Tool changer

TK-SQ series

TK-200-1250-SQ

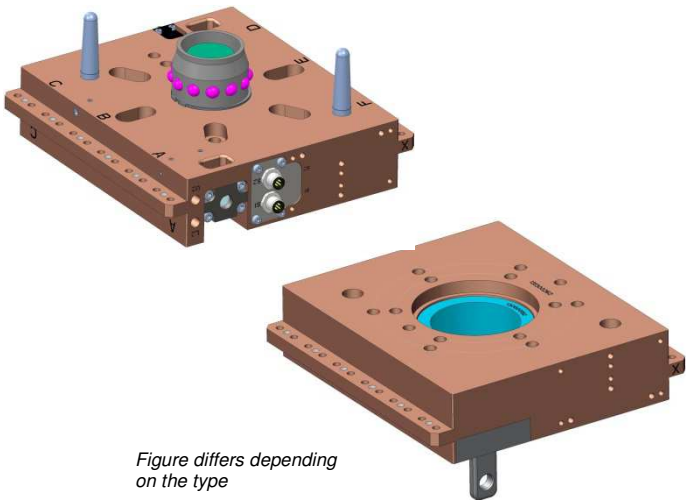

Figure differs depending on the type

Version 2.3 Last revision January 2021

Dear customer,

Thank you for the confidence you have placed in our company by purchasing an IPR product.

Each tool changer is fully assembled at the plant and subjected to an individual test. This includes examining complete proper functioning and operational safety.

These instructions illustrate the design and operating principle of the tool changer. In addition, all the main details for assembly, commissioning and maintenance are clearly arranged.

Please carefully read through the contents.

Please contact us directly if these instructions do not answer all of your questions. We are available at the following address.

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Translation of the original assembly instructions

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1. General

1.1. Information about these instructions

These instructions enable safe and effective handling of the tool changer (WZW). These instructions belong with the machine and should be kept on hand so the responsible personnel can easily access them.

The personnel involved must carefully read through and understand these instructions before beginning any work. Compliance with all safety and handling notices in these instructions is a prerequisite for safe work.

Local health & safety requirements and the general safety conditions where the machine is used are also applicable.

Illustrations in these instructions are provided to assist with basic understanding; they may deviate from the actual design.

Also follow the generally valid, statutory and other binding regulations of European and national legislation as well as the accident prevention and environmental protection provisions in force in your country.

1.2. Terms of warranty

The terms of warranty can be found in the manufacturer's general terms & conditions of business. Please contact to our Customer Service with any questions (see cover for contact data).

2. Safety

This section provides an overview of all important safety aspects for the protection of people as well as reliable, trouble-free operation. Further task-related safety instructions are included in the sections on the individual product life phases.

2.1. Explanation of symbols

Symbols identify the safety notices in these instructions. The safety notices are introduced by signalling words expressing the degree of hazard involved.

	**CAUTION!** Points to a **possible** dangerous situation which – if not avoided – may result in either minor or slight injuries.
	**NOTE!** Points to a **possible** dangerous situation which – if not avoided – may result in either material or ecological damage.
	This symbol highlights useful tips and recommendations as well as information on efficient, trouble-free operation.

2.2. Intended use

The TK tool changer system is exclusively used for the automatic and pneumatic change of robot tools. It consists of a gripper and a robot side. The gripper side (T) is mounted to the tool and the robot side (R) to the receiving flange of the robot.

Tool changers are not ready-to-use machines in accordance with the EU Machinery Directive. Tool changers are solely intended for fitting to machinery and equipment.

Please refer also to their system documentation.

	**NOTE!** You must use the tool changer exclusively in accordance with the operating conditions and performance specifications established in theses instructions.

2.3. Improper use

Any other use or any use going beyond that described in the "Intended Use" chapter is deemed to be inappropriate and will void all warranty or guarantee claims.

The owner – and not the manufacturer – will be liable for resulting damages.

	**NOTE!** The tool changer must not be used in explosive environments.

2.4. General hazards

The tool changer was manufactured according to the state-of-the-art at the time of delivery. Even so, dangers could still proceed from it if the safety information listed here in these instructions is not followed.

- The personnel involved must carefully read through and understand these instructions before beginning any work.
- The instructions must always be available to all users at the operating location of the tool changer.
- If the tool changer is passed on to a third party, these instructions must also be transferred.
- Do not reach into moving components or handle them during operations.
- Never open protective covers under ongoing operations.
- Only authorized qualified personnel are allowed to carry out any work such as assembly, commissioning, operating, dismantling and maintenance outside the danger zone.
- Before starting any work on the tool changer, the energy supply must be disconnected and the line system relieved of pressure. Secure the system against being unintentionally reactivated for the duration of the work.
- Ensure during commissioning that all pneumatic connections are either allocated or firmly closed.

2.5. Owner obligations

In addition to the safety instructions in this manual, the safety, industrial safety and environmental protection regulations of the machine or plant applicable for the area of application of the tool changer must be observed.

As part of his obligation to exercise due care, the owner is to ensure that:

- the tool changer is used as intended
- during the entire period of use of the tool changer a check is to be made on whether his operating instructions comply with the ongoing status of the standards & codes and, if necessary, he is to adapt them
- the responsibilities for installation, operation, fault rectification, maintenance and cleaning are clearly settled and laid down
- all persons who handle the tool changer must have read and understood these instructions in addition, he must regularly train the personnel involved and inform them of the hazards.

2.6. Requirements for the personnel

The variety of tasks described in these instructions place differing requirements on the qualifications of those performing these tasks.

Only appropriate specialist personnel or a duly instructed person under the supervision of specialist personnel are allowed to carry out any work such as assembly, commissioning, operating, dismantling and maintenance.

In view of their technical training, knowledge, experience and knowledge of the relevant standards and regulations, qualified personnel are in a position to perform the work they have been entrusted with and – on their own – to recognize/avoid any hazards.

3. Technical data

(Please refer to the current catalogue or IPR homepage for specifications of the individual tool changers)

3.1. General basic data

Operating pressure min:	4.5 bar
Operating pressure max:	8 bar
Temperature range:	5 °C to 80 °C (higher if requested)
Drive:	Pneumatic with gripping force safeguard via spring
Material:	casing of high-strength aluminium hard-coated/
	partially hardened steel/
	operating parts hardened tool-steel
Tolerance specifications	
Thread:	+/- 0.1 mm
Alignment pin drill hole:	+/- 0.02 mm

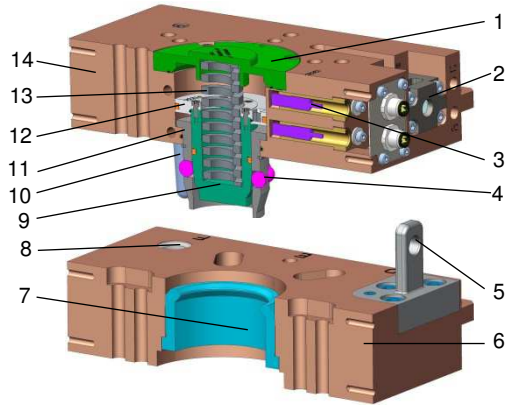
3.2. Operating conditions

The working environment must be free from dirt, dust, splash water and vapours. The machine is to be used at temperatures between 10 °C and 40 °C.

The maximum (non-condensing) relative air humidity is to be between 10% and 70%.

4. Construction and function

4.1. Overview

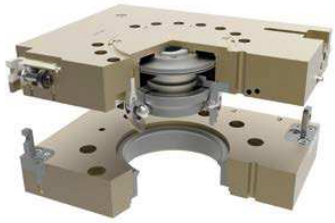


1	Cover	8	Centring sleeve
2	Safety interlock	9	Locking piston
3	Stroke sensor scan	10	Taper pin
4	Ball	11	Ball bushing
5	Locking tab	12	Piston ring
6	TK tool side	13	Spring gripping force safeguard
7	Locking bushing	14	Main body

4.2. Description of Operation

The locking mechanism of the tool changing system is ball-implemented. The balls are pressed via a bevel into a receptacle. If there is a drop in air pressure, the balls are kept in the receptacle by a spring integrated in the piston chamber. This ensures automatic locking should the compressed air drop.

Spring-fitted contacts are used for transferring signals. The springs prevent bending of the contacts. A connection enables the contact pins to be individually replaced should they become worn. This guarantees long service life and transmission dependability.



1

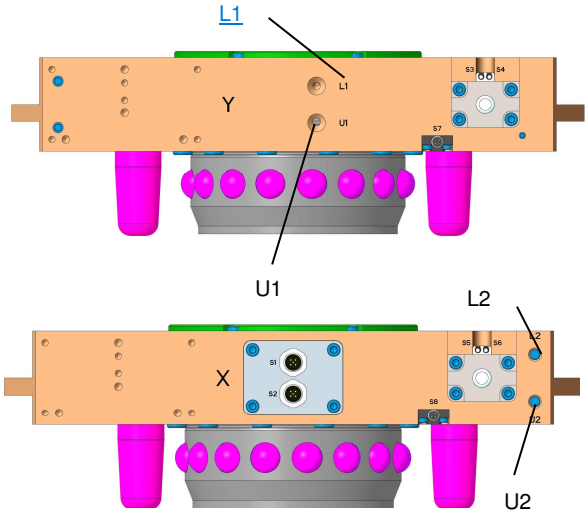
2

3

(1) System uncoupled; (2) System coupled; (3) System locked

Power and moment transmission take place by means of 2 generously proportioned pins that also function as anti-twist protection.

After locking the system, the TK tool changing system can transmit electrical signals from the robot side to the tool side, depending on the type of pneumatic lines and with the aid of the plug connectors, depending on the version.



Lock:

1.1 Air on "U (nlock) 2" opens the safety lock (the safety lock is spring-loaded and locked in the rest position), air pressure on "U2" up to point 4 is maintained

1.2 Air on "U (nlock) 1", the locking piston (main lock) moves into the unlocked position (so you don't have to overcome the spring force of the gripping force safety device when coupling), air pressure on "U1" up to point 3 is maintained

2. Position the robot side over the tool side, surfaces parallel to each other

3. If the distance between the robot and the tool side is <1mm, lock the main lock (air - 6bar - to "L (ock) 1")

4. lock the safety lock (air - 6bar - on "L2")

Maintain 6 bar air pressure on L1 and L2 in locked operation

Unlock:

1. Air on "U2" unlocks the safety lock, air pressure on "U2" is maintained

2. Air on "U1" unlocks the main lock, air pressure on "U1" is maintained

3. Move away from the robot side, the contact surface remains parallel to the tool side

We recommend 2 separate pneumatic circuits for the two locking systems.

Tool changers of the TK-SQ series have many advantages:

- Fast and trouble-free changing of tools and grippers on the robot or gantry up to a load capacity of 200-1250 kg.
- Transmission of electrical signals by spring-loaded contact pins
- Coupling and decoupling of pneumatic and hydraulic lines
- Specially splash-proof design (optional)
- IP65 sealed electrical signal transmission (optional)
- Water and dust protected according to IP67 (optional)
- Wide range of attachment options for media transmission according to Chapter 10 Accessories (optional)
- Changer in stainless steel design (optional)
- Safety interlock with separate pneumatic circuit
- Spring preload safety interlock

5. Transport, packing, storage

5.1. Transport

Immediately check for completeness and any transport damage upon delivery.

Proceed as follows if there are signs of external damage:

- Do not accept the delivery or only under reservation.
- Note down the extent of damage on the transportation documents or on the forwarder's delivery note.
- Initiate the complaint procedure.

	Object to any shortcoming as soon as it is discovered. Claims for damages can only be filed within the valid times allowed for complaints.

Transportation temperature -20 °C to 65 °C.

Protect against external impact (jolt, blow, vibration).

5.2. Packaging

The packaging is to protect the components up to the assembly stage from transport damage, corrosion, and other kinds of damage. Thus, the packing is to be left intact and only removed just before actual assembly.

Only recyclable materials are used for the packing.

Dispose of packaging materials in accordance with the respectively valid statutory regulations and local requirements.

5.3. Storage

Store packs under the following conditions:

- Do not store outdoors.
- Store in a dry and dust-free place.
- Do not expose to corrosive media.
- Protect from direct sunlight.
- Avoid mechanical shocks.
- Temperature for storage: 15 °C to 35 °C.
- Relative air humidity: max. 60%.
- In cases of storage exceeding three months, regularly check on the general condition of all the parts and packaging. If need be, either recondition or renew the conservation protection.

	Information may also be on the packages which extend beyond the requirements set out here. Adherence to such information is also mandatory.

6. Assembly and Commissioning

	**CAUTION!** Before assembling the tool changer, the energy supply needs to be disconnected and the line system relieved of pressure. Observe the safety instructions and general hazards from chapter 2.

6.1. Assembly

The assembly drill holes and pneumatic connections can be taken from our ongoing catalogue and/or the Internet.

The tool changer must only be fastened using threads provided for the purpose. If needed, make an appropriate adapter flange or purchase it from the manufacturer.

Tighten the assembly bolts with thread locking adhesive (e.g. Loctite 4052) or with Schnorr/Nord lock washers, as appropriate.

Compressed air with 4.5-8 bar must be provided; pneumatic connections installed, connections not needed closed.

Connect electrical signal lines on the robot and the tool side. Depending on the design, use sub-D plug connections or IP65 plug connections.

6.2. Commissioning

The system is not switched on/off separately. Once installed on the robot/tool and supplied with compressed air, the system is ready for use or, if the robot is stopped and the compressed air supply is interrupted, the system is also switched off.

In case of a drop in air pressure, the system is automatically locked. The balls are kept in the receptacle by a spring integrated in the piston chamber. Uncoupling of the tool is only possible when the system is supplied with compressed air.

The safety interlock is put into operation via a separate pneumatic circuit.

7. Malfunctions

Tool changer does not lock / unlock

- Check on supply of air, replace any non-tight lines, if necessary
- Air pressure too low, raise the air pressure
- Examine seals and renew, if necessary

Tool changer does not dock

- Foreign bodies/soiling present, clean tool changer

8. Service and repair

	**NOTE!** Observe the safety instructions and general hazards from chapter 2.

8.1. Cleaning and upkeep

	**NOTE!** Corrosive cleaning agents could damage the tool changer seals and result in them ageing more rapidly.

Please remember the following when cleaning and tending to the machine:

- Use protective caps and the like to firmly close all the openings.
- Check that all connections are tight.
- For cleaning, use a lint-free cloth and metal cleaner if necessary.
- Remove any coarse dirt and keep the coupling surfaces clean.

8.2. Maintenance

When used as intended the tool changer does not require any special maintenance in normal operation.

To retain the functions of the tool changer, we recommend carrying out the following maintenance actions at least 2x a year:

- Cleaning the tool changer
- Check screws and connections, retighten if necessary
- Check the tool changer function, repair if necessary

- Check the tool changer for signs of external deformation, damage and wear and repair, if necessary
- Check the sealing surfaces on the O-rings; replace if necessary

8.3. Repair work

The manufacturer provides you with a comprehensive repair service for tool changers.

Repairs are only to be carried out by authorized specialist personnel.

CAUTION!

Risk of injury from compression spring under tension

There is a strong, tensioned compression spring in the piston chamber of the robot side. This stored spring tension could result in serious injuries when dismantling is undertaken.

- Be careful when opening and disassembly

The following repair work can be carried out at the owner's:

- Replacement of seals of the coupling faces
- Replacement of locking piston/seals on robot side
- Replacement ball bushing on robot side
- Replacement of taper pins on robot side

Proceed as follows:

Locking piston

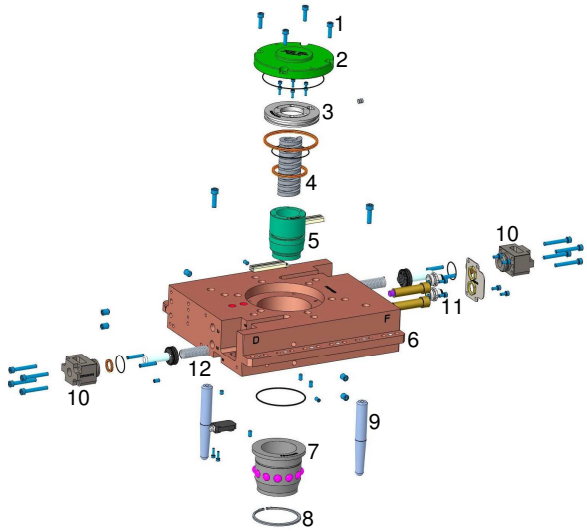
1. Loosen the fastening screws (1)
2. **Caution!** Cover (2) under spring tension – when unscrewing the final two screws, press the cover on the robot flange downwards to prevent injuries from the cover popping off
3. Remove the compression spring (4) and locking piston (5).
4. You can now replace the piston seals

Ball bushing

5. Carry out pos. 1-4
6. Place the main body (6) on the fastening surface
7. Remove the circlip (8) with a pair of appropriate pliers
8. Use a rubber mallet to lightly tap the ball bushing (7) inwards towards the piston chamber
9. Assemble in reverse order
10. Check the tool changer as to function

Tighten all screw connections with a tightening torque according to DIN and secure with a medium strength thread locking adhesive (e.g. Ergo 4052).

Spare parts and a full set of seals can be obtained through the manufacturer.



1	Cheese head screws	8	Circlip
2	Cover	9	Taper pin
3	Piston ring	10	Safety interlock
4	Spring	11	Stroke sensor scan
5	Locking piston	12	Compression spring -
6	Main body		Safety interlock
7	Ball bushing		

9. Dismantling, decommissioning, disposal

CAUTION!

Before disassembly of the tool changer, the energy supply must be disconnected and the line system relieved of pressure.

Observe the safety instructions and general hazards from chapter 2.

9.1. Dismantling

At the end of its useful life, the tool changer must be dismantled and disposed of in an environmentally compatible manner.

Properly clean sub-assemblies and components and disassemble them in consideration of the prevailing local health & safety and environmental protection provisions.

9.2. Decommissioning

You carry out decommissioning in the reverse order to commissioning.

- Malfunctions on the tool changer must be corrected before decommissioning
- Tool changer needs to be cleaned
- Non-plugged connection openings need to be firmly closed

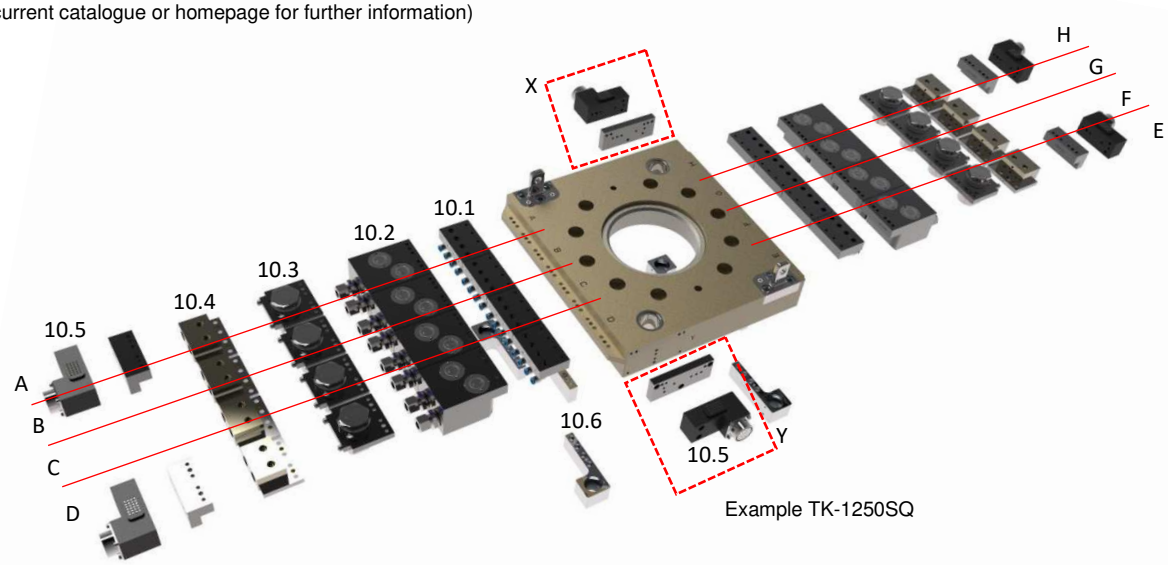
9.3. Disposal

Pass on disassembled parts for recycling if no arrangements have been made for returning them or disposal:

- Turn metals into scrap.
- Hand in plastic elements for recycling.
- Sort the rest of the components by material properties and dispose of accordingly.

10. Accessories

(The accessories can be freely configured, please refer to the current catalogue or homepage for further information)



Example TK-1250SQ

10.1. Pneumatic module

- Can be mounted on the side A-D; or E-H
- RS with seal

10.2. Hydraulic module

- Can be mounted on the side A-D; or E-H
- When using 2 modules, arrange diagonally

10.3. Coolant connection

- Can be mounted on the side A-D; or E-H

10.4. Pneumatic module self-locking

- Can be mounted on the side A-D; or E-H

10.5. Connector strips

- Can be mounted on pos. X, and Y
  Can be mounted on the side A-D; or E-H

10.6. Support strips and centring for storage

Support bar

Centring left

Centring right

- Can be configured as desired