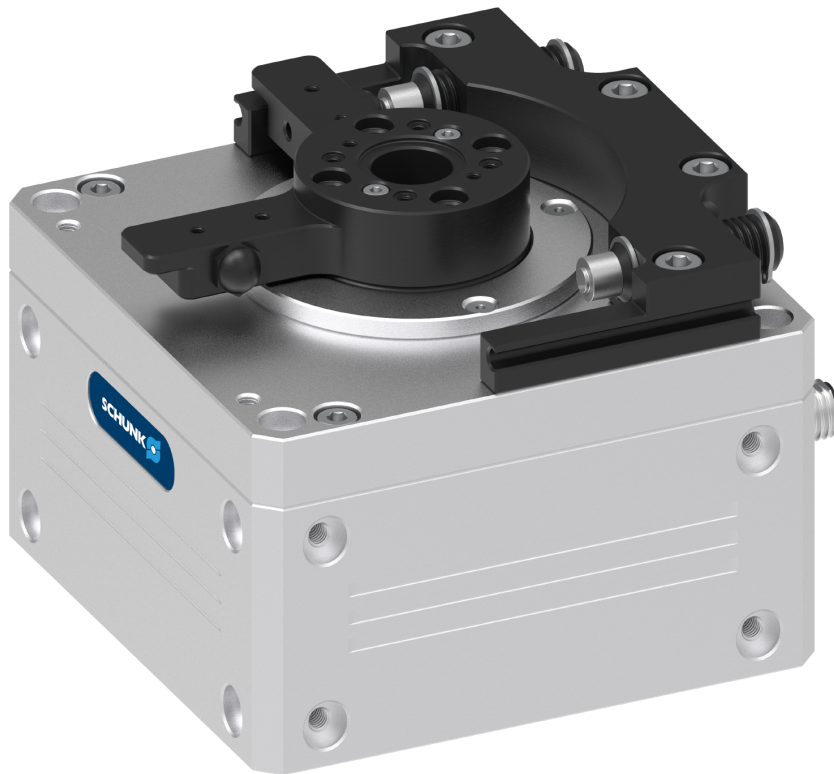


Assembly and Operating Manual

ERP

Electrical universal swivel unit



Superior Clamping and Gripping



Imprint

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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

Customer Management

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Please read the operating manual in full and keep it close to the product.

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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.

In addition to these instructions, the documents listed under ► 1.1.2 [6] are applicable.

NOTE: The illustrations in this manual are intended to provide a basic understanding and may deviate from the actual version.

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 labeled with an asterisk (*) can be downloaded from [schunk.com](https://www.schunk.com).

1.1.3 Definition of Terms

The term "product" replaces the product name on the title page in this manual.

1.1.4 Symbol definition

The following symbols are used in this manual:

- Prerequisite for an action

1. Action 1
2. Action 2

- ✓ Intermediate results

- ✓ Final results

- ▶ 1.1.4 [6]: chapter number and [page number] in hyperlinks

1.1.5 Sizes

This operating manual applies to the following sizes:

- ERP 25

1.1.6 Variants

This operating manual applies to the following variations:

Size	Variant angle of rotation		
ERP 25	45	90	180

1.1.7 Firmware

These instructions apply to products with firmware version 5-1.1.0 or higher, which can be found on the name plate, ▶ 4.2 [19].

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 ambient conditions and operating conditions, ▶ 2.5 [□ 9]
- Observe the maximum service life. ▶ 3 [□ 16]
- Observe the specified maintenance and lubrication intervals, ▶ 7 [□ 48]
- Observe the applicable documents, ▶ 1.1.2 [□ 6]

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

A disassembly of the product that exceeds the instructions described in this manual leads to an expiration of the warranty.

1.3 Scope of delivery

The scope of delivery includes

- Electrical universal swivel unit ERP in the version ordered
- Assembly and Operating Manual
- Accessory pack

1.3.1 Accessory pack

ID.-No. of the accessory pack

Accessory pack for	ID number
ERP 25	1392413

1.4 Accessories

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.

1.4.1 Spare parts package

ID. No. spare part kit "Seal kit"

Spare part kit for	ID number
ERP 25	1392426

Seal kit

2 Basic safety notes

2.1 Intended use

The product may only be used for swiveling permissible attachment parts or workpieces.

- The product may only be used within the scope of its technical data, ▶ 3 [□ 16].
- 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/automated system. The applicable guidelines for the machine/automated system 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

The product is not being used as intended if it

- is deployed without safety equipment
- is deployed in explosive environments.
- 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 Ambient conditions 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, ▶ 3 [□ 16].

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.

2.12.5 Protection against magnetic and electromagnetic fields

Work in areas with magnetic and electromagnetic fields

Magnetic and electromagnetic fields can lead to serious injuries.

- Persons with pace-makers, metal implants, metal shards, or hearing aids require the consent of a physician before entering areas in which components of the electric drive and control systems are mounted, started up, and operated.
- Persons with pace-makers, metal implants, metal shards, or hearing aids require the consent of a physician before entering areas in which magnetic grippers or motor parts with permanent magnets are stored, repaired, or assembled.
- Do not operate high-frequency or radio devices in the proximity of electric components of the drive system and their feed lines.

If the use of such devices is necessary:

When starting up the electric drive and control system, check the machine or automated system for possible failures when such systems are used at different intervals and in different states of the control system. A special additional EMC test may be necessary if the system has a high risk potential.

2.13 Notes on particular risks



⚠ DANGER

Risk of injury due to magnetic fields!

The integrated electric permanent magnets can pose a risk to people with an active or passive implant.

- People with pacemakers or active or passive implants are prohibited from entering the area of the magnetic field.

Information on the magnetic field:

- The strength of the magnetic field directly on the surface of the product can be up to 20 mT.
- At a distance of 150 mm, the magnetic field strength reaches a maximum of 0.1 mT.
- At a distance of 300 mm, the measurable magnetic field strength is within the natural range of the earth's magnetic field.
- External attachments can affect the strength of magnetic fields.



⚠ 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

Risk of burns through contact with hot surfaces!

Surfaces of components can heat up severely during operation. Skin contact with hot surfaces causes severe burns to the skin.

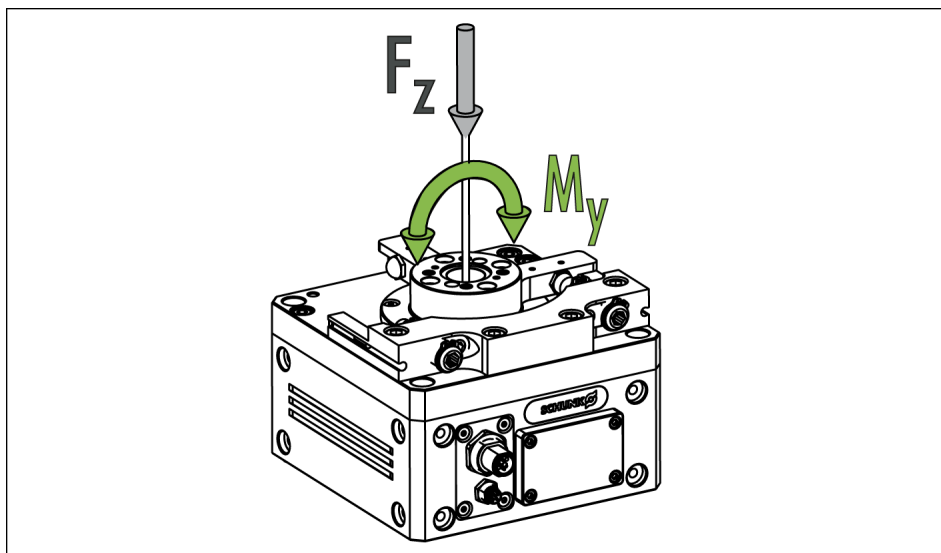
- For all work in the vicinity of hot surfaces, wear safety gloves.
- Before carrying out any work, make sure that all surfaces have cooled down to the ambient temperature.

3 Technical data

3.1 Basic data

Types	ERP 25-045	ERP 25-090	ERP 25-180
ID number	1372750	1372745	1372748
Angle of rotation [°] min./max.	35 / 55	80 / 100	170 / 190
Adjustment range per side [°]	±5	±5	±5
Logic voltage and actuator voltage [V] +/- 10%	24	24	24
Rated current (logic) [A]	0.04	0.04	0.04
Rated current (actuator) [A]	1.1	1.1	1.1
Current (actuator) [A] max.	2	2	2
Number of digital inputs	2	2	2
Level of digital inputs [V] high low	15 to 24 0 to 5	15 to 24 0 to 5	15 to 24 0 to 5
Input impedance digital inputs [kOhm]	4.7	4.7	4.7
Repeat accuracy (+ / -) [°]	0.01	0.01	0.01
Rated torque [Nm]	2	2	2
Moment of inertia attachment (horizontal) [kgm ²] max.	0.1	0.1	0.1
Moment of inertia attachment (vertical) [kgm ²] balanced max.	0.1	0.1	0.1
Permitted moment attachment (vertical) [Nm] max.	1	1	1
Weight [kg]	3.97	3.97	3.95
My ** [Nm] (static/life span) max.	137 / 15	137 / 15	137 / 15
Fz ** [N] (static/life span) max.	5300 / 800	5300 / 800	5300 / 800
Maximum cycles [piece]	50,000,000	50,000,000	50,000,000

** Moment My and force Fz may occur simultaneously



Force and torque

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

3.2 Ambient conditions and operating conditions

Designation	ERP 25
Ambient temperature [°C]	
min.	+5
max.	+55
Relative air humidity [%]	
min.	5
max.	95
Protection class IP, DIN EN 60529	IP 54
Noise emission [dB(A)], 1m	68

3.3 Auxiliary materials and lubricants (optional: H1 certified)

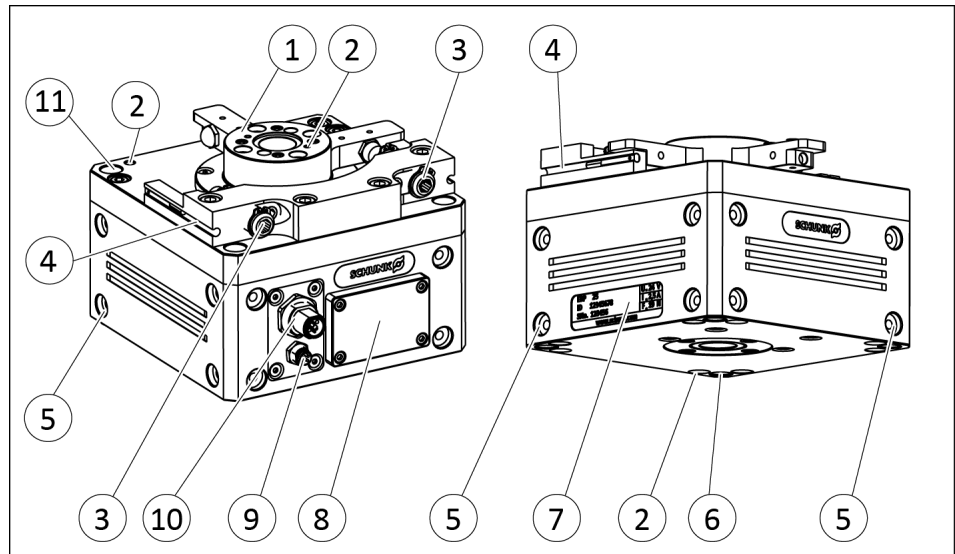
The following lubricants are included in the product:

Greasing area	Lubricant (standard)	Lubricant (optional: H1 certified *)
Guides (deep groove ball bearing)	Commercially available rolling bearing grease	QUINPLEX 4025 H1 NLGI 2
Guides (angular contact ball bearing)	Commercially available rolling bearing grease	QUINPLEX 4025 H1 NLGI 2
Seals	Renolit HLT 2	Rivolta F.L.G. GT-2

* Note: The product contains optional H1 certified lubricants. **The requirements of standard EN 1672-2:2020 are not fully met.**

4 Design and description

4.1 Configuration

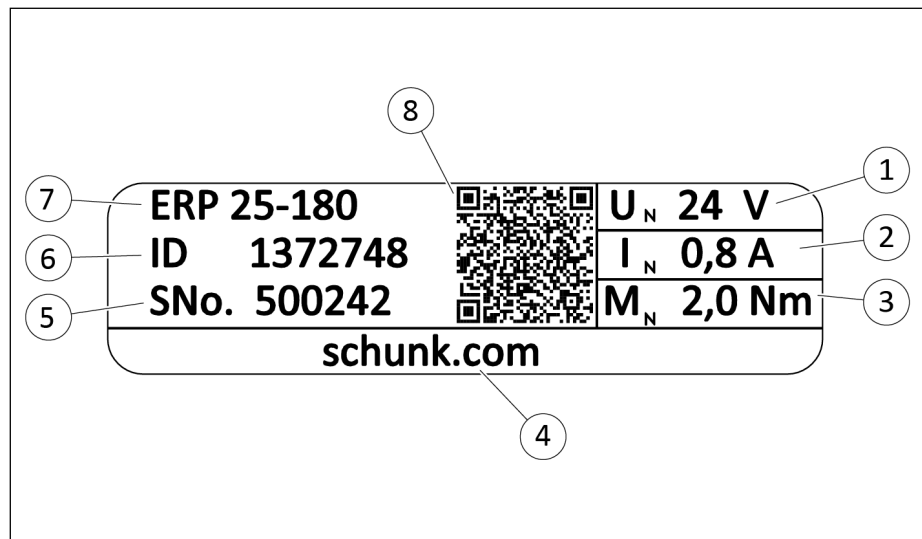


Electrical universal swivel unit ERP

1	Rotary table for fastening the customer application
2	Accessories fastening
3	Adjusting the end positions
4	Grooves for sensors (2 pieces)
5	Product fastening (side)
6	Product fastening (bottom)
7	Name plate
8	Operating field
9	M8 connector for digital signals
10	M12 connector for power supply
11	Product fastening (top)

4.2 Name plate

Name plate



1	Operating voltage [V]	5	Serial number
2	Nominal power current [A]	6	Ident number
3	Rated torque [Nm]	7	Product designation
4	Manufacturer Internet address	8	QR code

QR code breakdown

The QR code contains a character string according to the following scheme:

[product name]; [ID no.]; [serial no.]; [firmware version];
 [operating voltage]; [rated current]; [rated torque]; [creation date]; [Manufacturer Internet address];

Example



Example QR Code

ERP 25-180;
 ID 1372748;
 SNo. 500242;
 Firmware version: 5-1.1.0;
 U_n = 24 V;
 I_n = 0.8 A;
 M_n = 2.0 Nm;
 2020.01.10_11:41;
 schunk.com/erp;

NOTE

If the product has a firmware version older than 5-1.1.0, the firmware version is not included in the string.

4.3 Description

Electrical universal swivel unit with a directly driven 3 phase synchronous motor which produces rotary movements or forces

- No mechanical power transmission elements (direct drive)
- Electrical drive controllers integrated
- Control via digital signals
- Cycle times adjustable via rotary switch
- Factory setting "Auto-Learn" operating mode, ▶ 4.6.1 [□ 26]
- The operating mode can be changed, ▶ 5.5 [□ 41]
- End positions are configured via mechanical stops

4.3.1 Power supply

The product is supplied with energy via a combined power supply in the safety extra low voltage range.

Logic supply

Stable supply voltage 24 V to supply the controller and sensoric systems, hereinafter described as **Logic voltage** U_s .

Only consumers which do not supply any energy back to the supply are connected here. The power supply unit continually feeds in power in order to keep the voltage constant.

Actuator supply

Supply voltage 24 V to supply actuators, hereinafter described as **actuator voltage** U_a .

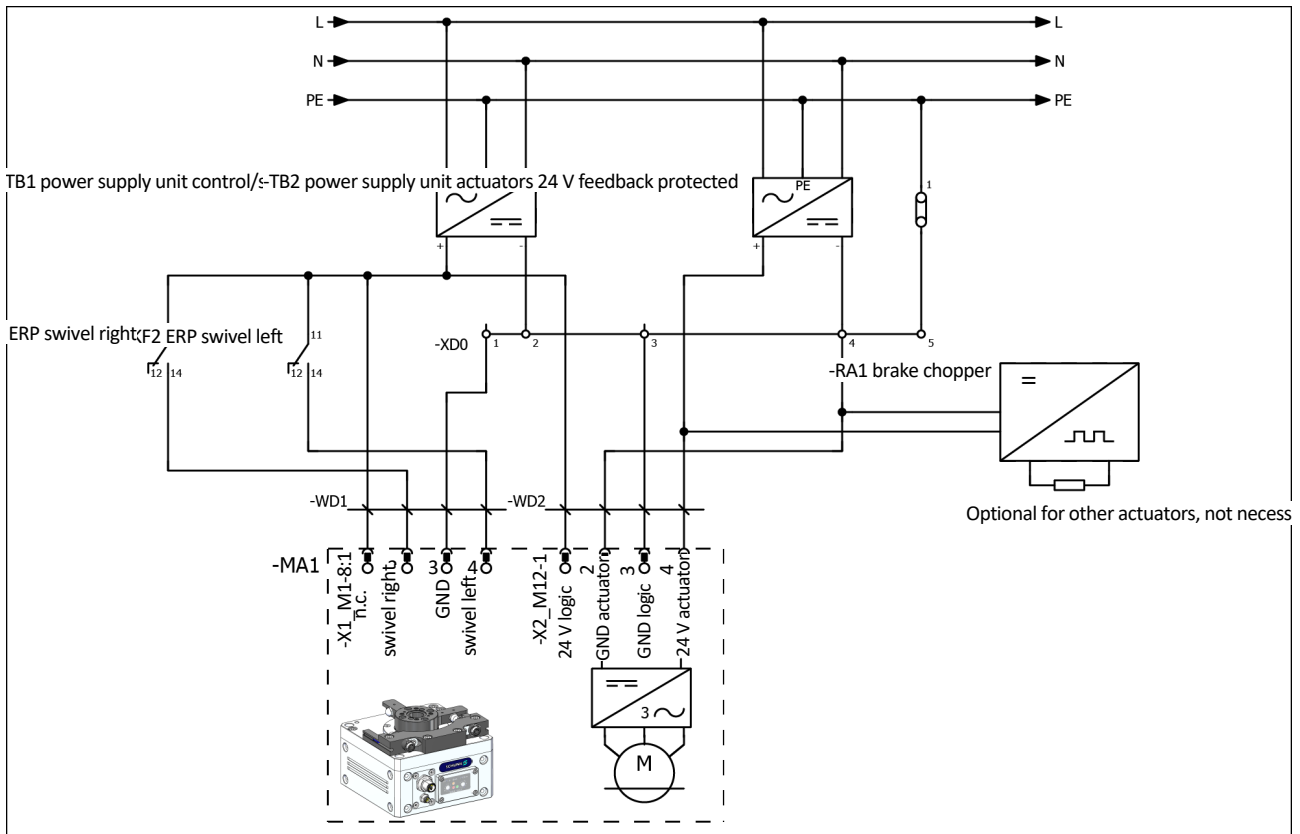
Consumers which intermittently supply any energy back to the supply are connected here. If the sum of all regenerative currents is greater than the sum of all consumption currents, the voltage increases, although the power supply unit interrupts the power supply. The increasing supply voltage may endanger the power supply unit as well as the connected devices. For this reason, the actuator voltage is loaded and restricted with an electronically controlled brake resistor in case of recovery. The power supply unit must be in a position to supply at short notice the sum of the peak current occurring simultaneously (see ▶ 3 [□ 16]) from all connected products. Only use power supply units with a recovery strength up to at least 35 V.

NOTE

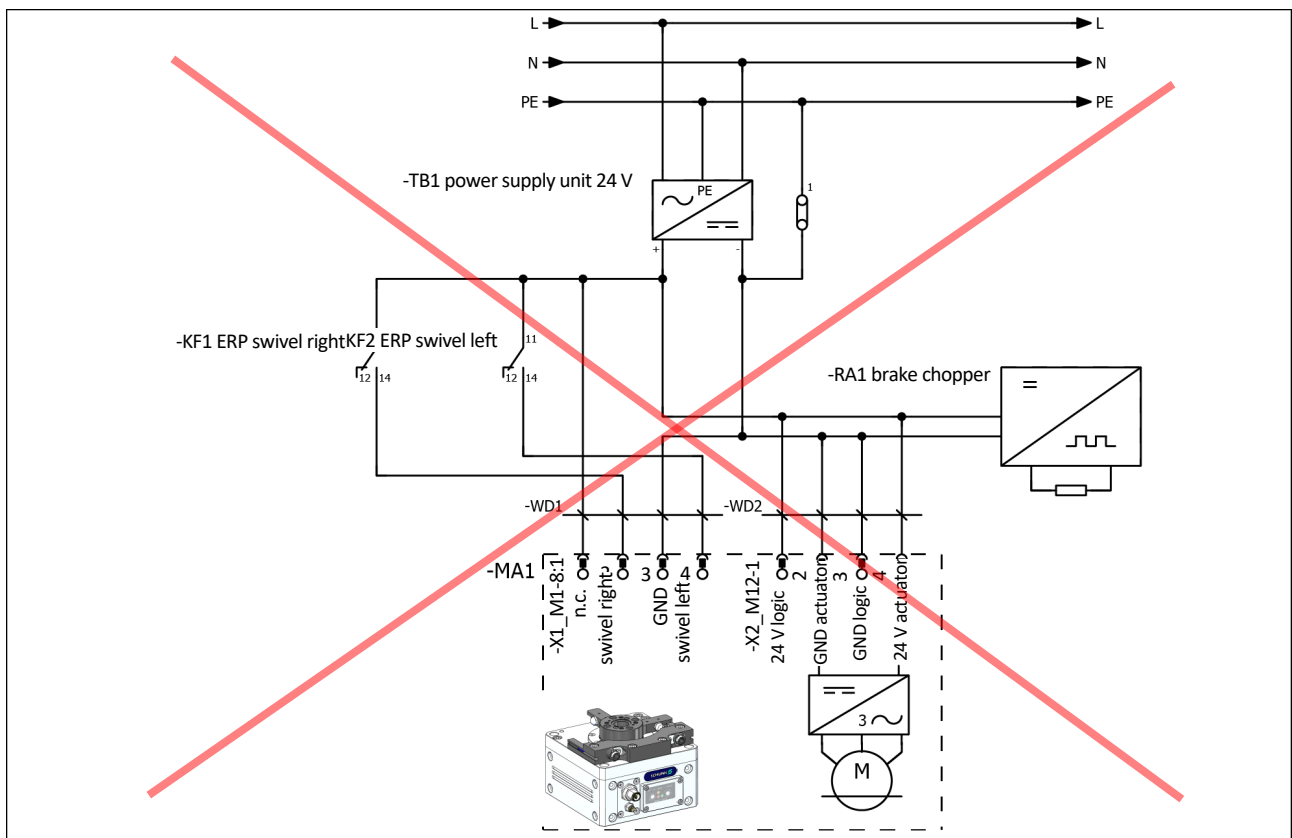
The product does not feed any energy back into the actuator supply. A brake chopper is only necessary in the case of shared use of the actuator supply with regenerative actuators.

Both supply voltages are electronically isolated in order to avoid them influencing each other due to high peak currents in a shared return line. The GND connections of both supply voltages must be connected to each other not in the product but rather only in the vicinity of the power supply units. A joint reference potential of both supplies is attained by connecting the power supply unit negative terminals via 0V terminals, which are connected to the protective conductor PE using a separation terminal. Only use the distributor recommended by SCHUNK as an accessory with separate return lines.

For the supply, power supply units with secure disconnection in accordance with IEC 60364-4-41 (DIN VDE 0100-410) must be used. The product's housing does not require any connection to PE. However, it may be connected with PE via conductive electrical assembly.



Wiring principle, correct



Wiring principle, incorrect

4.4 Safety function STO (Safe Torque Off)

The product does not have an input for STO. The "Power off" operating state is not a safety function and may not be used for STO. However, there is the possibility of a safety-monitored shutdown of the actuator voltage U_a and logic voltage U_s at the customer's site using a safety switch. The performance level corresponds to the PL of the shutdown device.

4.4.1 Examples of actuation in the event of an emergency stop

The following examples serve as possible templates for implementing an emergency stop. Correct actuation guarantees that no new teach-in process is necessary or that an error is triggered.

Example 1: Switching off the actuator and logic voltage

This example serves as a possible template for switching off the entire energy supply of the drive in case of an emergency stop.

1. Operator triggers emergency stop signal.
2. If the axis is installed vertically: Activate the lowering lock or move it to a safe position.
3. Switch off actuator and logic voltage with the appropriate safety switch.
4. Operator cancels emergency stop signal.
5. Set both actuation signals to logic 0 if travel is not desired upon reactivation or if lowering lock is active.
 - ✓ Definition of the operating states in chapter ▶ 4.8 [□ 29].
6. Switch on actuator and logic voltage with the safety switch.
7. Deactivate lowering lock.
8. Create the corresponding motion command to leave the "Power off" operating state.
 - ✓ The first run of the drive is performed at reduced speed.

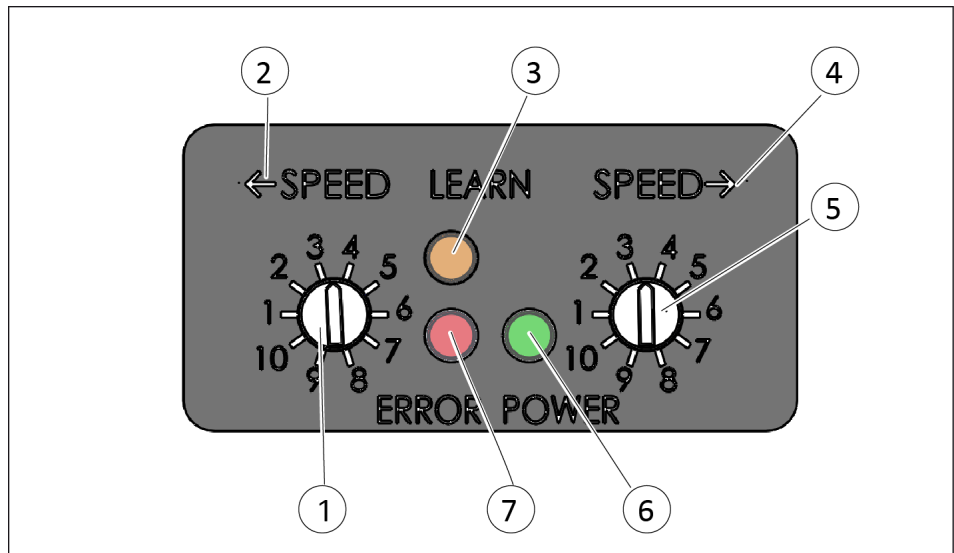
Example 2: Switching off the actuator voltage

This example serves as a possible template for switching off the actuator power supply in case of an emergency stop. The logic voltage is not switched off.

1. Operator triggers emergency stop signal.
2. If the axis is installed vertically: Activate the lowering lock or move it to a safe position.
3. Set both actuation signals to logic 0.
 - ✓ Definition of the operating states in chapter ▶ 4.8 [□ 29].
4. Switch off actuator voltage with the safety switch.
 - ✓ In the "Power off" operating state, the integrated monitoring of the actuator voltage is deactivated. Therefore, no error is triggered.

5. Operator cancels emergency stop signal.
6. Switch on actuator voltage with the safety switch.
7. Deactivate lowering lock.
8. Create the corresponding motion command to leave the "Power off" operating state.
 - ✓ The first run of the drive is performed at reduced speed.

4.5 Displays and control elements



Operating field

1	Rotary switch swiveling time: swiveling left *
2	Displays the travel direction for rotary switch (1)
3	LED diagnostics: Learn
4	Displays the travel direction for the rotary switch (5)
5	Rotary switch swiveling time: swiveling right *
6	LED diagnostics: Power
7	LED diagnostics: Error

* Swivel direction, ► [4.7 \[□ 29\]](#)

4.5.1 Rotary switch

The swiveling time can be set on the rotary switches. At level 10, the shortest swiveling times are reached. At low levels however, the product becomes increasingly sturdy with regard to interference factors in the process.

Level	Velocity	Sturdiness *
1	+	+++++
2 to 4	++	++++
5 to 7	+++	+++
8 to 9	++++	++
10	+++++	+

* Sturdiness: Tolerance with regard to interference factors such as

- Change in mass
- Change in installation position
- Oscillations

etc.

4.5.2 Displays in the "Auto-Learn" operating mode

LED	Color	Status	Meaning
Power	Green	ON	Ready for operation
		OFF	Logic voltage or actuator voltage are incorrectly poled or not in the valid range
Learn	Yellow	ON	The product has a previous stroke taught in
		OFF	Normal Operation
Error	Red	ON	The product has detected a deviation in the movement; error will be reset on the next movement
		Flashes 0.8 Hz	Overcurrent/overheating of the product
		Flashes 5 Hz	Actuator voltage has left the permitted range during the drive or pressing
		OFF	Normal Operation

4.5.3 Displays in the "M1" operating mode

LED	Color	Status	Meaning
Power	Green	ON	ready for operation
		OFF	Logic voltage or actuator voltage are incorrectly poled or not in the valid range
Learn	Yellow	Flashes	Impact velocity too high
		OFF	Normal operation
Error	Red	ON	Protection mode active
		Flashes 0.8 Hz	Overcurrent/overheating of the product
		Flashes 5 Hz	Actuator voltage has left the permitted range during travel or when pressed
		OFF	Normal operation

4.6 Operating mode

4.6.1 Operating mode "Auto-Learn"

Description

Using the auto-learn function, the product can be commissioned easily. This function takes into account the conditions such as

- horizontal or vertical setup,
- fitted payload,
- end stop setting,
- rotary switch setting and
- rigidity of the installation location.

At the beginning of the auto-learn function, the rotary table moves slowly between the end stops. For other travel, the speed is increased until the yellow LED goes out. Teaching is now complete. If it was not possible to successfully complete teaching, this is signaled by the red LED display and the auto-learn function is restarted. In this case, the cause must be eliminated or the set speed reduced (see chapter ▶ 6.1.2 [45]).

Advantages

The product's auto-learn function detects incorrect speed configurations. During the teaching process, the speed selected by the user is checked for the current payload. This precludes operation that is hazardous to the limit stops on account of excessively high impact speeds.

When does the product perform the auto-learn function?

- during initial commissioning
- after reset (not on error acknowledgment)
- after a blockage error has been removed
- if the acceleration monitor is used, e. g. due to mass change, position change, external forces ...

Switching off the logic voltage

Switching off the logic voltage does not lead to a new teach-in. If the logic voltage is switched on again, the product will move slowly in the selected direction until it comes to the stop. After this, the continued movement is determined by the settings, as with the completed auto-learn function.

NOTE

The operating mode can be changed, ► [5.5 \[□ 41\]](#).

NOTE

The end stop must be detected by the product. A travel command against the current direction of travel is implemented at slow speed.

When using end stop sensors for immediate change of direction (example: ejector unit), a delay of the signal of approx. 50 ms is recommended due to tolerances.

4.6.2 Operating mode "M1"

Description

In the operating mode "M1", the motion profile of the product can be adjusted manually. The length of the acceleration and braking phase is set directly via the rotary switch. The maximum adjustable level is limited by overall stroke, payload and position.

NOTE

The maximum impact velocity at the stop may not be exceeded. The drive must brake before the stop is hit.

A high impact velocity is indicated by a flashing diagnostic LED "Learn".

Protection mode

- During the **braking phase**, the product switches to protection mode when swiveling at increased speed **3x** towards the stop.
- During the **acceleration phase**, the product switches to the protection mode when swiveling at increased speed **1x** to the stop.

In protection mode, the diagnostic LED "Error" shines continuously. No further motion commands are performed. This status can be rectified with a reset.

Setting the length of the acceleration and braking phase

Precondition: attachment must be mounted. Angle of rotation and position match the process.

Note: Rotary switches are located on the control panel, ▶ 4.5 [□ 24].

- Set the rotary switch to level "1".
- Reverse the drive in test operation.
- Increase the rotary switch to the point at which the diagnostic LED "Learn" starts to flash.
- Set the rotary switch one level back.

NOTE

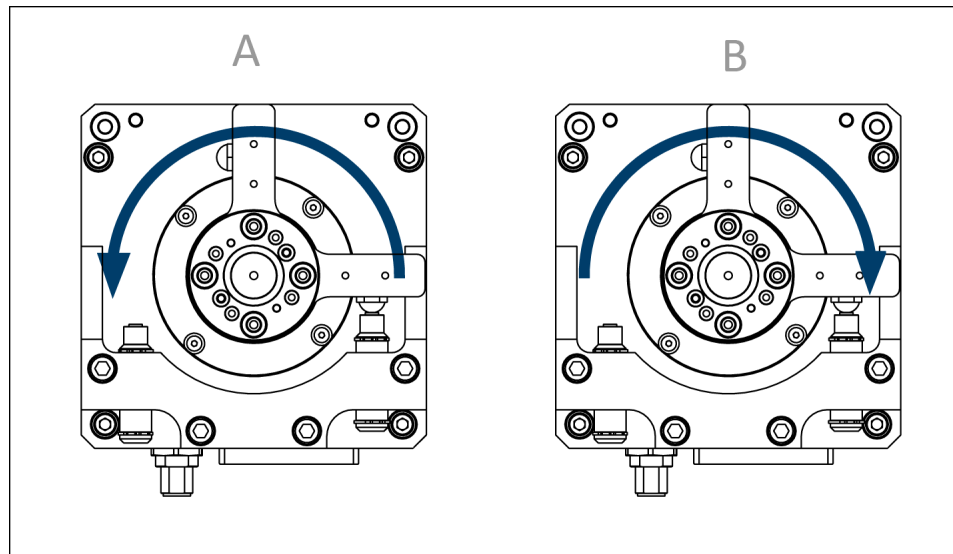
The operating mode can be changed, ▶ 5.5 [□ 41].

NOTE

The end stop must be detected by the product. A travel command against the current direction of travel is implemented at slow speed.

When using end stop sensors for immediate change of direction (example: ejector unit), a delay of the signal of approx. 50 ms is recommended due to tolerances.

4.7 Definition swivel direction



Swivel direction

A	swivel left (counter-clockwise)
B	swivel right (clockwise)

4.8 Actuation

Truth table

The truth table shows the actuation of the digital inputs during possible commands by the superordinated control unit.

The signals at the digital inputs may be switched simultaneously. On detecting a signal change, the product switches to the new status after the activation time has elapsed.

For current input see technical data, ▶ 3 [16].

Digital inputs - swivel right / swivel left

Function	Pin 4 (swivel left)	Pin 2 (swivel right)	Activation time [ms]
Power off	0	0	20
swivel left	1	0	6
swivel right	0	1	6
Reset	1	1	3000

Statuses

- **Power off:** The drive is powerless with speed-dependent braking due to the short-circuit of the motor coil. The next movement after a "Power off" always takes place with reduced speed.
- **Swiveling:** The rotary table is swiveled in the requested direction after the activation time. It is possible to change the direction of rotation during motion. Movement back to the stop, however, is performed at a reduced speed. The signals must also be continuously present in the end position for the position to be retained.
- **Reset:** The product is reset and is in the "Power off" status until the next command is activated. This resets the taught-in movement data, which means that the product requires a new teach-in process in the "Auto-Learn" mode. If an error is triggered by overcurrent, overheating or by monitoring the actuator voltage (i.e. the error LED flashes), this error can be acknowledged with a reset. This error acknowledgment does not reset the stored taught-in movement data, which means the drive does not require a new teach-in process for the "Auto-Learn" operating mode.

Examples for activation time

- Between the commands "swivel right" and "swivel left", an undesired time of 15 ms arises in the PLC actuation, during which time both signals at Pin 2 and Pin 4 are on "0". Here, the last motion command is not interrupted by a "Power off" function, as the activation time for "Power off" has not yet been reached.
- After the "Power off" function, the "swivel left" command is created. At the latest after 5 ms, the movement will start.
- The "Reset" command is created for 4 s. After 3 seconds, a reset is performed and the activation time for the next reset is restarted.

5 Assembly and settings

5.1 Assembly and connection



⚠ WARNING

Risk of injury due to sudden movements!

If the energy supply is switched on, this can cause components to move unexpectedly, which may result in serious injuries.

- Disconnect power sources before installation and calibration.
- Only allow qualified electricians to perform any work on electrical components.

Requirements for the assembly location

- For trouble-free operation, the connection structure must exhibit the required rigidity.
- The product generates dissipated heat during operation, which must be discharged out into the surroundings. The product must be installed in the machine in such a way so that it can dissipate heat by convection (transferring heat to the air) and by heat radiation. An efficient thermotechnical connection to the connection assembly will extend the product lifetime.
- Permanent magnets are installed in the product. These magnets may attract and hold iron fragments or other magnetic objects, thus damaging the product.

Overview

1. Check the evenness of the mounting surface, ▶ 5.2.1 [□ 32].
2. Screw the product to the machine/system, ▶ 5.2.1 [□ 32].
 - ✓ Centering sleeves from the accessory kit are to be used for the secure transmission of shearing forces and the positioning of the product.
 - ✓ Observe the maximal tightening torque, admissible screw-in depth and, if necessary, strength class.
3. Assemble customer application and, if required, install accessories, ▶ 5.2.1 [□ 32].
 - ✓ Observe the maximal tightening torque, admissible screw-in depth and, if necessary, strength class.
4. Adjust end positions, ▶ 5.3 [□ 37].
5. Mount sensor if necessary, ▶ 5.4 [□ 38].
6. Connect cable for power supply and actuation, ▶ 5.2.2 [□ 36]
7. Carry out function test for longest swiveling time. To do this, switch rotary switch to level 1, ▶ 4.5.1 [□ 25].
8. **WARNING! Danger of crushing – safety installations must be active.** Move rotary tables using actuation signal.
9. Configure the desired swiveling time using the rotary switch, ▶ 4.5.1 [□ 25].

5.2 Connections

5.2.1 Mechanical connection

5.2.1.1 Assembly options of the product

Evenness of the mounting surface

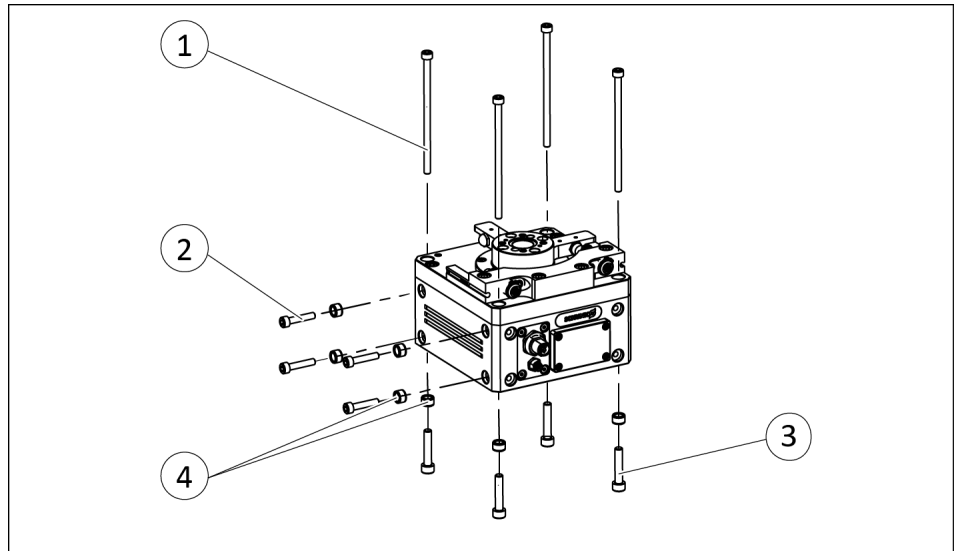
The values apply to the whole mounting surface to which the product is mounted.

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

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

The product can be assembled from several sides.

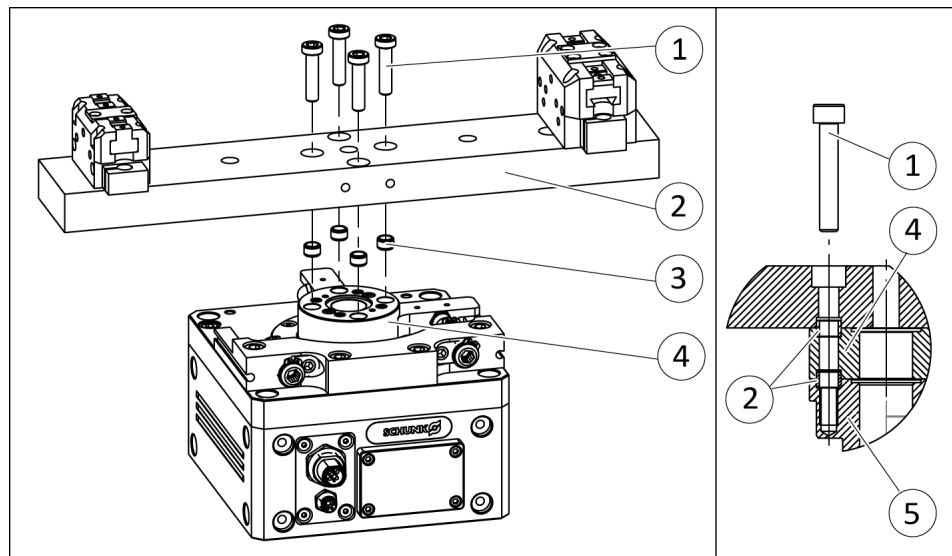
When selecting the fastening screws, observe the values prescribed by SCHUNK, see following table.



Assembly options

Item	Mounting	ERP 25
Mounting from above		
1	Screw, DIN EN ISO 4762	M5
4	Centering sleeve	Ø10
Mounting from below		
3	Screw	M6
	Max. depth of engagement [mm]	12
4	Centering sleeve	Ø10
Side mounting		
2	Screw	M5
	Max. depth of engagement [mm]	10
4	Centering sleeve	Ø10

5.2.1.2 Assembly possibilities for customer applications



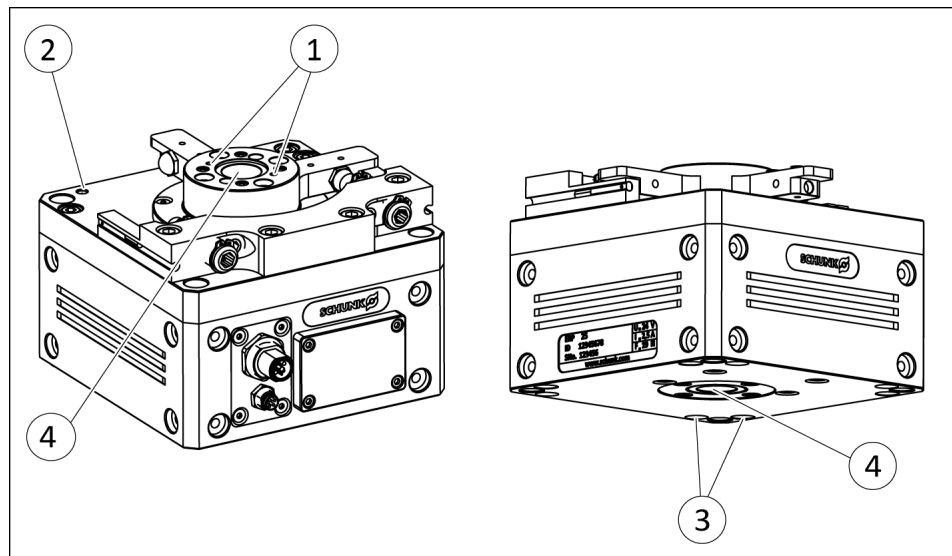
Assembly options - Customer application

Item	Mounting	ERP 25
1	Screw	M6
2	Customer application	
3	Centering sleeve	Ø8
4	Rotary table	
5	Drive shaft	

NOTE

In the delivery scope, the rotary table is only fixed. For problem-free operation, the customer application must be mounted according to the preceding drawing.

5.2.1.3 Assembly options for the accessories



Assembly options - Accessories

Item	Mounting	ERP 25
1	Thread	M3
	Thread depth	16
2	Thread	M5
	Thread depth	10
3	Thread	M5
	Thread depth	10
	Centering sleeve	Ø10
4	Quill for customer-side media feed-through	Ø17

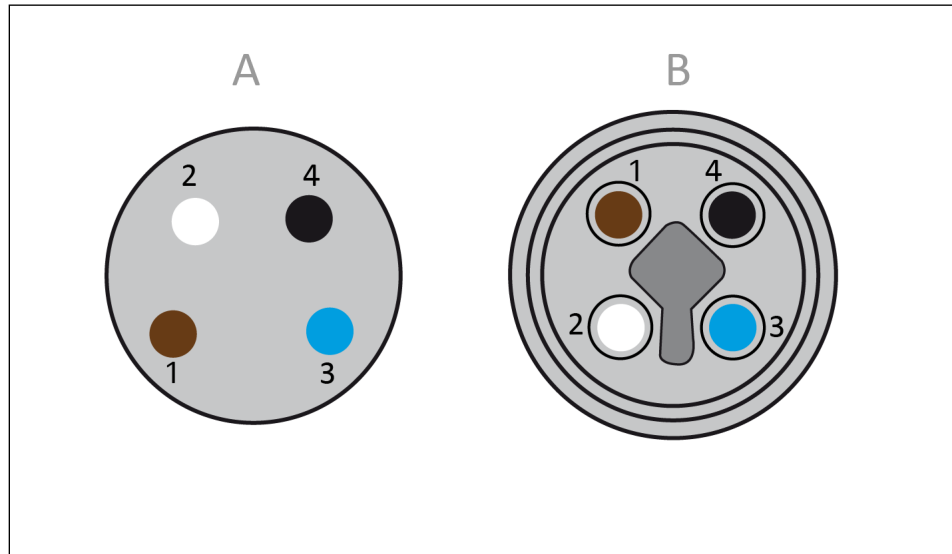
5.2.1.4 Tightening torques

Screw dimension	Tightening torque [Nm] for strength class 8.8 *
M4	3.1
M5	6.1
M6	10
M8	25

* SCHUNK recommends screws with a strength class of 8.8 and above.

5.2.2 Electrical connection

Pin allocation



Pin allocation

A: Connection for actuation
4-pole M8 connector (view on the connector)

B: Connection for power supply
4-pole M12 connector, T coded (view on the connector)

A: Actuation

Pin	Wire color	Signal
1	Brown	not connected
2	White	swivel right
3	Blue	GND
4	Black	swivel left

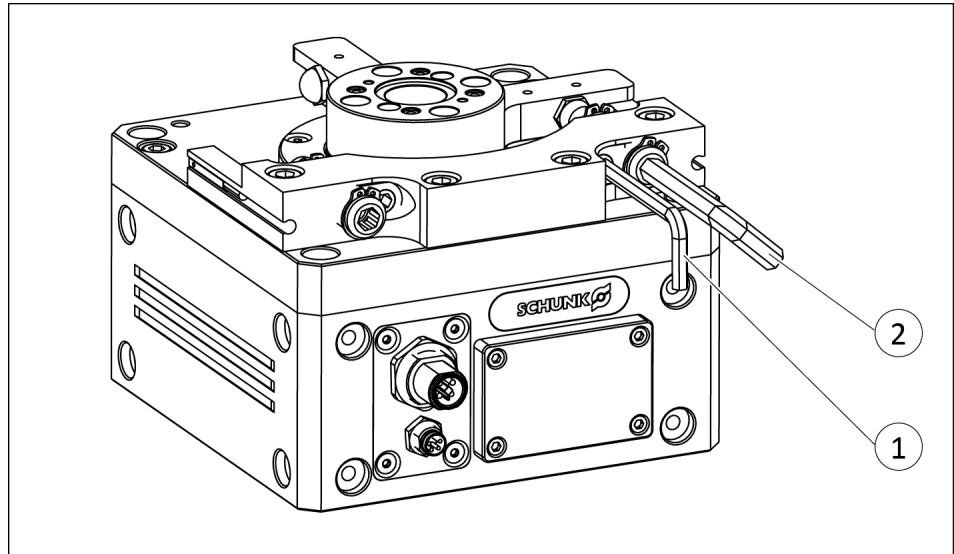
For current input see technical data, ▶ 3 [16].

B: Power supply

Pin	Wire color	Signal
1	Brown	+24 V DC supply electronics / logic voltage U_s
2	White	GND power
3	Blue	GND electronics
4	Black	+24 V DC supply power / actuator voltage U_A

For current input see technical data, ▶ 3 [16].

5.3 Adjust end position



1. Loosen clamping element with Allen key (1).
2. Put end position into the desired position using the Allen key (2). (Thread pitch 1 mm)
3. Retighten clamping element.

For tightening torque, see following table:

Item	Designation	ERP 25
1	Hexagon socket wrench for clamping element, wrench size A/F [mm]	4
	Tightening torque [Nm]	3.5
2	Hexagon socket wrench for set screw, wrench size A/F [mm]	6

5.4 Mounting the sensor

NOTE

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

The product is prepared for the use of sensors.

- For the exact type designations of suitable sensors, please see catalog datasheet and ▶ 5.4.1 [39].
- For technical data for the suitable sensors, see assembly and operating manual and catalog datasheet.
 - The assembly and operating manual and catalog datasheet 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.

5.4.1 Overview of sensors

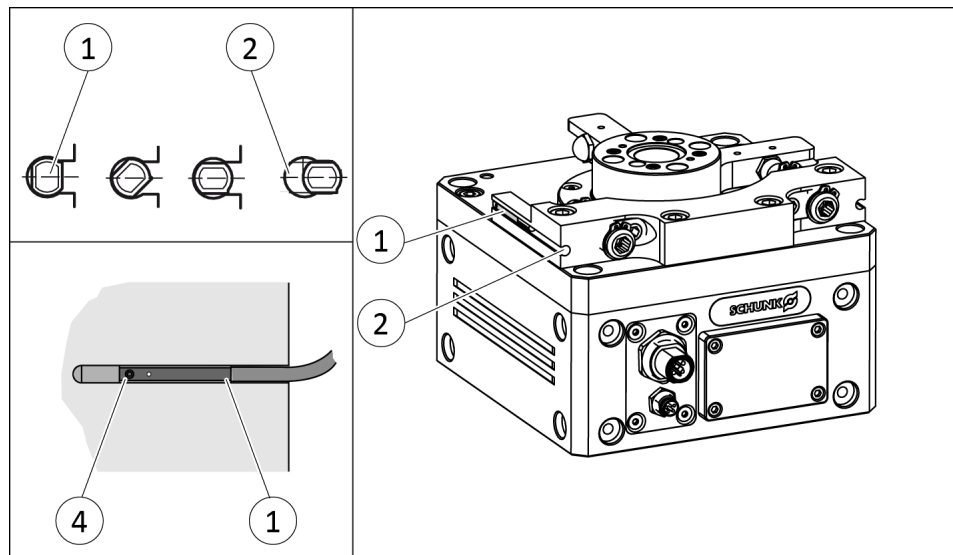
Designation	ERP 25
Magnetic switch MMS 22	x
Inductive proximity switch IN 80	x

5.4.2 Mounting magnetic switch MMS 22

CAUTION

Risk of damage to the sensor during assembly!

- Observe the maximal tightening torque.



- End position is set, ▶ 5.3 [□ 37].
1. Swivel rotary table into end position.
 2. Turn the sensor (1) into the groove (2).
 3. Slowly pull back the sensor (1) again until it switches (plus approx. 1 mm safeguard).
 4. Secure the sensor (1) using the set screw (4).
Tightening torque: 10 Ncm
 5. Swivel the rotary table to and fro to test the function.
 6. Mount the sensor on the other side in the same way.

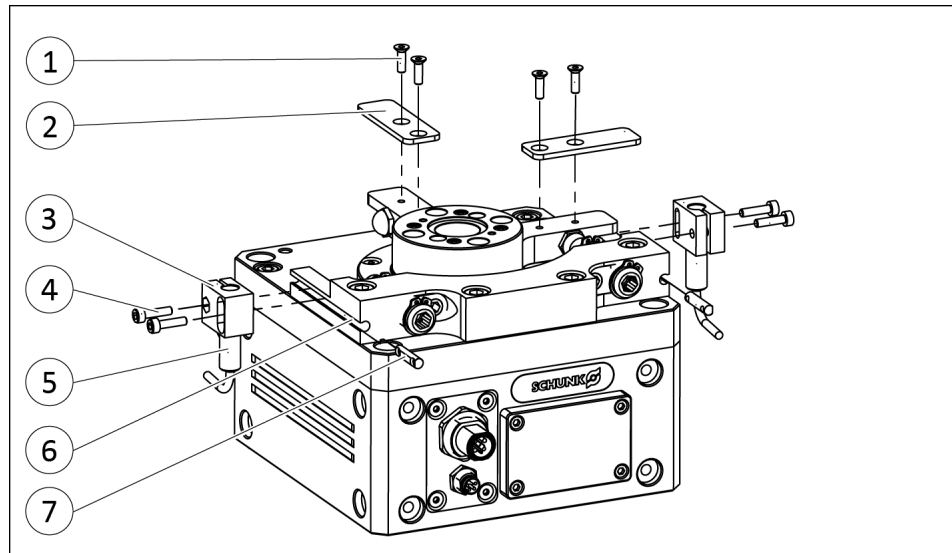
CAUTION: Constant end position positionings are only achieved during operation (end position power effect!).

5.4.3 Mounting inductive proximity switch IN 80

CAUTION

Risk of damage to the sensor during assembly!

- Observe the maximal tightening torque.



Item	Screw dimension	Maximum tightening torque [Nm]
1	M3 x 8, DIN 7991	1.2
4	M3 x 12, DIN EN ISO 4762	0.4

- End position is set, ▶ 5.3 [□ 37].
1. Attach the switching lug (2) with two screws (1) on the rotary table.
 2. Swivel rotary table into end position.
 3. Attach T-nut (7) with two screws (4) to the bracket (3). Tighten screws only slightly.
 4. Push the T-nut (7) with mounted holder (3) into the groove (6) until the bracket is under the switching lug.
 5. Slide sensor (5) into the bracket (3) as far as it will go.
 6. Position sensor (5) incl. bracket and T-nut centrally underneath the switching lug (2).
 7. Configure a distance of 0.5 mm between bracket (3) and switching lug (2). Tighten screws (4) with prescribed tightening torque.
 8. Move slide to and fro to test the functionality.
 9. Mount the sensor on the other side in the same way.

CAUTION: Constant end position positionings are only achieved during operation (end position power effect!).

5.5 Change operating mode

CAUTION

Damage or malfunction of the product possible!

Incorrect parameterization may lead to malfunctions or damage.

Using the auto-learn function, the product can be commissioned easily. In exceptional cases, however, it is possible that this operating mode may not be optimally suited to the workpiece. In this case it is possible to change the operating mode. Pay attention to the notes on operating modes, ▶ 4.6 [□ 26].

Possible reasons for the change may be:

- Auto-learn function not wanted as the user is experienced
- Change of the angle of rotation, e. g. 90° to 180°
- variable end stops

How is the change implemented?

- Activate change mode.
- Select the new operating mode.
- Exit operating state "Power off".

For further information, see the next chapters.

5.5.1 Change operating mode via rotary switch

Activate change mode

NOTE

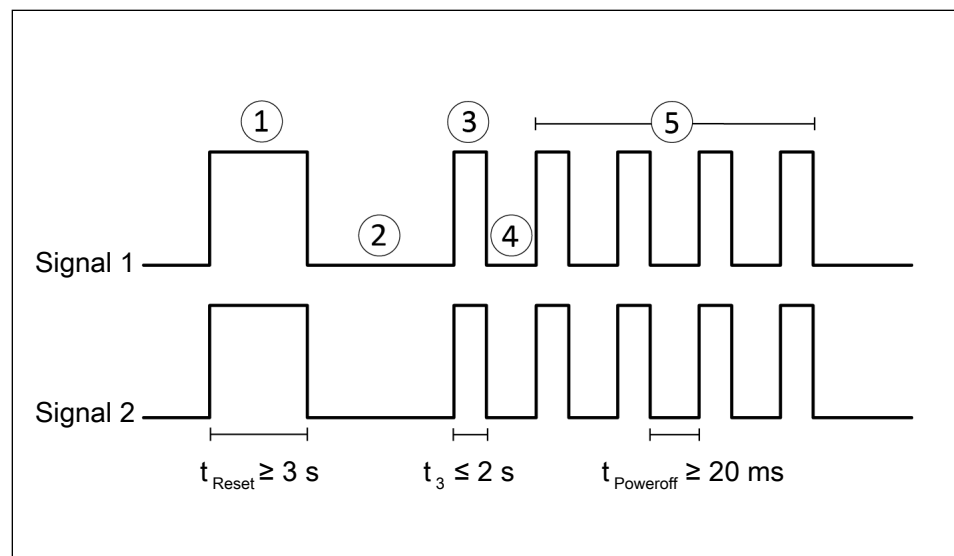
In change mode, turn the rotary switch slowly.

1. Put the product into "Power off" mode: to do this, set the actuation signal "Swivel" to a logical 0 or pull the "Actuation" connecting plug.
2. Set both rotary switches to level 1.
 - ✓ Rotary switches are located on the control panel, ▶ 4.5 [□ 24].
3. Turn the rotary switch "swivel right" clockwise to position 7.
4. Turn the rotary switch "swivel left" anti-clockwise to position 7.
5. Turn the rotary switch "swivel right" anticlockwise to position 1
6. Turn the rotary switch "swivel left" clockwise to position 1.
 - ✓ The red and yellow LED flash. The product is in change mode.
 - ✓ When no rotary switch is actuated, both LEDs go out after approx. 10 seconds. The product exits change mode.

5.5.2 Change operating mode via I/O signals

Activate change mode

1. Step 1: Put the product in the "Reset" operating state. To do this, set both actuation signals to logical 1.
 - ✓ Observe activation time of 3 seconds.
2. Step 2: Put the product in the "Power off" operating state. To do this, set both actuation signals to logical 0.
 - ✓ Observe activation time of 20 milliseconds.
3. Step 3: Set both actuation signals to logical 1.
 - ✓ Do not exceed max. signal duration of 2 seconds.
4. Step 4: Put the product in the "Power off" operating state. To do this, set both actuation signals to logical 0.
5. Step 5: Repeat the previous two steps 4 times.
 - ✓ The red and yellow LEDs flash. The product is in change mode.
 - ✓ If the operating mode is not entered via the IO signals, both LEDs go out after approx. 10 seconds. The product exits change mode.

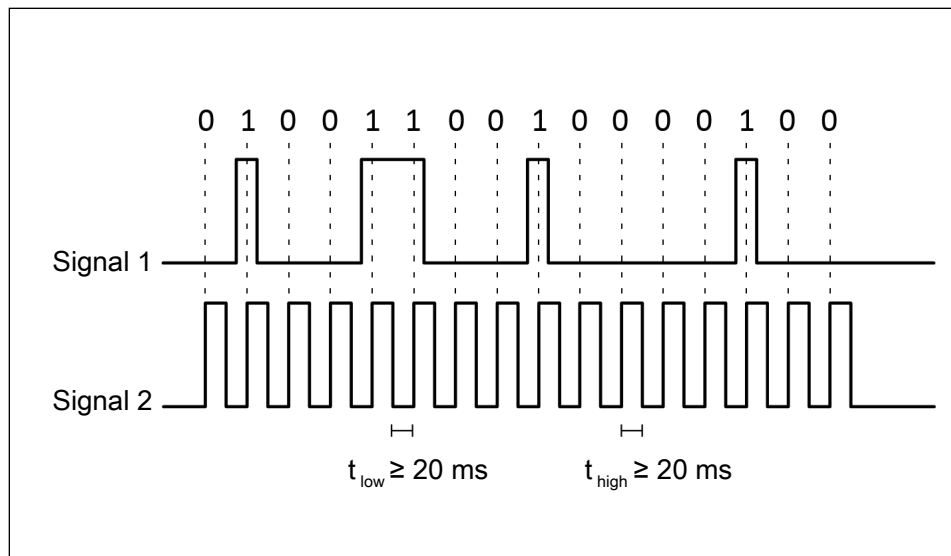


Signal 1	Swivel right
Signal 2	Swivel left

Select the new operating mode

The operating mode is selected by serial transmission of a bit sequence of length 16, with the actuation signal "Swivel right" as clock signal and the actuation signal "Swivel left" as data line. The rising edge on the clock signal indicates when a bit is present on the data line. The transmission must be carried out with the bit value "LSB 0", i.e. the least significant bit is sent first. The digital levels must be applied for at least 20 ms. The new operating mode is accepted when the bit sequence has been correctly transmitted.

- The product is in change mode. Both LEDs flash.
- Within 10 seconds, select an operating mode by serial transmission of the corresponding bit sequence.



Signal 1	Swivel left
Signal 2	Swivel right

Illustrated example:

Operating mode M1 / angle of rotation 180°
 Bit sequence: 0010 0001 0011 0010 = 0x2132

Operating mode	Angle of rotation	Bit sequence as hexadecimal
Auto-learn	45°	0x2111
	90°	0x2121
	180°	0x2131
	270°	0x2141
M1	45°	0x2112
	90°	0x2122
	180°	0x2132
	270°	0x2142

Example: Operating mode M1 / angle of rotation 180°
 bit sequence to be transmitted: 0x2132

NOTE

Sample programs can be provided.

6 Troubleshooting

6.1 Operating mode "Auto-Learn"

6.1.1 Product does not swivel

Operating field display	Possible cause	Corrective action
LED Power (green) = off	Logic voltage and/or actuator voltage are not present	<ul style="list-style-type: none"> • Check logic voltage and actuator voltage
	Product defective	<ul style="list-style-type: none"> • Replace the product
LED Error (red) = flashes with 0.8 Hz	Overcurrent/overheating of the product	<ul style="list-style-type: none"> • Check whether the product is attached so it is not thermally insulated • Refit logic voltage or trigger reset • If the error pattern keeps reappearing and the operating conditions are correct, replace the product
LED Error (red) = flashes with 5 Hz	Power supply unit of the actuator voltage is overloaded Overvoltage in the actuator voltage Error in the cabling of the actuator voltage	<ul style="list-style-type: none"> • Check actuator voltage • Use brake chopper • Replace power supply unit with a more powerful one • Replace defective cable • Refit logic voltage or trigger reset
LED Power (green) = on LED Error (red) = off	missing control signals	<ul style="list-style-type: none"> • Replace connection cable for control signals • Check control

6.1.2 Product teaches in again during the process

Control panel display	Possible cause	Corrective action
LED Error (red) = on	Oscillation of the assembly	<ul style="list-style-type: none"> • Eliminate oscillation or reduce speed
	Stop set incorrectly	<ul style="list-style-type: none"> • Check clamping of the stop screw
	Change in moved mass too great	<ul style="list-style-type: none"> • Reduce mass change or reduce speed
	Installation position of the product not constant	<ul style="list-style-type: none"> • Fix installation location or reduce speed

6.1.3 Product moving too slowly

Control panel display	Possible cause	Corrective action
LED Learn (yellow) = on	Teach-in phase not yet completed	<ul style="list-style-type: none"> Continue working until the teach-in phase is completed
LED Learn (yellow) = off	Speed too low	<ul style="list-style-type: none"> Increase speed setting on the rotary switches
Learn LED (red) = on	Product blocked	<ul style="list-style-type: none"> Remove blockage

6.2 Operating mode "M1"

6.2.1 Product does not swivel

Operating field display	Possible cause	Corrective action
LED Power (green) = off	Logic voltage and/or actuator voltage are not present	<ul style="list-style-type: none"> Check logic voltage and actuator voltage
	Product defective	<ul style="list-style-type: none"> Replace the product
LED Error (red) = flashes with 0.8 Hz	Overcurrent/overheating of the product	<ul style="list-style-type: none"> Check whether the product is attached so it is not thermally insulated Refit logic voltage or trigger reset If the error pattern keeps reappearing and the operating conditions are correct, replace the product
LED Error (red) = flashes with 5 Hz	Power supply unit of the actuator voltage is overloaded Overvoltage in the actuator voltage Error in the cabling of the actuator voltage	<ul style="list-style-type: none"> Check actuator voltage Use brake chopper Replace power supply unit with a more powerful one Replace defective cable Refit logic voltage or trigger reset
LED Power (green) = on LED Error (red) = off	missing control signals	<ul style="list-style-type: none"> Replace connection cable for control signals Check control

6.2.2 Product moving too slowly

Operating field display	Possible cause	Corrective action
LED Power (green) = on LED Learn (yellow) = off LED Error (red) = off	Configured level too low	<ul style="list-style-type: none"> • Increase level
LED Error (red) = on	Impact velocity too high (3 x)	<ul style="list-style-type: none"> • Reduce configured level
	Stop set incorrectly	<ul style="list-style-type: none"> • Check clamping of the stop screw
	Change in moved mass too great	<ul style="list-style-type: none"> • Reduce mass change or reduce speed
	Installation position of the product not constant	<ul style="list-style-type: none"> • Fix installation location or reduce speed

7 Maintenance

Maintenance-free

The product is maintenance-free under the following conditions:

- within the warranty
- if the protection class IP 54 is not required
- Operation within the permissible ambient and application conditions

Maintenance interval	Maintenance work
regularly	<ul style="list-style-type: none"> • Regularly check all electrical and mechanical connections for secure fitting. • Regularly check cables for damage. Replace any damaged cables.
as required	<ul style="list-style-type: none"> • Depending on contamination and the application conditions, clean the product regularly with a lint-free cloth.

Protection class IP 54

When using the product in protection class IP 54, additional maintenance intervals/tasks are possible:

Additional maintenance interval possible with protection class IP 54

Interval (million cycles)	Maintenance work
5	Replace all seals, ▶ 7.1 [□ 49]. The seals are in the enclosed sealing kit. ▶ 1.4.1 [□ 7].

NOTE

To ensure a proper seal, the specified maintenance interval must be observed. Use under harsh environmental conditions (e.g. casting or abrasive dust) can significantly reduce the service life of the seals, and the specified maintenance interval must then be reduced.

7.1 Replacing seals



⚠ 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

Risk of burns through contact with hot surfaces!

Surfaces of components can heat up severely during operation. Skin contact with hot surfaces causes severe burns to the skin.

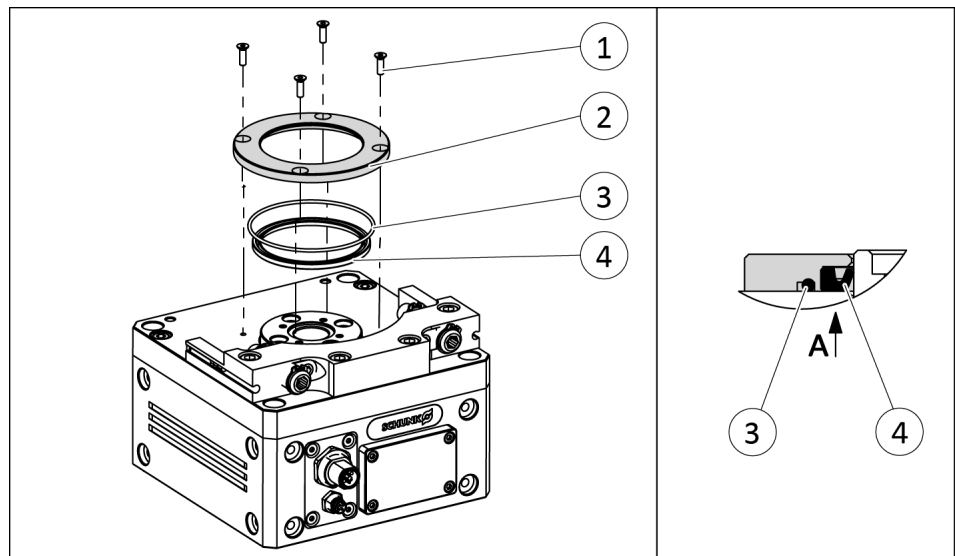
- For all work in the vicinity of hot surfaces, wear safety gloves.
- Before carrying out any work, make sure that all surfaces have cooled down to the ambient temperature.

Original spare parts

Use only original spare parts of SCHUNK when replacing spare and wear parts.

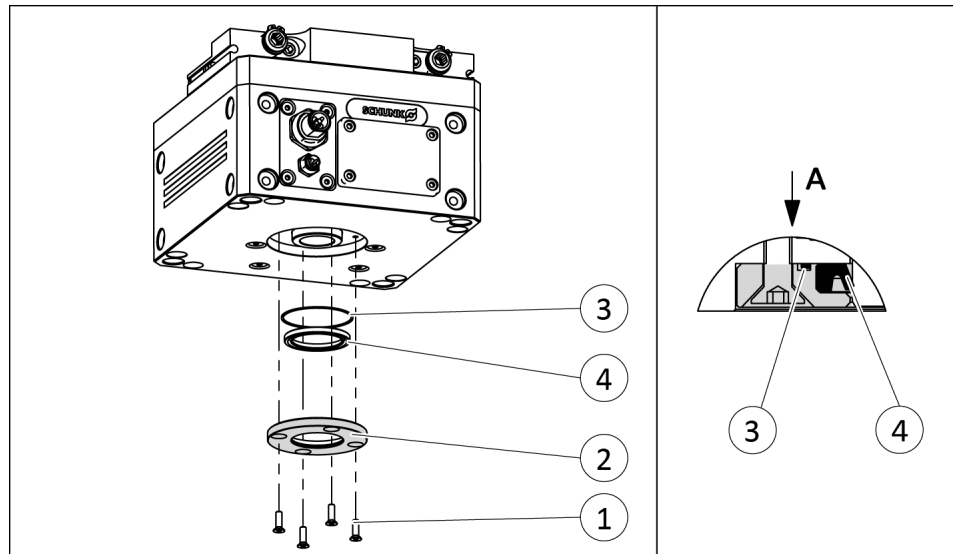
All seals are contained in the sealing kit, ▶ [1.4.1 \[7 \]](#).

Replacing upper seals



1. Remove the screws (1).
2. Remove seal mount (2), O-ring (3) and sealing ring (4).
3. Clean seal mount and seal surfaces in the housing.
4. Lubricate O-ring (3) and sealing ring (4) with prescribed lubricant on the inner and outer diameter, Link Schmierstoffe/ Schmierstellen.
5. Place the sealing ring (4) in the seal mount (2). Make sure that the notch on the sealing ring is pointing in the direction of the arrow (A).
6. Place the O-ring (3) into the groove of the seal mount (2).
7. Insert the seal mount (2) into the housing.
8. Tighten screws (1) with the prescribed tightening torque.
 - ✓ Tightening torque [Nm]: 1.2

Replacing lower seals



1. Remove the screws (1).
2. Remove seal mount (2), O-ring (3) and sealing ring (4).
3. Clean seal mount and seal surfaces in the housing.
4. Lubricate O-ring (3) and sealing ring (4) with prescribed lubricant on the inner and outer diameter, Link Schmierstoffe/ Schmierstellen.
5. Place the sealing ring (4) in the seal mount (2). Make sure that the notch on the sealing ring is pointing in the direction of the arrow (A).
6. Place the O-ring (3) into the groove of the seal mount (2).
7. Insert the seal mount (2) into the housing.
8. Tighten screws (1) with the prescribed tightening torque.
 - ✓ Tightening torque [Nm]: 1.2

8 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 Electronic Solutions GmbH
 Am Tannwald 17
 D-78112 St. Georgen

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.

The product also complies with the regulations found in directive 2014/30/EU from the European Parliament and the Council on electromagnetic compatibility.

Product designation: Electrical universal swivel unit / ERP / electric
ID number 1372750, 1372745, 1372748

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
EN 61000-6-2: 2019	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards -Immunity for industrial environments
EN 61000-6-4:2007 + A1:2011	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments (IEC 61000-6-4:2006 + A1:2010);

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:
Markus Ganter, Address: see manufacturer's address

Signature: see original declaration

St. Georgen, August 2022

p.p. Matthias Heilmann; Head of Development

9 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	Electrical universal swivel unit
Type designation	ERP
ID number	1372750, 1372745, 1372748

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

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