STARK.connect zero point clamping system

Translation of the original operating manual
WM-020-417-17-en BA STARK.connect

STARK.connect(.LK).M

Art. no.: S9000-XXX, S04665, S04735

Manufacturer:

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1 Table of contents

2 Identification of the partly completed machinery

Product:	Fast closing clamp
Function:	Clamping and centring of machine or system elements
Product group:	STARK.connect.M / STARK.connect.LK.M
Article number:	S9000-XXX, S04665, S04735
Trade name/	
General designation:	corresponds to product group, see above

3 User instructions

3.1 Purpose of the document

This operating manual

- describes the function, operation and maintenance of the fast clamping device
- gives important instructions for safe and efficient use of the fast clamping device

3.2 Revision history

Date	Version	Revision	Name
24/04/2018	WM-020-417-10	Document creation	magr
05/11/2018	WM-020-417-11	5.5 Integrated signalling/sensors 9 Technical data for	wavo
21/03/2019	WM-020-417-12	5 Description of the fast clamping device 9 Technical data for	wavo
14/04/2020	WM-020-417-13	STARK.connect (change of name + presentations) 9 Technical data for	chgo
14/03/2022	WM-020-417-14	connect LOCK M versions added	wavo
28/08/2023	WM-020-417-15	5.7 Programming aid STARK.airtec/connect	chgo
09/11/2023	WM-020-417-16	10 Technical data for versions with lock	chgo
24/10/2024	WM-020-417-17	9 Technical data for versions without lock 10 Technical data for versions with lock 13 Declaration of Incorporation	wavo

Table 1: Revision history

3.3 Presentation of safety instructions

Safety instructions are identified by a pictogram. The associated signal word describes the extent and severity of the impending hazard.

	**DANGER**	**Immediate** imminent risk to life and health of persons (serious injury or death). Be sure to follow these instructions and procedures!
	**CAUTION**	**Potentially** dangerous situation (minor injuries or property damage). Be sure to follow these instructions and procedures!
	**INFORMATION**	Application tips and particularly useful information.
	**INSTRUCTION**	Obligation for special conduct or an activity for the safe handling of the machine.

4 Essential safety instructions

4.1 Intended use

The fast closing clamp is used for clamping pallets with mounting devices for workpieces.
The workpieces are intended for processing, transporting and measuring.

The intended use also presupposes:

- compliance with all the instructions in the operating manual
- observance of the inspection and maintenance intervals
- use of only OEM parts.

4.2 Foreseeable misuse

Any other use than that described in chapter
“4.1 Intended use“ or any use going beyond this is considered a misuse and is not permitted!

Risks may occur if the product is not used as intended. Improper uses include e.g.:

- exceeding the technical values specified for normal operation
- application for hoist operation and load transportation

The operating company bears sole responsibility for any injury or damage resulting from such improper use. The manufacturer assumes no liability.

4.3 When using rotating machine tools

For rotating applications, the fast closing clamp may only be operated if it is ensured that it is securely clamped. It must also be ensured that the permissible forces acting on the fast closing clamp are not exceeded according to the technical data.
Specialists must be consulted to calculate and design the fast clamping clamps for rotating applications. STARK Spannsysteme GmbH provides this service.

4.4 Modifications or alterations

Unauthorised modifications or alterations of the fast clamping device will void any liability and warranty on the part of the manufacturer!
Therefore do not make any modifications or alterations to the fast closing clamp and retractable nipple without consultation with and the written approval from the manufacturer.

4.5 Spare and wear parts and auxiliary materials

Only retractable nipples from STARK Spannsysteme GmbH may be used on the remote station and must be installed according to the appropriate data sheet of STARK Spannsysteme GmbH.
The use of spare and wear parts from third-party manufacturers can result in risks. Use only OEM parts or parts approved by the manufacturer. STARK Spannsysteme GmbH accepts no liability for damage resulting from the use of spare and wear parts or auxiliary materials not approved by STARK Spannsysteme GmbH.

4.6 Obligations of the operating company

The operating company is obliged to allow only persons to work on the fast clamping device who

- are familiar with the fundamental occupational health an safety and accident prevention regulations
- have been instructed in the use of the fast clamping device and have read and understood this operating manual.

The requirements of EC Directive 2007/30/EC on the use of work equipment must be observed.

4.7 Residual risks

Attention must be paid to the existence of mechanical and pneumatic residual energies at the fast clamping device and the pressure in the cylinders and valves after switching off the fast clamping device!

4.7.1 Spring assembly

Improper disassembly of the fast closing clamp can result in material damage or even injuries due to the internal, pre-tensioned spring assembly. Assembly work may only be carried out by STARK Spannsysteme GmbH.

4.7.2 Malfunction in the hydraulics/ pneumatics during operation

Malfunctions in the hydraulics or pneumatics can lead to an unintentional pressure increase in the release line and subsequently to the release of the fast closing clamp. Particularly in rotating applications, this can result in a significant hazardous situation.

Possible measures to prevent accidental release:

- Mechanical disconnection of the release pressure line (decouple). This means that a pressure increase is no longer possible during operation.
- Decoupling the safety valves from the machine hydraulics/pneumatics. This means that a pressure increase is no longer possible during operation.
- When the hydraulic system is decoupled, the temperature in the system/pallet must not increase, e.g. due to hot chips or machining operations.
- With integrated pressure monitoring in the release circuit of the fast closing clamp, the machine can be stopped in the event of an unintentional pressure increase.

4.7.3 Excess pressure hazards

Lines or hoses bursting due to excessive pressures can endanger persons and the environment.

Measure:

- Protect hydraulic lines with overpressure safety valves.
- Observe the specified pressure limits.

4.7.4 Danger due to incorrect assembly of the fast closing clamp

Incorrect tightening of the fixing screws or insufficient strength of the screws can cause the pallet to come loose.

Measure:

The mounting instructions for arrangement, strength class and tightening torque must be observed.

4.7.5 Danger during use when rotating

Excessive rotational speed, excessive weight or unbalance can lead to failure of the fast closing clamp. As a result, the pallet could be slung away.

Measure:

It is essential to observe the manufacturer's specifications and regulations regarding maximum values!

4.7.6 Influences on service life

Negative influences include:

- Insufficient filtering of the oil or compressed air: a filter fineness of <15 µm must be guaranteed.
- External mechanical damage to functional components.
- Exceeding the specified forces or unintended load conditions.
- Insufficient ventilation of the hydraulic circuit.
- Overloading due to sudden pressure peaks.
- Excessive piston speeds: the specified release and clamping times must not be undercut due to excessive volume flows (note pump delivery rate)!
- Heavy contamination of the functional parts (e.g. chips, casting or grinding dust, etc.)
- Aggressive media or environmental influences, e.g. coolants or lubricants, cleaning agents, UV radiation. This attacks seals and wipers.
- Incorrect preload position or loading position.
- Damage due to excessive loading and unloading speed.
- Staying too long in the release position leads to unnecessary loads on the seals and springs.

5 Description of the fast clamping device

5.1 General

The products of the STARK.connect series are fast closing clamps made of high-quality tool steel and housings made of anodised, high-strength aluminium with very small space requirements due to compact external dimensions. The system is mechanically tensioned with springs, pneumatically power-enhanced and pneumatically released. The integrated spring assembly makes the STARK.connect self-locking.

The STARK.connect LOCK M versions (also named STARK.connect.LK.M) also have an integrated lock. As a result, higher insertion or clamping forces are achieved even in a depressurised state. Optionally, this function can also be pneumatically double-acting, which allows even higher values to be achieved.

The integrated querying unit detects and signals the clamping state using three/five signals (clamped, released, incorrectly clamped, additionally locked or unlocked for the STARK.connect LOCK M versions) via LEDs directly on the rear of the element and digitally for transmission to a higher-level control system. The query is designed to be fail-safe and suitable for use in welding systems.

The product series is designed for installation in systems for vehicle shell construction, assembly systems and for connecting machine elements. It is suitable for use in welding environments (weld-proof). Depending on the required accuracies, it can also be used for all common machining operations such as milling, grinding, eroding as well as on test benches and assembly devices. Ideal for automatic loading.

5.2 Operating principle

5.2.1 STARK.connect M

STARK.connect is a pneumatically operated zero point clamping system. A piston is held in the clamping position by springs. The piston has a double-acting pneumatic design. Both of the pneumatic connections for release and reclamping or the electrical control and visual display of the clamping state are located at the rear of the element.

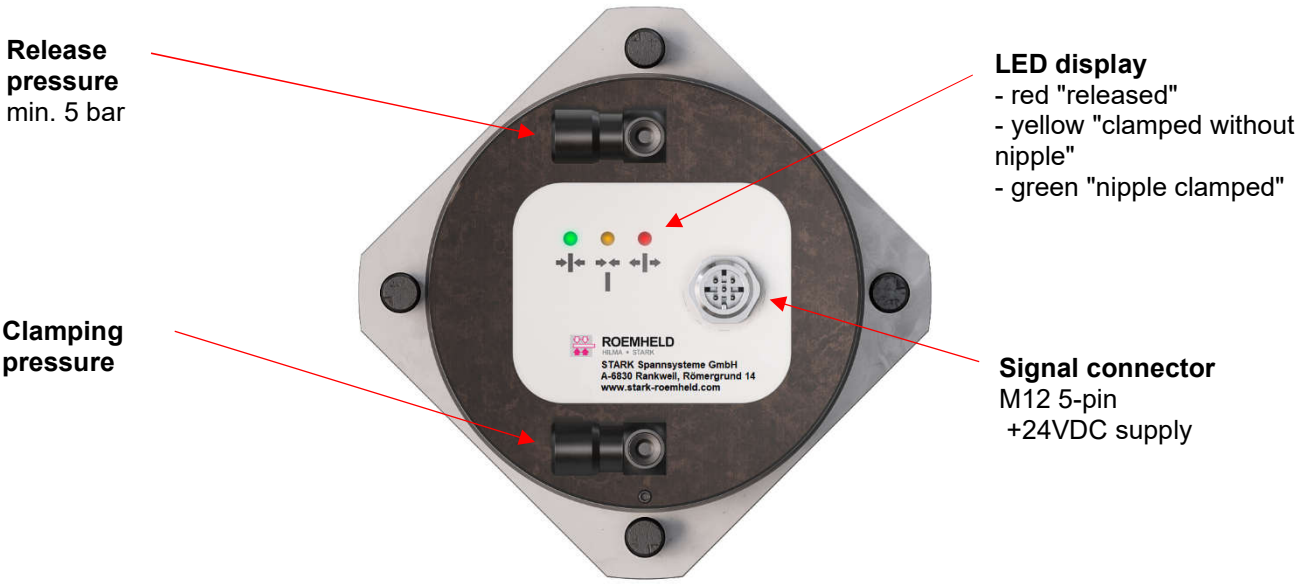


Figure 1: Bottom of STARK.connect M without lock

Release

When the release pressure is applied, the piston is moved into the release position against the spring force. The form fit of the embracing balls is released and the retractable nipple is pressed out (lifting path) - signal: "released".

Clamping without retractable nipple or faulty tensioning
If the release pressure is relieved, the piston retracts. If there is no retractable nipple in the system, the end position is reached - signal: "clamped without retractable nipple".

Clamping with retractable nipple
If a retractable nipple is within the axial tolerance ("axial pre-positioning"), the form fit between the retractable nipple and the piston is produced with the rotating balls when the piston is retracted. The piston continues to move, the retractable nipple is retracted until the system is reached (up to the maximum insertion force). The piston is held in a distinct intermediate position by spring force - "clamped with retractable nipple" signal.

The form fit is retained until the release connection is pressurised. This must be observed on the control side with regard to personal safety.

Clamping force increase
The spring-loaded insertion force can be pneumatically increased. If the clamping pressure is applied with 5 bar, the insertion force can be increased to 3,000 N.

5.2.2 STARK.connect LOCK M

In addition to the functions described under 5.2.1, the STARK.connect LOCK M versions have an internal lock. This can have single-acting or double-acting pneumatic control. In the first case, the locking mechanism acts only by means of spring force; in the second case, the effect can be amplified by applying additional pressure. A separate pneumatic control circuit is usually required to release the lock, but under certain conditions this can be combined with the first release line.

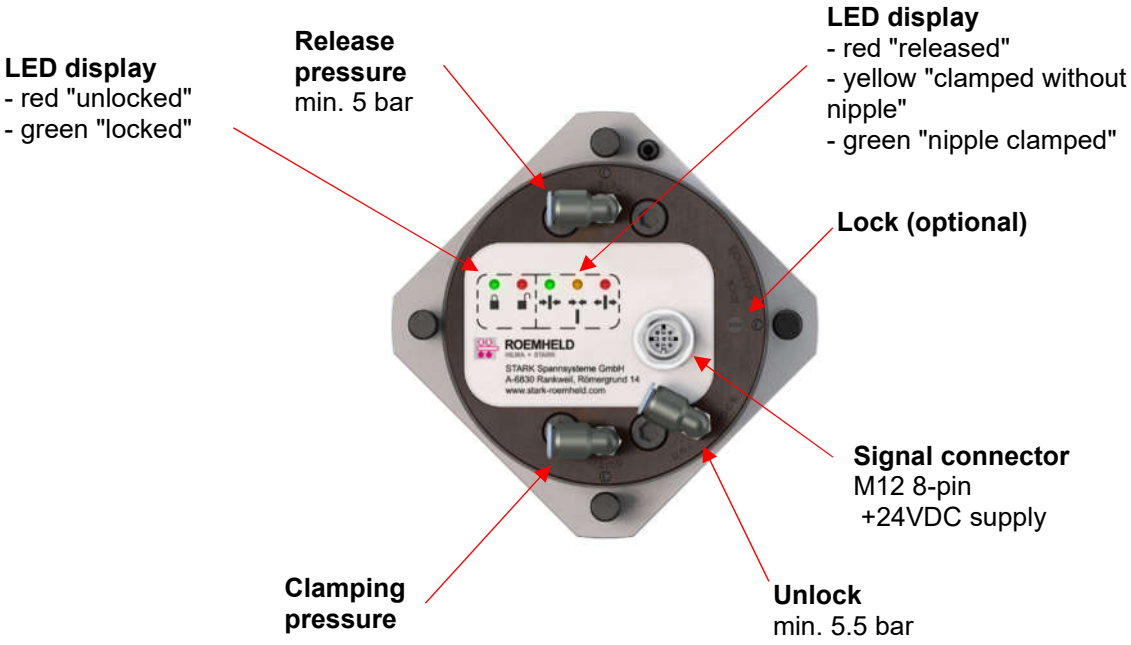
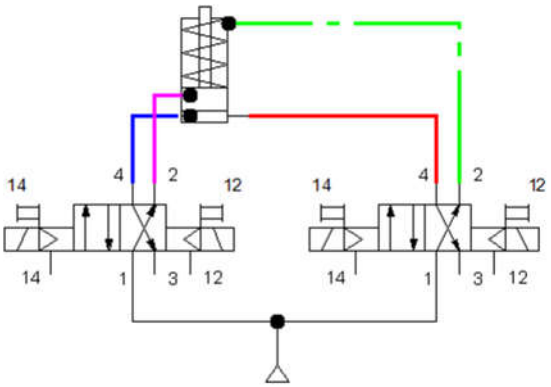


Figure 2: Bottom of STARK.connect LOCK M

If you want to apply additional pressure to the lock, replace the filter nipple in the corresponding M5 bore with a suitable pneumatic fitting (not included in the scope of delivery).

5.2.2.1 STARK.connect LOCK M dual-circuit control



The most flexibility is obtained with this control; each movement can be controlled independently if the corresponding signal of the forerunner is present. The recommended switching sequence or the sequence of signals can be seen in the diagrams below.

Legend for all the following schemes:
- Clamp (optional)
- Release
- Lock (optional)
- Unlock

Figure 3: STARK.connect LOCK M dual-circuit control

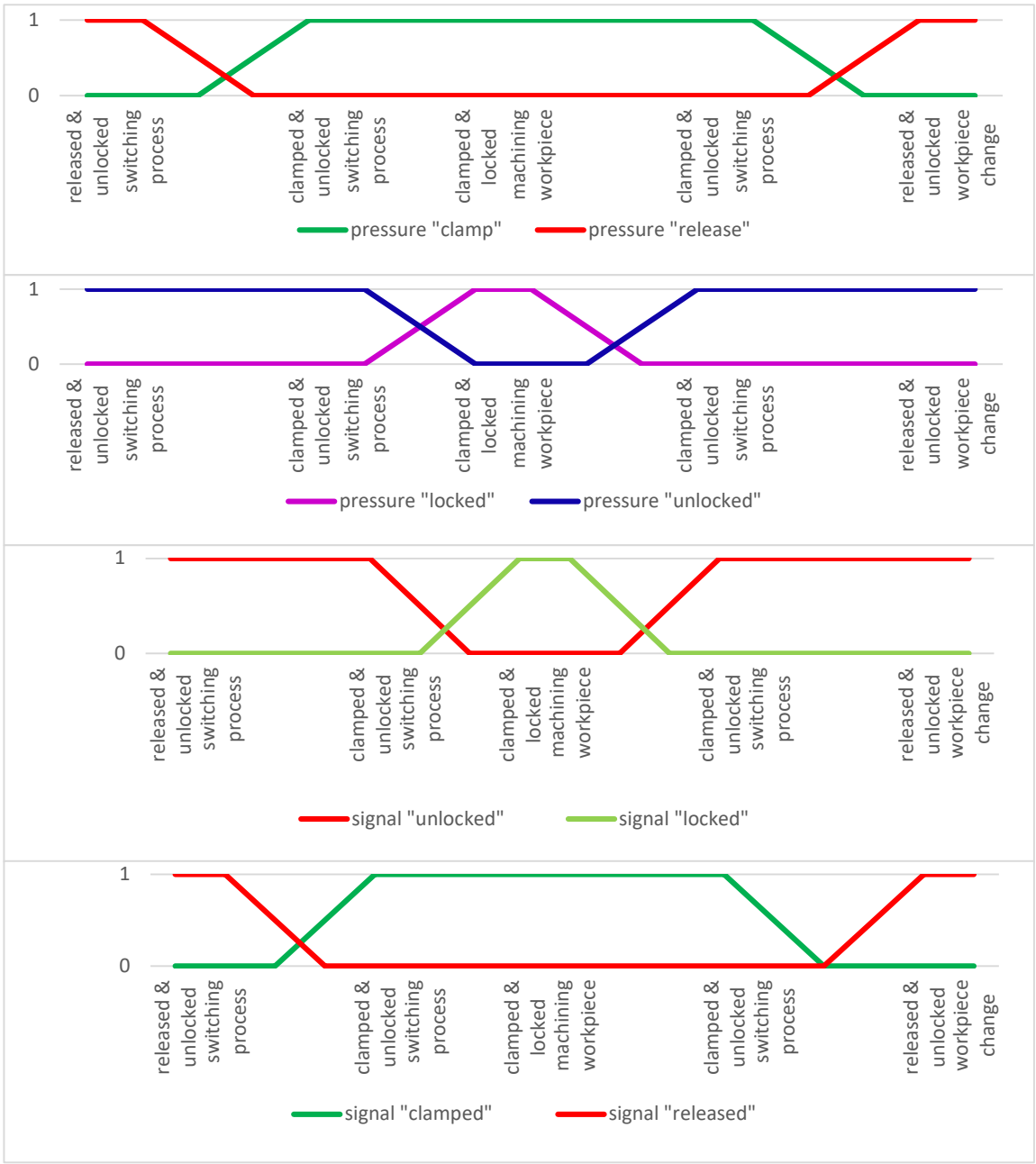


Figure 4: Sequence diagram

5.2.2.2 STARK.connect LOCK M single-circuit control

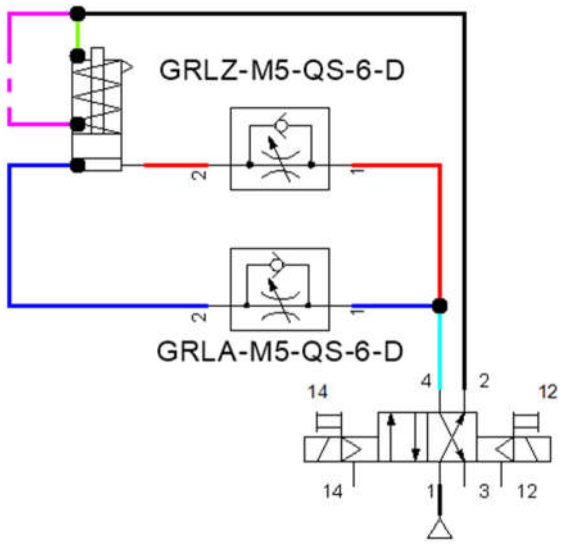


Figure 5: STARK.connect LOCK M single-circuit control

Using an exhaust air throttle on the release connection and a supply air throttle on the "unlock" connection, the speeds of the two pistons can be matched to each other in such a way that locking is only active when the clamping process is completed or that the release process only starts when locking is deactivated. This saves you from needing a control circuit and has the added advantage that the locking mechanism helps to pull the workpiece or device onto the flat support. The disadvantage of this control is that the individual movements cannot be controlled independently of each other and no signals are received for the intermediate states (the article numbers listed are Festo order numbers and are only to be regarded as examples). The switching sequence and the feedback signals can be seen in the diagrams below.

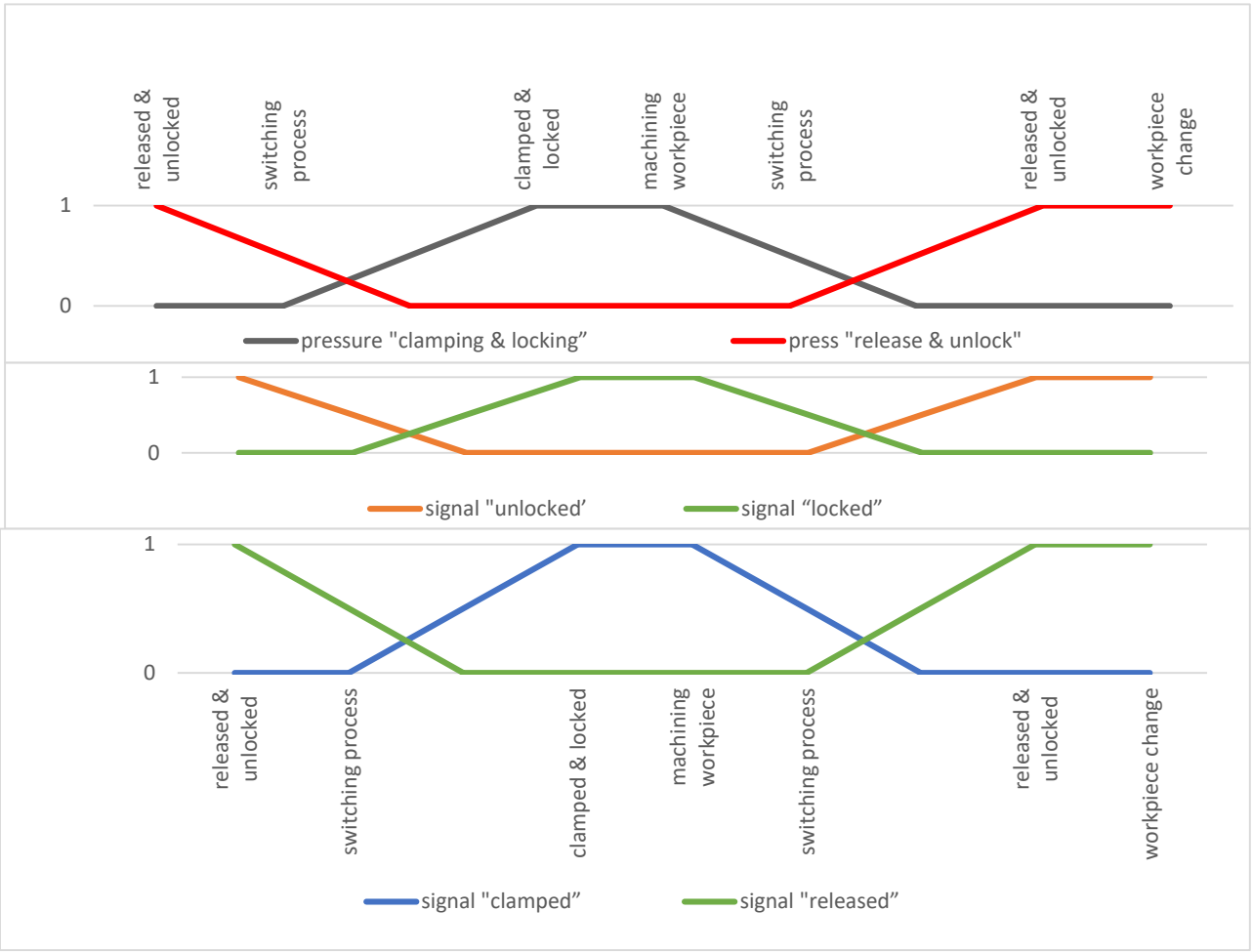


Figure 6: Flow diagram for single circuit control

5.2.2.3 Use of double check valves

If, due to the connection situation, it is not possible to apply constant pressure to the fast closing clamp during machining, the insertion or clamping force can be increased by using a non-return valve (this is also possible with the connect M versions without lock):

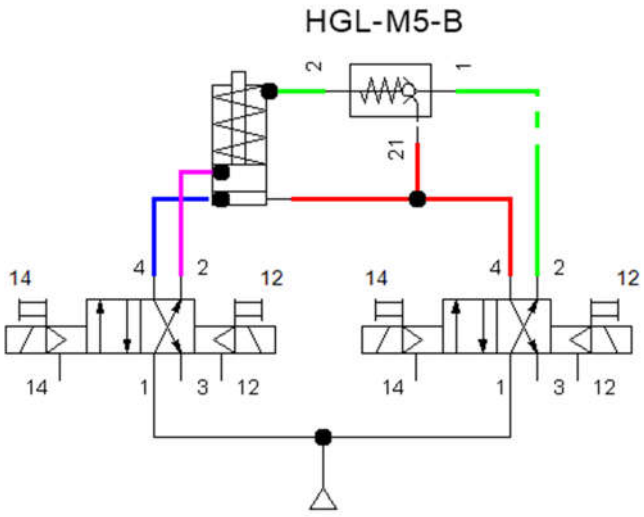


Figure 7: Dual-circuit control with non-return valve

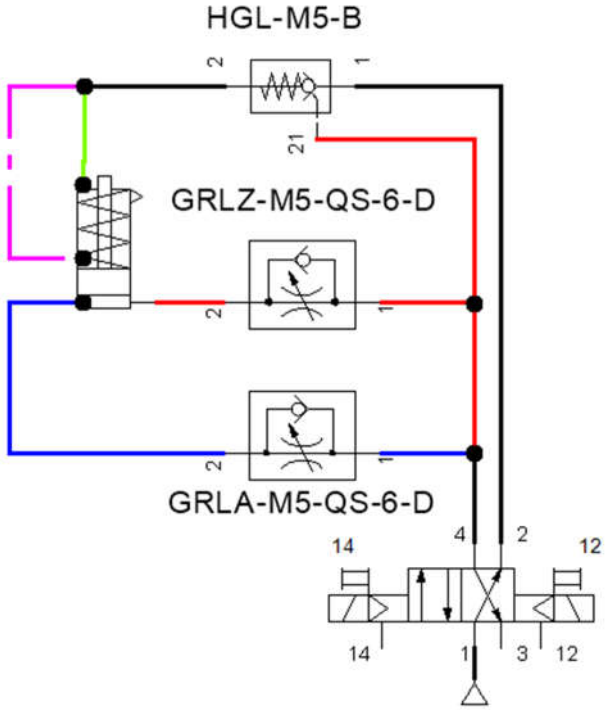


Figure 8: Single-circuit control with non-return valve

However, due to unavoidable leakage, it is not possible to predict exactly how long the amplification will last in this configuration. In any case, we recommend placing the non-return valve as close as possible to the fast closing clamp; the Festo article number listed as an example can be screwed in directly.

5.3 Equaliser options

Depending on the requirement, there are many possibilities to equalise tolerances with different materials and device sizes. In principle, the equalisation can be carried out on the machine or device.

- Equalisation via fast closing clamp ± 0.75 mm
- Equalisation via retractable nipple AG ± 0.05 mm / OZ ± 0.2 mm

The following symbols are used to describe the equaliser options and different fits:

NP – with zero point

AG – with equaliser

OZ – without centring

5.3.1 Equalisation via fast closing clamp

If equalisation is implemented using different elements (with zero point, with equaliser and without centring), zero point nipples must always be used on the device side. In doing so, the greatest possible equalisation can be achieved.

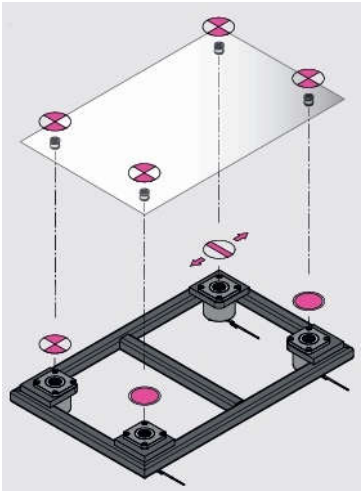


Figure 10: Equalisation via fast closing clamp

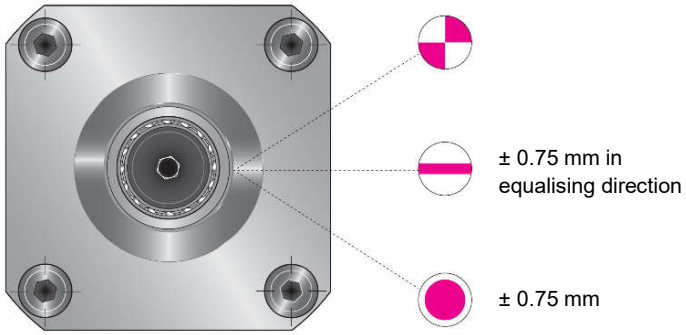


Figure 9: Fast closing clamp versions

5.3.2 Equaliser via retractable nipple

The classical approach to implement equalisation is to use different types of retractable nipples:

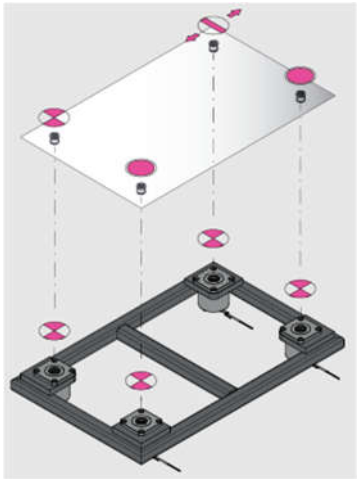


Figure 11: Equalisation via retractable nipple

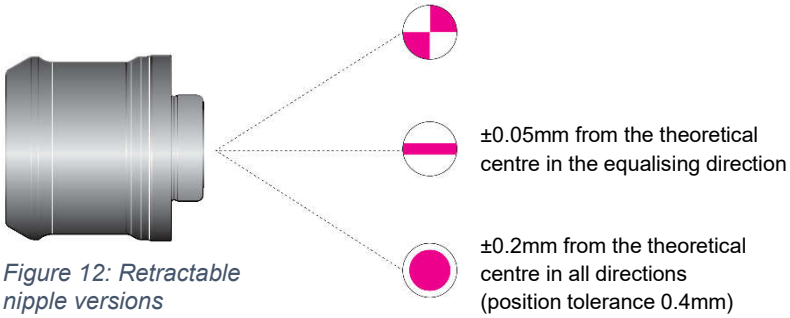


Figure 12: Retractable nipple versions

5.4 Lifting out of the fit

The elements of the STARK.connect family have, in addition to active insertion, an active ejection/lifting of the standard retractable nipple from the fit of the element.

Especially when loading with robots, it can be advantageous to work without lifting. In these cases, there may be unwanted interaction between the robot and the clamping elements. The robot can prevent the ejection of the retractable nipples (counterforce), so that the "released" position cannot be reached (faulty signalling). A possible solution is to switch the robot to "soft" (weight force compensation). However, if this cannot be done, shortened retractable nipples that are not ejected can also be used.

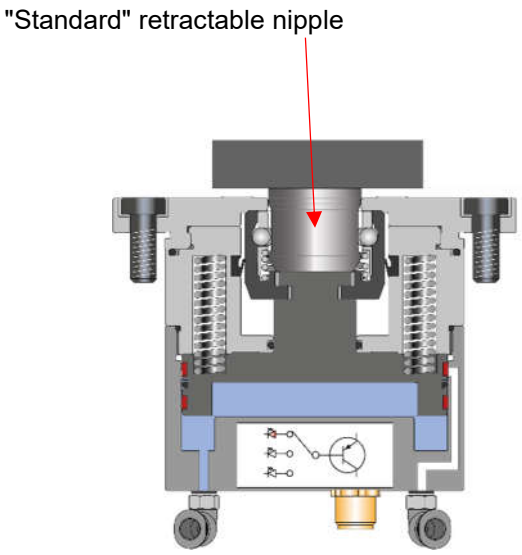


Figure 14: Released with lifting (1.5 mm)

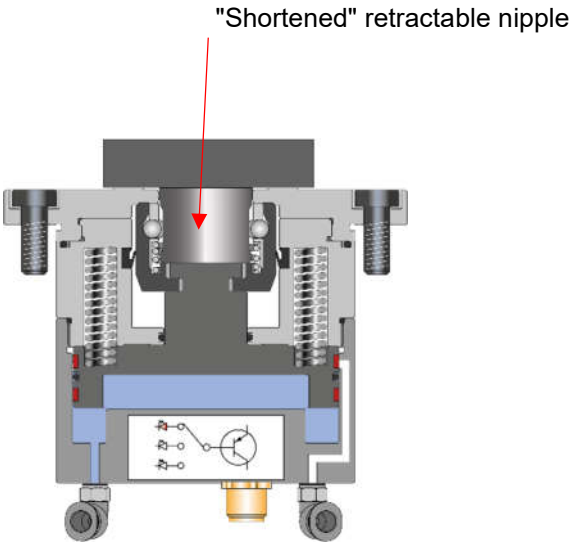
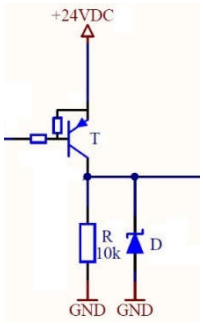


Figure 13: Released without lifting

The use of shortened nipples has no effect on all other functions (e.g. active retraction path). All types of retractable nipple assembly are also retained without restriction.

5.5 Integrated signalling/sensors

5.5.1 Electrical control



The integrated querying unit must be supplied with a nominal voltage of +24 VDC. The respective clamping state is indicated by an individual signal. The signal lines are designed as PNP outputs with a 10 kΩ pull-down resistor and each have a maximum continuous current capacity of 200 mA[1].

Depending on the application, the individual information of the elements can be further processed, or sum information can be generated by a simple parallel connection.[2] Please note, however, that a clamping element without a signal (e.g. dirty voltage) cannot be detected!

Commercially available T-distributors or Y-cables can be used for a parallel connection. It must also be ensured that all interconnected elements are in the same supply circuit, otherwise equalising currents can impair the function. If you need support with the selection, then just contact us.

Figure 15: Examples of Y-distributor or T-distributor

Example 1: An element is properly clamped and displays the "green" signal. A second element is also clamped, but with contamination between the support surface and pallet — this element does not produce any signal at all. If these two clamping elements are connected in parallel, the sum information is "green".

Example 2: An element is properly released and therefore displays the "red" signal. Another element could not be released (e.g. pneumatic hose torn out). It still produces the "green" signal for clamped. In this case, two signals, "green" and "red", are displayed as sum information.

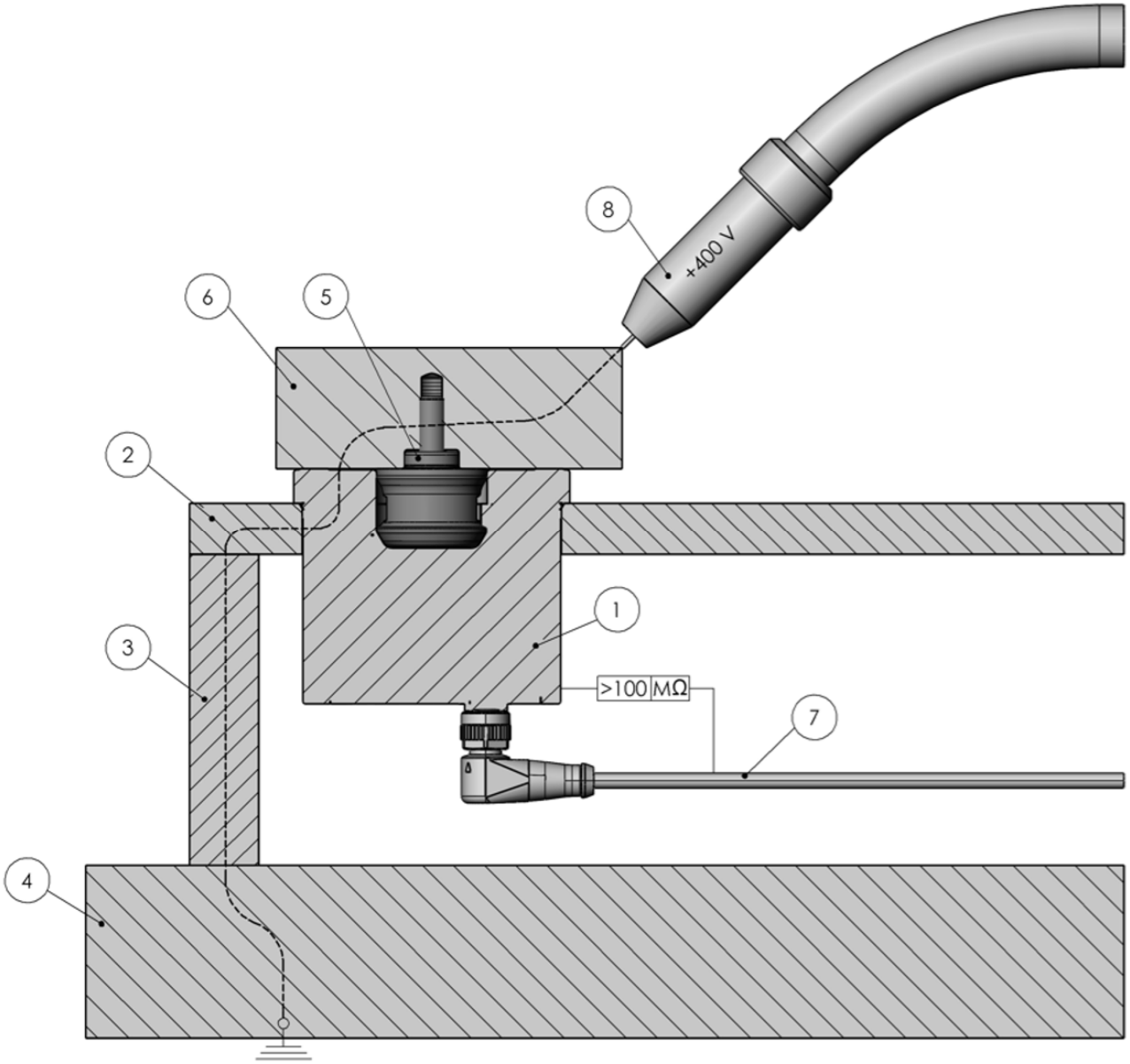
For the STARK.connect LOCK M versions, there are ready-made distributors (art. no.: S958-203 and S958-215) with a 3 or 5 metre connection line, with which the 5 signals can be split to three 4-pin sensor cables M12.

Figure 16: Distributor for STARK.connect LOCK M

[1] 100 mA for a delivery date before 14/08/2018

[2] A parallel connection is only possible from delivery date 14/08/2018

5.5.2 Welding currents



1 - Fast closing clamp

2, 3, 4 - Installation situation/foundation

5 - Retractable nipple

6 - Pallet/workpiece

7 - Connection cable, 5-pin

8 - Welding torch

The clearances and creepage distances were designed for a potential of 400V. Thus, the use in welding applications is possible.

The shield connection is not electrically connected on the clamping element side (rear connector). The extent to which an insulated or non-insulated cable should be used depends on the application.

5.5.3 Switching points

If the element is released, the piston moves to the end position and signals "released" regardless of the ambient conditions. If no retractable nipple is clamped, the piston moves to the other end position and signals "clamped without retractable nipple". These two signals cannot be influenced by the use of the element (installation situation, device tolerances, etc.) and the associated retractable nipple.

The signalling of the "clamped" state, however, is influenced by the interaction of the element with the retractable nipple and thus also depends on the respective installation situation. If the signalling is not correct, check the following switching points in the application:

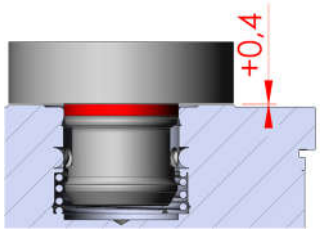
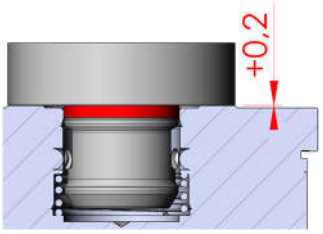
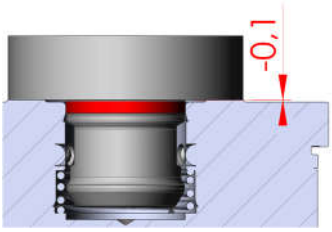
From a gap of **0.4 mm** between the pallet and contact surface on the element, a "clamped" signal is no longer displayed.	
Up to a gap of **0.2 mm** between the pallet and contact surface on the element, "clamped" is reliably displayed.	
Even if the retractable nipple protrudes by up to **0.1 mm** (into the element), a "clamped" signal is reliably displayed.	

Table 2: "Clamped" switching points

For larger devices where the flatness or parallelism of the support surfaces cannot be established with sufficient accuracy, or where there is distortion due to weight forces, clean signalling due to violation of the above tolerances is not guaranteed.

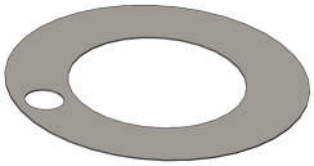


Figure 17: Spacer

If the accuracy requirements of the application allow it, some fixture error can be compensated by placing spacers (art. no.: S9000-902) under the retractable nipples.

5.5.4 Pin assignment of STARK.connect M without lock

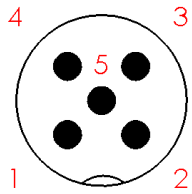


Figure 18: M12 connector, male, 5-pin, A-coding

Assignment	Description	Signal
Pin 1	+24 VDC	Supply
Pin 2	Signal "clamped without nipple"	PNP
Pin 3	GND	Supply
Pin 4	Signal "nipple clamped"	PNP
Pin 5	Signal "released"	PNP
Shield	Not applied	

Table 3: Pin assignment of STARK.connect M without lock

5.5.5 Pin assignment of STARK.connect LOCK M

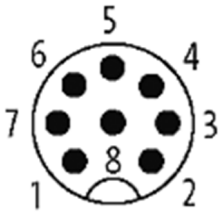


Figure 19: M12 connector, male, 8-pin, A-coding

Assignment	Description	Signal
Pin 1	+24 VDC	Supply
Pin 2	Signal "clamped without nipple"	PNP
Pin 3	GND	Supply
Pin 4	Signal "nipple clamped"	PNP
Pin 5	Signal "released"	PNP
Pin 6	Not assigned	
Pin 7	"Locked" signal	PNP
Pin 8	"Unlocked" signal	PNP
Shield	Not applied	

Table 4: Pin assignment of STARK.connect LOCK M

5.5.6 Frequently asked questions about sensors (FAQs)

The following is an overview of typical error patterns and possible remedies:

Error	Possible cause	Possible remedy
"Released" signal is not reached	The device cannot be lifted because a robot presses against it	Switch the robot to "soft"
		Use shortened retractable nipple
	The device cannot be lifted out because it is too heavy.	Increase release pressure
		Use shortened retractable nipple
"Clamped" signal is not reached	The retractable nipple is drawn in too little, e.g. due to distortion of the device.	Check the dimensional accuracy of the device
		Increase clamping pressure
		Shim nipple (art. no. S9000-902)
No signal is reached at all	Signal or supply line not connected	Check the wiring or the power supply
	Short-circuit due to incorrect pin assignment (see 5.5.1)	The sensors must be replaced at the factory.

Table 5: FAQs on sensors

5.6 Force curves

The following diagram shows the course of the insertion force as a function of the applied clamping pressure. The path-dependent decrease of the insertion force in all pressure ranges results from the decreasing pre-tensioning force of the spring assembly.

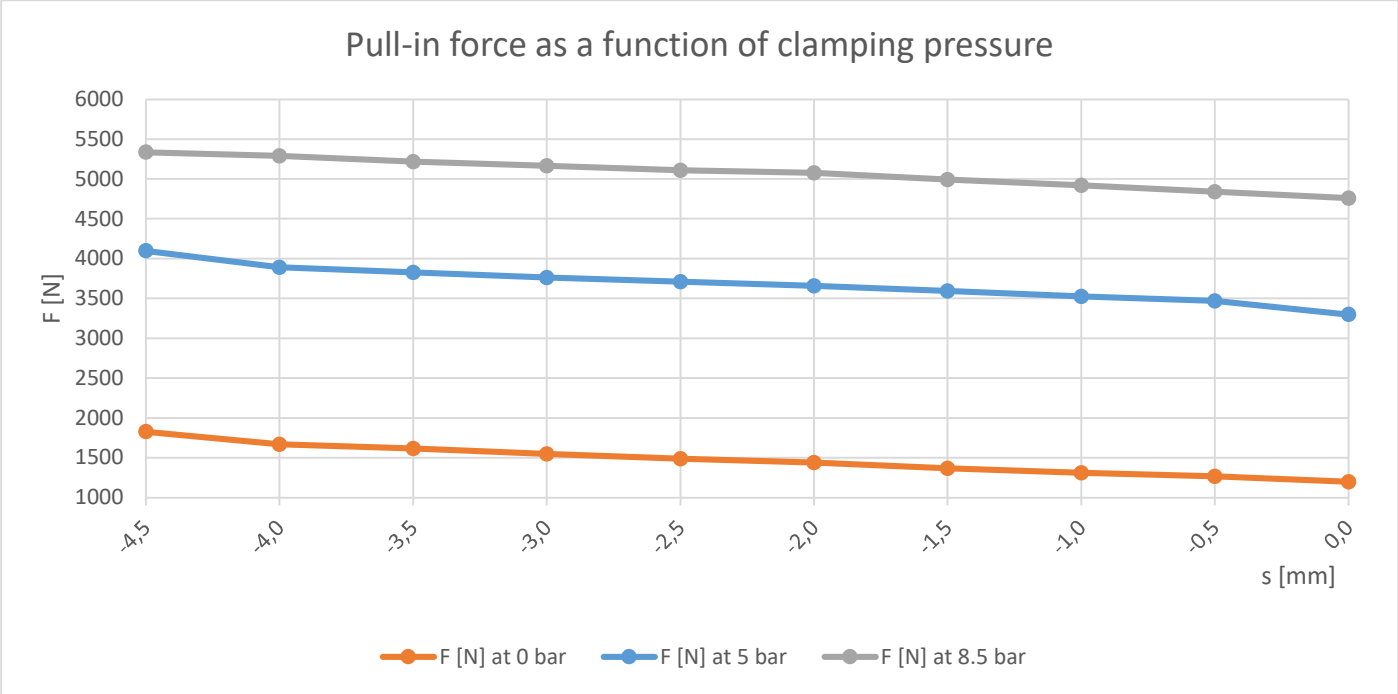


Figure 20: Insertion force curve

The specified 3,000 N insertion force at a pneumatic clamping pressure of 5 bar is achieved or exceeded over the entire path.

The following diagram shows the course of the counterforce of the element when a release pressure of 5 bar is applied. This force is relevant, for example, if a workpiece is to be placed with a robot and positioned against the "output" of the element.

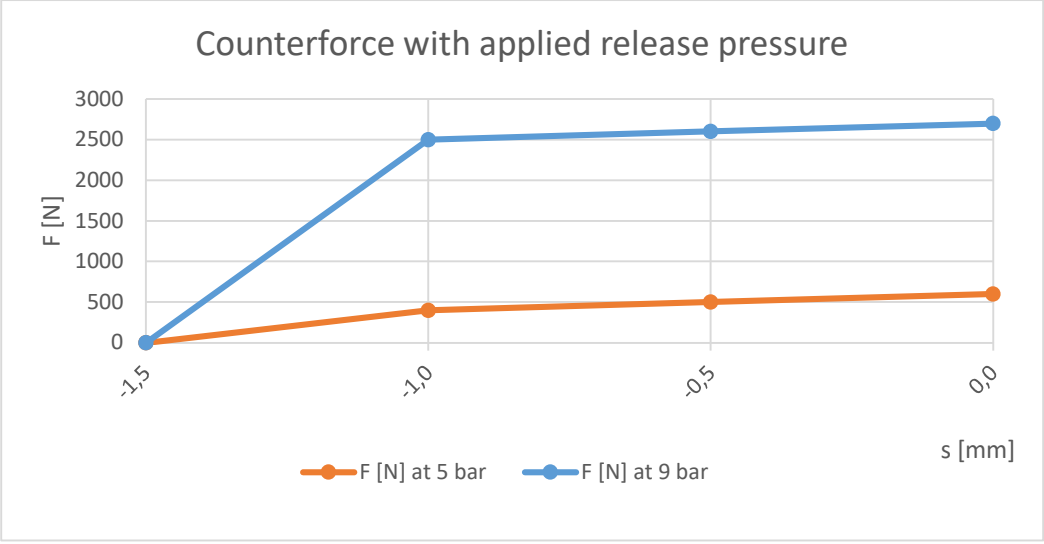


Figure 21: Counterforce curve

At the specified release pressure of 5 bar, for example, a robot has to apply around 600 N to press the workpiece onto the flat support.

With the STARK.connect LOCK M versions, the following clamping forces can be achieved in different operating modes or pressures:

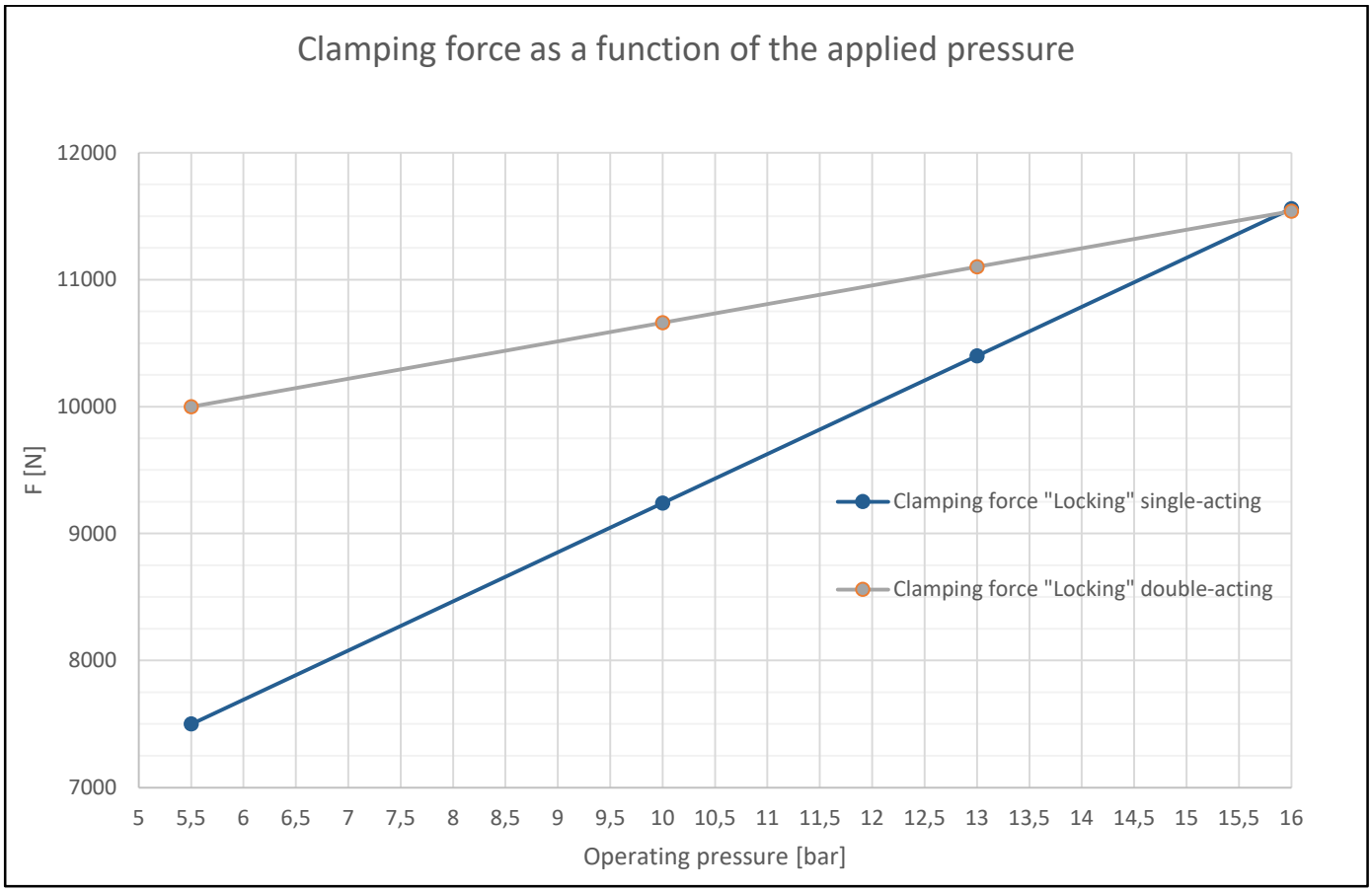
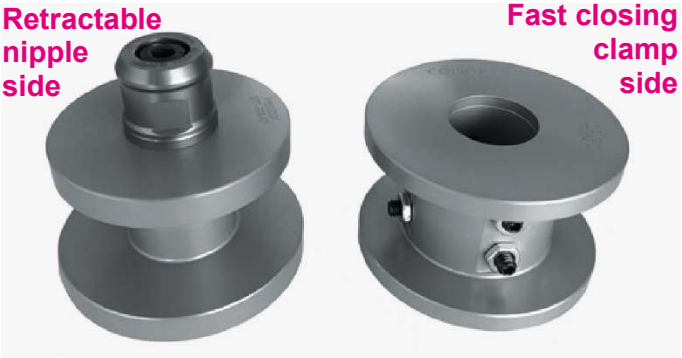


Figure 22: Clamping forces depending on the applied pressure

The forces were measured with Δs = 0.05 mm (lifting of the retractable nipple) from the initial situation of the retractable nipple being correctly clamped on the flat support. See also chapter 10 Technical data for versions with lock.

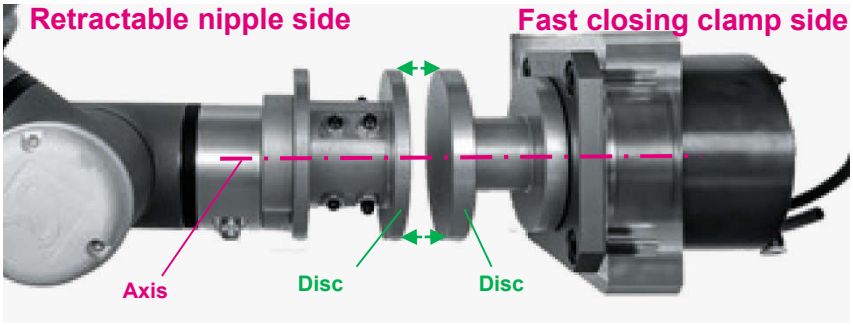
5.7 Programming aid STARK.airtec/connect

The programming aid is used to support the teach-in of a work cycle with a robot. The programming aid case contains three sets for the STARK.airtec and STARK.connect. One set consists of a 50 mm attachment for the side of the retractable nipple and a 50 mm attachment for the side of the fast closing clamp. Both attachments together thus result in a distance of 100 mm. After the coordinates have been successfully determined, the 2 × 50 mm can be corrected again in the programming.



Application:

When teaching-in, it must be ensured that both sides of the programming aid (retractable nipple & fast closing clamp) are on one axis and that the discs are on the stop at the end. Only then is the alignment correct.



Programming aid for fast closing clamps
of type Typ STARK.connect and STARK.airtec
Art no. S9000-901

- 1× case with foam insert and associated tool
- 3× nipple side (turning attachment STARK.airtec/connect)
- 3× element side with pre-assembled STARK.connect nipple with zero point
- 3× nipple for STARK.airtec with zero point

6 Assembly and installation

The element is completely pre-assembled when supplied. The four M8 fixing screws provided are used for installation. The delivery also includes 90° push-in fittings for pneumatic hoses with an outer diameter of 6 mm for making the connections.

6.1 Fast closing clamp installation

Before installing the fast closing clamp, the installation contour for the STARK.connect must be checked for dimensional accuracy and surface quality.

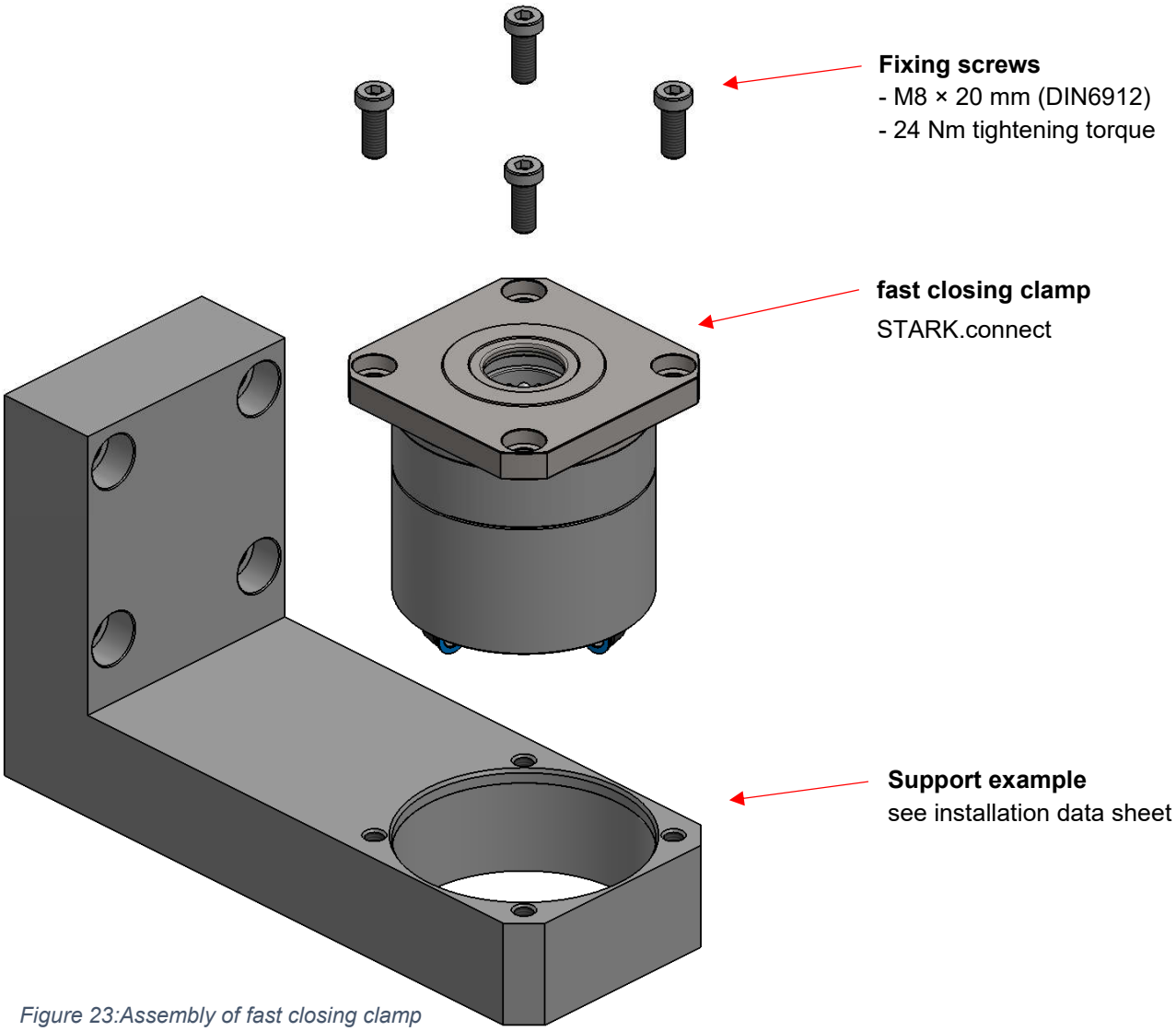


Figure 23:Assembly of fast closing clamp

After inserting the element, the four fixing screws M8 × 20 mm (DIN6912, screw quality 8.8) can be tightened evenly with a torque of 24 Nm.

Due to the design, the **rotatory orientation** of the connections is undefined. The pneumatic connections can be rotated, but the locking of the connector is specified. When designing the system, space must therefore be provided for the cable outlet.

After mechanically fixing the element, the pneumatic lines can be connected. A 90° M5 push-in fitting for a hose with an outer diameter of 6 mm is provided at the factory for this purpose.

In order to ensure that the elements function continuously, appropriate air quality must be provided. Stark's specifications therefore refer to a purity according to ISO 8573-1:2010 [7:4:4].

6.2 Removing the fast closing clamp

The system must be completely depressurised before disassembly is started. Disconnect the energy supply to the pressure generator, prevent unintentional commissioning and reduce possible residual pressures (e.g. non-return valves, stopcocks and similar).

The pneumatic and electrical connections must be disconnected from the element before disassembly and/or it must be ensured that the lines are long enough so that they can be disconnected after removal of the element.

To disassemble, simply loosen all four screws evenly and remove them. Two of the existing fixing holes are provided with an internal thread M10. With two M10 jack screws, the STARK.connect can be lifted evenly out of the fit, whereby the fixing threads can be protected by screwing in set screws M8.

6.3 Emergency release

If the compressed air supply fails or the clamping element cannot be released for any other reason, an emergency release can be carried out as follows:

1. Remove the pneumatic connections and the electrical plug connection.
2. Remove the 4 screws M6/DIN 912 (AF 5) on the underside (only for the versions with lock).
3. A "bridge" can now be fitted in the threaded holes of the pneumatic connections. The two M5 screws only have to be adjusted manually.
4. The clamping piston can now be pushed into position with the central M6 hexagon head screw loosened: First, a few mm must be overcome without force. In doing so, the adhesive film is pierced (there is a through hole in the cover underneath). When the screw comes into contact with the piston, a further piston travel of approx. 9 mm must be passed through to the top dead centre. The clamping piston is now positioned inside the fast closing clamp.
5. The retractable nipple is released.
6. The affected clamping element must be replaced and possibly sent to us for service (depending on the cause, only the adhesive film may need to be replaced).
7. Check the retractable nipple for damage and replace if necessary.

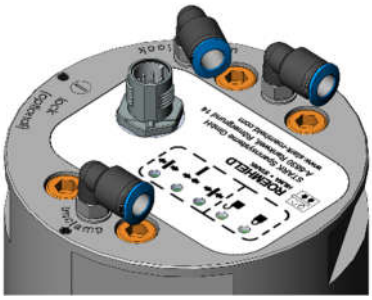


*Figure 24: 4× DIN 912 / M6 for *LOCK – Versions*

Figure 25: Emergency release bridge

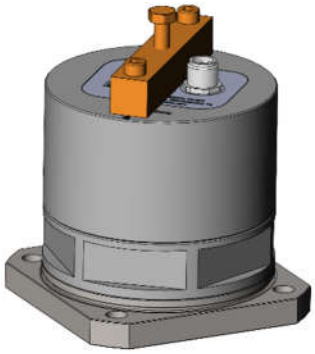


Figure 26: Emergency release bridge mounted

The article "Emergency release bridge" is available under order number S9000-900.

7 Commissioning, handling and operation

7.1 During initial commissioning

- Perform a visual inspection of the entire machine and/or system and the fast closing clamp.
- Check the fast closing clamp for pneumatic tightness.
- Check the release and clamping pressure as well as the electrical connection of the element.

7.2 Function check

- If all clamping elements connected to the same circuit are installed as described above and tightened with the appropriate torque, the pneumatic pressure generator can be connected to the circuit.
- Release/unlock: Slowly and carefully increase the pressure to the release pressure. When doing so, check the clamping elements for leaks, switch off the pressure generator immediately if necessary and eliminate the leakage.
- Clamp: Slowly and carefully increase the pressure to the clamping pressure. When doing so, check the clamping elements for leaks, switch off the pressure generator immediately if necessary and eliminate the leakage.
- Lock: Depressurise the "Unlock" connection, if necessary pressurise the "Lock" connection. When doing so, check the clamping elements for leaks, switch off the pressure generator immediately if necessary and eliminate the leakage.
- The clamping state is indicated on the rear LEDs. Check that the LEDs match the existing clamping state ("released", "clamped with nipple" and "clamped without nipple" or "unlocked" and "locked")

7.3 Operation

The speed when retracting the retractable nipples into the fast clamping elements must be less than 100 mm/s, otherwise the retractable nipples and fast clamping elements may be damaged.

Only pressurise the fast closing clamp for the actual change procedure.
Do *not* leave under permanent pressure (released)!

- Set the release pressure of the fast closing clamps (see chapter 9 Technical data for)
- Monitor the max. operating pressure of the fast closing clamps. Set the excess pressure safety valve to max. 5 bar above the max. operating pressure (see chapter 9 Technical data for)

8 Maintenance and repair

8.1 Function check

Check the fast closing clamp for proper function: When the fast closing clamp is released, check that all balls move back. If the retractable nipple cannot be inserted and removed without force into the locating bore when loosened, servicing by STARK Spannsysteme GmbH is required immediately. If no service is performed, safe clamping of the retractable nipple is not possible.

Figure 27: Top of connect M

Monthly:
Check the retraction of all balls with the released fast closing clamp.

Yearly or after 5000 clamping cycles:
Check all functions of the fast closing clamp. If one or more functions are no longer in perfect working order, servicing by STARK Spannsysteme GmbH is necessary immediately.

8.2 Spring assembly maintenance interval

When the clamping cycles or replacement intervals have been reached, the fast closing clamp must be serviced by STARK Spannsysteme GmbH (see chapter 9 Technical data for).

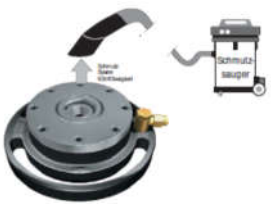
Please contact us to coordinate the service work:
Tel.: +43 5522 37 400
Mail: info@stark-roemheld.com

8.3 Cleaning

No contamination is permitted in the fast closing clamp. Cleaning depends on the application and replacement interval.

Widespread practice!
The fast closing clamp may be blown out and off with compressed air.

Correct and better!
Extraction and suction of chips, dirt and coolant from the fast closing clamp.



8.4 General cleaning

For general cleaning, the fast closing clamp must be dismantled. Assembly work may only be carried out by STARK Spannsysteme GmbH. The necessary safety measures must be observed in their entirety and without exception during all work.

Hazard information: The fast closing clamp is permanently under spring pressure! Do not open the housing. There is a risk of personal injury or material damage!

The product may not be cleaned with:

- corrosive or caustic components
- organic solvents such as halogenated or aromatic hydrocarbons and ketone (nitro thinner, acetone etc.) These substances would destroy the seals.

The element must be cleaned at regular intervals. In particular, the area of bore, ball holder and housing must be cleaned of chips and other liquids. In case of heavy contamination, cleaning must be carried out at shorter intervals.

8.5 Storage

Until first use:
If you do not use the fast closing clamp immediately, please store it dry and dust-free in its original packaging.

Long period of storage after use:
Before storage, clean the fast closing clamp (see chapter "8.4 General cleaning") and carry out suitable measures for corrosion protection.

After a long period of storage:
After a long period of storage (approx. 3 years), the seals must be replaced before the system is used again. This must always be done by STARK Spannsysteme GmbH.

8.6 Disposal/recycling

All parts, auxiliary materials and process media of the fast clamping device must be separated according to type and disposed of in accordance with the local regulations and directives.

Hazard information: The fast closing clamp is permanently under spring pressure! Do not open the housing. There is a risk of personal injury or material damage!

9 Technical data for versions without lock

		STARK.connect M NP	STARK.connect M AG	STARK.connect M OZ
Order number		S9000-001, S04665	S9000-002	S9000-003, S04735
Function		with zero point	with equaliser	without centring
Maintenance interval (max. number of clamping cycles)	[cycles]	2,000,000	2,000,000	2,000,000
Equalisation	[mm]	0	±0.75 (in equalising direction)	±0.75 (in all directions)
Insertion force[1] depressurised	[N]	1,200	1,200	1,200
Insertion force[1] at 5 bar / 20 bar clamping pressure	[N]	3,000 / 8,500	3,000 / 8,500	3,000 / 8,500
Retention force[2]	[N]	10,000	10,000	10,000
Min. release pressure	[bar]	5	5	5
Max. operating pressure	[bar]	10 / 20 **	10 / 20 **	10 / 20 **
Lifting force at 5 bar	[N]	500	500	500
Lifting path*	[mm]	1.5	1.5	1.5
Total retraction path*	[mm]	4.5	4.5	4.5
Max. permitted lateral forces[3]	[N]	7,000	7,000 ***	-
Air volume (release/clamp)	[cm^3]	64	64	64
Operating temperature	[°C]	+ 10 to + 80	+ 10 to + 80	+ 10 to + 80
Min. permitted clamping time / release time	[s]	0.5	0.5	0.5
Radial pre-positioning[4]	[mm]	± 1	± 1	± 1
Max. axial pre-positioning[5]	[mm]	- 3	- 3	- 3
Max. loading angle	[°]	± 1.5	± 1.5	± 1.5
Repeat accuracy[6]	[mm]	< 0.05	< 0.05	< 0.05
System accuracy[7]	[mm]	< 0.1	< 0.1	< 0.1
Weight	[kg]	1.8	1.8	1.8
Air connection	[mm]	M5	M5	M5
Electrical connection	[mm]	M12 5-pin	M12 5-pin	M12 5-pin
Voltage range	[V]	24 (18 to 34)	24 (18 to 34)	24 (18 to 34)
Protection class	[IP]	67	67	67
Typ. current consumption	[mA]	40	40	40
Max. continuous direction per output	[mA]	200	200	200
MTTF / $MTTF_D$ sensors [40 °C]	[years]	1.300 / 2.600	1.300 / 2.600	1.300 / 2.600
MTTF / $MTTF_D$ sensors [70 °C]	[years]	430 / 860	430 / 860	430 / 860
$MTTF_D$ mechanical components[8]	[years]	150	150	150

Table 6: Technical data for versions without lock

* Other lifting/retraction paths possible on request ** with push-in fitting S953-273, S953-272 *** 90 degrees in equalising direction

[1] **Insertion force**: This is the load up to which the zero point is guaranteed. The retractable nipple is actively retracted 4.5 mm with this force.

[2] **Retention force**: This is the maximum overload at which the nipple is still held but has already left the zero point.

[3] **Lateral force**: The permitted force only applies to retractable nipples with zero point and retractable nipples with 90° equalisation to the equalising direction.

[4] **Radial pre-positioning**: The loading device must be powerless and flexible for manual and automated loading.

[5] **Axial pre-positioning**: The max. distance between the retractable nipple and the piston crown (limit stop before clamping) so that clamping occurs with a form fit. Within this tolerance, the retractable nipple is retracted with the specified insertion force on the flat support.

[6] **Repeat accuracy**: This usually indicates the accuracy that refers to the change of the same pallet position-oriented on the same interface.

[7] **System accuracy**: This refers to the accuracy resulting from changing several pallets, e.g. on different machines.

[8] **$MTTF_D$ mechanical components:** estimated according to the informative procedure in Table C.1 of ISO 13849-1:2015 for mechanical components.

10 Technical data for versions with lock

		STARK.connect LOCK M NP	STARK.connect LOCK M AG	STARK.connect LOCK M OZ
Order number		S9000-031	S9000-032	S9000-033
Function		with zero point	with equaliser	without centring
Maintenance interval (max. number of clamping cycles)	[cycles]	2,000,000	2,000,000	2,000,000
Equalisation	[mm]	0	±0.75 (in equalising direction)	±0.75 (in all directions)
Insertion force[1] at 5.5 bar / 20 bar clamping pressure, unlocked	[N]	3,500 / 9,000	3,500 / 9,000	3,500 / 9,000
Clamping force[1] at 0 bar clamping pressure & activated lock (fast closing clamp depressurised)	[N]	6,000	6,000	6,000
Clamping force[1] at 5.5 bar / 20 bar clamping pressure & depressurised lock	[N]	7,500 / 12,000	7,500 / 12,000	7,500 / 12,000
Clamping force[1] at 5.5 bar / 20 bar clamping and locking pressure	[N]	10,000 / 12,000	10,000 / 12,000	10,000 / 12,000
Retention force[2]	[N]	30,000	30,000	30,000
Min. operating pressure	[bar]	5.5	5.5	5.5
Max. operating pressure	[bar]	10 / 20 **	10 / 20 **	10 / 20 **
Lifting force at 5 bar	[N]	500	500	500
Lifting path*	[mm]	1.5	1.5	1.5
Total retraction path*	[mm]	4.5	4.5	4.5
Max. permitted lateral forces[3]	[N]	7,000	7,000 ***	-
Air volume (release/clamp/unlock)	[cm^3]	64	64	64
Operating temperature	[°C]	+ 10 to + 80	+ 10 to + 80	+ 10 to + 80
Min. permitted clamping time / release time	[s]	0.5	0.5	0.5
Radial pre-positioning[4]	[mm]	± 1	± 1	± 1
Max. axial pre-positioning[5]	[mm]	- 3	- 3	- 3
Max. loading angle	[°]	± 1.5	± 1.5	± 1.5
Repeat accuracy[6]	[mm]	< 0.05	< 0.05	< 0.05
System accuracy[7]	[mm]	< 0.1	< 0.1	< 0.1
Weight	[kg]	3.2	3.2	3.2
Air connection	[mm]	M5	M5	M5
Electrical connection	[mm]	M12 8-pin	M12 8-pin	M12 8-pin
Voltage range	[V]	24 (18 to 34)	24 (18 to 34)	24 (18 to 34)
Protection class	[IP]	67	67	67
Typ. current consumption	[mA]	25	25	25
Max. continuous direction per output	[mA]	200	200	200
Reverse polarity protection	[-]	Yes	Yes	Yes
MTTF / $MTTF_D$ sensors [40 °C]	[years]	640 / 1.280	640 / 1.280	640 / 1.280
MTTF / $MTTF_D$ sensors [70 °C]	[years]	235 / 470	235 / 470	235 / 470
$MTTF_D$ mechanical components[8]	[years]	150	150	150

Table 7: Technical data for versions with lock

* Other lifting/retraction paths possible on request ** with push-in fitting S953-273, S953-272 *** 90 degrees in equalising direction

[1] **Insertion force or clamping force**: This is the load up to which the zero point is guaranteed. The retractable nipple is inserted 4.5 mm with the active insertion force, held in position with the clamping force; see also diagrams on page 19 et seq.

[2] **Retention force**: This is the maximum overload at which the nipple is still held but has already left the zero point.

[3] **Lateral force**: The permitted force only applies to retractable nipples with zero point and retractable nipples with 90° equalisation to the equalising direction.

[4] **Radial pre-positioning**: The loading device must be powerless and flexible for manual and automated loading.

[5] **Axial pre-positioning**: The max. distance between the retractable nipple and the piston crown (limit stop before clamping) so that clamping occurs with a form fit. Within this tolerance, the retractable nipple is retracted with the specified insertion force on the flat support.

[6] **Repeat accuracy**: This usually indicates the accuracy that refers to the change of the same pallet position-oriented on the same interface.

[7] **System accuracy**: This refers to the accuracy resulting from changing several pallets, e.g. on different machines.

[8] **$MTTF_D$ mechanical components:** estimated according to the informative procedure in Table C.1 of ISO 13849-1:2015 for mechanical components.

11 List of figures

12 List of tables

13 Declaration of Incorporation

This document refers to the Declaration of Incorporation according to Machinery Directive 2006/42/EC Annex II No. 1 letter B:

Manufacturer: **STARK Spannsysteme GmbH**
Römergrund 14
A-6830 Rankweil
Austria

Authorised representative to compile the technical documentation:

Mr. Martin Greif, Managing Director, address: See manufacturer.

Product:	Fast closing clamp
Function:	Clamping and centring of workpiece pallets or workpieces
Product group:	STARK.connect.M / STARK.connect.LK.M
Article number:	S9000-XXX, S04665, S04735
Trade name/ general designation:	Fast closing clamp

The manufacturer undertakes to provide the specific technical documentation relating to the incomplete machinery to national authorities in electronic or written form upon justified request.

Before it is established that the complete machine complies with the provisions of the Machinery Directive 2006/42/EC, it is prohibited to put the incomplete machinery into service.

The manufacturer certifies that the above-mentioned products are safe within the meaning of the national regulations when used as intended and in compliance with the operating instructions and the warnings on the product and that

- a risk assessment has been carried out in accordance with ISO 12100:2010.
- the relevant basic and proven safety principles of the annexes of ISO 13849-2:2012 are observed for the products, taking into account the specifications of the documentation. The parameters, limitations, ambient conditions, characteristic values, etc. for intended operation are defined in the operating instructions.
- fault exclusion with regard to the fault ‘Unexpected release without release signal applied’.
- fault exclusion with regard to the fault ‘Breakage during operation’ in compliance with the parameters, limitations, ambient conditions, characteristic values and maintenance intervals etc. specified in the operating instructions.

If applicable, there are additional guidelines for the machine integrator, among others, to observe and implement completely and correctly before commissioning:
EN ISO 12100; EN ISO 4413
- in the respective valid version of the legally prescribed date.

STARK Spannsysteme GmbH Rankweil, 24/10/2024

Martin Greif
Managing Director / Geschäftsführer

The following part of the Declaration of Incorporation according to the Machinery Directive 2006/42/EC Annex II No. 1 letter B describes which parts of the Machinery Directive 2006/42/EC have already been fulfilled for the system used at the time of handover of the product(s) or still have to be fulfilled subsequently by the integrator of the complete machine. The list is drawn up in accordance with the Machinery Directive 2006/42/EC Annex I.

If a superordinate provision is marked and the sub-items are not indicated, this shall apply collectively to all subordinate provisions which are thus to be fulfilled or have already been fulfilled.

If individual aspects are not relevant to the system described in this document by the manufacturer or distributor, this does NOT necessarily mean that the integrator of the complete machine does not have to consider these aspects in general.

If two columns are marked, this means that parts of the provisions have already been partially or fully complied with, but the integrator is responsible for full compliance.

	To be fulfilled by the system integrator:		↓
	Fulfilled on the part of the system manufacturer:	↓	
	Not relevant: ↓		
1. Essential health and safety requirements			
1.1. General remarks			
1.1.1. Definitions		X	X
1.1.2. Principles of safety integration		X	X
1.1.3. Materials and products		X	X
1.1.4. Lighting			X
1.1.5. Design of a machinery product to facilitate its handling		X	X
1.1.6. Ergonomics			X
1.1.7. Operating positions			X
1.1.8. Seating			X
1.2. Control systems			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 a combined machinery product			X
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. Risk of uncontrolled movements			X
1.4. Required characteristics of guards and protective devices			X
1.5. Risks due to other causes			
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	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.					Emission 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			X
1.7.					Information			
1.7.1.					Information and warnings on the machinery product		X	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 a machinery product			X
1.7.4.					Instructions		X	X
1.7.4.1.					General principles for the drafting of instructions		X	X
1.7.4.2.					Contents of the instructions		X	X
1.7.4.3.					Sales literature		X	X
2.					Supplementary essential health and safety requirements for certain categories of machinery products			X
3.					Supplementary essential health and safety requirements to offset risks 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 products intended for underground work			X
6.					Supplementary essential health and safety requirements for machinery products presenting particular risks due to the lifting of persons			X

Alle derzeit verfügbaren Sprachen finden Sie unter:
All currently available languages can be found at:
https://www.stark-roemheld.com/download