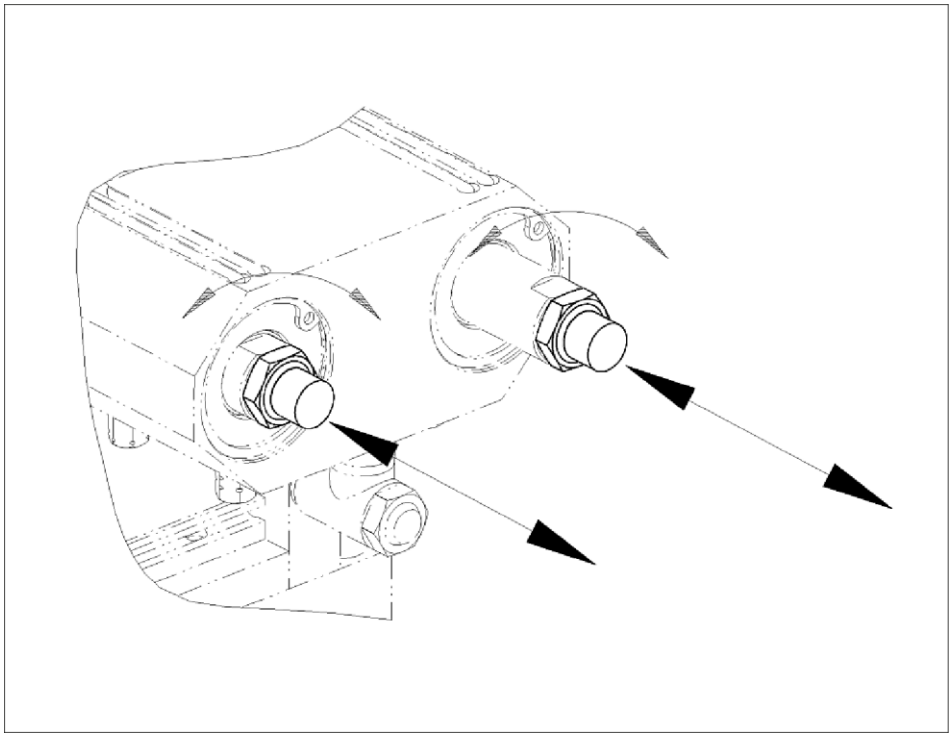

Center position air connections

Thread diameter and designation of the air connections

| Item | Connection | Description | Connection | Connection $D_a$ |
|---|---|---|---|---|
| 1 | MA | Center position<br>counter-clockwise rotation inactive | Fixed throttle | M5 |
| 2 | MB | Center position<br>counter-clockwise rotation active | Fixed throttle | M5 |
| 3 | MC | Center position<br>clockwise rotation inactive | Fixed throttle | M5 |
| 4 | MD | Center position clockwise rotation active | Fixed throttle | M5 |

### 7.5.2 Dampening adjustment

Dampening is preset at the production facility.
It must be adjusted to the corresponding load and swivel speed by turning the shock absorber.



Dampening adjustment

1 Loosen the lock of the corresponding shock absorber; spanner flats are located on the sleeves for exerting counter pressure.

2 Dampening adjustment

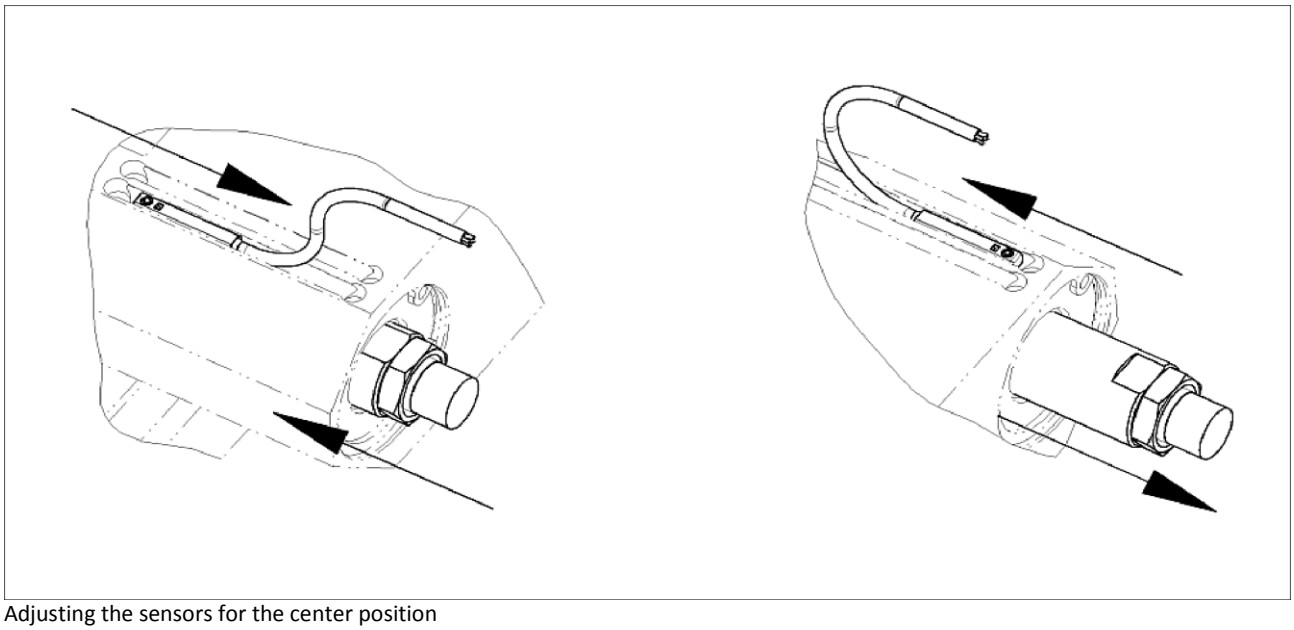
3 Securing the shock absorber

### 7.5.3 Sensors

To ensure safe operation of the device it is recommended to monitor the position of the stop pistons with SCHUNK standard sensors (type MMS).

Exact type designation of the compatible sensors see ☞ catalog.

- If you require further information on sensor operation, contact your SCHUNK contact person or download information from our homepage.
- Technical data for the sensors can be found in the data sheets (included in the scope of delivery).



Adjusting the sensors for the center position

Sensor adjustment for monitoring active center position piston (Fig. left):

1 Pressurize air connection MB or MD / alternatively press in the respective stop manually as far as possible

2 Screw MMS sensor into the groove and adjust to the switching point as illustrated

Sensor adjustment for monitoring inactive center position piston (Fig. right):

1 Pressurize air connection MA or MC / alternatively pull out the respective stop manually as far as possible

2 Screw MMS sensor into the groove and adjust to the switching point as illustrated

| | |
|---|---|
|  | ***NOTICE*** |
| | **Risk of damage to the sensor during assembly.**<br>Observe a maximum tightening torque of 10 Ncm for the set-screws. |

# 8 Handling and operation

## 8.1 Delivery state

All components required for operation are installed on delivery:

- The shock absorbers are preset for safe operation
- Throttles of connections A and B (vertical drive) are fully opened
- Throttles of connections C and D (rotational drive) are fully closed
- The sensors are not preset.
- The end positions are set to maximum stroke.

## 8.2 SPS function module

SPS function modules are available for the stroke-turning unit DRL (see assembly and operating manual of SPS function module). The SPS function module serves as aid for correctly commissioning and controlling the sequences of the product. Function modules are available for the following software:

- TwinCAT
- CoDeSys
- Siemens Step 7 Classic
- Siemens TIA Portal V13

## 8.3 Start-up

***NOTICE***

**The throttles must be slightly open.**
The units can be destroyed if the throttles are open too far.

- Check the technical specifications, (☞ 6, Page 13) and (☞ 7.2, Page 21).
- Do not use the unit until its perfect working order has been checked, taking all permissible operating parameters into account.
- For start-up with the optional center position, see chapter (☞ 8.4.3, Page 41)

To start up the unit, proceed as follows:

1 Open the throttles of connections C and D **slightly**.
2 Adjust the swivel stroke (☞ 8.5.1, Page 46)
3 Adjust the vertical end positions (☞ 8.5.2, Page 47)
4 Adjust the sensors (☞ 8.5.3, Page 48)
5 Adjust the shock absorbers (☞ 8.5.5, Page 50)
To do so, run the device in the standard sequence (☞ 8.4.1, Page 33)
6 Adjust the throttles (☞ 8.3, Page 32)
To do so, run the device in the standard sequence (☞ 8.4.1, Page 33)
7 It may be necessary to readjust the shock absorbers after adjusting the throttles.

⇨ The unit is now completely set.

## 8.4 Adjusting the throttles

***ACHTUNG***

**Only use SCHUNK throttles!**
The throttle check valves mounted at the factory may not be exchanged, since cycle times and correct sequences cannot be guaranteed anymore.

- The throttles installed at the factory can be used to set the speed of the swiveling movements and vertical movements.
- On delivery, the throttles A and B are in opened position and the throttles C and D in closed position.

1 Use the throttles at connections C and D to adjust the swivel stroke to ensure smooth forward and backward movement of the device in the curves and to ensure that the cycle time of the standard sequence (☞ 6.4.1, Page 33) corresponds to the stipulated minimum times (☞ 4.3, Page 15).
2 Use the throttle at connections A and B to further throttle the vertical stroke, if required.

***NOTICE***

**If the permissible cycle times are not reached, the device can become overloaded and mechanical damage can occur.**

## 8.5 Actuation / operation

### 8.5.1 Standard sequence

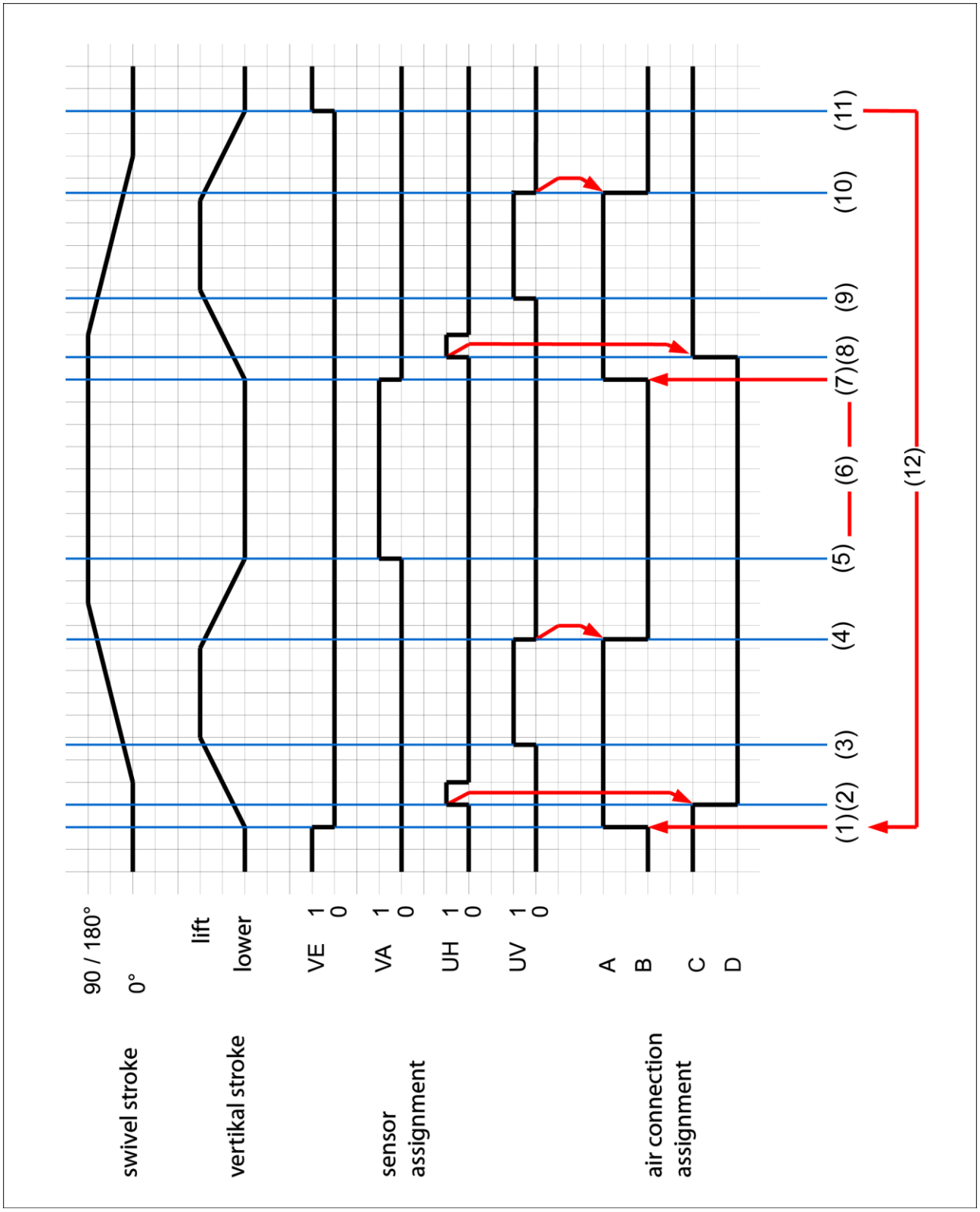
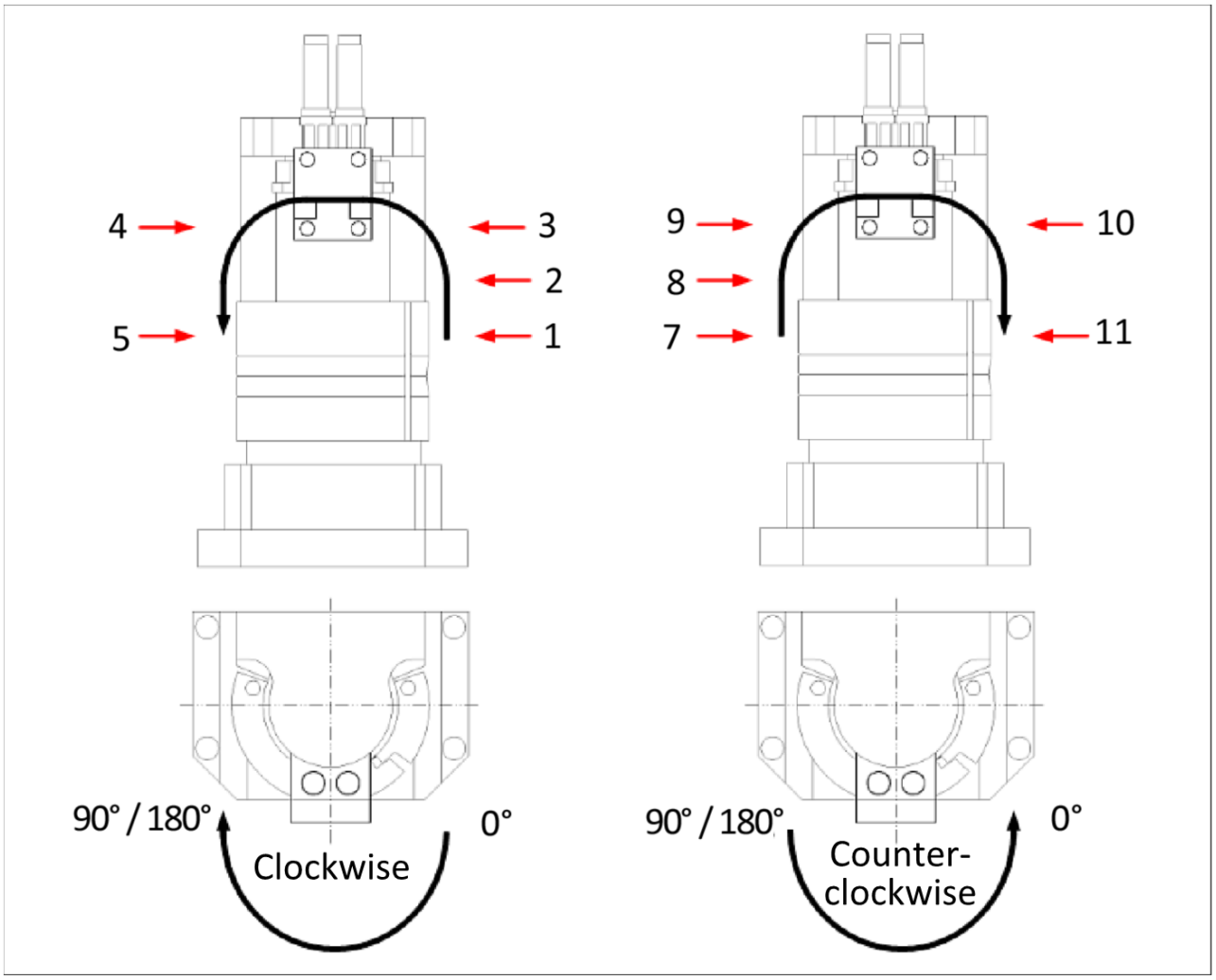



Diagram of the actuation of the standard operating sequence




Flow chart of the standard operating sequence

**Description of the standard sequence**

DRL in end position / home position:

- Rotation: 0°; pressurized connection: (C)
- Vertical: swivel arm lowered; pressurized connection: (B)
- Sensor assignment: (VE)

1 Unit in end position:
Actuation of valve B --> A (lower --> lift)
Start operating cycle
Swivel arm moves vertically upwards

2 Reaching the UH switching point sensor:
Actuation of valve C --> D (swivel counter-clockwise -> clock-wise)
Clockwise swiveling movement is initiated
Swivel arm still only moves upwards for the moment due to forced guidance, then along the curve radius

3 Reaching the UV switching point sensor:
Maintain actuation of both valves
Roller is at end of curve
Swivel arm only performs clockwise rotary movement

4 Leaving the UV sensor:
(The roller reaches the 90°/180° curve radius, the switching range of the UV sensor is left due to forced guidance)
Actuation of valve A --> B (lift --> lower)
Vertical movement is initiated
Swivel arm moves along the curve radius for the moment, then only vertically downwards

5 90°/180° end position has been reached:
– Rotation: 90°/180°; pressurized connection: (D)
– Vertical: swivel arm lowered; pressurized connection: (B)
– Sensor assignment: (VA)

6 Waiting time: execution of additional movements (gripping etc.) + possibly external start

7 Unit in 90°/180° end position:
Actuation of valve B --> A (lower --> lift)
Start of return stroke
Swivel arm moves vertically upwards

8 Reaching the UH switching point sensor:
Actuation of valve C --> D (swivel clockwise -> counter-clockwise)
Counter-clockwise swivel movement is initiated
Swivel arm still only moves upwards for the moment due to forced guidance, then along the curve radius

9 Reaching the UV switching point sensor:
Maintain actuation of both valves
Roller is at end of curve
Swivel arm only performs counter-clockwise rotary movement

10 Leaving the UV sensor:
(The roller reaches the 0° curve radius, the switching range of the UV sensor is left due to the forced guidance)
Actuation of valve A --> B (lift --> lower)
Vertical movement is initiated
Swivel arm moves along the curve radius for the moment, then only vertically downwards

11 0° end position / home position has been reached:
– Rotation: 0°; pressurized connection: (C)
– Vertical: swivel arm lowered; pressurized connection: (B)
– Sensor assignment: (VE)

12 Waiting time: execution of additional movements (gripping etc.) + possibly external start, operating cycle starts again

### 8.5.2 Sequence with waiting position approach

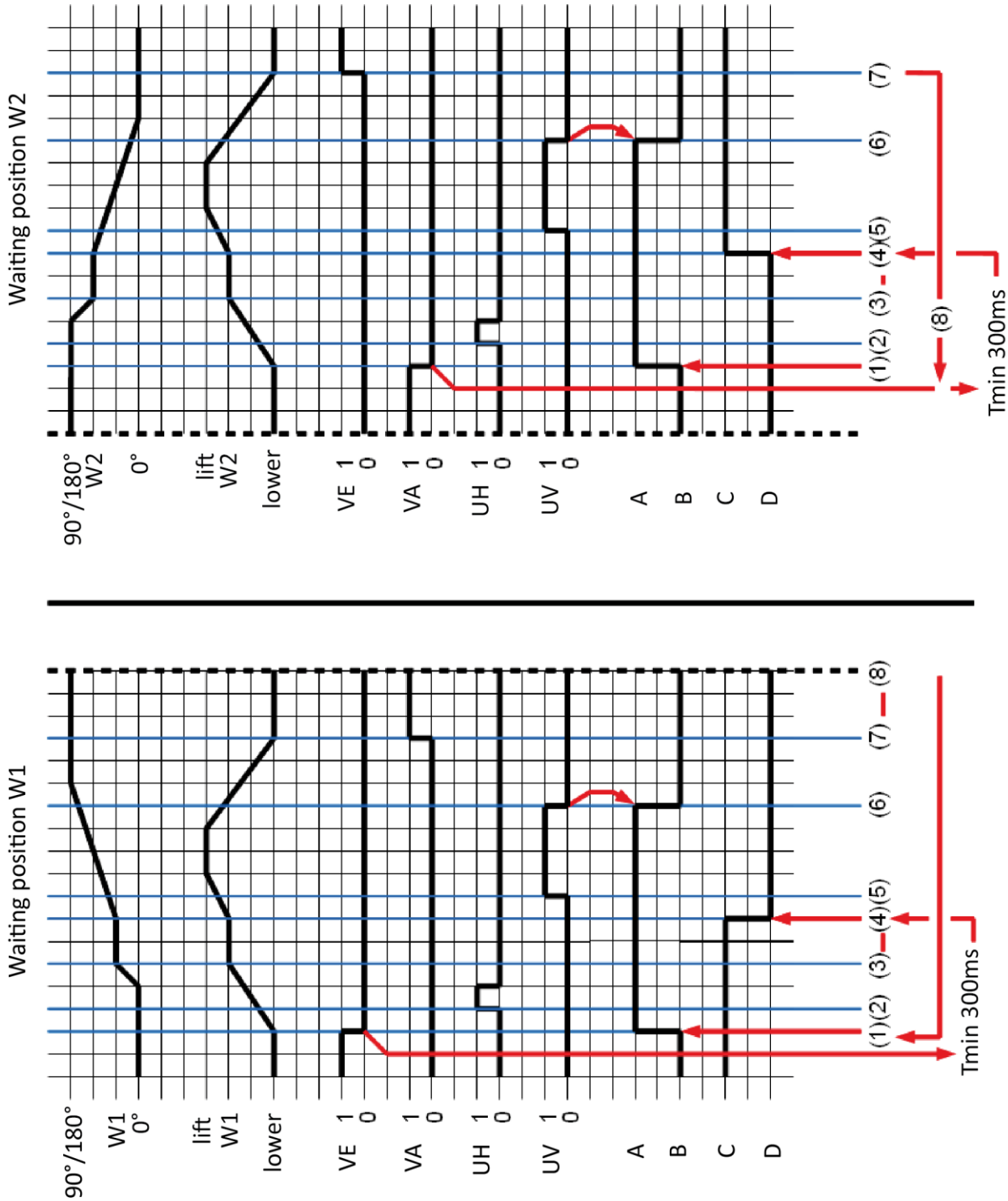
Two waiting positions can be approached:

- W1 waiting position:
  Can be found above the 0° end position.
  Waiting position W1 can only be approached from end position 0°
- W2 waiting position:
  Can be found above the 90°/180° end position.
  Waiting position W2 can only be approached from end position 90° / 180°

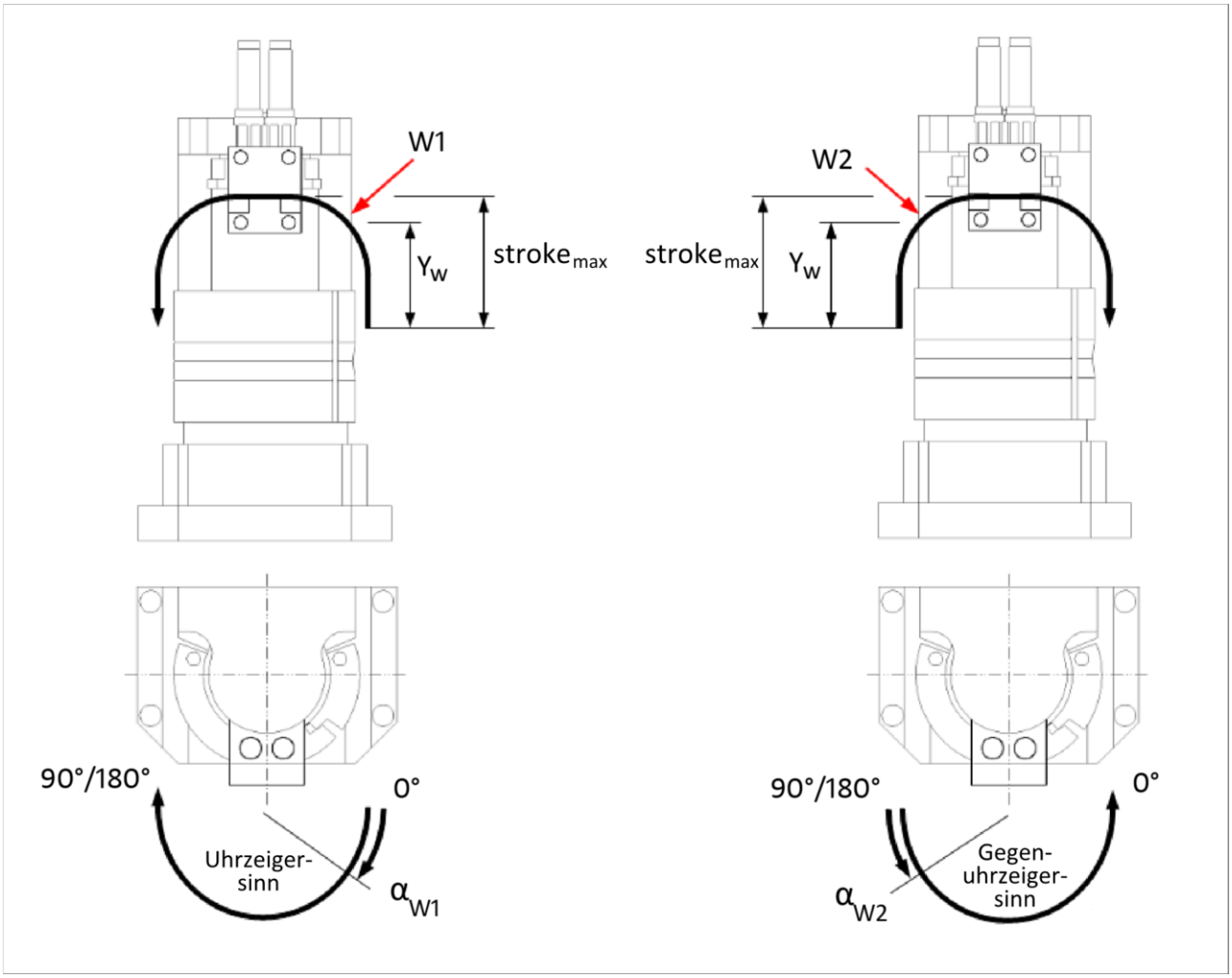
Further information is contained in the diagrams below and in the description.

| | |
|---|---|
|  | ***NOTICE***<br>**The waiting position has not been defined exactly**<br>For the area occupied by the extension arm in the waiting positions, see figure "Flow chart for waiting position approach, waiting position range", (☞ 8.4.2, Page 38). |

| | |
|---|---|
|  | ***ACHTUNG***<br>**Min. waiting time when leaving the waiting position**<br>The waiting position may only be approached no earlier than 3**00ms** after leaving the end switch VA or VE (corresponding end position). |




Approaching waiting positions from 0° end position




Flow chart of waiting position approach, waiting position range

Waiting position approach/range

| Designation | DRL 20 | DRL 25 |
|---|---|---|
| $Stroke_{max.}$ [mm] | 33 | 40 |
| $\alpha_{W1\ max.}$ in resting position [°] | 20 | 25 |
| $\alpha_{W1\ max.}$ overshooting due to approaching 0° -> W1 [°] | 50 | 50 |
| $\alpha_{W2\ max.}$ in resting position [°] | 20 | 25 |
| $\alpha_{W2\ max.}$ overshooting due to approaching 90°/180° -> W2 [°] | 50 | 50 |
| $Y_{w\ min.}$ in resting position [mm] | 25 | 35 |
| $Y_{W\ min.}$ when approaching 0° -> W1 and 90°/180° -> W2 [°] | 30 | 37.5 |

**Description of W1 approach from 0° end position**

DRL in 0° end position / home position:

- Rotation: 0°; pressurized connection: (C)
- Vertical: swivel arm lowered; pressurized connection: (B)
- Sensor assignment: (VE)

1 Unit in "right" end position:
Actuation of valve B --> A (lower --> lift)
Approach W1 waiting position
Swivel arm moves vertically upwards

2 Reaching the UH switching point sensor:
Maintain actuation of both valves:
To approach the waiting position, the signal from the UH sensor is ignored
The UV sensor is also reached temporarily by overshooting – ignore this signal too!

3 W1 waiting position has been reached

4 Unit in W1 waiting position:
Actuation of valve D --> C (counter-clockwise -> clockwise)
Start Pick and Place rotation cycle from the W1 waiting position
This step may not be initiated earlier than 300ms after leaving the sensor VA! Swivel arm continues movement on curved track

5 Reaching the UV switching point sensor:
Maintain actuation
Roller is at end of curve
Swivel arm only performs clockwise rotary movement

6 Leaving the UV sensor:
(The roller reaches the 90°/180° curve radius, the switching range of the UV sensor is left due to the forced guidance)
Actuation of valve A --> B (lift --> lower)
Vertical movement is initiated
Swivel arm moves along the curve radius for the moment, then only vertically downwards

7 90°/180° end position has been reached:
– Rotation: 0°; pressurized connection: (D)
– Vertical: swivel arm lowered; pressurized connection: (B)
– Sensor assignment: (VA)

8 Waiting time: Execution of additional movements (gripping etc.) + possibly external start
**either**
continue with standard sequence from no. 7 Standard sequence
**or**
approach the W1 or W2 waiting position from the 90°/180° end position.

**Description of W2 approach from 90°/180° end position**

DRL in 90°/180° end position:

- Rotation: 90°/180°; pressurized connection: (D)
- Vertical: swivel arm lowered; pressurized connection: (B)
- Sensor assignment: (VA)

1 Unit in 90°/180° end position:
Actuation of valve B -> A (lower --> lift)
Approach W2 waiting position
Swivel arm moves vertically upwards

2 Reaching the UH switching point sensor:
Maintain actuation of both valves:
To approach the waiting position, the signal from the UH sensor is ignored
The UV sensor is also reached temporarily by overshooting – ignore this signal too!

3 W2 waiting position is reached

4 Unit in W2 waiting position:
Actuation of valve D -> C (clockwise -> counter-clockwise)
This step may not be initiated earlier than 300ms after leaving the sensor VA!
Swivel arm continues movement on curved track

5 Reaching the UV switching point sensor:
Maintain actuation
Roller is at end of curve
Swivel arm only performs counter-clockwise rotary movement

6 Leaving the UV sensor:
(The roller reaches the "right" 0° curve radius, the switching range of the UV sensor is left due to the forced guidance)
Actuation of valve A -> B (lift -> lower)
Vertical movement is initiated
Swivel arm moves along the curve radius for the moment, then only vertically downwards

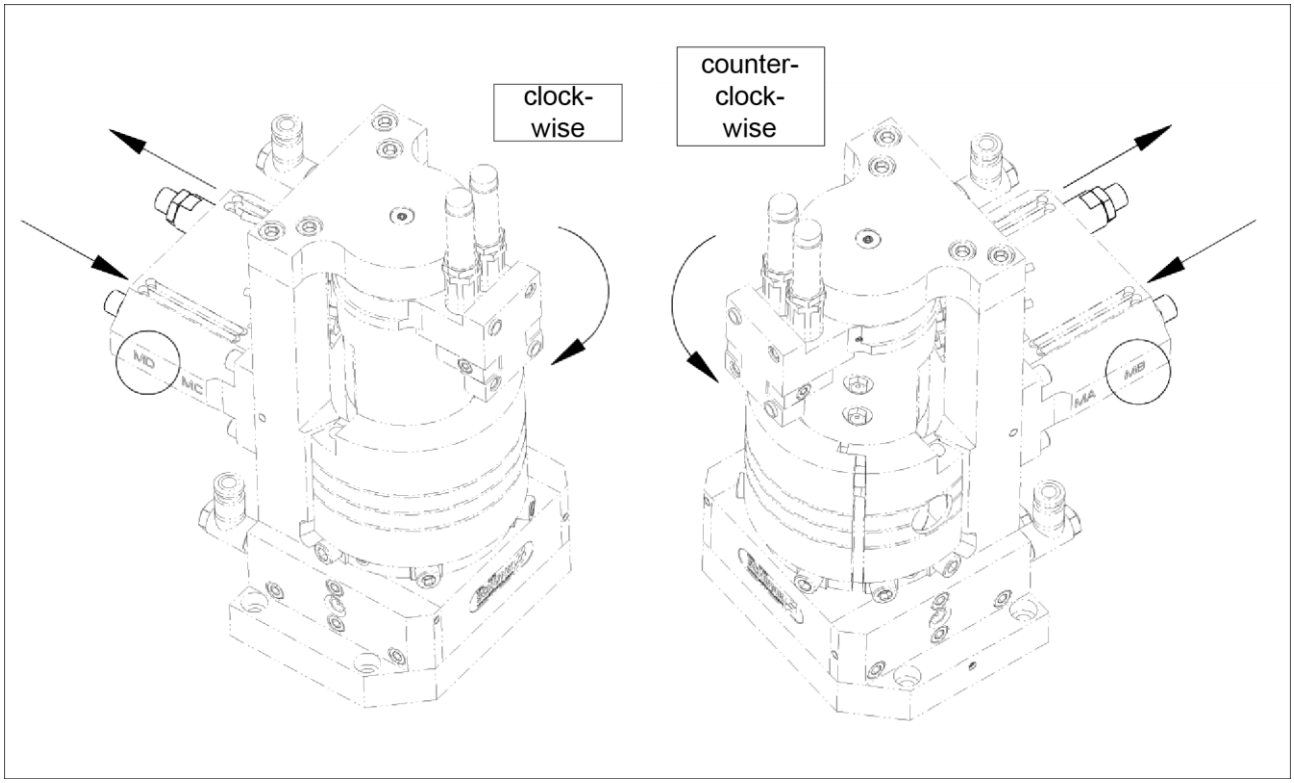
7 0° end position has been reached:
– Rotation: 0°; pressurized connection: (C)
– Vertical: swivel arm lowered; pressurized connection: (B)
– Sensor assignment: (VE)

8 Waiting time: execution of additional movements (gripping etc.)
+ possibly external start, Pick and Place rotation cycle starts again

### 8.5.3 Sequence for center position actuation

The center position is located in the 90° position of the module and can be approached from both end positions (0° and 180°).

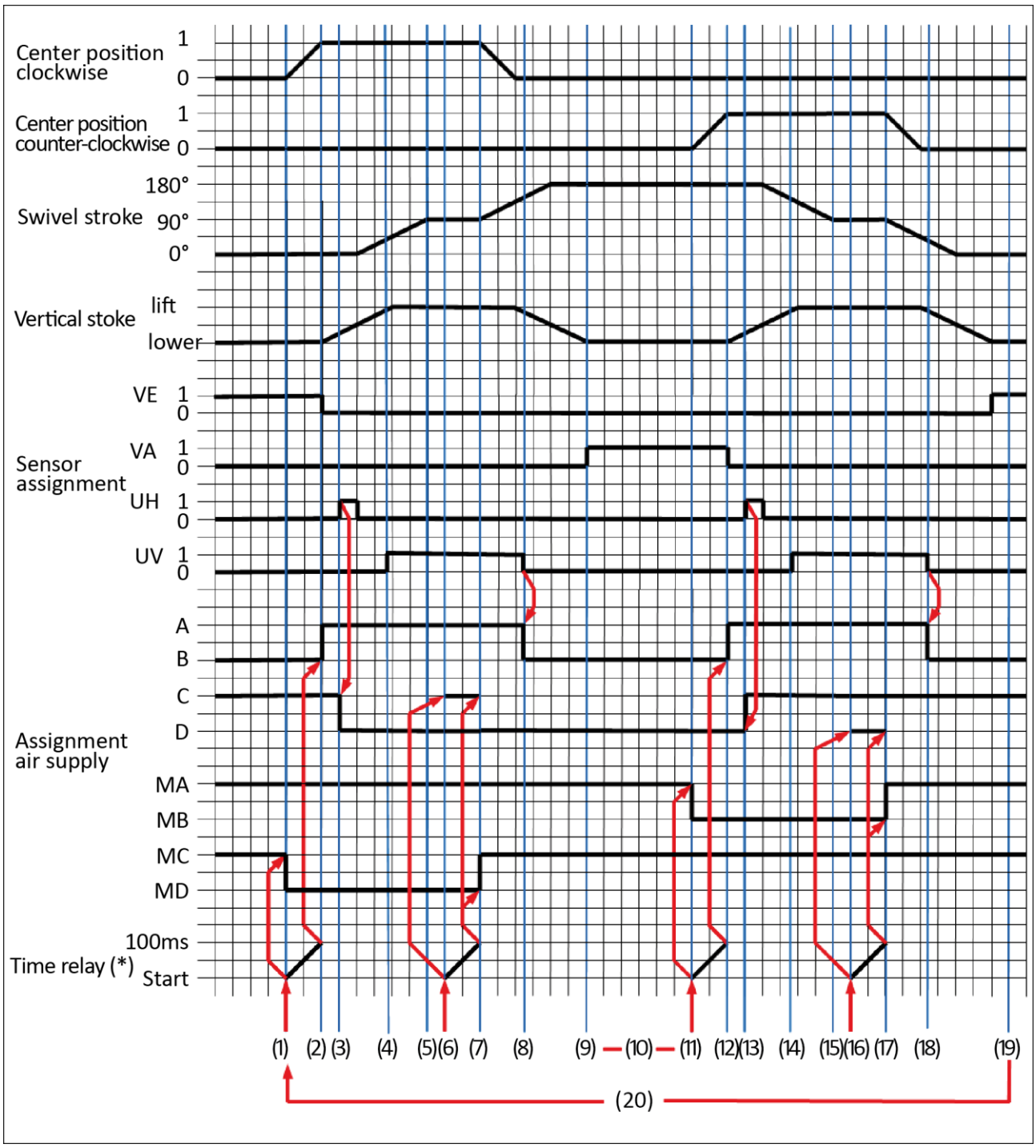
| | |
|---|---|
| | ***NOTICE*** |
| | **Ensure correct actuation!**<br>Incorrect actuation can result in mechanical damage!<br>• Control in accordance with flow chart - Program diagram<br>• Check the sequence again in accordance with the following Fig. and table |



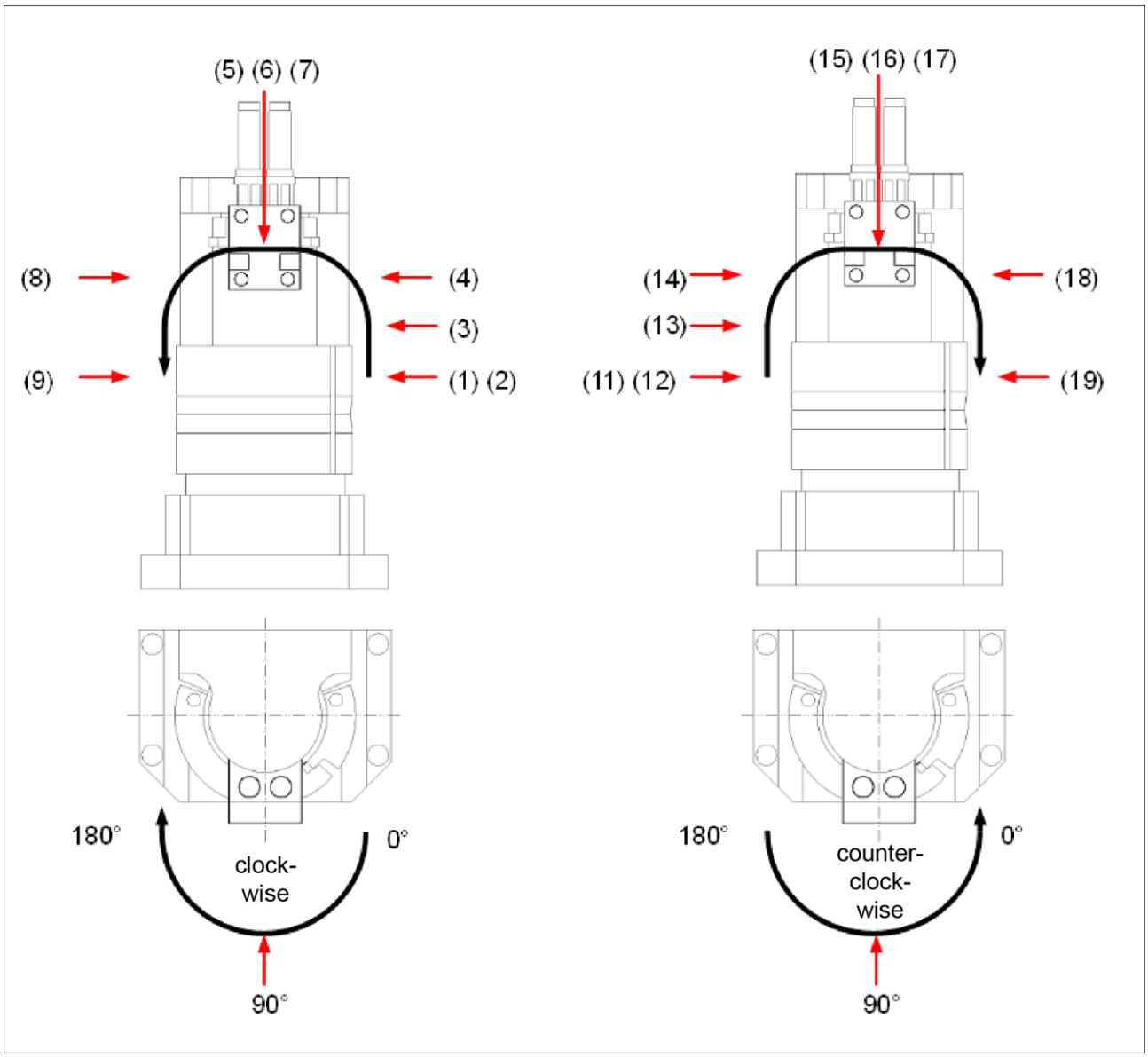

Check --> approach of center position direction of rotation

Check --> approach of center position direction of rotation, actuation of air connections

| Direction of rotation | Condition MA | Condition MB | Condition MC | Condition MD |
|---|---|---|---|---|
| Clockwise | 1 | 0 | 0 | 1 |
| Counter-clockwise | 0 | 1 | 1 | 0 |




Actuation diagram - DRL-M Pick and Place – Rotation with center position




Flow chart - DRL-M Pick and Place – Rotation with center position

**Sequence for center position**

DRL in end position / home position:

- Rotation: 0°; pressurized connection: (C)
- Vertical: swivel arm lowered; pressurized connection: (B)
- Center position: both sides deactivated; pressurized connections: (MA) and (MC)
- Sensor assignment: (VE)

1 Unit in end position:
Actuation of connection MC ⇒ MD
End stop for clockwise rotation is activated and extends.

⇨ Waiting time until step 2 via time relay
or alternatively: Monitoring the position of the back stop

2 Unit in end position, clockwise stop active:
Actuation of connection B -> A (lower -> lift)
Start Pick and Place rotation cycle
Swivel arm moves vertically upwards

3 Reaching of UH switching point sensor:
Actuation of connection C -> D (swivel counter-clockwise -> clockwise)
Clockwise swivel movement is initiated
Swivel arm still only moves upwards
for the moment due to forced guidance, then along the curve radius

4 Reaching the UV switching point sensor:
Maintain actuation of both connections
Roller is at end of curve
Swivel arm only performs clockwise rotary movement

5 The center position is reached at 90°
Waiting time as required

6 Filling of the pressure pad to throttle the movement
Pressurize connection C
⇒ Waiting time until step 7 via time relay

7 Initiation of the rotary movement:
Venting of connection C
Actuation of connection MD ⇒ MC
Rotary movement 90°⇒ 180°

8 Leaving the UV sensor:
(The roller reaches the 180° curve radius, the switching range of the UV sensor is left due to the forced guidance)
Actuation of valve A -> B (lift -> lower)
Vertical movement is initiated
Swivel arm moves along the curve radius for the moment, then only vertically downwards

9 180° end position has been reached:
- Rotation: 180°; pressurized connection: (D)
- Vertical: swivel arm lowered; pressurized connection: (B)
- Sensor assignment: (VA)

10 Waiting time: Execution of additional movements (gripping etc.) + possibly external start

11 Unit in end position:
Actuation of connection MA ⇒ MB
End stop for counter-clockwise rotation is activated and extends
⇒ Waiting time until step 2 via time relay
or alternatively: Monitoring the position of the back stop

12 Unit in end position, counter-clockwise stop active:
Actuation of connection B -> A (lower -> lift)
Start Pick and Place rotation cycle
Swivel arm moves vertically upwards

13 Reaching the UH switching point sensor:
Actuation of connection D -> C (swivel clockwise -> counter-clockwise)
Counter-clockwise swivel movement is initiated
Swivel arm still only moves
upwards for the moment due to forced guidance, then along the curve radius

14 Reaching the UV switching point sensor:
Maintain actuation of both connections
Roller is at end of curve
Swivel arm only performs counter-clockwise rotary movement

15 The center position is reached at 90°
Waiting time as required

16 Filling of the pressure pad to throttle the movement
Pressurize connection D
⇒ Waiting time until step 17 via time relay

17 Initiation of the rotary movement:
Venting of connection D
Actuation of connection MB ⇒ MA
Rotary movement 90°⇒ 0°

18 Leaving the UV sensor:
(The roller reaches the 0° curve radius, the switching range of the UV sensor is left due to the forced guidance)
Actuation of valve A -> B (lift -> lower)
Vertical movement is initiated
Swivel arm moves along the curve radius for the moment, then only vertically downwards

19 0° end position has been reached:
- Rotation: 0°; pressurized connection: (C)
- Vertical: swivel arm lowered; pressurized connection: (B)
- Sensor assignment: (VE)
- Center position: both sides deactivated; pressurized connections:
(MA) and (MC)

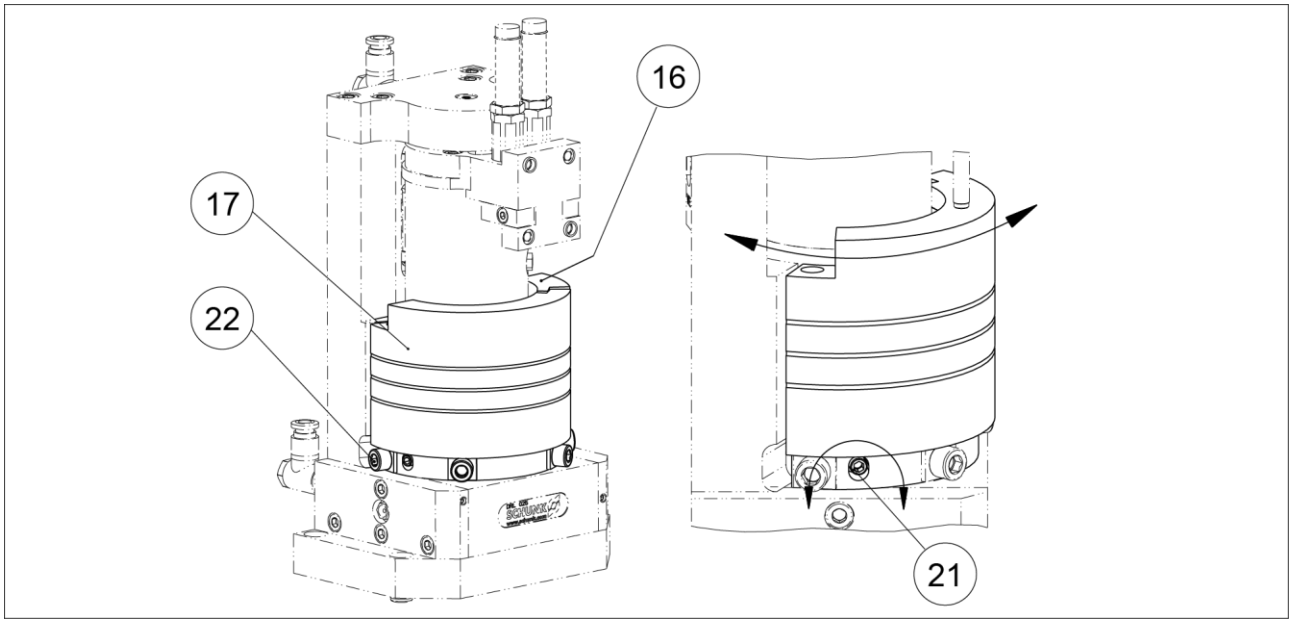
20 Waiting time: execution of additional movements
(gripping etc.) + possibly external start, Pick and Place rotation cycle starts again

## 8.6 Adjusting the end positions and absorbers

The end positions can be adjusted vertically as well as separately within the swiveling range.

The dampening is also adjusted separately and has no influence whatsoever on the position of the end positions.

### 8.6.1 Fine adjustment of the swivel stroke




Fine adjustment of the swivel stroke

1 Approach the desired end position either manually or by actuating the A/B and C/D compressed air connections.

2 Loosen the attachment screws (22) slightly on the side of the end position to be adjusted.

3 Bring the connecting member (17) into the desired position by turning the setscrew (21).

4 Tighten the attachment screws. **Observe the tightening torque!**

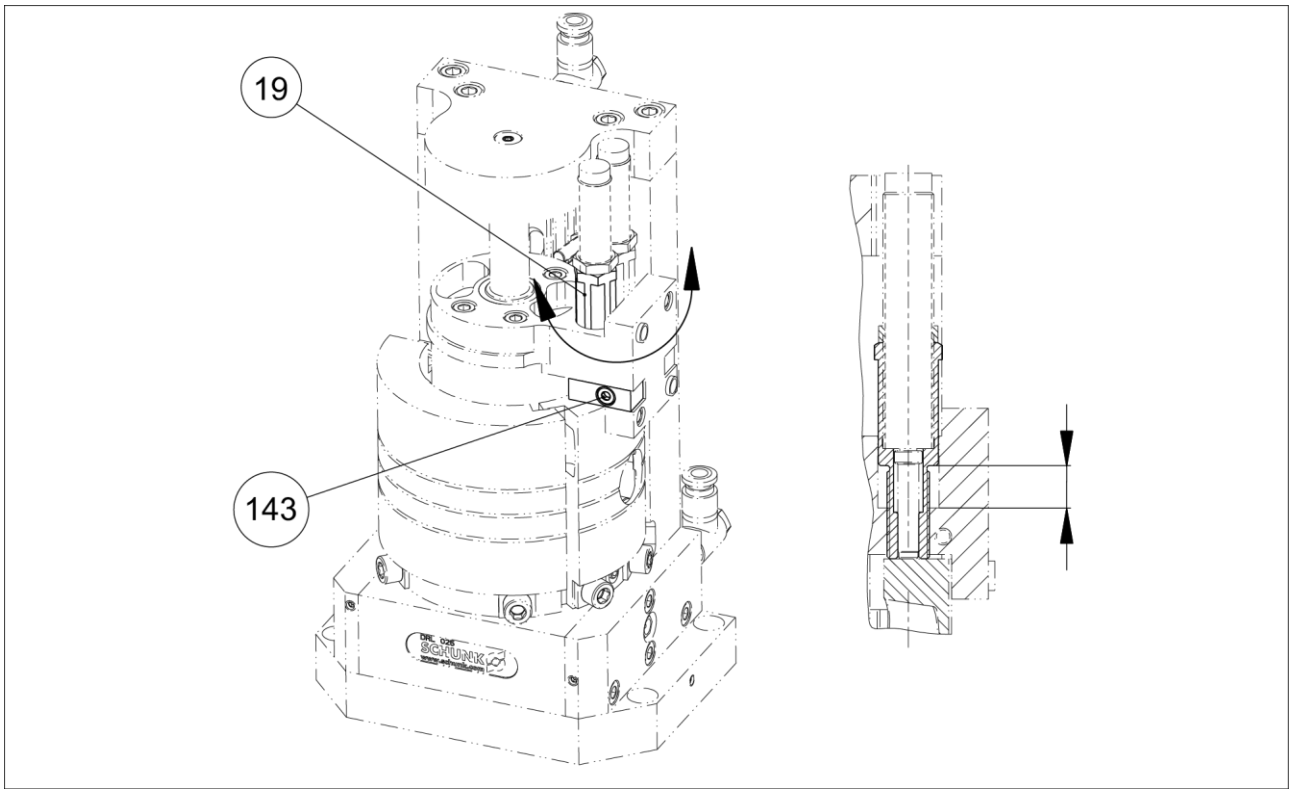
5 Repeat the procedure on the second connecting member (16) if necessary.

Tightening torques for attachment screws

| | DRL20 | DRL25 |
|---|---|---|
| Tightening torque | 5 [Nm] | 6 [Nm] |

### 8.6.2 Adjusting the end positions vertically

| | |
|---|---|
|  | **⚠ WARNING**<br>**Risk of injury when the machine/system moves unexpectedly!**<br>Switch off power supply. |




Adjusting the end positions vertically

1 Approach the desired end position either manually or by actuating the A/B and C/D pressure connections.

2 Loosen the attachment screw (143) for the end position to be adjusted slightly.

3 Bring the end position into the desired position by turning the stop coupling (19) (adjustment range of 0 ... 10 mm).

4 Tighten the attachment screw (143).

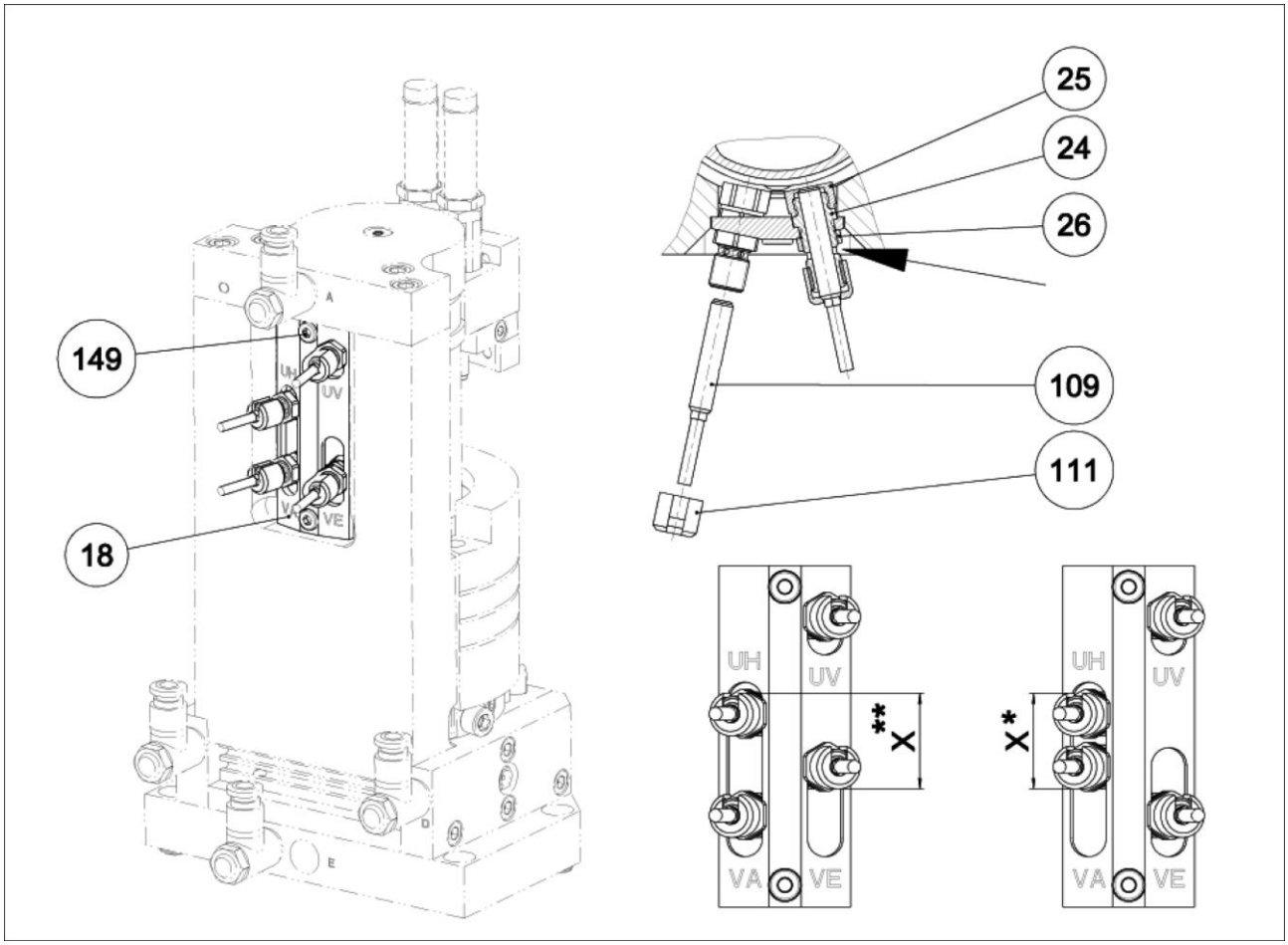
5 Repeat the procedure on the second end position if necessary.

### 8.6.3 Attaching and adjusting the sensors

The sensors required for operation have been installed at the factory.

| | |
|---|---|
| | ***NOTICE*** |
| | **The sensors have not been preset!**<br>All sensors must be adjusted during the start-up procedure. |

- For further information on handling sensors, consult your SCHUNK contact person or use the download options on our web site.
- Technical data of the sensors can be found in the catalog or data sheets (included in the scope of delivery or can be found on our web site).




Attaching and adjusting the sensors

* Case 1 (bottom, right view, adjust X*):
VA = upper end position, VE = lower end position

** Case 2 (bottom, center view, adjust X**):
VE = upper end position, VA = lower end position

Adjusting the IN sensors

| Item | Designation | Value |
|---|---|---|
| X* [mm] | Distance between UH sensor and VA (upper end position) | approx. 21 |
| X** [mm] | Distance between UH sensor and VE (upper end position) | approx. 21 |

Sensor assignment

| Sensor | Description |
|---|---|
| VE | Sensor for right end position |
| VA | Sensor for left end position |
| UH | Switching point for horizontal drive |
| UV | Switching point for vertical drive |

**Adjusting the sensors**

- The back stops of the end positions have been set (☞ 8.5.2, Page 47)
- The unit has been depressurized

**NOTE**

• If a sensor is active, it is indicated via the respective sensor LED in the inspection holes (arrow)

**VE and VA end positions**

1 Approach the right end position (VE) manually.
2 Push the VE sensor from below against the control cam until there is a signal at the output and fixate the position with a counter nut.
3 Approach the left end position (VE) manually.
4 Push the VA sensor from below against the control cam until there is a signal at the output and fixate the position with the counter nut.

**UV and UH switching points**

1 Approach the top position of the cycle movement manually.
2 Push the UV sensor from above against the control cam until there is a signal at the output and fixate the position with the counter nut.
3 Set the UH sensor at a distance of X to the upper end position and fixate the position with a counter nut.

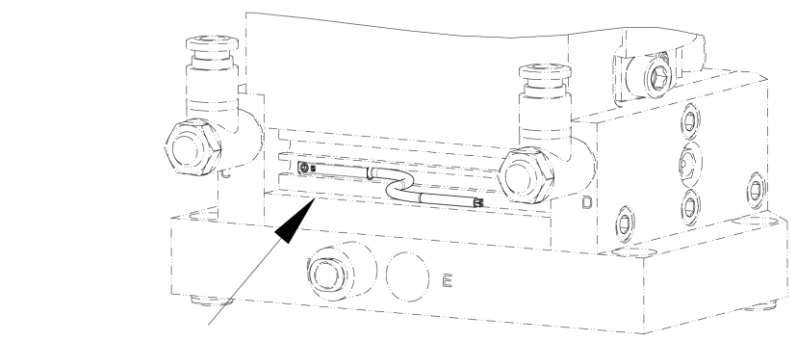
**Replacing the sensors**

In the event of a defect the sensors can be replaced without losing the set position:

1 Loosen the coupling ring (111).
2 Replace the sensor
3 Gently retighten the coupling ring.

### 8.6.4 Attaching and adjusting optional MQL sensors

| | |
|---|---|
| | ***NOTICE*** |
| | **Risk of damage to the sensor during assembly.**<br>Observe a maximum tightening torque of 10 Ncm for the set-screws. |



MMS sensor assembly

1 Tilt the sensor slightly in order to insert it in the monitoring groove.

2 Set the sensor to the desired monitoring position and clamp it with the set-screw.

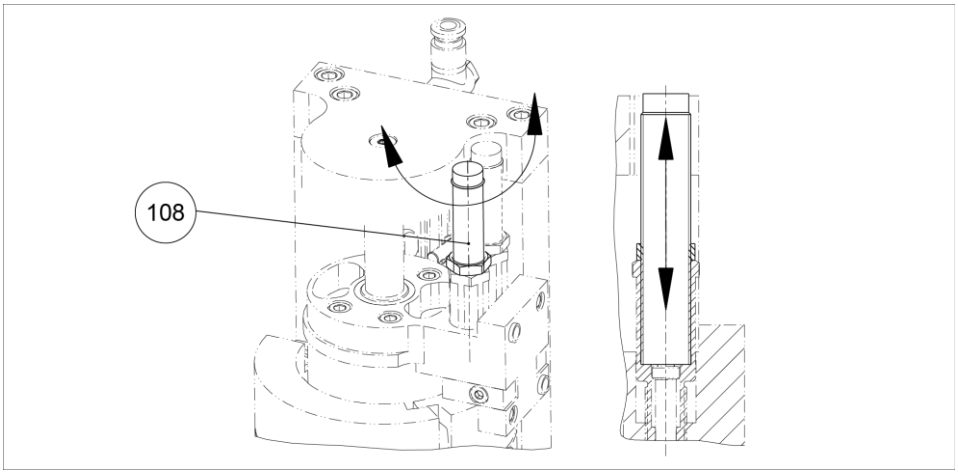
Several sensors can be installed in the two grooves on top of each other.

### 8.6.5 End position dampening

The shock absorbers have been installed at the factory and are preset in such a manner to ensure safe operation with a maximum load.

The shock absorbers can be adjusted in installed condition. It is not necessary to readjust the end positions.

- The end position of the swivel stroke have been adjusted, (☞ 8.5.1, Page 46).
- The back stops of the vertical end positions have been adjusted, (☞ 8.5.2, Page 47).




Dampening adjustment

1 Loosen the counter nut of the shock absorber (108).

2 Turn the shock absorber (108) into the desired position and tighten the counter nut.

3 Check the dampening in operation and correct it again if necessary.

⇨ The shock absorber (108) is set correctly if the device reaches its end position swiftly without any mechanical impact.

# 9 Trouble shooting

## 9.1 No operating movement?

| Possible cause | Corrective action |
|---|---|
| Pressure drops below minimum. | Check the air supply. (☞ 7.3, Page 21) |
| Pressure lines swapped / connected incorrectly | Check compressed air lines. (☞ 7.3, Page 21) |
| Sensor not set correctly | Repair the proximity switch. (☞ 8.5.3, Page 48) |
| Sensor defective | Replace sensor |
| Module is actuated incorrectly | Check actuation by means of flow chart (☞ 8.4, Page 33) |
| | If necessary, use SPS function module |
| The internal cycle time of the control is set too high or too low. | See valve and control specifications, chapters 6.3.3 and 6.3.4 |

## 9.2 Cycle speed is not reached?

| Possible cause | Corrective action |
|---|---|
| Use of unsuitable valves | Check valve switching times and consult SCHUNK contact person if necessary. |
| | See valve and control specifications, chapter 6.3.3 and 6.3.4 |
| Shock absorbers extended too far | Withdraw / readjust shock absorbers, (☞ 8.5, Page 46). |
| Nominal pressure not reached | Check the air supply. (☞ 6, Page 13). |

| Possible cause | Corrective action |
|---|---|
| Permissible lengths of connection lines exceeded | Shorten compressed air lines from valves to unit, (☞ 7.3, Page 21). |
| Switching points have not been set correctly | Check the UH and UV sensor settings, (☞ 8.5.3, Page 48). |
| Compressed air lines not implemented optimally | Check compressed air lines:<br>– Inner diameters of compressed air lines are of sufficient size in relation to compressed air consumption<br>– Flow rate of directional control valve is of sufficient size in relation to compressed air consumption |

## 9.3 Rough sequence?

| Possible cause | Corrective action |
|---|---|
| Use of unsuitable valves | Check the valve switching times and consult a SCHUNK contact person if necessary. |
| | See valve and control specifications, chapters 6.3.3 and 6.3.4 |
| Module is not actuated correctly | Check whether the actuation corresponds to the flow charts (☞ 8.4, Page 33). |
| | If necessary, use SPS function module. |
| Switching points have not been set correctly | Check the UH and UV sensor settings, (☞ 8.5.3, Page 48). |
| Permissible lengths of connection lines exceeded | Shorten compressed air lines from valves to unit, (☞ 7.3, Page 21). |
| Very quick operating cycle | Slow down sequence by adjusting compressed air throttles (☞ 8.3, Page 32)<br>Slow down sequence by adjusting UH sensor upwards. |
| Operating pressure too high | Check maximum pressure of air supply, (☞ 6, Page 13). |

## 9.4 Impact in the end positions?

| Possible cause | Corrective action |
|---|---|
| Shock absorbers are defective | Replace and adjust shock absorbers, (☞ 10.5, Page 61). |
| Shock absorbers retracted too far | Readjust shock absorbers (☞ 8.5, Page 46). |
| Exhaust air throttles defective | Check working order of throttles and replace them if necessary. |
| Exhaust air throttles open too far | Close exhaust air throttles further (☞ 8.3, Page 32). |

## 9.5 Signal for vertical position or horizontal piston position monitoring missing?

| Possible cause | Corrective action |
|---|---|
| IN sensor adjusted incorrectly | Readjust sensor, (☞ 8.5.3, Page 48). |
| Sensor defective | Replace sensor |
| Cable breakage | Replace sensor<br>Replace connection cable extension (provided by the customer) if necessary. |

## 9.6 Center position (option) cannot be approached correctly?

| Possible cause | Corrective action |
|---|---|
| Swivel movement too quick | Close exhaust air throttles of connections C and D further |
| Shock absorbers for center position defective | Replace shock absorbers of center stop |
| Pressure lines swapped / connected incorrectly | Check compressed air lines (☞ 7.5.1, Page 28) |
| Module is actuated incorrectly | Check actuation by means of flow chart (☞ 8.5.3, Page 48) |

## 9.7 Center position (option) bounces upon impact of the swing arm?

| Possible cause | Corrective action |
|---|---|
| Swivel movement too quick | Close exhaust air throttles of connections C and D further |
| Shock absorbers for the center position are set incorrectly | Replace shock absorbers of intermediate stop (☞ 7.5.2, Page 29) |
| Shock absorbers for center position defective | Replace shock absorbers of center stop |

# 10 Maintenance and care

## 10.1 Maintenance and lubrication intervals

***NOTICE***

**At ambient temperature above 60°C the lubricants can harden faster.**

- Interval decrease accordingly.

***NOTICE***

**Lubricate guidance regularly!**
Dry running of the guidance of the stroke/swivel unit can cause serious mechanical damage and shorten service lives considerably.

- Observe the lubrication intervals!

***NOTICE***

**Regularly check the shock absorber!**

- The shock absorbers have a limited life span. A shock absorber failure can lead to serious mechanical damage; for this reason, they must be checked regularly for proper function. The shock absorber is working correctly if the device reaches its end position swiftly without any mechanical impact.
- Overloading of the unit or exceeding the permitted cycle frequency can lead to drastic reduction of the service life of the shock absorbers.

Maintenance intervals

| Activity | Interval [Mio. cycles] | |
|---|---|---|
| | DRL20 | DRL25 |
| Lubricate the guidance (☞ 10.2, Page 58) | 4 | 4 |
| Replace the cam roller (☞ 10.3, Page 59)<br>If function is checked regularly, the cam roller can also be operated for a longer period. | 8 | 8 |
| Replace the shock absorbers (recommended for safe operation) (☞ 10.5, Page 61) | 6 | 6 |

| Activity | Interval [Mio. cycles] | |
|---|---|---|
| | DRL20 | DRL25 |
| Clean the guidance and interior of the module with a soft cloth to remove any excess grease and dirt (☞ 10.4, Page 60) | 10 | |
| Clean and re-lubricate the slipway in the connecting members (☞ 10.4, Page 60) | 10 | |
| Test the module for functionality and tightness | Regular testing | |

**NOTE**
The pistons have life-time lubrication. They only have to be re-lubricated upon removal/replacement.

## 10.2 Lubricants/Lubrication points (basic lubrication)

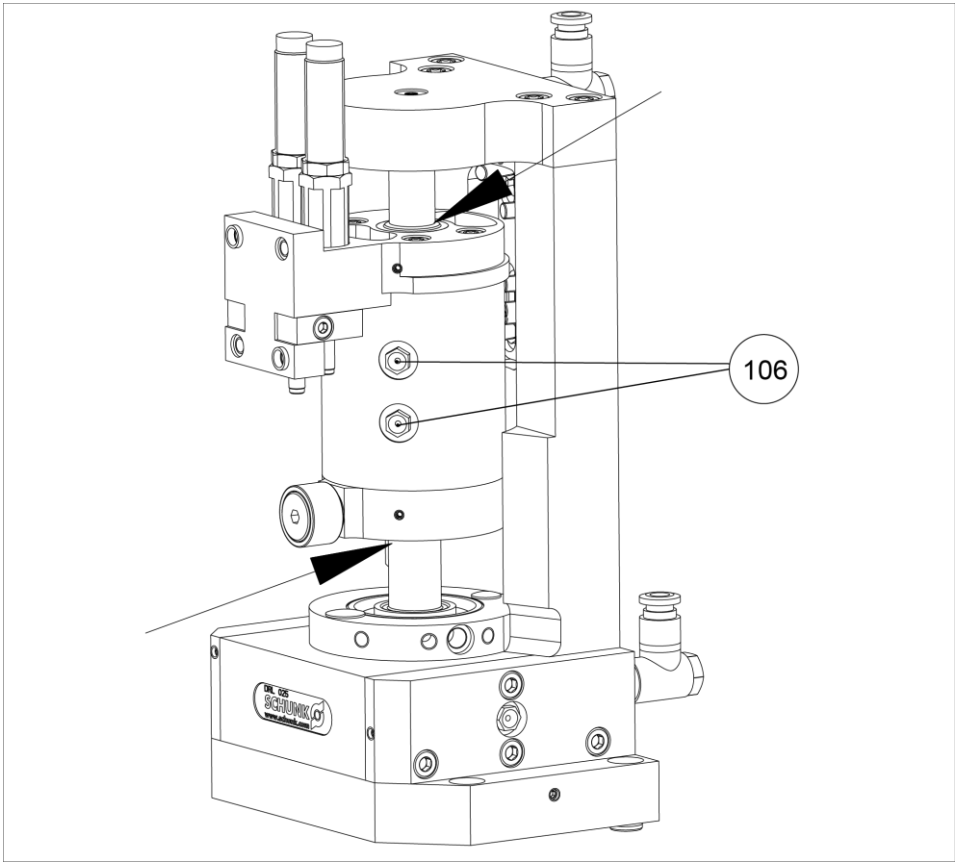
We recommend the lubricants listed.

During maintenance, treat all greased areas with lubricant. Thinly apply lubricant with a lint-free cloth.

Greasing areas, grease

| Lubricant point | Action | Lubricant |
|---|---|---|
| Greasing area Guidance | Press in grease through both inlets (pos. 106) until grease escapes from the respective sealing side (arrows). | Renolit HLT 2 (from Fuchs) |
| Bore hole in the piston * | Grease the entire surface slightly | Renolit HLT 2 (from Fuchs) |
| All seals * | Grease slightly | |
| Slipway of connecting members | Grease slightly | Klueberlub BE 41-542 (from Klueber) |

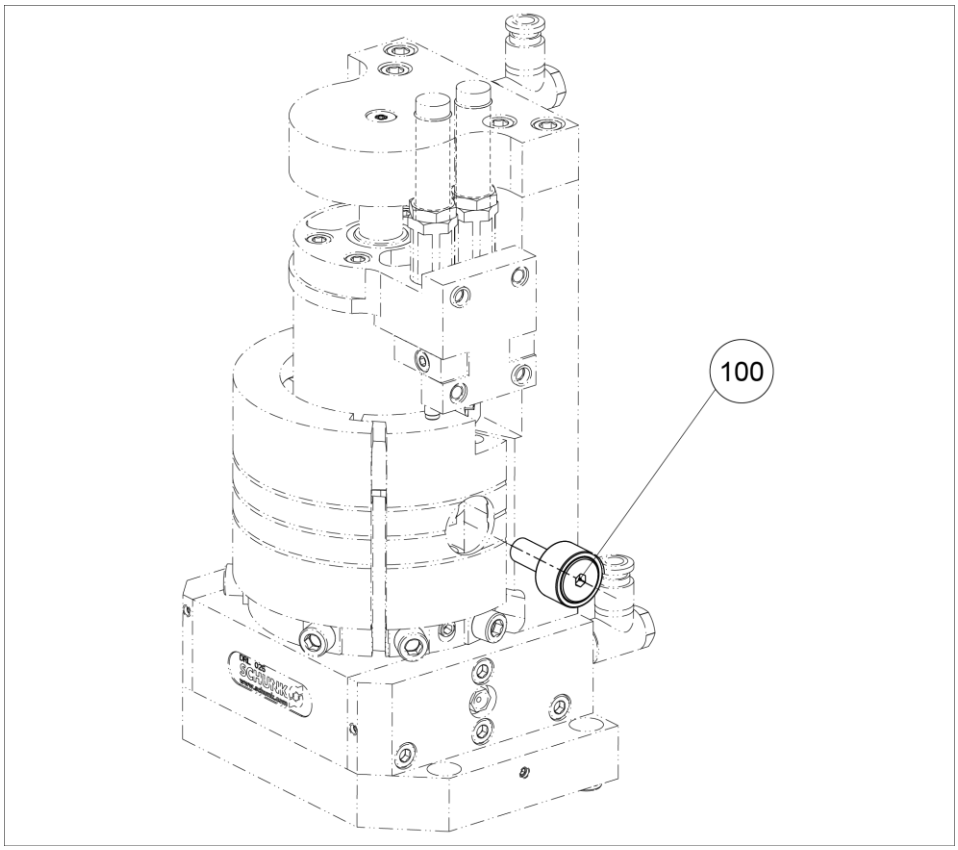
* Only after disassembling the module for repairs




Guidance lubrication inlet

## 10.3 Replacing the cam roller

When replacing the cam roller, several end positions and settings will remain saved.




Replacing the cam roller

**Replacing the cam roller**

✓ The unit has been depressurized.

1 Swivel the unit into the 0° position and raise the swivel arm to a stroke position of approx. 20 mm - now the roller can be seen through the cut-out in the connecting member.

2 Turn out the cam roller (100) with a hexagon socket.

⇨ The new roller can now be installed.

3 Ensure the thread of the cam roller is free of grease.

4 Completely wet the thread of the cam roller with suitable chemical screw lock.

5 Completely screw in the cam roller; observe the prescribed tightening torque when doing this!

**NOTE**
Secure the new roller with suitable chemical screw lock when installing it (observe tightening torque)!

Tightening torque

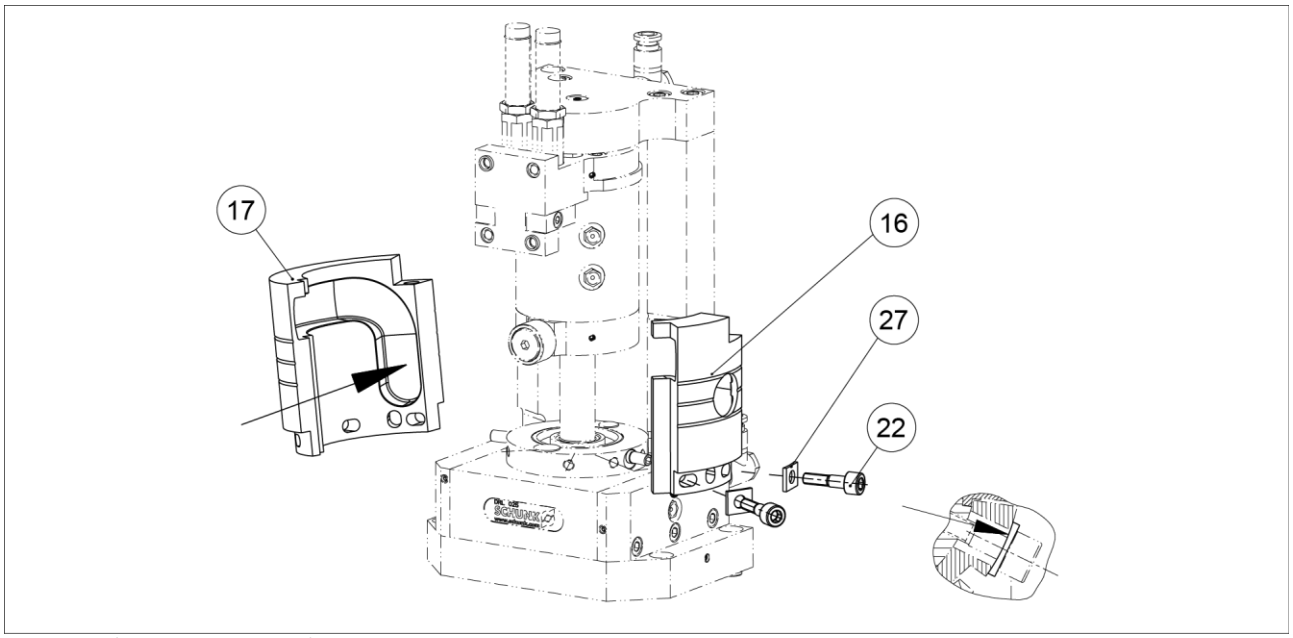
| Item | Designation | Tightening torque [Nm] | |
|---|---|---|---|
| | | DRL 20 | DRL 25 |
| 100 | Cam roller | 8 | 20 |

## 10.4 Maintenance of the connecting members and module interior

The connecting members have to be removed in order to clean, lubricate and test them.

**NOTE**
The settings of the rotating angle end positions are lost by removing the connecting members.
Readjust the end positions after maintenance, (☞ 8.5.1, Page 46).

### Removal/ maintenance of the connecting members




Removing the connecting members

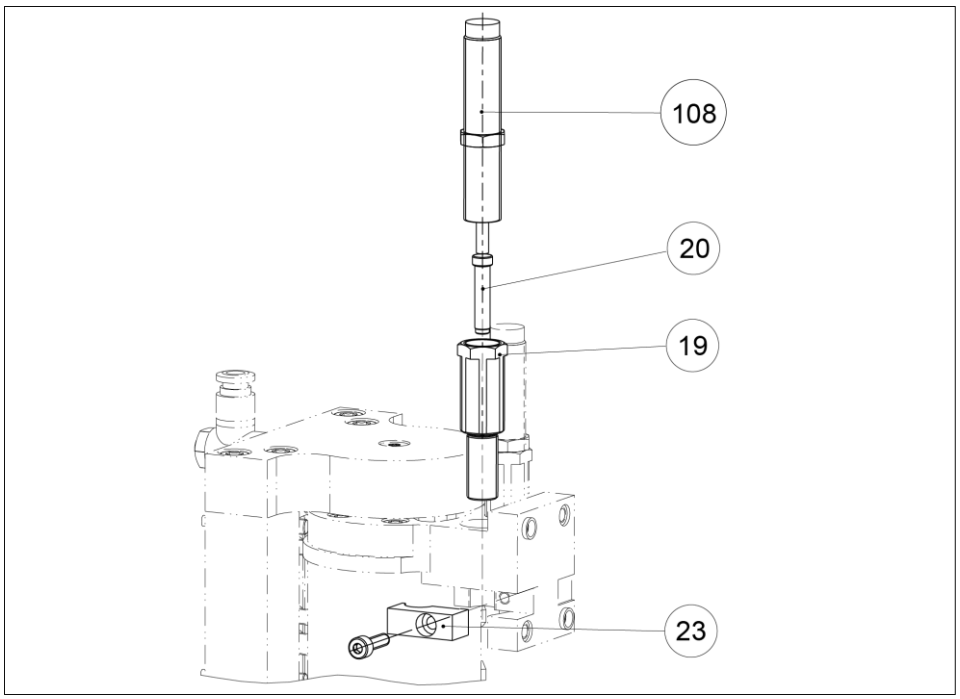
| Item | Designation |
|---|---|
| 16 | Connecting member |
| 17 | Connecting member |
| 22 | Retaining screws |
| 27 | Washers |

1 Loosen the retaining screws (22).
2 Remove the connecting members (16, 17).
3 Clean the interior and shaft of the module with a soft cloth soaked in oil.
4 Clean and re-lubricate the guide groove of both connecting members (see arrow).
5 Re-attach the connecting members. **CAUTION Observe the tightening torque** (☞ 8.5.1, Page 46)

**NOTE**
The washers (27) have been assigned a radius.
Ensure correct alignment.

- Observe the tightening torques!

## 10.5 Removing the absorbers and back stop elements



Removing the absorbers and back stop elements

**Removing the absorbers (108)** Loosen the counter nut of the absorber (108) and turn the absorber out of the stop coupling (19).

**Removing the rod (20)** Remove the absorber (108) and take out the rod (20) upwards.

**Removing the stop coupling (19)** Loosen the attachment screw (143) for the retaining plate (23) and turn out the stop coupling (19).

**Readjust the end position.** (☞ 8.5.2, Page 47)

# 11 Spare parts / wearing parts

**NOTICE**

**The module may only be disassembled to the extent described in Chapter 10.**
Any further disassembly by the customer is not allowed and results in the expiry of the warranty and liability for all resulting warranty and subsequent damage.

- Have defective modules repaired at the production facility. Consult the SCHUNK contact person.

**Spare parts**

All air connections, shock absorbers and back stop elements as well as the cam roller and connecting members can be ordered as spare parts.

| Item | Designation |
|---|---|
| 16 | Connecting member |
| 17 | Connecting member |
| 19 | Stop coupling |
| 20 | Rod |
| 22 | Retaining screw |
| 23 | Retaining plate |
| 27 | Washers |
| 100 | Cam roller |
| 108 | Dampener |

For further information, see the chapters "Replacing the cam roller" (☞ 10.3, Page 59), "Maintenance of the connecting members and interior module" (☞ 10.4, Page 60) and "Removing the absorbers and back stop elements" (☞ 10.5, Page 61).

**Wearing parts**

- All parts in contact with the workpiece
- All seals
- All bearings, connecting members and the guide roller
- All drive elements, such as pistons and gears, cylindrical housings and vertical drives

## Notes

# 12 Translation of original declaration of incorporation

in terms of the Directive 2006/42/EG, Annex II, Part 1.B of the European Parliament and of the Council on machinery.

| | |
|---|---|
| Manufacturer/ Distributor | SCHUNK GmbH & Co. KG Spann- und Greiftechnik<br>Bahnhofstr. 106 – 134<br>D-74348 Lauffen/Neckar |

We hereby declare that on the date of the declaration the following incomplete machine complied with all basic safety and health regulations found in the directive 2006/42/EC of the European Parliament and of the Council on machinery. The declaration is rendered invalid if modifications are made to the product.

| | |
|---|---|
| Product designation: | Rotary loader / DRL 20, DRL 25 |
| ID number | 0314770, 0314771, 0314780, 0314781, 0314772,0 0314773, 0314782, 0314783 |

The incomplete machine may not be put into operation until conformity of the machine into which the incomplete machine is to be installed with the provisions of the Machinery Directive (2006/42/EC) is confirmed.

Applied harmonized standards, especially:

| | |
|---|---|
| EN ISO 12100:2011-03 | Safety of machinery - General principles for design - Risk assessment and risk reduction |

The manufacturer agrees to forward on demand the relevant technical documentation for the partly completed machinery to state offices.

The special technical documents according to Appendix VII, Part B belonging to the incomplete machine have been compiled.

Person authorized to compile the technical documentation:
Robert Leuthner, Address: see manufacturer's address

Lauffen/Neckar, Juni 2016

p.p. Ralf Winkler,
Head of Gripping Systems Development