Assembly and Operating Manual

PPU-P

Pick and Place Unit

Superior Clamping and Gripping

SCHUNK®

Imprint

Technical changes:

We reserve the right to make alterations for the purpose of technical improvement.

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Dear Customer,

thank you for trusting our products and our family-owned company, the leading technology supplier of robots and production machines.

Our team is always available to answer any questions on this product and other solutions. Ask us questions and challenge us. We will find a solution!

Best regards,

Your SCHUNK team

SCHUNK GmbH & Co. KG
Clamping and gripping technology

Bahnhofstr. 106 - 134
D-74348 Lauffen/Neckar

Tel. +49-7133-103-0
Fax +49-7133-103-2399

info@de.schunk.com
schunk.com

Table of Contents

1 General

1.1 About this manual

This manual contains important information for a safe and appropriate use of the product.

This manual is an integral part of the product and must be kept accessible for the personnel at all times.

Before starting work, the personnel must have read and understood this operating manual. Prerequisite for safe working is the observance of all safety instructions in this manual.

Illustrations in this manual are provided for basic understanding and may differ from the actual product design.

In addition to these instructions, the documents listed under Applicable documents [▶ 6] are applicable.

1.1.1 Presentation of Warning Labels

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

⚠ DANGER

Danger for persons!

Non-observance will inevitably cause irreversible injury or death.

⚠ WARNING

Dangers for persons!

Non-observance can lead to irreversible injury and even death.

⚠ CAUTION

Dangers for persons!

Non-observance can cause minor injuries.

CAUTION

Material damage!

Information about avoiding material damage.

1.1.2 Applicable documents

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

The documents marked with an asterisk (*) can be downloaded on our homepage **schunk.com**

1.1.3 Sizes

This operating manual applies to the following sizes:

- PPU-P 10
- PPU-P 30

1.1.4 Accessories

The following accessories, which must be ordered separately, are required for the product:

- Sensors
- Base plate mounting kit
- Anti-fall device
- Energy hose mounting kit
- Adapter plate mounting kit

A wide range of accessories are available for this product

For information regarding which accessory articles can be used with the corresponding product variants, see catalog data sheet.

1.1.4.1 Sensors

Overview of the compatible sensors

Designation	Type
Magnetic switch	MMS

- Exact type designation of the compatible sensors see catalog.
- Information on handling sensors is available at schunk.com or from SCHUNK contact persons.

1.1.4.2 Base plate mounting kit

Designation	ID number
Base plate mounting kit AS-PPU-P10-GPL	0314702
Base plate mounting kit AS-PPU-P30-GPL	0314707

For easy mounting of the PPU-P from above.

Parts included:

- Centering pins for exact positioning on PPU-P.
- Connecting screws for mounting on PPU-P.

1.1.4.3 Anti-fall device

CAUTION

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

The rod lock can be damaged due to incorrect actuation or overload.

- The rod lock may only be triggered and unlocked when the product has been shut down or is in its waiting position.
- Observe the specifications for the static holding force. The occuring forces in clamped condition may not exceed the retention 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.

Prevents payload from falling from the stand-by position in case of pressure loss.

Designation	ID number
Anti-fall device ASP-P010	0314703
Anti-fall device ASP-P030	0314708

1.1.4.4 Energy hose mounting kit

Designation	ID number
Energy hose mounting kit AS-PPU-P10-ES	0314700
Energy hose mounting kit AS-PPU-P30-ES	0314705

Guiding of energy and sensor cables from the housing to the cantilever arm

Parts included:

- Mounting material

1.1.4.5 Adapter plate mounting kit

Designation	ID number
Adapter plate mounting kit AS-PPU-P10-APL	0314701
Adapter plate mounting kit AS-PPU-P30-APL	0314706

For adaptation to the connecting diagram of the GEMOTEC system:

Parts included:

- Connecting screws for mounting on unit

1.2 Warranty

If the product is used as intended, the warranty is valid for 24 months from the ex-works delivery date under the following conditions:

- Observe the specified maintenance and lubrication intervals
- Observe the ambient conditions and operating conditions

Parts touching the workpiece and wear parts are not included in the warranty.

1.3 Scope of delivery

The scope of delivery includes

- Pick and Place Unit PPU-P in the version ordered
- Assembly and Operating Manual
- Accessory pack

2 Basic safety notes

2.1 Intended use

The product is exclusively designed for linear movement of useful loads into any desired position.

- The product may only be used within the scope of its technical data, Technical Data [▶ 17].
- When implementing and operating components in safety-related parts of the control systems, the basic safety principles in accordance with DIN EN ISO 13849-2 apply. The proven safety principles in accordance with DIN EN ISO 13849-2 also apply to categories 1, 2, 3 and 4.
- The product is intended for installation in a machine/system. The applicable guidelines must be observed and complied with.
- The product is intended for industrial and industry-oriented use.
- Appropriate use of the product includes compliance with all instructions in this manual.

2.2 Not intended use

It is not intended use if the product is used, for example, as a pressing tool, stamping tool, lifting gear, guide for tools, cutting tool, clamping device or a drilling tool.

- Any utilization that exceeds or differs from the appropriate use is regarded as misuse.

2.3 Constructional changes

Implementation of structural changes

By conversions, changes, and reworking, e.g. additional threads, holes, or safety devices can impair the functioning or safety of the product or damage it.

- Structural changes should only be made with the written approval of SCHUNK.

2.4 Spare parts

Use of unauthorized spare parts

Using unauthorized spare parts can endanger personnel and damage the product or cause it to malfunction.

- Use only original spare parts or spares authorized by SCHUNK.

2.5 Environmental and operating conditions

Required ambient conditions and operating conditions

Incorrect ambient and operating conditions can make the product unsafe, leading to the risk of serious injuries, considerable material damage and/or a significant reduction to the product's life span.

- Make sure that the product is used only in the context of its defined application parameters, Technical Data [▸ 17].
- Ensure that maintenance and lubrication intervals are observed, Maintenance [▸ 48].
- 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.
- Ensure that no strong magnetic fields impair the function of the product.
  Contact your SCHUNK partner if the product is to be used in strong magnetic fields.

2.6 Personnel qualification

Inadequate qualifications of the personnel

If the personnel working with the product is not sufficiently qualified, the result may be serious injuries and significant property damage.

- All work may only be performed by qualified personnel.
- Before working with the product, the personnel must have read and understood the complete assembly and operating manual.
- Observe the national safety regulations and rules and general safety instructions.

The following personal qualifications are necessary for the various activities related to the product:

Trained electrician	Due to their technical training, knowledge and experience, trained electricians are able to work on electrical systems, recognize and avoid possible dangers and know the relevant standards and regulations.
Qualified personnel	Due to its technical training, knowledge and experience, qualified personnel is able to perform the delegated tasks, recognize and avoid possible dangers and knows the relevant standards and regulations.
Instructed person	Instructed persons were instructed by the operator about the delegated tasks and possible dangers due to improper behaviour.
Service personnel of the manufacturer	Due to its technical training, knowledge and experience, service personnel of the manufacturer is able to perform the delegated tasks and to recognize and avoid possible dangers.

2.7 Personal protective equipment

Use of personal protective equipment

Personal protective equipment serves to protect staff against danger which may interfere with their health or safety at work.

- When working on and with the product, observe the occupational health and safety regulations and wear the required personal protective equipment.
- Observe the valid safety and accident prevention regulations.
- Wear protective gloves to guard against sharp edges and corners or rough surfaces.
- Wear heat-resistant protective gloves when handling hot surfaces.
- Wear protective gloves and safety goggles when handling hazardous substances.
- Wear close-fitting protective clothing and also wear long hair in a hairnet when dealing with moving components.

2.8 Notes on safe operation

Incorrect handling of the personnel

Incorrect handling and assembly may impair the product's safety and cause serious injuries and considerable material damage.

- Avoid any manner of working that may interfere with the function and operational safety of the product.
- Use the product as intended.
- Observe the safety notes and assembly instructions.
- Do not expose the product to any corrosive media. This does not apply to products that are designed for special environments.
- Eliminate any malfunction immediately.
- Observe the care and maintenance instructions.
- Observe the current safety, accident prevention and environmental protection regulations regarding the product's application field.

2.9 Transport

Handling during transport

Incorrect handling during transport may impair the product's safety and cause serious injuries and considerable material damage.

- When handling heavy weights, use lifting equipment to lift the product and transport it by appropriate means.
- Secure the product against falling during transportation and handling.
- Stand clear of suspended loads.

2.10 Malfunctions

Behavior in case of malfunctions

- Immediately remove the product from operation and report the malfunction to the responsible departments/persons.
- Order appropriately trained personnel to rectify the malfunction.
- Do not recommission the product until the malfunction has been rectified.
- Test the product after a malfunction to establish whether it still functions properly and no increased risks have arisen.

2.11 Disposal

Handling of disposal

The incorrect handling of disposal may impair the product's safety and cause serious injuries as well as considerable material and environmental harm.

- Follow local regulations on dispatching product components for recycling or proper disposal.

2.12 Fundamental dangers

General

- Observe safety distances.
- Never deactivate safety devices.
- Before commissioning the product, take appropriate protective measures to secure the danger zone.
- Disconnect power sources before installation, modification, maintenance, or calibration. Ensure that no residual energy remains in the system.
- If the energy supply is connected, do not move any parts by hand.
- Do not reach into the open mechanism or movement area of the product during operation.

2.12.1 Protection during handling and assembly

Incorrect handling and assembly

Incorrect handling and assembly may impair the product's safety and cause serious injuries and considerable material damage.

- Have all work carried out by appropriately qualified personnel.
- For all work, secure the product against accidental operation.
- Observe the relevant accident prevention rules.
- Use suitable assembly and transport equipment and take precautions to prevent jamming and crushing.

Incorrect lifting of loads

Falling loads may cause serious injuries and even death.

- Stand clear of suspended loads and do not step into their swiveling range.
- Never move loads without supervision.
- Do not leave suspended loads unattended.

2.12.2 Protection during commissioning and operation

Falling or violently ejected components

Falling and violently ejected components can cause serious injuries and even death.

- Take appropriate protective measures to secure the danger zone.
- Never step into the danger zone during operation.

2.12.3 Protection against dangerous movements

Unexpected movements

Residual energy in the system may cause serious injuries while working with the product.

- Switch off the energy supply, ensure that no residual energy remains and secure against inadvertent reactivation.
- Never rely solely on the response of the monitoring function to avert danger. Until the installed monitors become effective, it must be assumed that the drive movement is faulty, with its action being dependent on the control unit and the current operating condition of the drive. Perform maintenance work, modifications, and attachments outside the danger zone defined by the movement range.
- To avoid accidents and/or material damage, human access to the movement range of the machine must be restricted. Limit/ prevent accidental access for people in this area due through technical safety measures. The protective cover and protective fence must be rigid enough to withstand the maximum possible movement energy. EMERGENCY STOP switches must be easily and quickly accessible. Before starting up the machine or automated system, check that the EMERGENCY STOP system is working. Prevent operation of the machine if this protective equipment does not function correctly.

2.12.4 Protection against electric shock

Possible electrostatic energy

Components or assembly groups may become electrostatically charged. When the electrostatic charge is touched, the discharge may trigger a shock reaction leading to injuries.

- The operator must ensure that all components and assembly groups are included in the local potential equalisation in accordance with the applicable regulations.
- While paying attention to the actual conditions of the working environment, the potential equalisation must be implemented by a specialist electrician according to the applicable regulations.
- The effectiveness of the potential equalisation must be verified by executing regular safety measurements.

2.13 Notes on particular risks

⚠ WARNING

Risk of injury from objects falling and being ejected!

Falling and ejected objects during operation can lead to serious injury or death.

- Take appropriate protective measures to secure the danger zone.

⚠ WARNING

Risk of injury from objects falling during energy supply failure

Products with a mechanical gripping force maintenance can, during energy supply failure, still move independently in the direction specified by the mechanical gripping force maintenance.

- Secure the end positions of the product with SCHUNK SDV-P pressure maintenance valves.

⚠ WARNING

Risk of injury due to unexpected movements!

If the power supply is switched on or residual energy remains in the system, components can move unexpectedly and cause serious injuries.

- Before starting any work on the product: Switch off the power supply and secure against restarting.
- Make sure, that no residual energy remains in the system.

⚠ WARNING

Danger of crushing and impacts during movement of the unit or attachments. Risk of injury due to attachments breaking or becoming loose.

Surround the unit with a protective barrier during operation.

Danger during decommissioning

⚠ WARNING

Possible danger of injury due to residual energy in the attachments!

Uncontrolled motion of the individual parts of the module is possible during disassembly!

- Before decommissioning, ensure that no residual energy remains in the system.

3 Technical Data

Designation	PPU-P 10	PPU-P 30
Mechanical operating data		
Weight [kg]	4.5	15.5
Max. permissible payload * [kg]	1.0	3.0
Ambient temperature [°C]	5 - 60	
Piston force (lifting) ** [N]	101	245
Piston force (lowering) ** [N]	86	188
Piston force (extending) ** [N]	47	86
Piston force (retracting) ** [N]	57	101
Repeat accuracy Vertical [mm] Horizontal [mm]	 ± 0.01 ± 0.01	
Noise emission [dB(A)]	≤ 70	
Achievable cycle time [ms]	See catalog	
Max. permissible number of cycles [rpm]	95	75
Max. horizontal stroke adjustment per side [mm]	12	18
Max. independent vertical stroke adjustment [mm]	15	20
Max. vertical stroke difference [mm]	8	10
Installation position	horizontal	
Operating data for compressed air connection		
Pressure medium	Compressed air, compressed air quality according to ISO 8573-1:7 4 4	
Min. pressure [bar]	4	
Max. pressure [bar]	5	
Nominal working pressure [bar]	5	

* in permissible center of gravity range, Attachment of loads [▶ 21]

** at nominal operating pressure

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

3.1 Anti-fall device

Designation	PPU-P 10	PPU-P 30
Static holding force [N]	80	180
Max. axial play of clamp [mm]	0.2	0.2
Min. release pressure [bar]	3	3
Pneumatic connection	M5	M5

3.2 Valve and control specifications

Designation	PPU-P 10	PPU-P 30
directional control valves	4 x 3/2 directional control valve monostably vented	4 x 3/2 directional control valve monostably vented
Nominal flow	200 l/min	400 l/min
response time "on"	28 ms	28 ms
Response time "off"	8 ms	8 ms
Recommended cycle time of the PLC *	< 1 ms	< 1 ms

* If the digital input signals are wired directly to the PLC input module, make sure that this does not exceed a maximum cycle time of **5 ms**. Due to the speed of the PPU-P, the PLC cannot record any input signals and if the cycle time is exceeded, malfunctions may occur.

4 Assembly

4.1 Mechanical connection

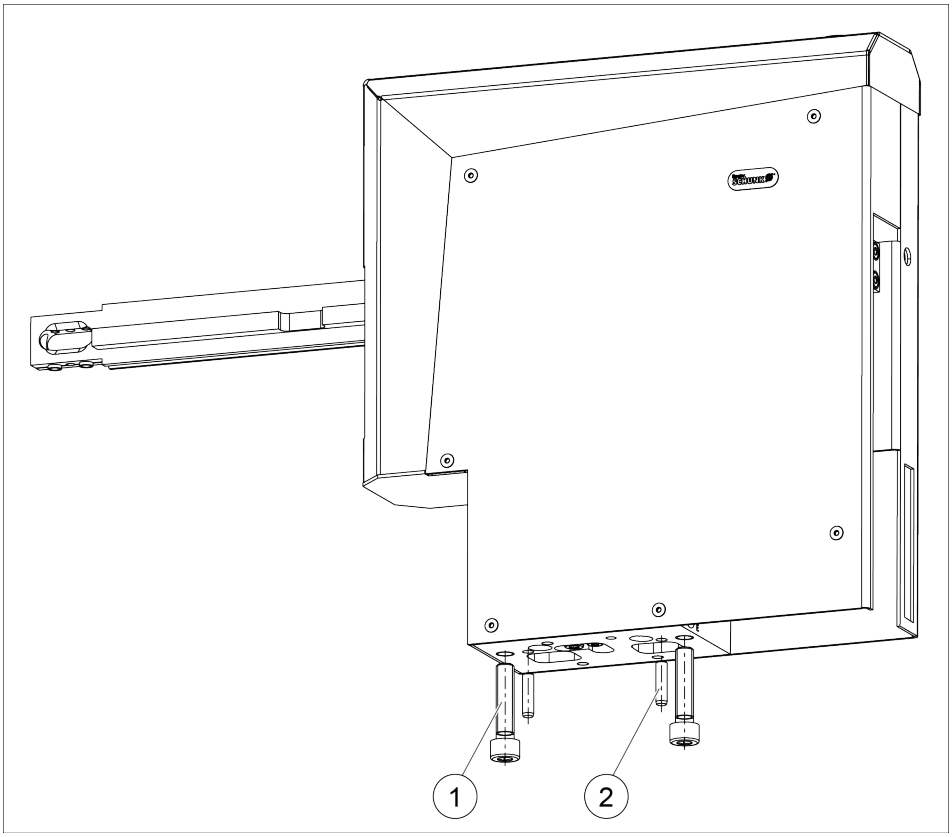
Evenness of the mounting surface

The values apply to the whole mounting surface to which the product is mounted.

Requirements for evenness of the mounting surface (Dimensions in mm)

Edge length	Permissible unevenness
< 100	< 0.02
> 100	< 0.05

Mounting



Mounting of the unit

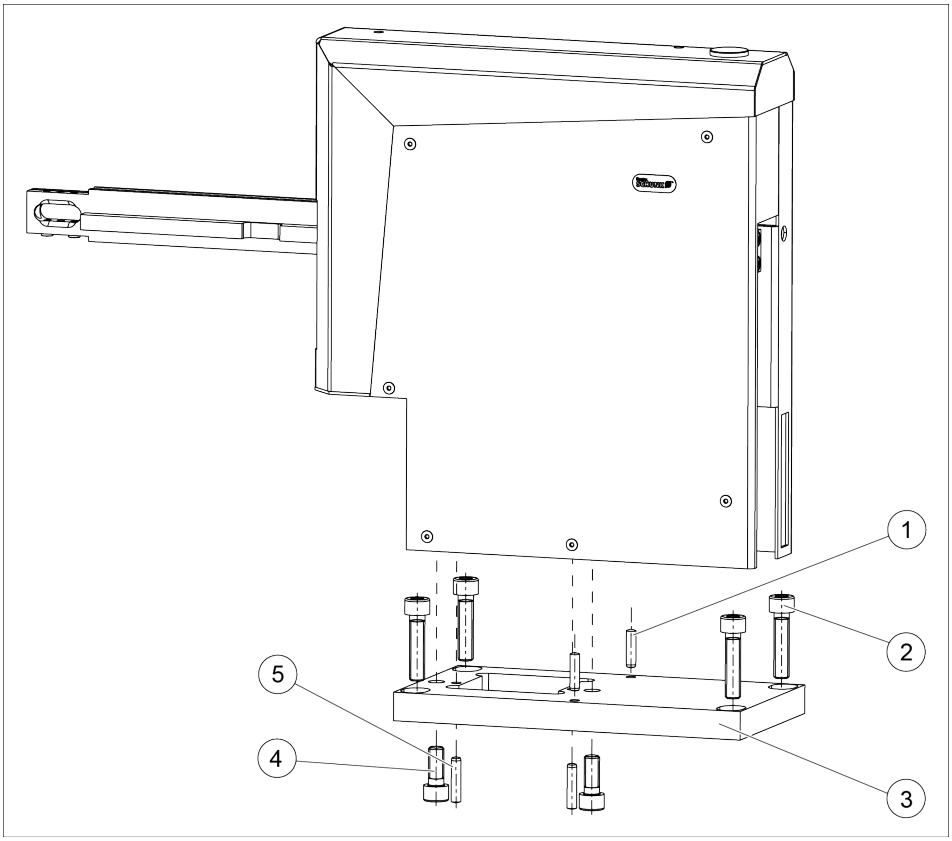
The unit must be mounted on the floor space below.

The following mounting materials are necessary for installation of the unit and must be provided by the customer:

Mounting material

Item	Designation	PPU-P 10	PPU-P 30
1	Screw ISO 4762	M8 / 2x	M10 / 4x
2	Cylindrical pin ISO 8734	Ø5m6 / 2x	Ø6m6 / 2x

Mounting of the unit from above with the base plate mounting kit



Mounting of the unit with the base plate option

The unit must be mounted on the floor space below.

The following mounting materials are necessary for installation of the unit with the base plate mounting kit:

Mounting material for base plate option (provided by customer)

Item	Designation	PPU-P 10	PPU-P 30
2 *	Screw ISO 4762	M8 / 4x	M10 / 4x
1 *	Cylindrical pin ISO 8734	Ø5m6 / 2x	Ø6m6 / 2x
3	Base plate	-	-
4	Screw ISO 4762	M8x20 / 2x	M10x30 / 4x
5	Cylindrical pin ISO 8734	Ø5m6 l=24mm / 2x	Ø6m6 l=30mm / 2x

*must be provided by customer

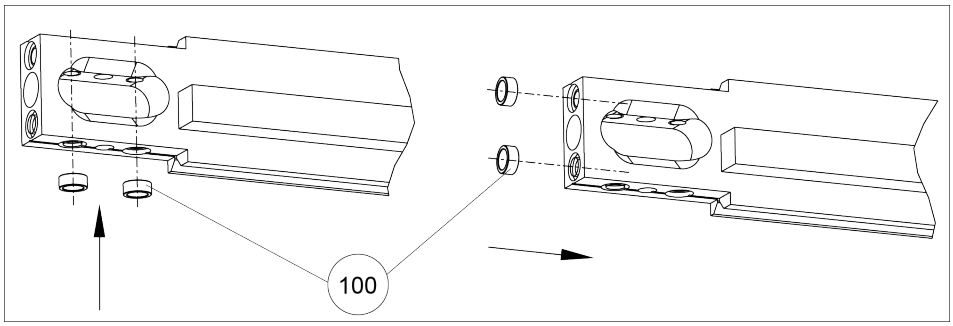
NOTE

Always observe screw tightening torques!

Select the suitable screw tightening torque for mounting of the loads on the unit in accordance with the generally applicable directives for screw connections

4.2 Attachment of loads

Loads can be mounted on the cantilever arm on the front end or from below.



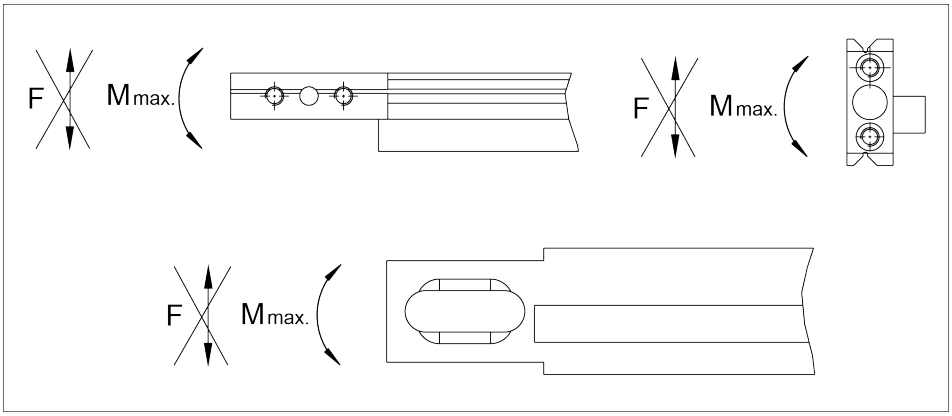
Centering elements for fastening loads

Item	Designation	ID number	
		PPU-P 10	PPU-P 30
100 *	Centering sleeve	0313367	0313368

* included in scope of delivery

CAUTION

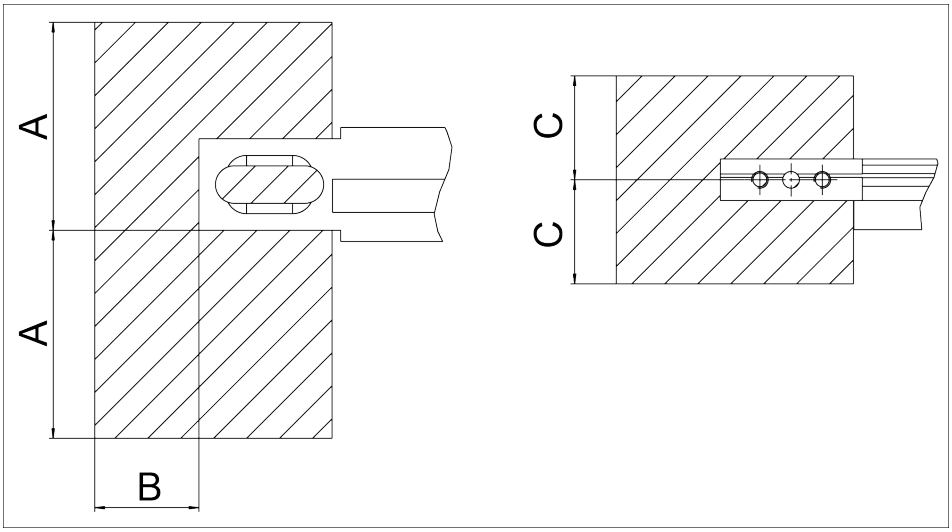
- Please note the permissible range of the center of mass of the load.
- Always mount loads with the cantilever arm **retracted**!
- Select the suitable screw tightening torque for mounting of the loads on the unit in accordance with the generally applicable directives for screw connections.
- When mounting loads, only the maximum permissible moments can be applied to the cantilever arm – no forces!



Permissible additional loads when mounting the load

permissible moments when attaching loads

Load	PPU-P 10	PPU-P 30
M_{max} [Nm]	15	45



permissible range of the center of mass of the load

Dimension	PPU-P 10	PPU-P 30
A [mm]	50	80
B [mm]	25	30
C [mm]	25	30

4.3 Air connections

⚠ WARNING

Risk of injury due to unexpected movements!

If the power supply is switched on or residual energy remains in the system, components can move unexpectedly and cause serious injuries.

- Before starting any work on the product: Switch off the power supply and secure against restarting.
- Make sure, that no residual energy remains in the system.

CAUTION

Pressure medium:

The unit must not under any circumstances be operated with oiled air before operation with unoiled air (washing out of factory lubrication).

CAUTION

Observe the requirements for the air supply
Technical Data [▶ 17].

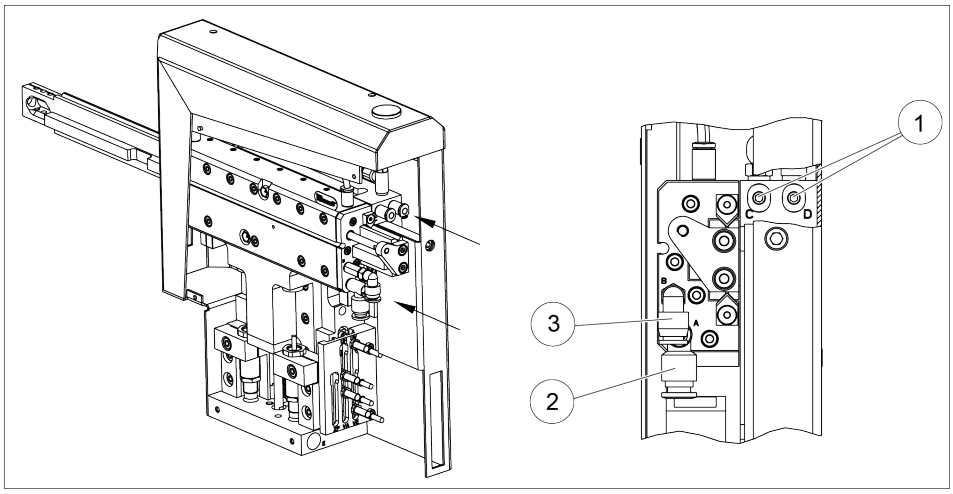
CAUTION

The lengths of the hoses from the valve to the unit affect the cycle time!

The hose lengths have to be as short as possible!

Hose lengths

Hose lengths	PPU-P 10	PPU-P 30
Maximum permissible length [m]	1.0	1.4
Recommended [m]	0.5	0.7



Location of air connections

Item	Connection	Plug-in connection for hose D_a [mm]	
		PPU-P 10	PPU-P 30
1	Compressed air connection C / D: Actuation of horizontal drive (C-Retract / D-Extend)	4	6
2	Compressed air connection A Actuation for raising vertical drive	6	6
3	Compressed air connection B: Actuation for lowering of vertical drive	6	6

4.4 Mounting of accessories

4.4.1 Mounting of base plate mounting kit AS-PPU-P...-GPL

Mechanical connection [▶ 19]

4.4.2 Mounting of optional anti-fall device ASP-P...

CAUTION

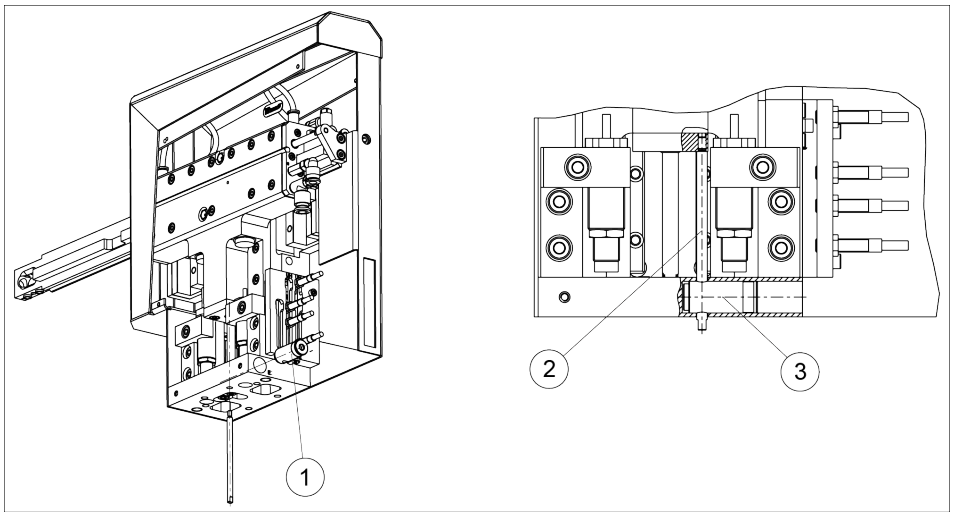
Damage to the rod lock due to incorrect actuation / overload!

The rod lock can be damaged due to incorrect actuation or overload.

- The rod lock may only be triggered and unlocked when the product has been shut down or is in its waiting position.
- Observe the specifications for the static holding force. The occuring forces in clamped condition may not exceed the retention 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

Item	Designation	ID number	
		PPU-P 10	PPU-P 30
1*	M5 air connection	-	-
2	Rod	5520567	1306449
3	Rod lock	9955686	9954333

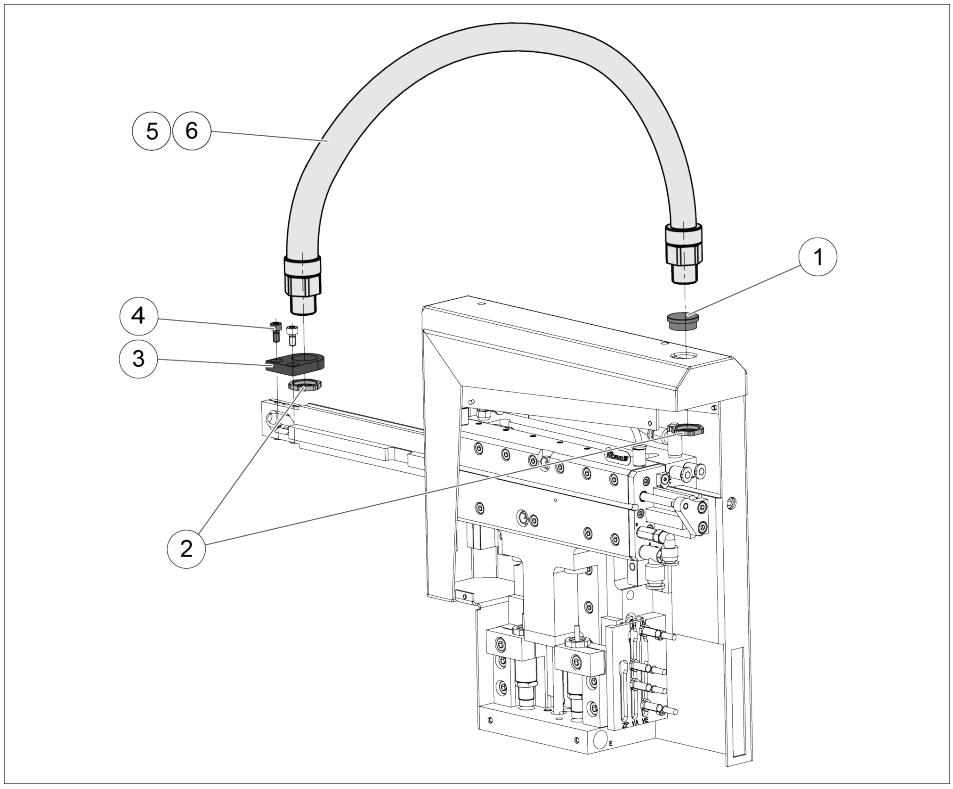
* Must be provided by customer

Rod lock assembly option

- Bore hole for the locking cartridge and thread for the rod are free from dirt
- The screw for undoing the clamping is screwed into the rod lock (3)

➢ Remove the front cover plate.
➢ Insert the rod lock (3) as far as it will go into the designated bore hole.
➢ Push the rod (2) into the designated hole from below and screw it into the thread.
➢ Secure the thread.
➢ Remove the screw from the locking cartridge and screw in the air connection (1).

4.4.3 Mounting of energy hose mounting kit AS-PPU-P...-ES



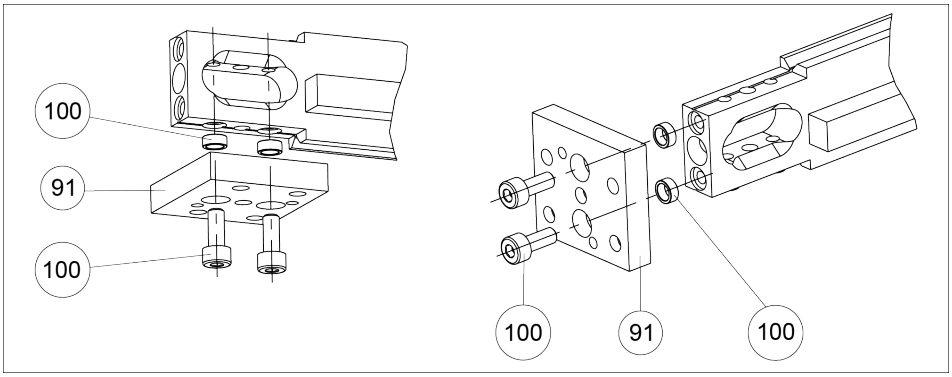
Mounting of energy hose mounting kit

Item	PPU-P 10	PPU-P 30
3	Mount	
6	Cable protection sleeve (pre-mounted)	
5	Threaded hose coupling (pre-mounted)	
2	Metal lock nut	
4	Screw DIN 4762 M4 x 8 / 2x	Screw DIN 4762 M5 x 12 / 2x

Mounting of energy hose mounting kit

- Remove front cover plate.
- Remove plug (1) from cover.
- Attach mount (3) to cantilever arm using cylindrical screws (4).
- Screw threaded hose couplings (5) with metal lock nuts (6) to the mount or from inside to the cover.

4.4.4 Mounting of adapter plate mounting kit AS-PPU-P...-APL



Item	PPU-P 10	PPU-P 30
91*	Adapter plate	
100 **	Centering sleeve	
195*	Screw, ISO 4762 M4x10 / 2x	Screw, ISO 4762 M5x12 / 2x

* Optional adapter plate included

** Included

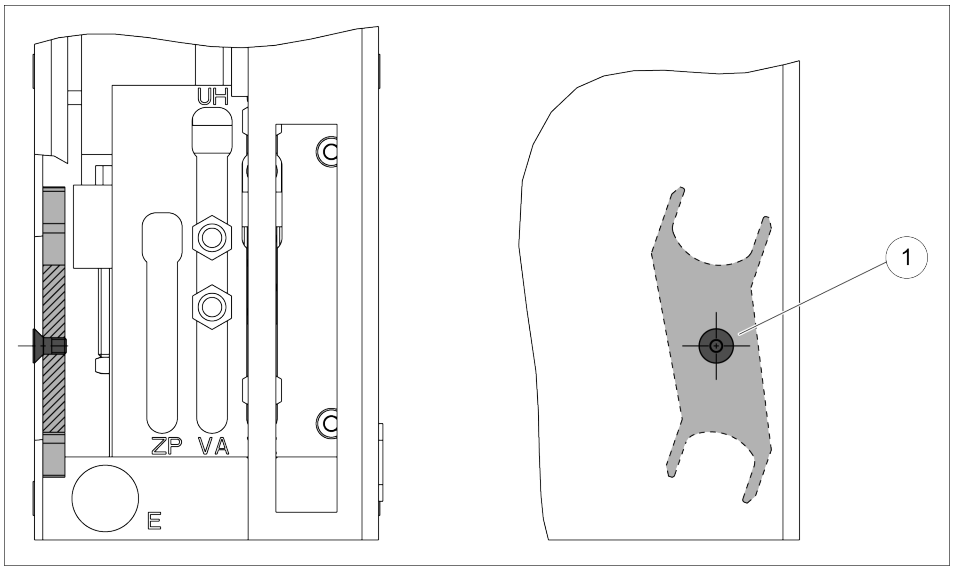
CAUTION

See instructions for attachment of loads, Attachment of loads [▶ 21].

4.5 Adjusting end positions and shock absorbers

The end positions can be adjusted separately from each other, both horizontally and vertically.

	PPU-P 10	PPU-P 30
Horizontal adjustment range	Each 12 mm	Each 18 mm
Vertical adjustment range	Each 15 mm	Each 20 mm
Maximum vertical difference	8 mm	10 mm



Key

The key (1) included with the unit can be used to adjust the vertical end position and the shock absorbers.

The key is integrated in the front wall of the cover.

CAUTION

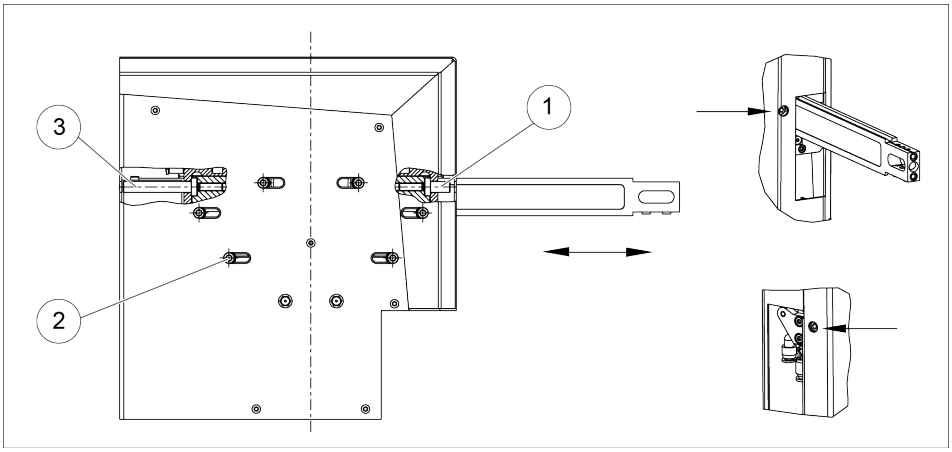
The key is designed only for low tightening torques.

4.5.1 Adjustment of horizontal end positions

⚠ CAUTION

Risk of injury due to unexpected motion of the cantilever arm.

- In case of pneumatic actuation of the end position, take safety measures to ensure that no unwanted motion of the cantilever arm is possible during adjustment.
- Pneumatic actuation is permitted only with all covers in place.



- ➢ Actuate the desired end position by pressurizing the compressed air connections A/B and C/D or actuate manually.
- ➢ Slightly loosen the 3 clamping screws (2) on the side of the end position to be adjusted.

NOTE

For exact positioning, horizontal pressure (pneumatic or manual) must be applied to the cantilever arm in the direction of the respective end position.

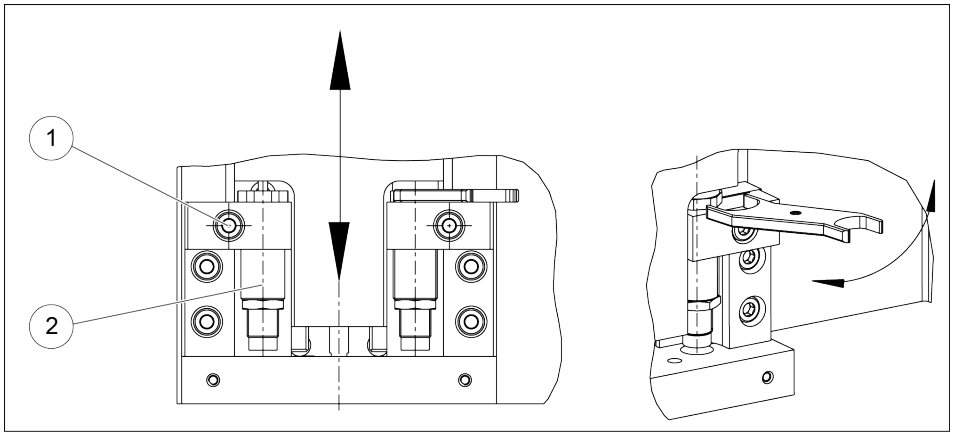
- ➢ Set the end position to the desired position by turning the adjusting screws (1) and (3).
- ➢ Tighten clamping screws (2).
- ➢ If necessary, repeat the process at the 2nd end position.

4.5.2 Adjustment of vertical end positions

⚠ CAUTION

Risk of injury due to sudden movements of the extension arm.

Take measures to ensure that the unit is safely disconnected from the power supply during adjustment.



Adjusting the end positions vertically

Depressurize the unit.

- Unscrew the cover plate of the paneling.
- Approach the desired end position manually.
- Slightly loosen the attachment screw (1) on the side of the end position to be adjusted.

NOTE

For precise positioning, vertical pressure must be applied to the slide from above.

- Place the end position in the desired position by turning the sleeve (2).
- Tighten the attachment screws (1).
- If necessary, repeat procedure for the 2nd end position.

4.6 Mounting and adjustment of sensors

NOTE

Observe the assembly and operating manual of the sensor for mounting and connecting.

The product is equipped for the use of sensors.

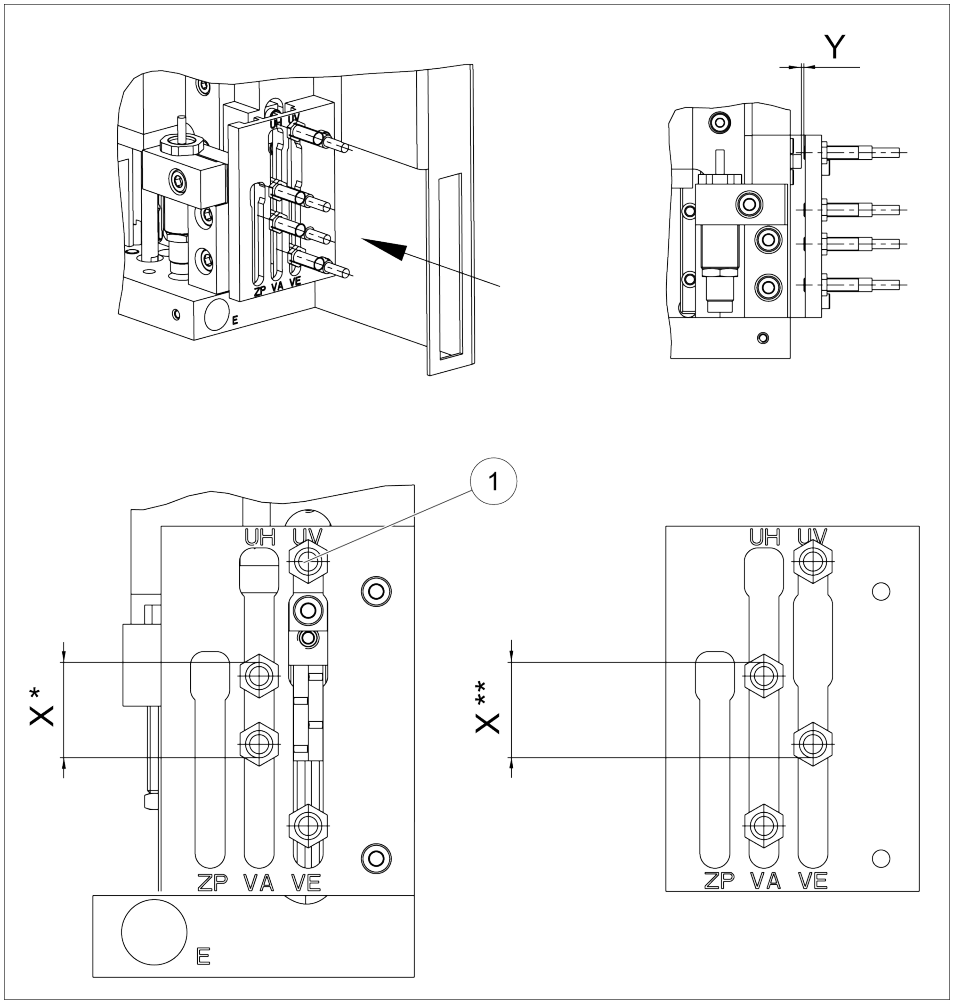
- For the exact type designations of suitable sensors, please see the catalog data sheet.
- For technical data for the suitable sensors, see Assembly and Operating Manual and catalog data sheet.
  - The Assembly and Operating Manual and catalog data sheet are included in the scope of delivery for the sensors and are available at schunk.com.
- Information on handling sensors is available at schunk.com or from SCHUNK contact persons.
- The sensors required for operation are factory-installed.
- MMS sensors for sensing the horizontal position of the piston are available as an option.

CAUTION

The sensor positions are not preadjusted.

All sensors must be adjusted during the start-up procedure, Mounting and adjustment of sensors IN [▶ 32] and Commissioning [▶ 38].

4.6.1 Mounting and adjustment of sensors IN



* Case 1 (shown on bottom left):
VA = upper end position, VE = lower end position
* Case 2 (shown on bottom right):
VE = upper end position, VA = lower end position

Adjusting the IN sensors

Item	Description	PPU-P 10	PPU-P 30
121	IN sensor	-	
X* [mm]	Distance between UH and VA sensor (upper end position)	15	23
X** [mm]	Distance between UH and VE sensor (upper end position)	15	23
Y [mm]	Switching distance	approx. 0.5	approx. 0.8

Sensor assignment

Sensor	Description
VE	Sensor for rear end position (home position) --> extension arm returned
VA	Sensor for front end position --> extension arm extended
UH	Switching point for horizontal drive
UV	Switching point for vertical drive

Adjusting sensors for VE and VA end positions

- The back stops of the end positions have been set, Adjustment of vertical end positions [▶ 30].
- The unit has been depressurized.

➢ Unscrew the cover plate of the paneling.
➢ Approach rear end position manually (extension arm retracted).
➢ Push the VE sensor against the control cam from below until there is a signal at the output.

NOTE

Observe the Y switching distance when fastening the counter nuts.
Switching distance Y is preadjusted at the factory via two hexagon nuts.

➢ Approach front end position manually (extension arm extended).
➢ Push the VA sensor against the control cam from below until there is a signal at the output.
➢ Secure position by tightening the sensor.

Adjusting sensors for UV and UH switching points

- Back stops of the vertical end positions have been adjusted, Adjustment of vertical end positions [▶ 30].
- Sensors of end positions have been adjusted (see above).
- The unit has been depressurized.

➢ Unscrew the cover plate of the paneling.
➢ Approach the top position of the cycle movement manually.
➢ Push the UV sensor against the control cam from above until there is a signal at the output.

NOTE

Observe the Y switching distance when fastening the counter nuts.
Switching distance Y is preadjusted at the factory via two hexagon nuts.

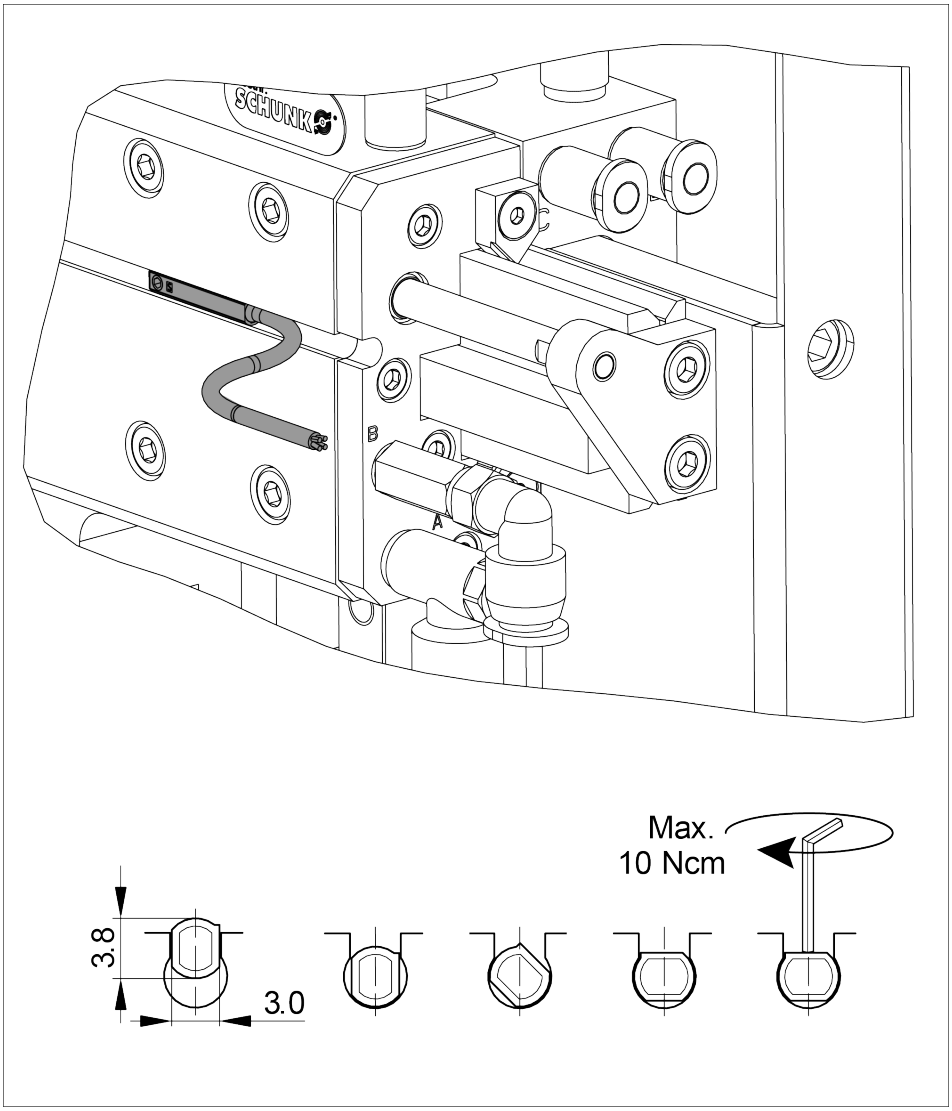
➢ Set the UH sensor at a distance of X to the upper end position, Mounting and adjustment of sensors IN [▶ 32].
➢ Secure position by tightening the sensor.

4.6.2 Mounting and adjustment of optional sensors MMS

CAUTION

Sensor can be damaged during assembly.

Do not exceed the maximum tightening torque of 10 Ncm.



Mounting of Sensor MMS

- Unscrew the front cover plate from the cover.
- Tilt sensor slightly to insert it into the monitoring groove.
- Adjust sensor to desired monitoring position and fasten with set screw.

4.7 Adjustment and replacement of shock absorbers

The shock absorbers are installed at the factory and are adjusted for safe operation at maximum load.

NOTE

To achieve the optimal cycle time the adjustment of the shock absorbers must be adapted to the operating situation (load, travel, etc.)

4.7.1 Adjustment of shock absorbers

The shock absorbers can be adjusted in installed state. Re-adjustment of the end positions is not necessary.

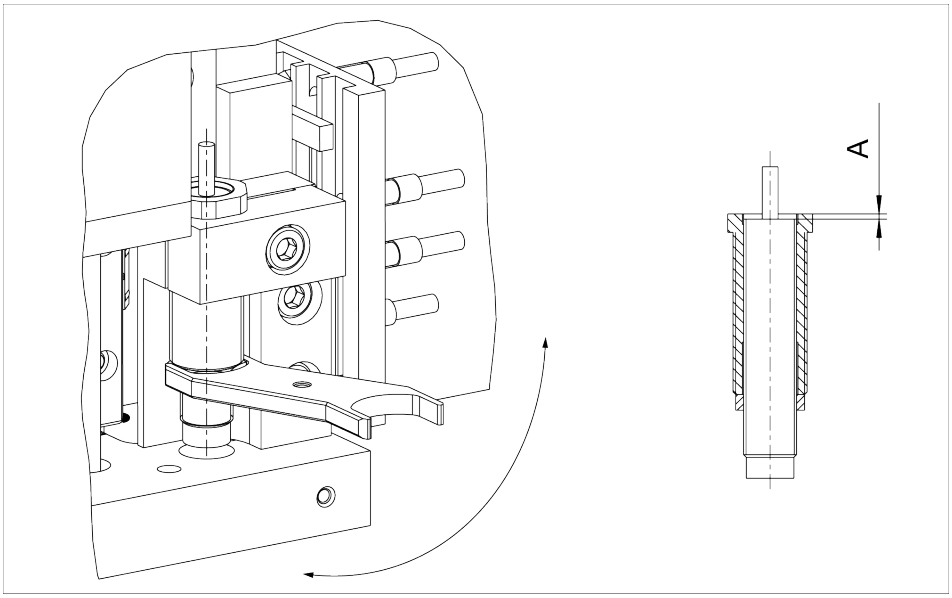
- The horizontal end positions have been set Adjustment of horizontal end positions [▶ 29].
- The stops for the vertical end positions have been set Adjustment of vertical end positions [▶ 30].

CAUTION

The vertical stop of the unit is the sleeve.

Never unscrew the shock absorber so far that it extends past the sleeve. $\mathbf{A_{min}}$ **~0.2mm**.

➢ Unscrew the front cover plate from the cover.

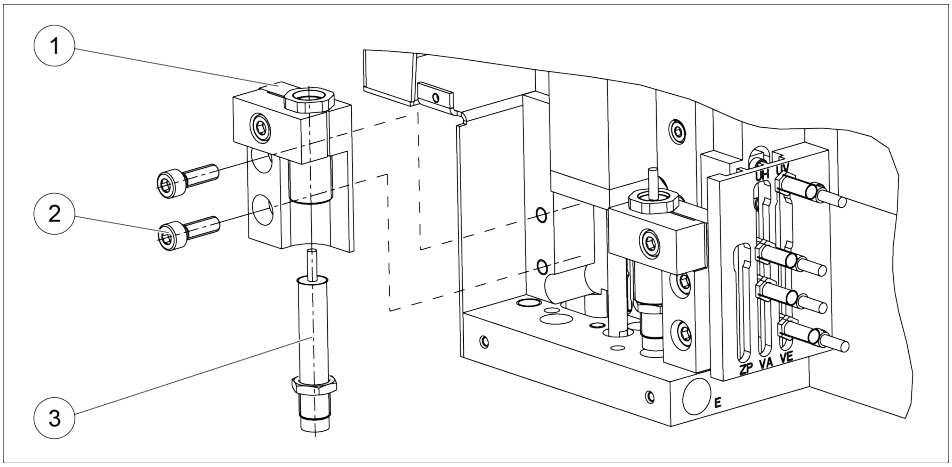


Loosening the lock nut

➢ Loosen the lock nut on the shock absorber.
➢ Turn shock absorber to the desired position.
➢ Tighten lock nut.

- ➢ Check shock absorption during operation and correct, if necessary.
- ✓ The shock absorber is set correctly when the unit reaches its end position quickly and without mechanical impact.

4.7.2 Replacement of shock absorbers

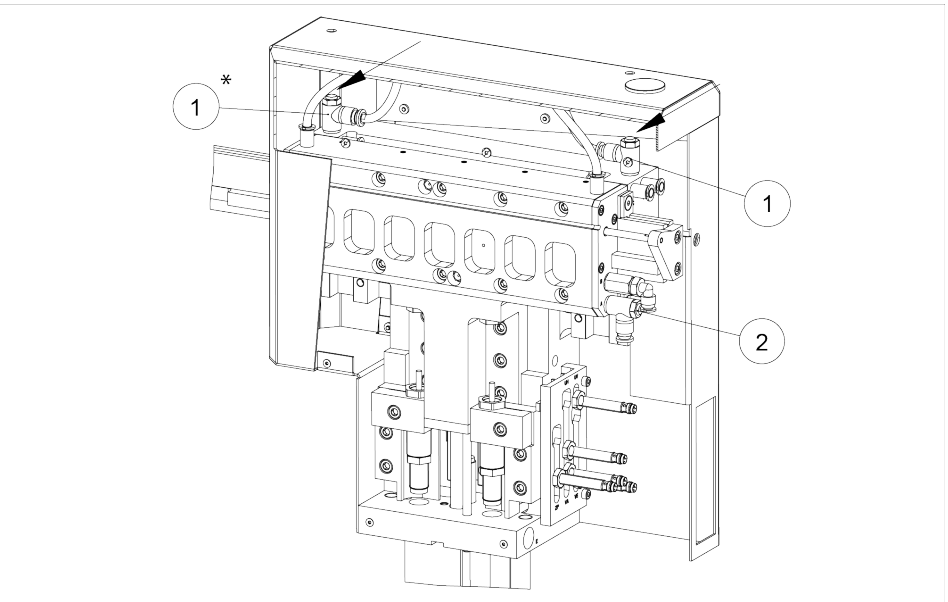


Item	PPU-P 10	PPU-P 30
1	Mount	
3	Shock absorbers	
2	Screw ISO 4762 M5x16	Screw ISO 4762 M6x20

- ➢ Unscrew the front cover plate from the cover.
- ➢ Remove the entire mounting assembly, with the clamp, sleeve and shock absorber.
- ➢ Write down dimension A Adjustment of shock absorbers [▶ 35].
- ➢ Unscrew the shock absorber (110) from the sleeve and replace with a new shock absorber.
- ➢ Set to dimension A and fix with a lock nut.
- ➢ Reinstall the entire mounting assembly, with the clamp, sleeve and shock absorber, pressing the assembly onto the surface of the base plate.
- ➢ Check the position of the end position and correct if necessary Adjustment of vertical end positions [▶ 30].
- ➢ Readjust shock absorber if necessary Adjustment of shock absorbers [▶ 35].

4.8 Adjustment of regulator valves

- The speed of the horizontal return motion and of the vertical downward motion can be adjusted by means of the regulator valves which were installed at the factory.
- The regulator valves are set to closed state at the factory.



Adjustment of regulator valves

1	Regulator valve for horizontal stroke
2	Regulator valve for vertical stroke
* PPU-P 30 only	

NOTE

The adjusting screw can be accessed through a hole in the cover (arrows).

- ➢ Adjust the horizontal stroke by means of the regulator valve (1) so that the forward and return motions of the cantilever arm take place at the same speed.
- ➢ Adjust the vertical stroke by means of the regulator valve (2) so that the cycle time of the standard process Standard sequence [▶ 39] complies with the mimimum times and the maximum number of cycles is not exceeded.

CAUTION

If the cycle times are exceeded, the device can be overloaded and it can occur mechanical damages.

5 Handling and operation

5.1 Delivery state

All components required for operation are factory-installed:

- The shock absorbers are preset for safe operation
- Throttles of connections A and B (vertical drive) are closed
- Throttles of connections C and D (horizontal drive) are closed
- Sensor positions are not preadjusted
- End positions are set to maximum stroke

5.2 Commissioning

5.2.1 Steps for commissioning

- Check the Technical Specifications Technical Data [▶ 17] and Attachment of loads.
- Do not use the unit until you have determined that it is in perfect operating condition, after having checked for compliance with all permissible operating parameters.

Further information

Attachment of loads [▶ 21]

5.2.2 First steps

Proceed as follows to commission the unit.

➢ Adjust horizontal end positions, Adjustment of horizontal end positions [▶ 29].

➢ Adjust vertical end positions, Adjustment of vertical end positions [▶ 30].

➢ Adjust sensor IN, Mounting and adjustment of sensors IN [▶ 32].

➢ Adjust the regulator valves, Adjustment of regulator valves [▶ 37]. For this purpose, allow the unit to operate in standard sequence, Standard sequence [▶ 39].

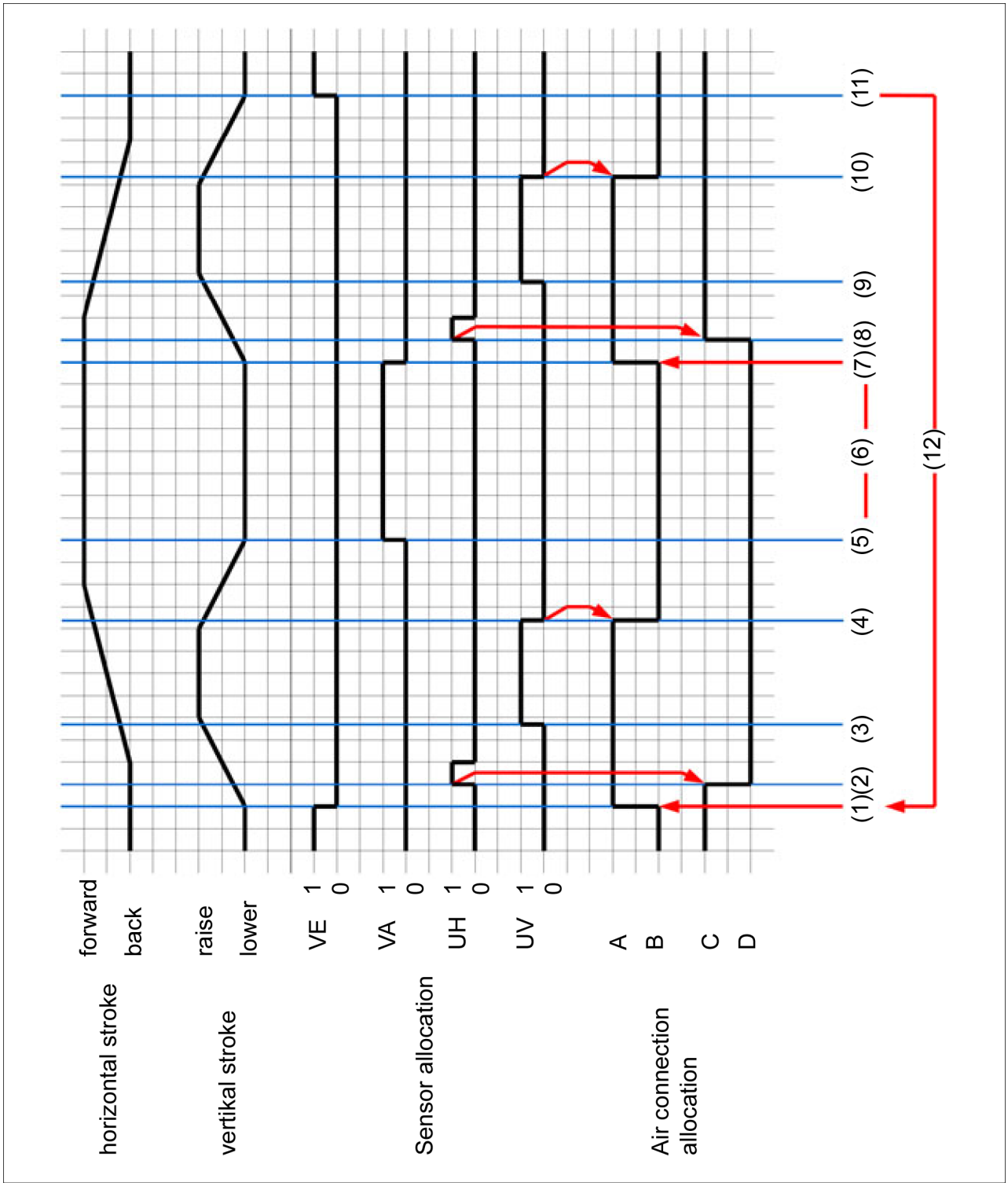
➢ Adjust shock absorbers, Adjustment of shock absorbers [▶ 35]. For this purpose, allow the unit to operate in standard sequence,

➢ If necessary, readjust shock absorbers and regulator valves.

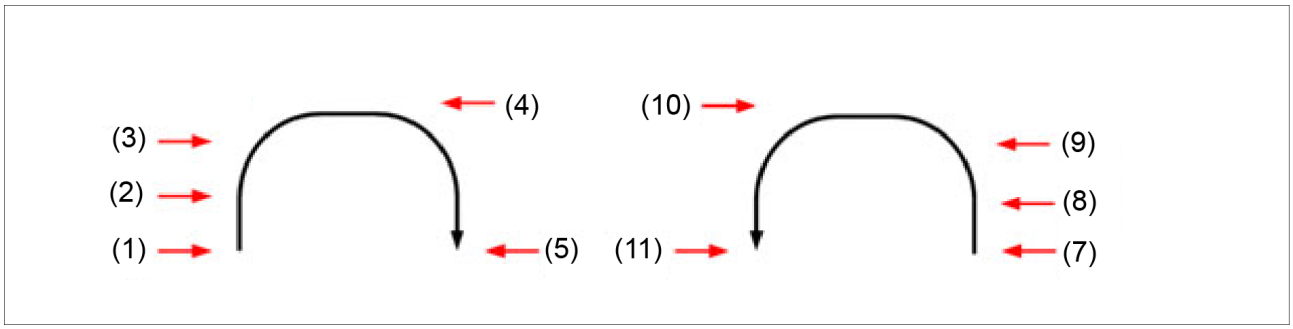
✓ Adjustment of the unit is now complete.

5.3 Actuation / operation

5.3.1 Standard sequence



Actuation diagram for standard Pick&Place sequence



Sequence diagram for standard Pick&Place sequence

Description of standard sequence

PPU-P in back end position / home position:

- Horizontal: Cantilever arm retracted pressurized connection: (C)
- Vertical: Cantilever arm lowered pressurized connection: (B)
- Sensor allocation: (VE)

➢ Unit in back end position
Actuation of valve B → A (lower → raise)
Start Pick&Place cycle
Cantilever arm moves vertically upward

➢ Sensor reaches switching point UH:
Actuation of valve C → D (return stroke forward stroke)
Horizontal motion is initiated
Cantilever arm first continues moving upward only, force-driven, then on the curve radius

➢ Sensor reaches switching point UV
Maintain actuation of both valves
Roller is at start of curve
Cantilever arm moves only horizontally

➢ Sensor UV leaves
(The roller reaches the front curve radius, leaves the switching range of the sensor UV force-driven)
Actuation of valve A → B (raise → lower)
Vertical motion is initiated
Cantilever arm moves first out of the curve radius, then vertically downward

➢ Front end position is reached
– Horizontal: Cantilever arm extended pressurized connection: (D)
– Vertical: Cantilever arm lowered pressurized connection: (B)
– Sensor allocation: (VA)

➢ Stand-by time: Execution of additional motions (gripping, etc.) + external start, if applicable

➢ Unit in front end position
Actuation of valve B → A (lower → raise)
Start return stroke of Pick&Place cycle
Cantilever arm moves vertically upward

- Sensor reaches switching point UH:
  Actuation of valve D → C (forward stroke → return stroke)
  Horizontal motion is initiated
  Cantilever arm first continues moving upward only, force- driven, then on the curve radius
- Sensor reaches switching point UV
  Maintain actuation of both valves
  Roller is at start of curve
  Cantilever arm moves only horizontally
- Sensor UV leaves
  (The roller reaches the back curve radius, leaves the switching range of the sensor UV force-driven)
  Actuation of valve A → B (raise → lower)
  Vertical motion is initiated
  Cantilever arm moves first out of the curve radius, then vertically downward
- Back end position / home position is reached:
  – Horizontal: Cantilever arm retracted pressurized connection: (C)
  – Vertical: Cantilever arm lowered pressurized connection: (B)
  – Sensor allocation: (VE)
- Stand-by time: Execution of additional motions (gripping, etc.) + external start, if applicable, restart of Pick&Place cycle

5.3.2 Sequence with actuation of stand-by position

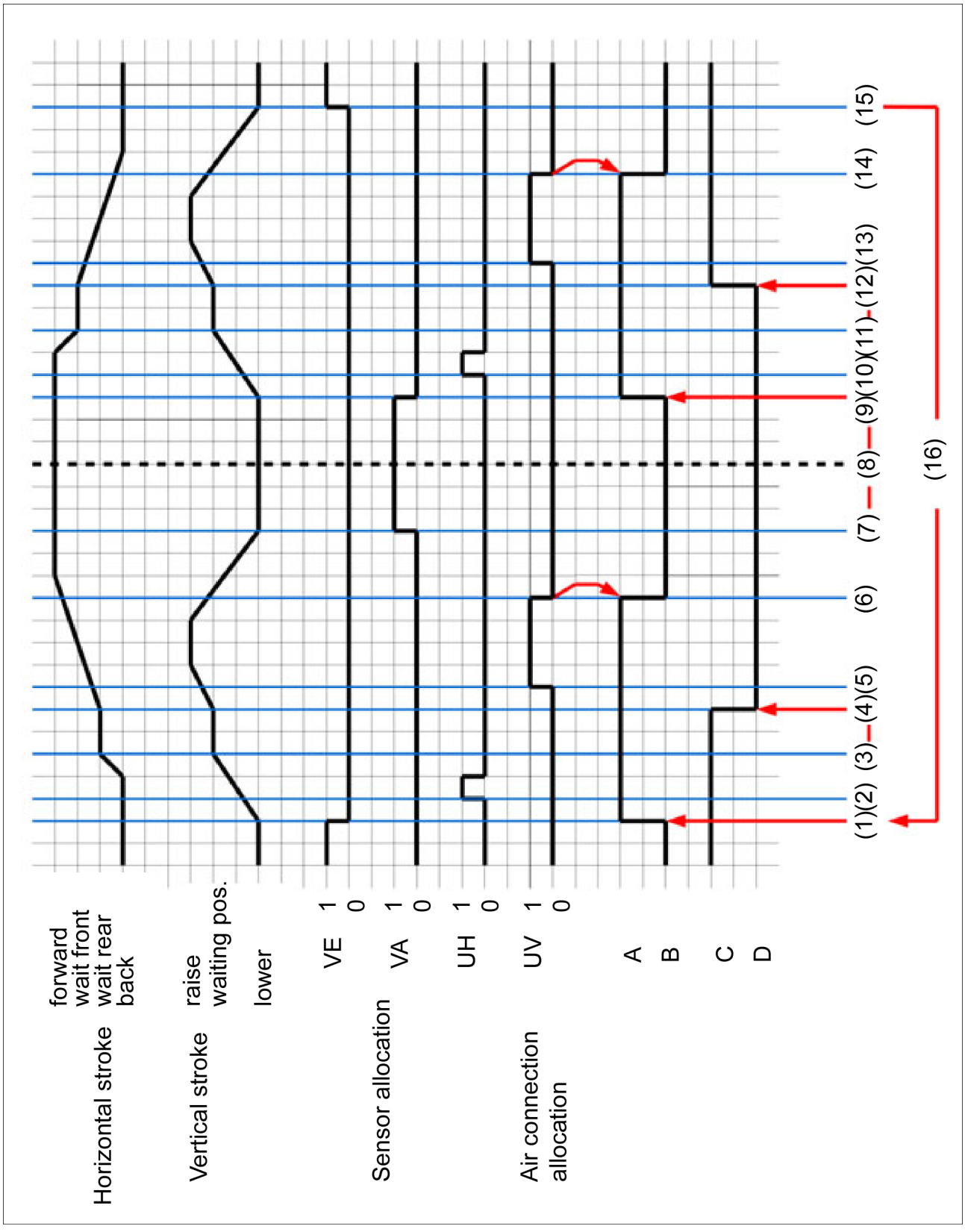
The unit can move to 2 stand-by positions:

- Back stand-by position:
  Located above the back end position (home position) Can be moved to only from the back end position.
- Front stand-by position:
  Located above the front end position Can be moved to only from the front end position.

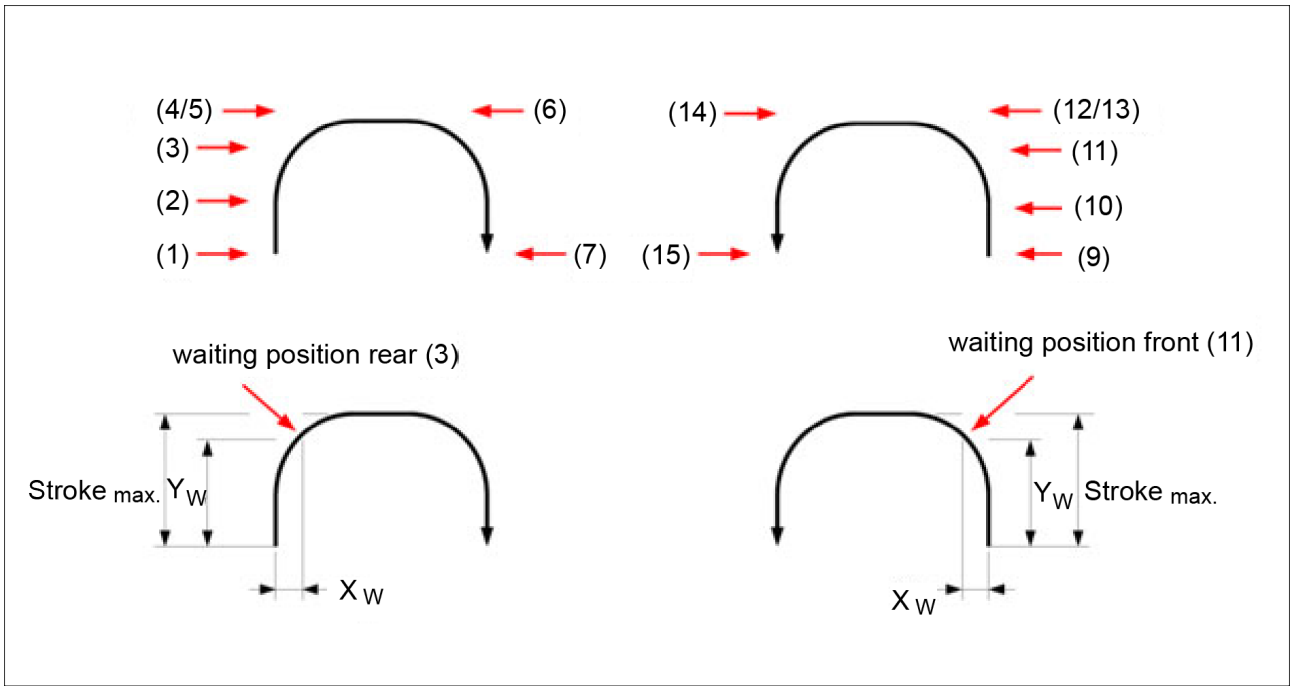
CAUTION

Position of the stand-by position is not defined exactly.

For the location area of the cantilever arm in the stand-by positions Sequence with actuation of stand-by position [▶ 43].



Actuation of stand-by positions



Flow diagram for actuation of stand-by position, stand-by position range

Stand-by position range

Designation	PPU-P 10	PPU-P 30
$Stroke_{max}$ [mm]	45	60
$X_{W\ max.}$ at rest [mm]	17.5	25
$X_{W\ max.}$ Overshoot upon actuation [mm]	35	50
$Y_{W\ min.}$ [mm]	32.5	50

Description of actuation of back stand-by position

PPU-P in back end position / home position:

- Horizontal: Cantilever arm retracted pressurized connection: (C)
- Vertical: Cantilever arm lowered pressurized connection: (B)
- Sensor allocation: (VE)

➢ PPU-P in back end position Actuation of valve B → A (lower → raise)
Move to back stand-by position
Cantilever arm moves vertically upward

➢ Sensor reaches switching point UH
Maintain actuation of both valves:
To move to the stand-by position the signal of the sensor UH is ignored
By overshooting, sensor UV is also reached briefly – ignore this signal also!
Cantilever arm continues moving vertically only, then upward on curve radius

➢ The back stand-by position is reached

- Unit in back stand-by position
  Actuation of valve D → C (return stroke → forward stroke)
  Start Pick&Place cycle from the back stand-by position
  Cantilever arm continues motion on curved path
- Sensor reaches switching point UV
  Maintain actuation of both valves
  Roller is at start of curve
  Cantilever arm moves only horizontally
- Sensor UV leaves
  (The roller reaches the front curve radius, leaves the switching range of the sensor UV force-driven)
  Actuation of valve A → B (raise → lower)
  Vertical motion is initiated
  Cantilever arm moves first out of the curve radius, then vertically downward
- Front end position is reached:
  Horizontal: Cantilever arm extended pressurized connection: (D)
  Vertical: Cantilever arm lowered pressurized connection: (B)
  Sensor allocation: (VA)
- Stand-by time: Execution of additional motions (gripping, etc.) + external start, if applicable

either

- continue with standard sequence Standard sequence [▶ 39]

or

- for actuation of the front stand-by position sequence as follows

Description of actuation of front stand-by position

- Unit in back end position
  Actuation of valve B → A (lower → raise)
  Move to front stand-by position
  Cantilever arm moves vertically upward
- Sensor reaches switching point UH
  Maintain actuation of both valves:
  To move to the stand-by position the signal of the sensor UH is ignored
  By overshooting, sensor UV is also reached briefly – ignore this signal also!
  Cantilever arm continues moving vertically only, then upward on curve radius
- The front stand-by position is reached
- Unit in front stand-by position
  Actuation of valve C → D (forward stroke → return stroke)
  Start Pick&Place cycle from the front stand-by position
  Cantilever arm continues motion on curved path
- Sensor reaches switching point UV
  Maintain actuation of both valves
  Roller is at start of curve
  Cantilever arm moves only horizontally
- Sensor UV leaves
  (The roller reaches the back curve radius, leaves the switching range of the sensor UV force-driven)
  Actuation of valve A → B (raise → lower)
  Vertical motion is initiated
  Cantilever arm moves first out of the curve radius, then vertically downward
- Back end position / home position is reached:
  – Horizontal: Cantilever arm retracted pressurized connection: (C)
  – Vertical: Cantilever arm lowered pressurized connection: (B)
  – Sensor allocation: (VE)
- Stand-by time: Execution of additional motions (gripping, etc.) + external start, if applicable

6 Troubleshooting

6.1 No Pick&Place motion

Possible cause	Corrective action
Pressure drops below minimum.	Check air supply. Air connections [▶ 23]
Pressure lines connected incorrectly.	Check compressed air lines. Air connections [▶ 23]
Sensor inaccurately adjusted or defective.	Readjust or change sensor. Mounting and adjustment of sensors IN [▶ 32]
Product is actuated incorrectly.	Check actuation based on sequence diagram. Actuation / operation [▶ 39]

6.2 Cycle speed is not reached?

Possible cause	Corrective action
Use of unsuitable valves.	Check valve switching times and consult SCHUNK contact person if necessary.
Shock absorber extended too far.	Readjustshock absorber setting. Adjustment of shock absorbers [▶ 35]
Fallen short of nominal pressure.	Check air supply. Technical Data [▶ 17]
Permissible lengths of connection lines exceeded.	Keep compressed air lines between the product and directional control valve as short as possible. Air connections [▶ 23]
Switching points have not been set correctly.	Check the UH and UV sensor settings. Mounting and adjustment of sensors IN [▶ 32]
Compressed air lines are not installed optimally.	Check compressed air lines.
	Inner diameters of compressed air lines are of sufficient size in relation to compressed air consumption.
	Flow rate of valve is sufficiently large relative to the compressed air consumption.

6.3 Rough sequence

Possible cause	Corrective action
Use of unsuitable valves.	Check valve switching times and consult SCHUNK contact person if necessary. Valve and control specifications [▶ 18]
Product is actuated incorrectly.	Check actuation based on sequence diagram. Actuation / operation [▶ 39]
	If necessary, use the PLC funtion module.
Switching points have not been set correctly.	Check the UH and UV sensor settings. Mounting and adjustment of sensors IN [▶ 32]
Permissible lengths of connection lines exceeded.	Shorten compressed air lines from valves to product. Air connections [▶ 23]
Very quick operating cycle	Slow down sequence by adjusting compressed air throttles. Adjustment of regulator valves [▶ 37]
	Slow down sequence by adjusting UH sensor upwards.
Operating pressure too high.	Check maximum pressure of air supply. Technical Data [▶ 17]

6.4 Impact in the end positions

Possible cause	Corrective action
Shock absorber defective.	Change and adjust shock absorber. Adjustment and replacement of shock absorbers [▶ 35]
Shock absorber postponed too far.	Readjustshock absorber setting. Adjustment of shock absorbers [▶ 35]
Exhaust throttle defective.	Change the function of the throttle and change if necessary. Adjustment of regulator valves [▶ 37]

6.5 Module does not achieve the opening and closing times?

Possible cause	Corrective action
Sensor inaccurately adjusted or defective.	Adjust sensor or if necessary change sensor. Mounting and adjustment of sensors [▶ 31]
Proximity switch defective or set incorrect.	Change sensor.
Cable breakage.	Change sensor. Replace connection cable extension (provided by the customer) if necessary.

7 Maintenance

7.1 Shock absorbers

CAUTION

Check shock absorbers regularly!

- The shock absorbers have a limited life. Failure can result in serious mechanical damage; therefore, they must be inspected regularly to ensure that they are functioning properly. The shock absorber is functioning correctly when the unit reaches its end position quickly and without mechanical impact.
- An overload of the unit or exceeding the permissible cycle frequency can significantly reduce the life of the shock absorbers Technical Data [▶ 17] and Adjustment of shock absorbers [▶ 35].

Recommended replacement intervals for shock absorbers

Size	PPU-P 10	PPU-P 30
Interval [Mio. cycles]	3	5

For replacement instructions Replacement of shock absorbers [▶ 36].

7.2 Lubricants/Lubrication points

We recommend the lubricants listed.

- During maintenance, treat all grease areas with lubricant. Apply the lubricant very carefully and thinly with a stiff brush or a non-fluffing cloth.

Lubricants/Lubrication points

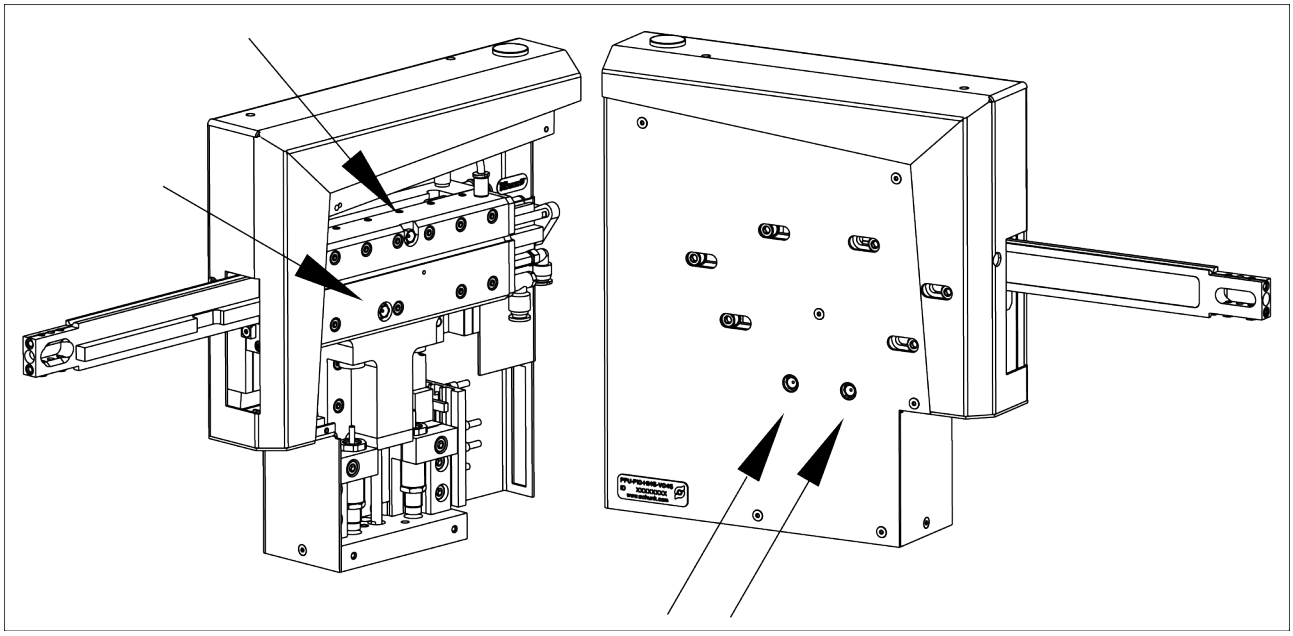
Lubricant point	Lubricant
Lubrication points guidance	Isoflex-Topas NCA 52
All seals	
Bore hole at the piston	

7.3 Pistons and seals

The pistons are permanently lubricated and only need to be lubricated if they are removed or replaced.

- Check regularly for correct function and leaks; replace, if necessary.

7.4 Lubricate the guides



Lubrication points of the guides

- Lubricate horizontal and vertical guide at the specified lubrication points.

Recommended lubrication intervals for guides

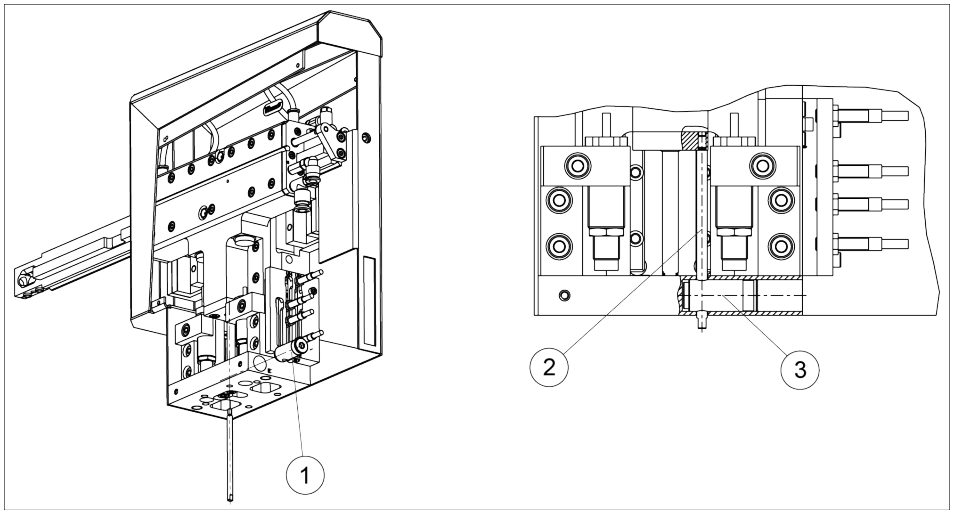
Size	PPU-P 10 / 30
Interval [Mio. cycles]	10

7.5 Replace clamping cartridge

CAUTION

In event of dynamic load, the clamping cartridge can be damaged, and must be replaced if necessary.

Dynamic load at pressure drop can not be avoided in operation.



Replace clamping cartridge

Item	Designation	ID number	
		PPU-P 10	PPU-P 30
2	Rod	5520567	5522706
3	Clamping cartridge	9955686	9954333

Disassembly

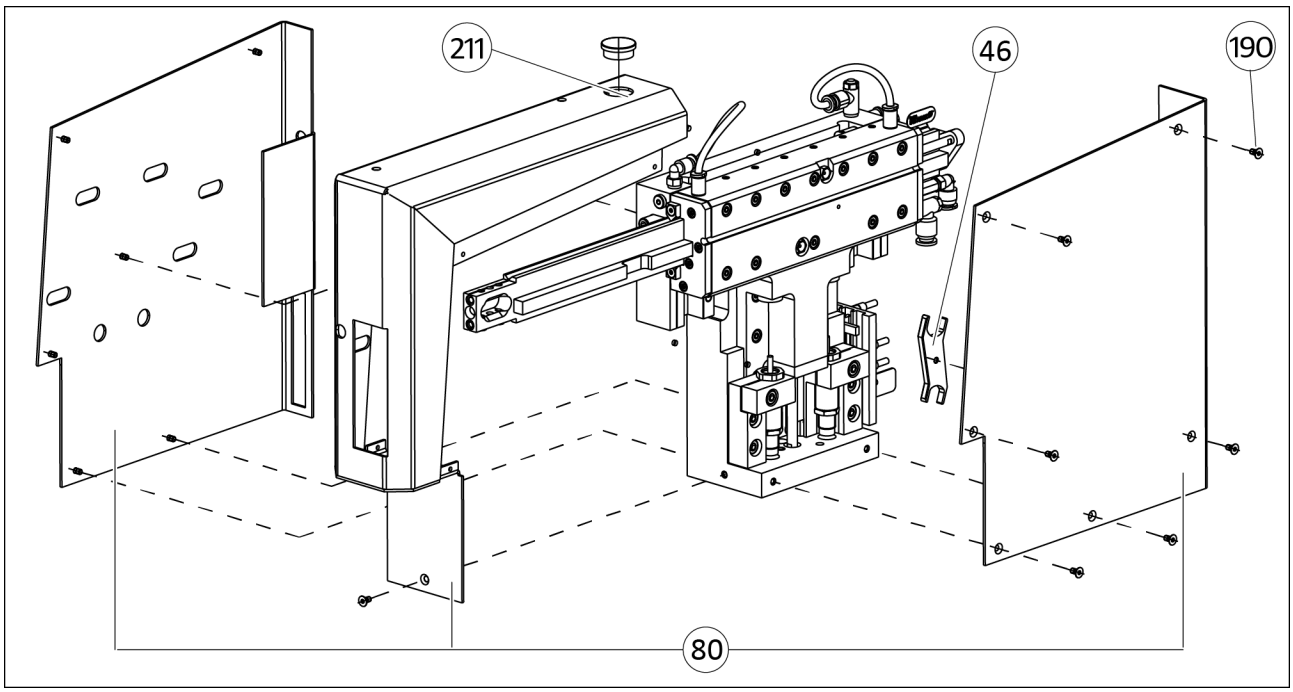
- ➢ remove air connection M5 (1).
- ➢ unlock thread.
- ➢ Unscrew rod (2) from thread and remove it from the hole.
- ➢ Remove clamping cartridge (3).

Assembly

Assemble clamping cartridge, as described in chapter "Mounting of optional anti-fall device ASP-P..."
Mounting of optional anti-fall device ASP-P... [▸ 25].

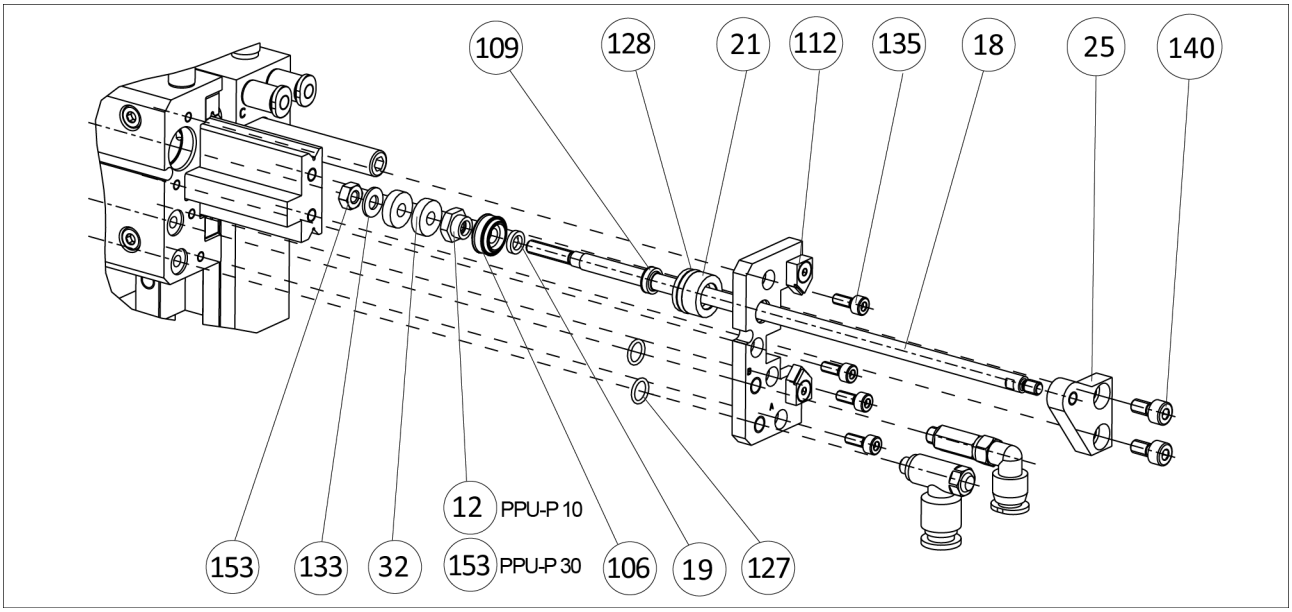
8 Spare parts

8.1 Cover



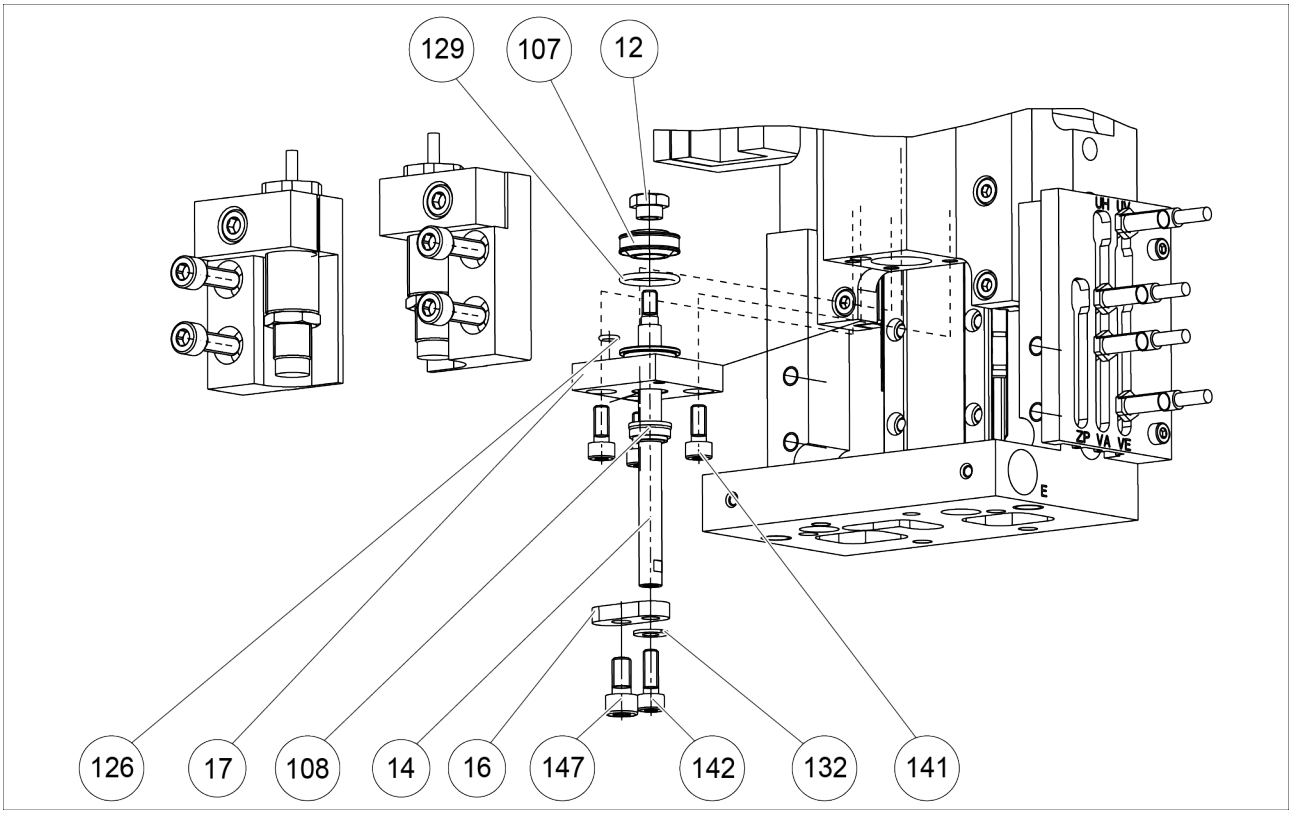
Item	Designation	Amount	Wear parts
80	Cover, complete	1	
46	Key	1	X
190	Countersunk screw Torx DIN 965 A2 M3x5	7	
211	End cap	1	

8.2 Horizontal drive



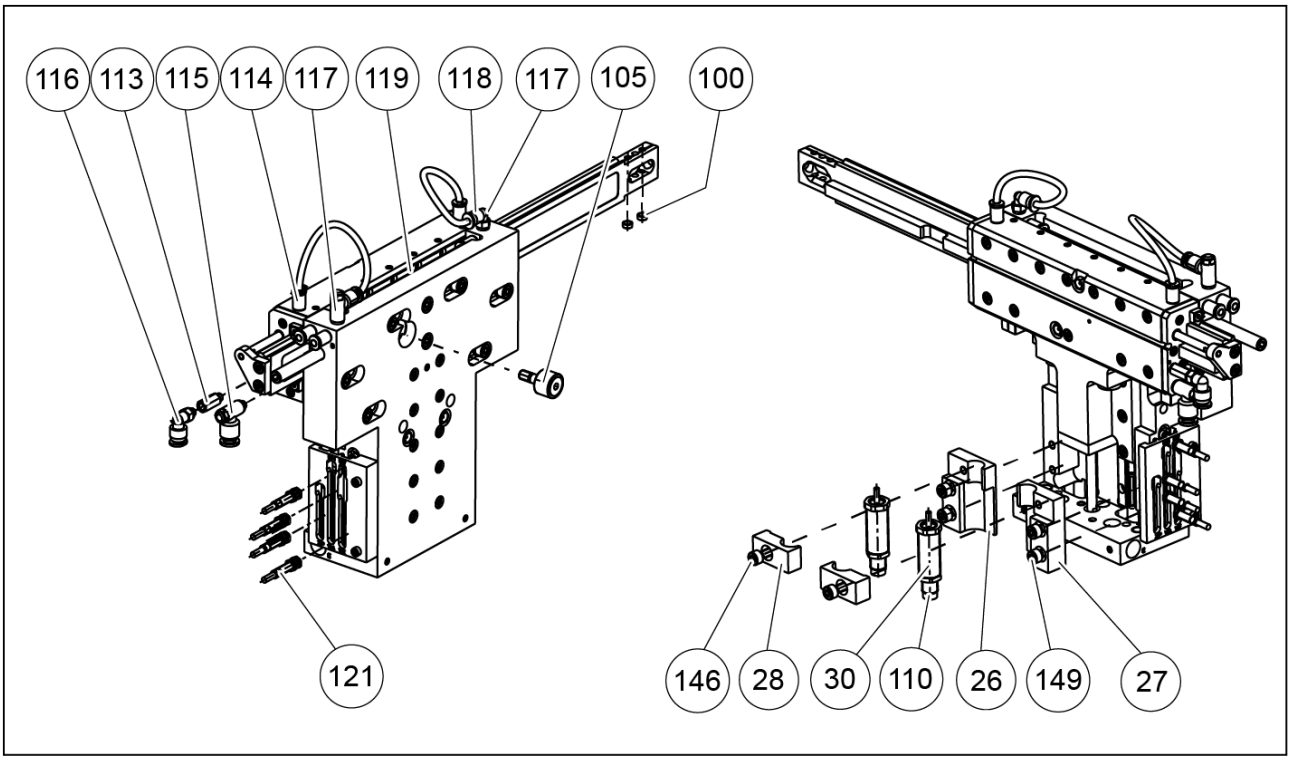
Item	Designation	PPU-P 10	PPU-P 30	Wear parts
12	Hexagon nut	1x	-	
18	Piston rod II	1x	1x	
19	Washer	1x	1x	
21	Stopper for rod side	1x	1x	
25	Pusher	1x	1x	
32	Magnetic disk (Install south to south)	2x	2x	
106	Complete piston	1x	1x	X
109	Seal scraper ring	1x	1x	X
112	End piece with scraper	4x	4x	X
127	O-ring	2x	2x	X
128	O-ring	1x	1x	X
133	Washer DIN 125 A 4.3 rostfrei	1x	1x	
135	Screw ISO 4762	4x M3 x 8	4x M4 x 8	
140	Screw ISO 4762	2x M4 x 8	2x M5 x 10	
153	Nut DIN 934 M4 rostfrei	1x	2x	

8.3 Vertical drive



Item	Designation	PPU-P 10	PPU-P 30	Wear parts
12	Hexagon nut	1x	1x	
14	Piston rod I	1x	1x	
16	Support	1x	1x	
17	Cover plate	1x	1x	
107	Complete piston	1x	1x	X
108	Seal scraper ring	1x	1x	X
126	O-ring	1x	1x	X
129	O-ring	1x	1x	X
132	Washer DIN 125 A 4.3	1x	-	
141	Screw ISO 4762 M4 x 10	3x	3x	
142	Screw ISO 4762	1x M4 x 12	1x M6 x 14	
147	Screw ISO 4762	1x M5 x 10	1x M6 x 16	

8.4 End positions, air connections, sensor IN, deflection pulley, centering sleeve



Item	Designation	PPU-P 10	PPU-P 30	Wear parts
26	Bracket I	1x	1x	
27	Bracket II	1x	1x	
28	Clamping piece	2x	2x	
30	Sleeve	2x	2x	
100	Centering sleeve	2x	2x	
105	Cam roller	1x	1x	X
110	Shock absorber Counter nut	2x ID number 9955916 2x ID number 9937717	2x ID number 9958228 2x ID number 9953769	X -
113	Extension	1x	1x	
114	Plug connection screw	4x	4x	
115	One-way flow control valve (exhaust)	1x	1x	
116	Angled plug connection screw	1x	1x	
117	One-way flow control valve (supply air)	1x	2x	
118	Angled plug connection screw	1x	-	
119	Air hose			X
121	Inductive proximity switch IN incl. Counter nut	4x	4x	
146	Screw ISO 4762	2x M5 x 14	2x M6 x 16	
149	Screw ISO 4762	4x M5 x 16	4x M6 x 20	

8.5 Other wearing parts

The following wearing parts cannot be replaced by the customer.

Defects in the guide systems (horizontal and vertical) and in the stop kinematics must be repaired by SCHUNK.

In this case, please consult your SCHUNK contact person

Item	Designation		Quantity
5	Roller cage	Guide systems / Cantilever arm	2
6	Roller cage		2
7	Guide rail		2
8	Guide rail		1
9	Guide rail		1
10	Guide rail		1
13	Slide II		1
31	Stop plunger	Stop kinematics	2
35	Plunger nut		2
111	Compression spring		2
122	Lock washer		2

9 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 Clamping and gripping technology Bahnhofstr. 106 - 134 D-74348 Lauffen/Neckar

We hereby declare that on the date of the declaration the following partly completed 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:	Pick and Place Unit / PPU-P / pneumatic
ID number	0314710, 0314711

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

Applied harmonized standards, especially:

EN ISO 12100:2010	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 in electronic form to national authorities.

The relevant technical documentation according to Annex VII, Part B, belonging to the partly completed machinery, has been created.

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

Signature: see original declaration

Lauffen/Neckar, May 2020

p.p. Ralf Winkler,
Manager for development
of gripping system components

9.1 Annex to Declaration of Incorporation

according 2006/42/EG, Annex II, No. 1 B

1.Description of the essential health and safety requirements pursuant to 2006/42/EC, Annex I that are applicable and that have been fulfilled with:

Product designation	Pick and Place Unit
Type designation	PPU-P
ID number	0314710, 0314711

To be provided by the System Integrator for the overall machine		⇓
Fulfilled for the scope of the partly completed machine	⇓	
Not relevant	⇓	

1.1	**Essential Requirements**			
1.1.1	Definitions		X	
1.1.2	Principles of safety integration		X	
1.1.3	Materials and products		X	
1.1.4	Lighting		X	
1.1.5	Design of machinery to facilitate its handling		X	
1.1.6	Ergonomics		X	
1.1.7	Operating positions			X
1.1.8	Seating			X

1.2	**Control Systems**			
1.2.1	Safety and reliability of control systems		X	
1.2.2	Control devices		X	
1.2.3	Starting		X	
1.2.4	Stopping		X	
1.2.4.1	Normal stop		X	
1.2.4.2	Operational stop		X	
1.2.4.3	Emergency stop		X	
1.2.4.4	Assembly of machinery		X	
1.2.5	Selection of control or operating modes		X	
1.2.6	Failure of the power supply			X

1.3	**Protection against mechanical hazards**			
1.3.1	Risk of loss of stability			X
1.3.2	Risk of break-up during operation			X
1.3.3	Risks due to falling or ejected objects			X
1.3.4	Risks due to surfaces, edges or angles		X	
1.3.5	Risks related to combined machinery			X

1.3	Protection against mechanical hazards			
1.3.6	Risks related to variations in operating conditions			X
1.3.7	Risks related to moving parts		X	
1.3.8	Choice of protection against risks arising from moving parts			X
1.3.8.1	Moving transmission parts		X	
1.3.8.2	Moving parts involved in the process			X
1.3.9	Risks of uncontrolled movements			X

1.4	Required characteristics of guards and protective devices			
1.4.1	General requirements			X
1.4.2	Special requirements for guards			X
1.4.2.1	Fixed guards			X
1.4.2.2	Interlocking movable guards			X
1.4.2.3	Adjustable guards restricting access			X
1.4.3	Special requirements for protective devices			X

1.5	Risks due to other hazards			
1.5.1	Electricity supply		X	
1.5.2	Static electricity		X	
1.5.3	Energy supply other than electricity		X	
1.5.4	Errors of fitting		X	
1.5.5	Extreme temperatures			X
1.5.6	Fire			X
1.5.7	Explosion			X
1.5.8	Noise			X
1.5.9	Vibrations			X
1.5.10	Radiation	X		
1.5.11	External radiation	X		
1.5.12	Laser radiation	X		
1.5.13	Emissions of hazardous materials and substances			X
1.5.14	Risk of being trapped in a machine	X		
1.5.15	Risk of slipping, tripping or falling	X		
1.5.16	Lightning			X

1.6	Maintenance			
1.6.1	Machinery maintenance		X	
1.6.2	Access to operating positions and servicing points		X	
1.6.3	Isolation of energy sources		X	
1.6.4	Operator intervention		X	
1.6.5	Cleaning of internal parts		X	

1.7	**Information**			
1.7.1	Information and warnings on the machinery		X	
1.7.1.1	Information and information devices		X	
1.7.1.2	Warning devices		X	
1.7.2	Warning of residual risks		X	
1.7.3	Marking of machinery	X		
1.7.4	Instructions	X		
1.7.4.1	General principles for the drafting of instructions	X		
1.7.4.2	Contents of the instructions	X		
1.7.4.3	Sales literature	X		

	The classification from Annex 1 is to be supplemented from here forward.			
2	Supplementary essential health and safety requirements for certain categories of machinery			X
2.1	Foodstuffs machinery and machinery for cosmetics or pharmaceutical products			X
2.2	Portable hand-held and/or guided machinery			X
2.2.1	Portable fixing and other impact machinery			X
2.3	Machinery for working wood and material with similar physical characteristics			X
3	Supplementary essential health and safety requirements to offset hazards due to the mobility of machinery		X	
4	Supplementary essential health and safety requirements to offset hazards due to lifting operations		X	
5	Supplementary essential health and safety requirements for machinery intended for underground work			X
6	Supplementary essential health and safety requirements for machinery presenting particular hazards due to the lifting of persons		X	