Training

Maintenance



The training materials are exclusively intended for training by Starrag and are not subject to any continuous change management. Starrag will accept no liability for the information in the training materials. These training materials may only be reproduced with permission from Starrag. Company names are mentioned in the training materials for demonstration purposes only. The detailed operating instructions are a fixed part of the delivery scope of the relevant machine tool and must be observed in all cases!

This page was intentionally left blank.

Table of Contents

1 Safety Instructions 7
1.1 Warning notices in this training document 7
1.2 Health and safety in the Starrag facilities 8
2 Linear axes X, Y, Z 10
2.1 Machine base 10
2.2 Column 13
2.3 Slide 14
2.4 Feed drive 15
2.5 Locknuts 17
2.6 V-belt tensions 18
2.6.1 General notes 18
2.6.2 Sequence 19
2.6.3 Table of setting specifications 20
2.7 Measuring systems 23
2.7.1 Introduction 23
2.7.2 Preparatory work 24
2.7.3 Assembly and adjustment 25
2.8 Service notes for the central oil lubrication 27
2.9 Abschlussfragen zum Kapitel 28
3 Spindle carrier with horizontal gear spindle 30
3.1 Carriage 30
3.2 Gear spindle 31
3.3 Tool clamping 32
3.4 Main gear box 34
4 NC Rotary table 36
4.1 NC rotary table DA 800 36
4.2 Extract from the documentation NC rotary table 42
4.3 Abschlussfragen zum Kapitel 43
5 Pallet changer, Tool changer, Tool magazine 44
5.1 Pallet changer 44
5.2 Pallet 50
5.3 Load-unload station 51
5.4 Tool changer 52
5.5 KMT 128 tool chain magazine 56
5.5.1 Overview 57
5.5.2 Frame with chain guide and lubrication 57
5.5.3 Magazine chain drive 58
5.5.4 Chain space indexing 58
5.5.5 Control columns 59
5.5.6 Unlocking the loading bay 59
5.5.7 Tool chain space 60
5.6 Abschlussfragen zum Kapitel 61
6 Fluid systems 64
6.1 Description of the symbols 64
6.2 Selected fluid diagrams 67
6.3 Cooling unit 69
6.4 Cooling lubricant pressure stages (ASi) 71
6.5 Coolant pressure stages (BCD) 73

6.6 Abschlussfragen zum Kapitel ... 74
7 Options ... 75
7.1 Emission extraction ... 75
7.2 Abschlussfragen zum Kapitel ... 77
8 Maintenance and lubrication ... 79
8.1 Service products ... 80
8.2 Abschlussfragen zum Kapitel ... 82
9 Control and drive system ... 83
9.1 System Overview ... 83
9.1.1 General structure of Solution Line ... 83
9.1.2 System components ... 84
9.1.2.1 IPC ... 84
9.1.2.2 Interfaces of the OP 015 AT operator panel ... 85
9.1.2.3 NCU ... 86
9.1.2.4 NX15 expansion module ... 92
9.1.2.5 Machine control panel ... 92
9.1.2.6 Power supply for the drives ... 93
9.1.2.7 Motor modules ... 94
9.1.2.8 Connecting external measuring systems by way of sensor modules ... 95
9.1.2.9 Connecting the motor measuring systems ... 96
9.1.2.10 Distributed PLC I/O modules and safety technology ... 98
9.1.3 Electronic key system "PITmode" ... 99
9.1.3.1 Description ... 99
9.1.3.2 Operating mode selector switch "PITmode" ... 100
9.2 CNC / Drives ... 102
9.2.1 Machine and setting data ... 102
9.2.1.1 Concept of protection levels ... 102
9.2.1.2 Handling machine data ... 103
9.2.1.3 Activation of machine data ... 105
9.2.1.4 Data backup ... 106
9.2.2 Checking the active measuring systems ... 110
9.2.3 Zero points ... 112
9.2.3.1 Referencing absolute-value encoders ... 112
9.2.3.2 X axis zero point ... 113
9.2.3.3 Y axis zero point ... 114
9.2.3.4 Z axis zero point ... 115
9.2.3.5 B axis zero point ... 116
9.2.4 Spindle alignment position ... 117
9.2.5 Gantry axes ... 118
9.2.5.1 Machine specifications ... 118
9.2.5.2 Use on a HEC500-800 and on a HEC500D XXL ... 118
9.2.6 Change points with the HEC500-800 ... 119
9.3 Diagnostics ... 120

9.3.1 The "Alarm list" softkey ... 121
9.3.2 The "Messages" softkey ... 121
9.3.3 The „HELP” button ... 122
9.3.4 The "Alarm log" softkey ... 123
9.3.4.1 The "Save log" softkey ... 123
9.3.5 Softkey "NC/PLC variables” ... 124
9.3.6 "Version" softkey ... 126
9.3.7 Softkey "Axis diagnostics" ... 127
9.3.7.1 "Service axis" softkey ... 128
9.3.7.2 "Service drive" softkey ... 129
9.3.8 Softkey "System utilization" ... 130
9.3.9 Softkey "Drive system" ... 131
9.3.9.1 "Configuration" softkey ... 132
9.3.9.2 "Topology" softkey ... 133
9.4 Safety Integrated (SI) ... 133
9.4.1 Brief description ... 133
9.4.2 Safety-related functions ... 134
9.4.3 User enable ... 135
9.4.4 Start-up functions ... 137
9.4.5 Safe programmable logic (SPL) ... 138
9.4.6 Error determination when cross-checking ... 141
9.4.7 Forced checking procedure (test stop) ... 142
9.5 Data backup ... 143
9.5.1 Introduction ... 143
9.5.2 Start-up archives: NC, PLC and DP archives ... 143
9.5.2.1 Secure of NC archives ... 143
9.6 Service operation ... 149
9.6.1 Service mode ... 149
9.7 Abschlussfragen zum Kapitel ... 152
10 Specific start-up tasks ... 154
10.1 Programmierbefehle ... 154
10.2 Starting up the central oil lubrication system for the axes ... 157
10.3 Replacement of defective slaves ... 158
10.3.1 Identification defective slaves on DP/ASi-Link (Solution Line) ... 158
10.3.2 Replacing a defective slave / automatic address programming ... 158
10.3.3 Addressing ... 159
10.4 Abschlussfragen zum Kapitel ... 160
11 Appendixes ... 162
11.1 Contact ... 162
11.2 Further training offers ... 163
11.3 Recommended tools and equipment ... 164

11.3.1 Measuring device for measuring the belt tension 165
11.3.2 Taper wiper for cleaning of the internal taper of the workspindle 166
11.3.3 PowerCheck for measuring the pull-in force of the tool clamping fixture 167
11.3.4 Mounting tool for the tool clamping 168
11.3.5 Assembly spray for maintenance of the tool clamping fixture 169
11.3.6 Run-out gauge 170
11.3.7 Equipment for measuring the pull-in force of the clamping cones 171
11.3.8 Plug gauge and measuring disc for the adjustment of the tool change positions 172
11.3.9 Adapter cable 173
11.3.10 PP2001 Programming and Display Unit 174
11.3.11 Repumping Unit for Filling the Hydraulic Unit via a Filling Coupling 175
11.3.12 Filling equipment for filling the Hydac pressure accumulator 176
11.3.13 Measuring equipment for static acceptance 177
11.3.14 Further media and auxiliary substances 179
11.3.15 Simatic PC USB-FlashDrive 180
11.3.16 AS interface addressing unit 181
11.4 Final test 182

1 Safety Instructions

1.1 Warning notices in this training document

This training document includes the following warning notices:

NOTICE

Warning “Attention”

Notice with this symbol contain information regarding your safety. Failure to observe these warnings can lead to material damage.

- The warnings are to be observed without fail during all work on the assembly!

⚠CAUTION

Warning “Caution”

Notes with this symbol contain information regarding your safety. Failure to observe these warnings can lead to minor or moderate injuries.

- The warnings are to be observed without fail during all work on the assembly!

⚠WARNING

Warning “Warning”

Notes with this symbol contain information regarding your safety. Failure to observe these warnings can lead to serious injury or death.

- The warnings are to be observed without fail during all work on the assembly!

⚠DANGER

Warning “Danger”

Notes with this symbol contain information regarding your safety. Failure to observe these warnings can lead to death.

- The warnings are to be observed without fail during all work on the assembly!



Notes with this symbol contain additional information.

1.2 Health and safety in the Starrag facilities

- When attending training at Heckert, always wear sturdy footwear and practical clothing.
- Always observe the relevant safety notes. These also include announcements, as well as warning or prohibition signs, and signs giving orders or providing important notices.
- Always use the prescribed sidewalks and stairs on the plant site; do not look for short cuts!
- Never enter parts of the plant not connected with your work. Always use the official paths and traffic routes intended for you.
- Pay attention to transport vehicles, fork-lift trucks and electro-trolleys on the company site and in the production halls.
- Vehicle gates and doors are forbidden for use by persons; always use the relevant personnel doors.
- Please take note the ban on smonking!
- Never stand under suspended loads.
- If you are instructed to work on machines, for your own safety, you should use the relevant personal safety equipment required for the appropriate work place, such as protective goggles, protective shoes, protective clothing and protective gloves.
- Observe any stumbling and slipping hazards (e.g. objects lying around or leaked oil) and inform the responsible person.
- Always check the devices and equipment you want to work with for proper condition before starting work. If you discover any defects or hazards which you cannot remedy immediately, report them to the person responsible. Never use damaged devices or equipment not complying with the relevant health and safety standards!
- Work only on machines, devices or other equipment if you are familiarized with them and if you are authorized to work with them.
- Never intervene into machines running in regular operation or on a trial run. Protective devices (guards, limit switches, photocells) are often ineffective on machines running in the trial run. Always observe the relevant instructions of the responsible person at the company.
- Inform yourself where fire extinguishers are installed and how they are operated. Keep yourself familiar with alarm plans, as well escape routes and emergency exits.
- Do not consume alcoholic drinks during the work time!
- Should any industrial accident occur during your work in the company, inform the responsible member of the Heckert GmbH staff immediately.



No photos!



No smoking!

2 Linear axes X, Y, Z

2.1 Machine base

The illustrations below show, e.g.:

- The thermo-symmetrically installed cross-bed;
- The arrangement of the sectional rail guides and linear measuring systems for the slide (Z axis) and frame column (X axis).

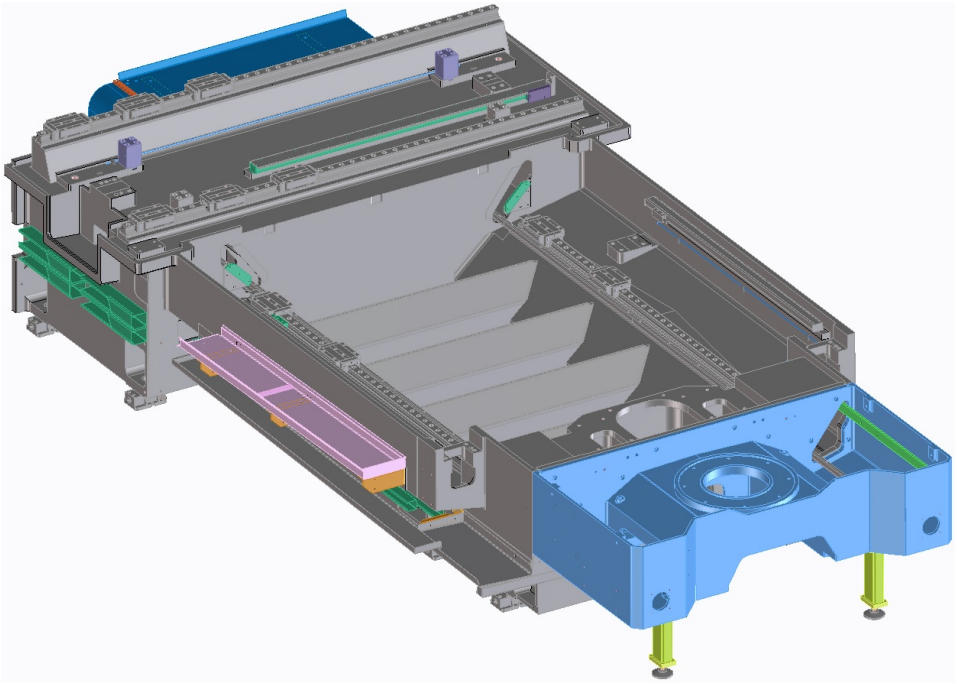


Fig. 1: Machine bed HEC/STC 800 (171599)

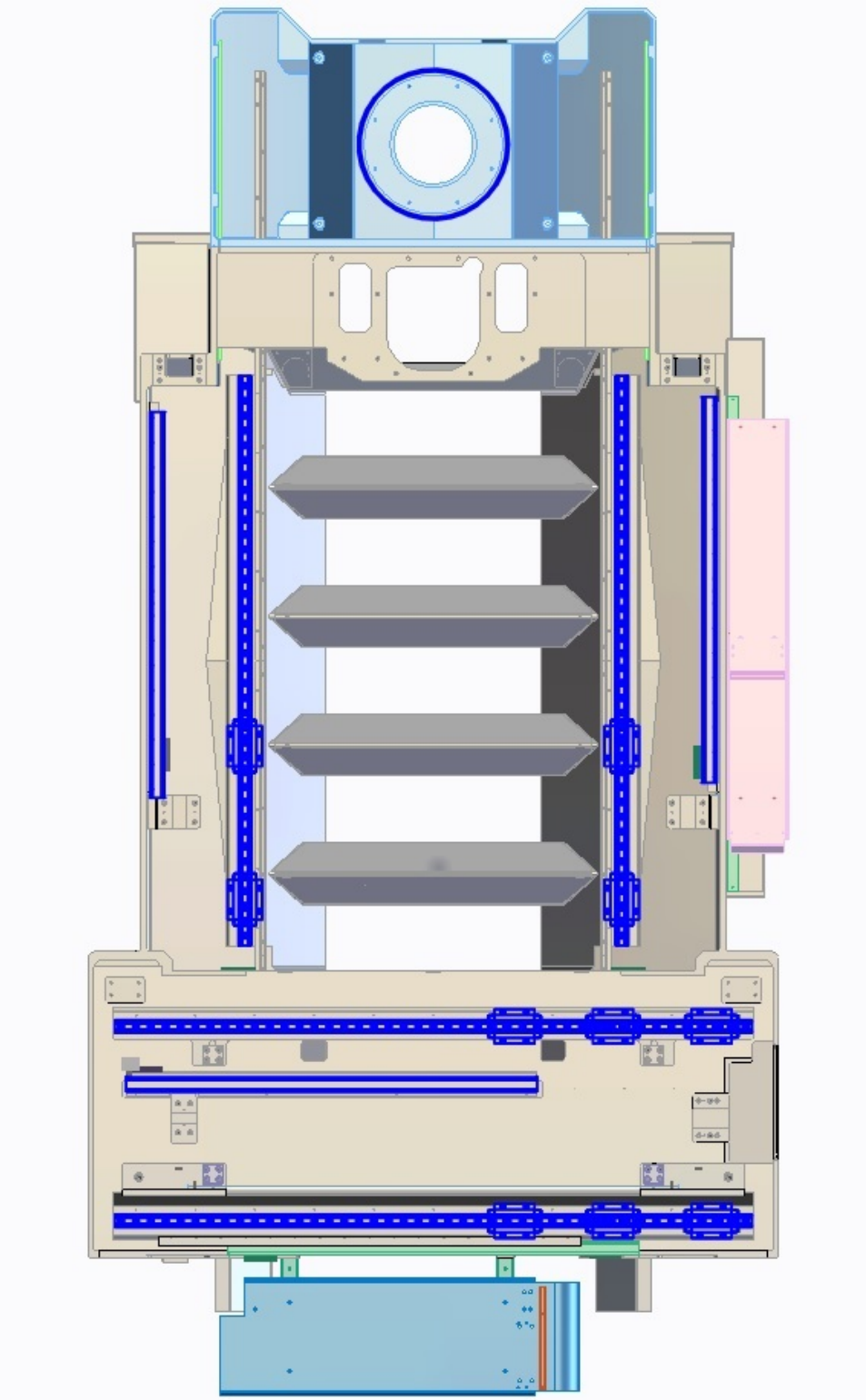


Fig. 2: Machine bed HEC/STC 800, view from above (171599)

- mounting faces for the drive and counterbearings of the ballscrews;
- mounts for the subassemblies 'pallet changer' and 'load-unload station';
- strips and cover plates for covering the sectional rail guides and ballscrews of the Z axis (on both sides);
- Z axis is designed as a gantry axis;
- leading axis can be found at the magazine end;
- synchronized axis can be found on the operator side.

2.2 Column

The machine tool table moves on the X guide of the cross-bed and serves for accommodation of the slide rest with the main spindle.

The illustrations below show, e.g.:

- The sectional rail guide and the ballscrew nut of the X axis, as well as the related components of the central lubrication system;
- The hydraulic counterweight balancing with hydraulic cylinder and pressure accumulator;
- The arrangement of the sectional rail guides, of the ballscrew and the linear measuring system for the slide rest (Y axis).

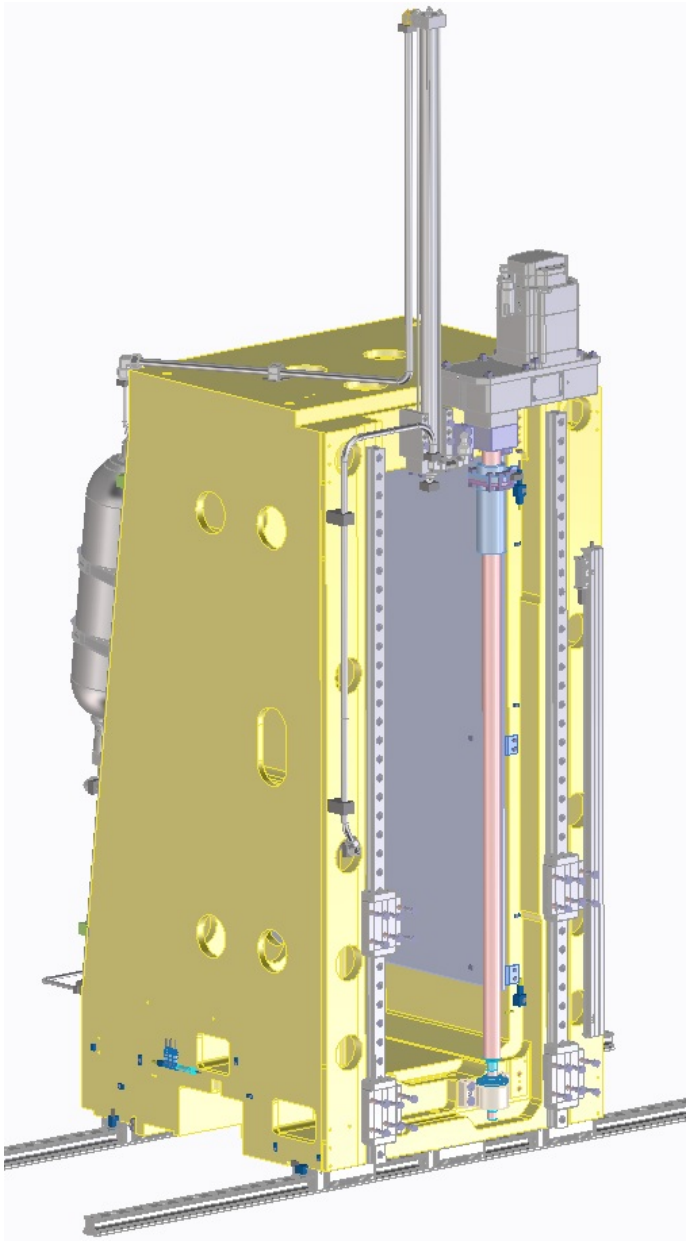


Fig. 3: Column HEC/STC 800 (163007)

2.3 Slide

The slide moves on the Z guide of the cross-bed and serves for accommodation of the NC rotary table (B axis) with the pallet.

The illustrations below show, e.g.:

- The trailing cables for the Z and B axes;
- The components of the pneumatic pallet alignment control, and
- The NC rotary table mount in its fitting.

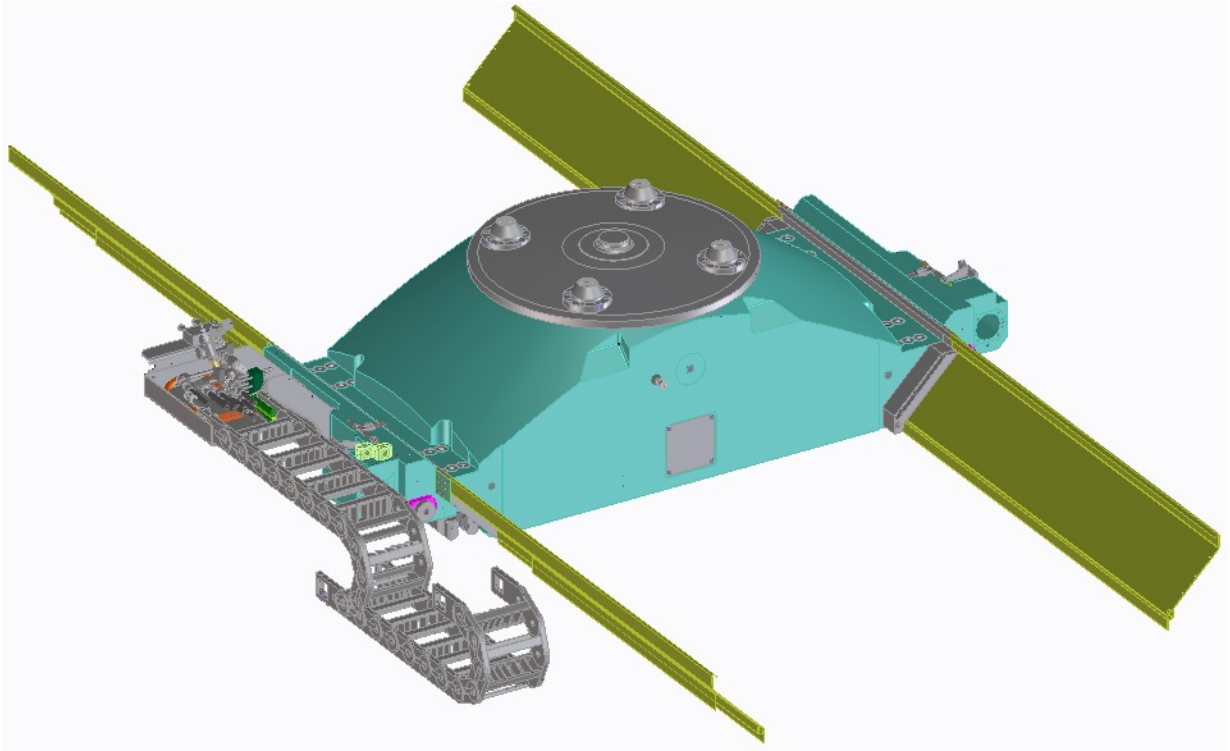


Fig. 4: Slide HEC/STC 800 (163006)

2.4 Feed drive

The feed drive is realized by way of digital AC servo motors via toothed belts on preloaded ballscrews.

The illustration below shows the following components for each axis:

- Ballscrew with spindle nut;
- Toothed lock washer and clamping set on the ballscrew;
- Drive housing with motor plate and feed motor;
- Toothed lock washer and clamping set on the feed motor;
- Toothed belt and toothed belt tension master setting piece;
- Drive and counter-bearings with bearing housings.



Fig. 5: Feed drive X (164447)

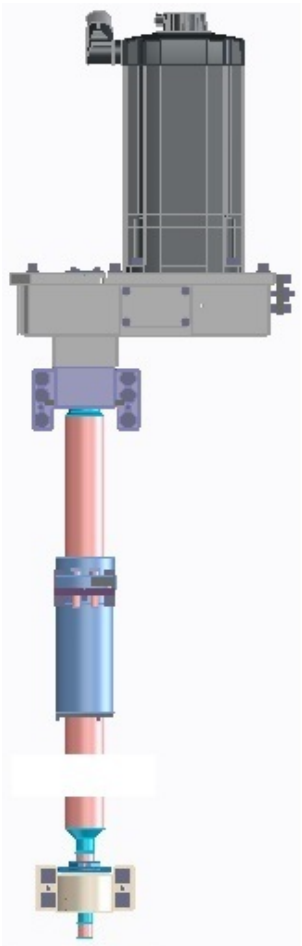


Fig. 6: Feed drive Y (164447)

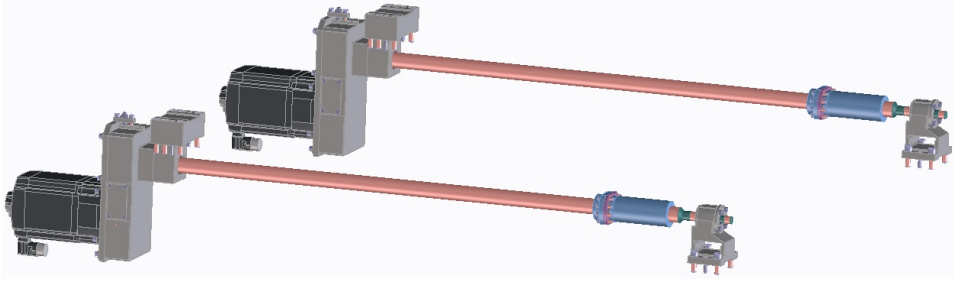


Fig. 7: Feed drive Z / ZZ (164447)

2.5 Locknuts

Spieth nut tightening torques

The following increased tightening torques are specified for Spieth nuts based on the high dynamic properties of the feed drives and the resulting high acceleration torques and forces.

Identification symbol	Tightening torque	Preloading torque	Clamping screws		
	Ma (Nm)	Mv, increased (Nm)	ISO 4762	Qty.	MA (Nm)
MSA 20x1	50	65	M3	5	2 B
MSA 25x1,5	75	100	M3	5	2 B
MSA 30x1,5	95	125	M3	5	2 B
MSA 35x1,5	120	160	M4	4	3 B
MSA 45x1,5	195	260	M4	5B	3 B
MSR 50x1,5	225	300	M4	6	3 B
MSR 25x1,5	75	100	M4	4	3 B
MSR 30x1,5	95	125	M4	4	3 B
MSA 40x1,5	165	220	M4	4	3 B
MSR 50x1,5	225	300	M4	6	3 B



The nut threads are to be secured with Loctite 222.

When preloading bearings on the side of the counter-bearing by way of two locking nuts of different size, the tightening torques for the larger locking nut are to be applied for both nuts.



Current Assembly Instructions "Assembly/Disassembly of Spieth Locknuts". Available upon request.

2.6 V-belt tensions

2.6.1 General notes

General

Toothed belts are used for instance:

- in feed drives;
- on measuring system main gears;
- on the tower magazine;
- on the (dynamic) chain magazine.

Precise tensioning of the toothed belt during assembly is essential for the performance and reliability of the drive. During maintenance work, check the toothed belts and tighten them if necessary.

Use the tower tension measuring device Tension Meter WF-TM NANO to adjust and check the belt pre-tension.

⚠DANGER

High risk of injury from running drives

Coming into contact with running or unintentionally starting drives can cause serious injuries.

- ▸ Before starting a measurement, ensure the drive unit is switched off and secured against unintentional starting. Never perform measurements on running drives!

Measuring principle

The measuring device is designed for fast and easy measurement of the belt pre-tension.

You can use it to measure all V, toothed and power belts which are in the specified measurement range of 10 to 600 Hz. Because the system uses the acoustic measurement principle, the type, colour and nature of the belt does not influence the measurement result.

The principle of forced oscillation is applied. The belt vibrates when a pulse is transferred to it. The oscillation frequency is in a fixed ratio to the belt pre-tension. Therefore, the higher the oscillation frequency, the higher the belt tension.

Sensor

The sensor is directly fixed to the housing with a connector. This makes it possible to operate the device with one hand. For measurement at inaccessible positions, you can install the extension cable included in the supply between the device and the measuring head.

Operating instructions

Press the left-hand button to switch the device on.

The message “--------” appears on the display. Now the device is ready.

Measurement

After assembly, turn the drive a few times by hand to ensure the belt is fully settled and to balance out any tension differences before the measurement.

Hold the device measuring head approx. 10 mm above the belt. Always measure in the centre of the free section. Start the belt oscillating using a suitable tool, e.g. a ball-type Allen key. Now the measuring device starts measuring. After completing the measurement, the device displays the frequency.



A detailed manual for the tension measuring device is provided.

2.6.2 Sequence

- Assemble the drive and pre-tense the toothed belt - ensure correct fit and exact position of the toothed belt
- Turn the drive a few times by hand (release motor brake) to ensure the belt is fully settled and to balance out any tension differences before the measurement - rest the slide and supports on vertical axes prior to this.

2.6.3 Table of setting specifications

The belt tension is set/corrected according to the setting frequencies specified for the drive in question **the permissible deviation is +/- 5 %**.

Maschine	Achse	Motortyp	Über-set-zung	Typ KGT	Zahnriementyp	Ein-stell-fre-quenz (Hz)
HEC500-800 65 m/min Siemens	X Y Z ZP Y Z	1FK7105-XAF 1FK7103-XAF 1FK7103-XAF 1FK7083-2AF 1FK7105-XAF 1FK7105-XAF	64/28 64/28 64/28 48/22 64/28 64/28	50x40 50x40 50x40 32x10 50x40 50x40	GT8M-720-36 GT8M-720-36 GT8M-720-36 GT8M-512-30 GT8M-720-36 GT8M-720-36	190 190* 190 240 190* 190
HEC500-800 DBF X,Y=40m/min Z=60m/min***L*** Siemens	X Y Z	1FK7108-XAF 1FK7105-X5AF 1FK7103-X5AF	64/28 64/28 64/28	50x25 50x25 50x40	GT8M-720-36 GT8M-720-36 GT8M-720-36	190 190* 190
HEC500-800 100 m/min Siemens	X Y Z	1FT7108-8AF 1FT7108-8AF 1FT7108-8AF	43/33 43/33 43/33	50x40 50x40 50x40	GT8M-720-36 GT8M-720-36 GT8M-720-36	200 200* 200
HEC500-800***L*** X,Y=40m/min***L*** Z=60m/min***L*** Fanuc***L***	X***L*** Y***L*** Z***L***	α50/3000HVis***L*** α40/4000HVis***L*** α40/4000HVis***L***	64/32***L*** 64/28***L*** 64/28***L***	50x25 50x25 50x40	GT8M-720-36***L*** GT8M-720-36***L*** GT8M-720-36***L***	210***L*** 190****L*** 190***L***
HEC500-800 65 m/min Fanuc	X Y Z ZP Z	α50/3000HVis α40/4000HVis α40/4000HVis α12/4000HVis α50/3000HVis	64/32***L*** 64/28***L*** 64/28***L*** 48/18***L*** 64/32***L***	50x40 50x40 50x40 32x10 50x40	GT8M-720-36 GT8M-720-36 GT8M-720-36 GT8M-512-30 GT8M-720-36	210 190* 190 220 190
HEC500-800 65 m/min BRC	X Y Z	MSK101E-300 MSK101D-450 MSK101D-450	64/26 64/26 64/26	50/40 50/40 50/40	GT8M-720-36 GT8M-720-36 GT8M-720-36	210 190* 190
TM500:						
TM500 SK50/HSK100 Siemens	V WZB	62-2AF71	42/25 64/32	- -	8MGT-640-36 8MGT1000-12	160* 300
TM500 SK50/HSK100 Fanuc	V WZB	α-8-400HVis	42/25 64/32	- -	8MGT-640-36 8MGT1000-12	160* 300
Turmmagazin:						
Turmmagazin SK50/HSK100 Siemens	Q V WZB	1FK7083-XAF 1FK7083-XAF 1FK7042-XAF –	34/34 34/34 78/39 26/52	– – – –	75WFL-AT10M 75WFL-AT10M PC-8MGT-1120-50 PC-8MGT-1896-36	65* 65* 180 110

Maschine	Achse	Motortyp	Über-set-zung	Typ KGT	Zahnriementyp	Ein-stell-fre-quenz (Hz)
Turmmagazin SK50/HSK100 Fanuc	W V V1	α-12-4000HVis α-12-4000HVis α-8-4000HVis	34/34 34/34 78/39 26/52	– –	75WFL-AT10M 75WFL-AT10M PC-8MGT-1120-50 PC-8MGT-1896-36	65* 65* 180 110
Messsysteme:						
Hauptgetriebe Hauptgetriebe Hauptgetriebe Hauptgetriebe	C C C C	W6500-12500 P125/P150 STC-Starrag HV-Schwenkkopf	86/86 99/99 52/52 133/76		3MGT-501-9 3MGT-501-9 3MR-450 3MGT-552-9	170 220 190 190

⚠CAUTION

Incorrectly adjusted toothed belt tension can greatly damage the machine!

The specified values are typical example values. If the toothed belt tension is too low, strong vibrations can occur.
If the toothed belt tension is too high, bearing damage can occur and the ball screw can shear off.

- ▸ Consult with Starrag before altering the toothed belt tension!

2.7 Measuring systems

2.7.1 Introduction

The length measurement in the X, Y and Z axes takes place by means of direct path measurement systems. They are encapsulated in an aluminium housing and impinged on with sealing air. Pressure setting according to fluid diagram: 1 bar. As a result, the length measuring system is optimally protected.

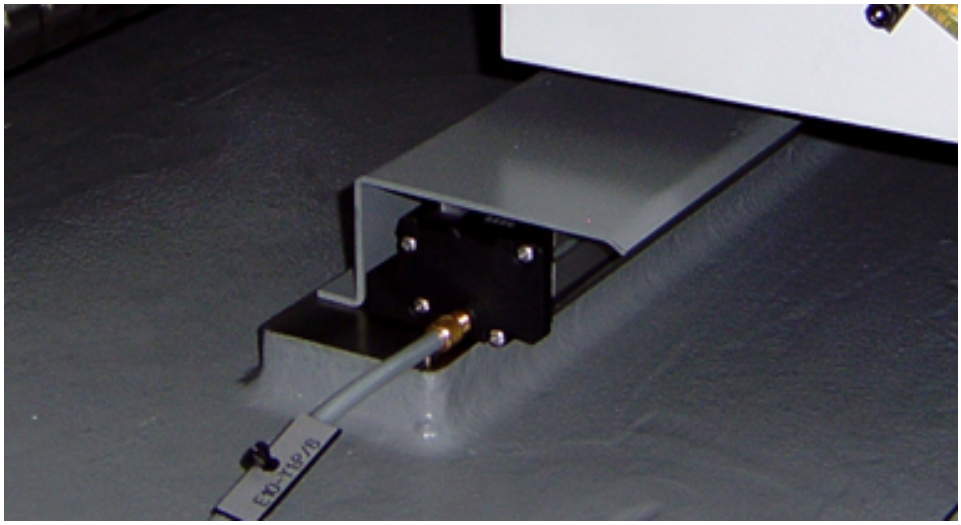


Fig. 8: Measuring system with cover and sealing air connection

2.7.2 Preparatory work

Removing the securing rod

In the case of measuring system types LC 181/ LC182/ LC 183

Loosen the screw by one quarter turn

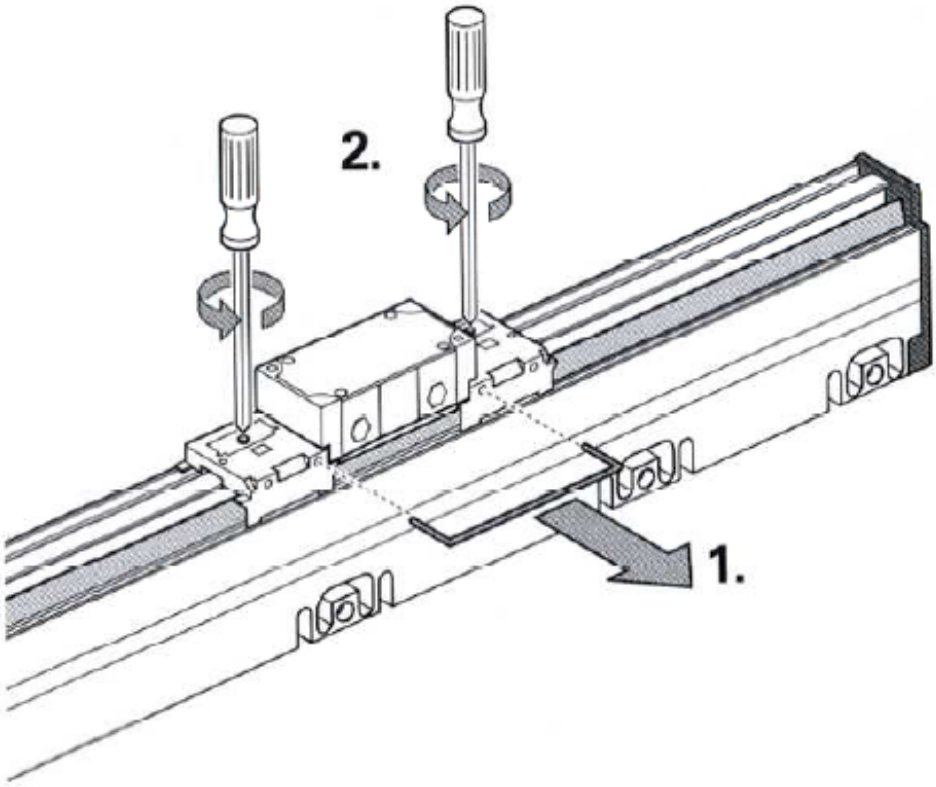


Fig. 9: Removing securing rod from LC 181/ LC 182/ LC 183

2.7.3 Assembly and adjustment

Measuring points for alignment of LC 181/ LC 182/ LC 183

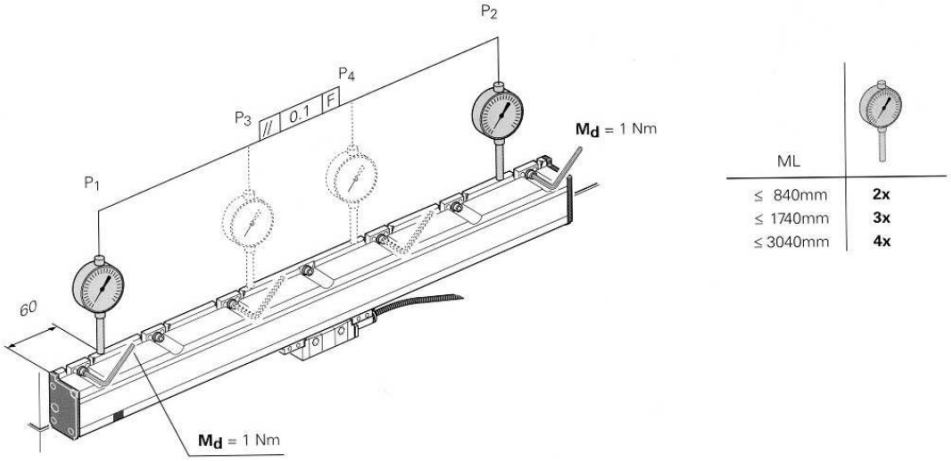


Fig. 10: P = measuring points for alignment of LC 181/ LC 182/ LC 183

Observe fixing sequence for LC 181/ LC 182/ LC 183

The centre fixing is absolutely necessary (thermal fixed point).

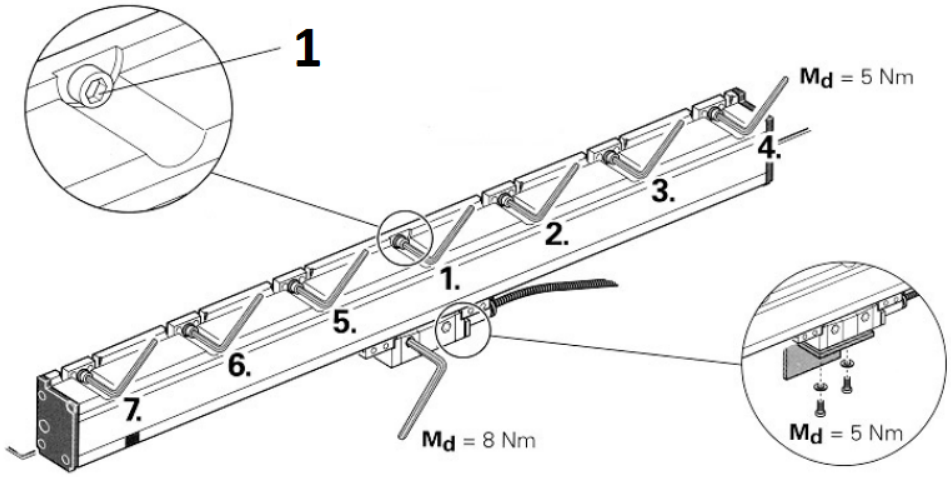


Fig. 11: Fixing sequence for LC 181/ LC 182/ LC 183

1 Thermal fixed point

Measuring system types LC 181/ LC 182/ LC 183

The plastic gliders on the sides act as spacing guides for the scanning carriage. (Distance 1.5 mm +/- 0.2)

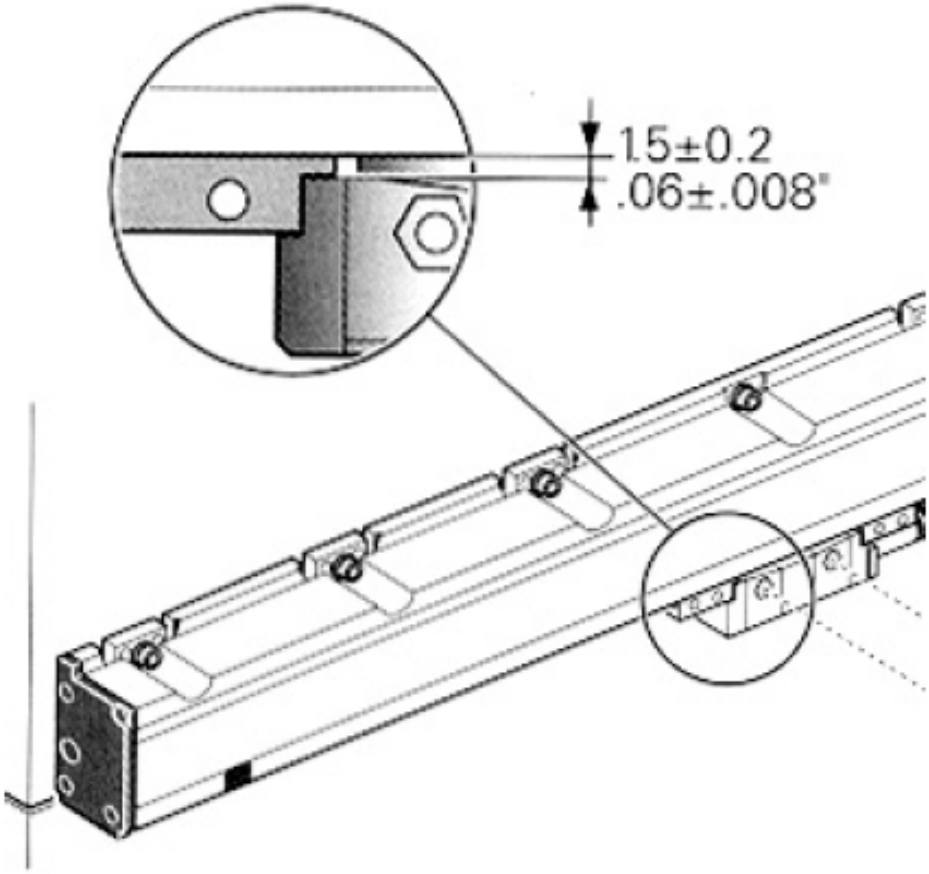


Fig. 12: Spacing guide of LC 181/ LC 182/ LC 183

After fastening the scanning carriage, remove the lateral spacing guides and plastic gliders.

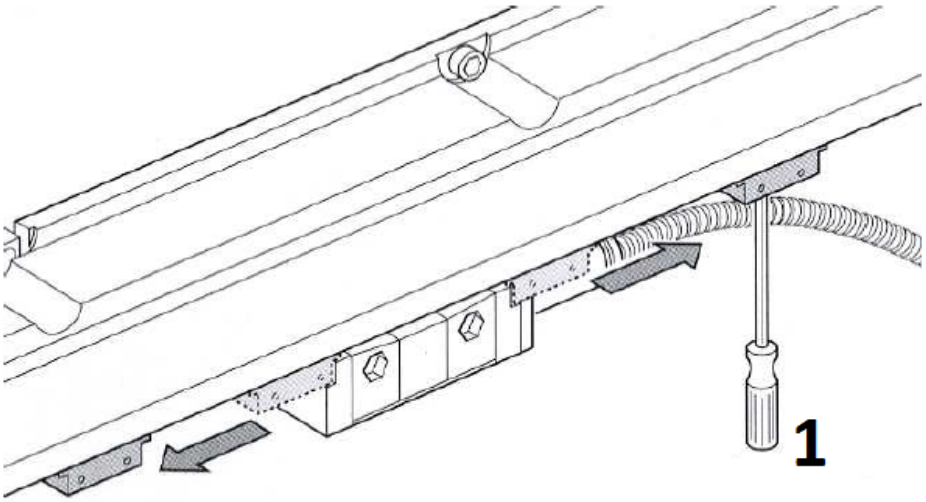


Fig. 13: Removing the plastic gliders/spacing guides on the LC 181/ LC 182/ LC 183

1 Remove screw completely

2.8 Service notes for the central oil lubrication

Brief description

The ball screws (with drive and partly counter-bearings) as well as the profile rail guides on the linear axes feature a low-maintenance central oil lubrication system.

Also included here is the pallet change stop.

The E10-M1 pump is switched on every 90 minutes. This opens the HV4 valve and presses oil into the line. By increasing the pressure, the piston distributors apply a defined oil quantity to the lubrication points.

This process is reliably achieved with a pressure of approx. 20 bar. The E10-B5 electronic pressure sensor indicates the pressure buildup. To ensure this pressure is achieved at all points in the line, the pump operates with a brief overrun period. When the pump switches off, the HV4 closes again and relieves the lubrication system. The metering chambers of the piston distributor fill up with spring force. The E10-B5 electronic pressure sensor also monitors the pressure relief.

The oil volume in the lubrication unit is sufficient for 240 ... 550 operating hours, depending on the Specification. After minimum filling level, the machine continues to work for further 36 ... 80 hours; then, no further workpiece program is started.

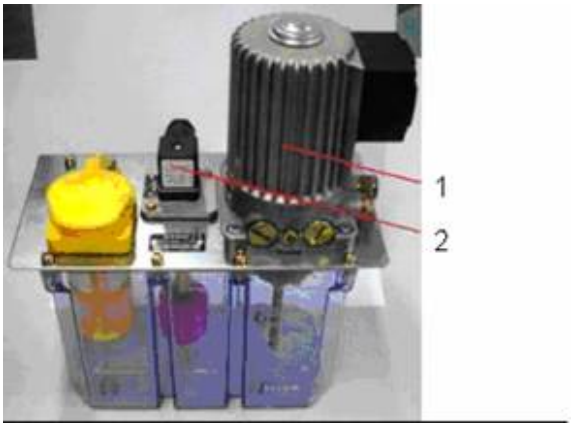


Fig. 14: Gear pump unit



Fig. 15: Example of an oil distributor

1. Oil pump for the axis lubrication
2. Oil lubricant filling level

2.9 Abschlussfragen zum Kapitel

- Beschrifte in der Zeichnung Maschinenbett … wo sich die Achse Z1 & Z2 befindet!

- Auf welcher Seite befindet sich der Heidenhain Maßstab in der Achse Z?

- Bedienerseite
- Magazinseite

- Beschreibe drei Auswirkungen die ein defekter Gewichtsausgleich hervorruft

- Nenne eine Möglichkeit den Gewichtsausgleich auf seinen Verschleißzustand zu überprüfen

- Nenne eine Möglichkeit an einen defekten Schlauch im Schlitten zu kommen

- Wie wird die Kraft vom Motor auf den Kugelgewindetrieb übertragen?

- Was muss beachtet werden bevor die Riemenspannung einer Senkrechachse gemessen wird

- Nenne eine Fehlerursache die für den Fehler „Messsysteme laufen auseinander“ verantwortlich ist

- Welches Messsystem ist das „aktive Messsystem“?

- Welche Aufgabe hat die Sperrluft?

- Wie wird geprüft ob Schmieröl an der gewünschten Baugruppe ankommt?

3 Spindle carrier with horizontal gear spindle

3.1 Carriage

The overview drawing includes:

- Guide element with the guide carriage of the profile rail guide of the Y-axis;
- Holder for the Y-axis ball screw;
- the respective central lubrication components;
- Retaining plate for the hydraulic weight compensation piston rod;
- Supply for coolant through the nozzles;
- Tank with magnetic filter for the support lubrication.

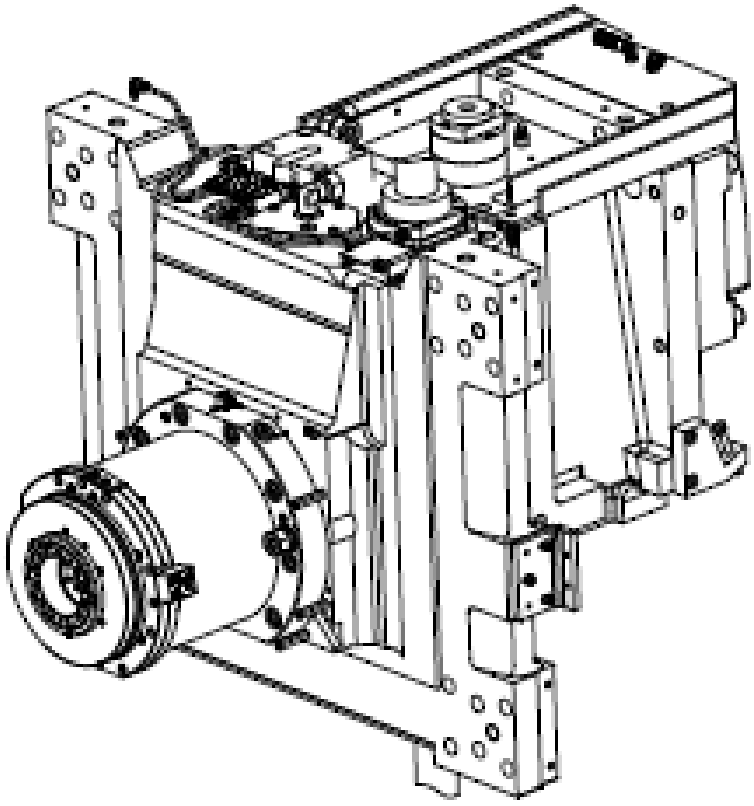


Fig. 16: Guide quill horizontal (163075)

3.2 Gear spindle

The complete drawing shows the following, e.g.:

- the fitting for mounting of the workspindle in the guide;
- the workspindle bearing;
- the coupling sleeve between main spindle and main gearbox;
- the feeding system for the coolant through the nozzles;
- the grease slinger with the coolant drainage channels;
- the position of the main spindle during tool change (0° position).

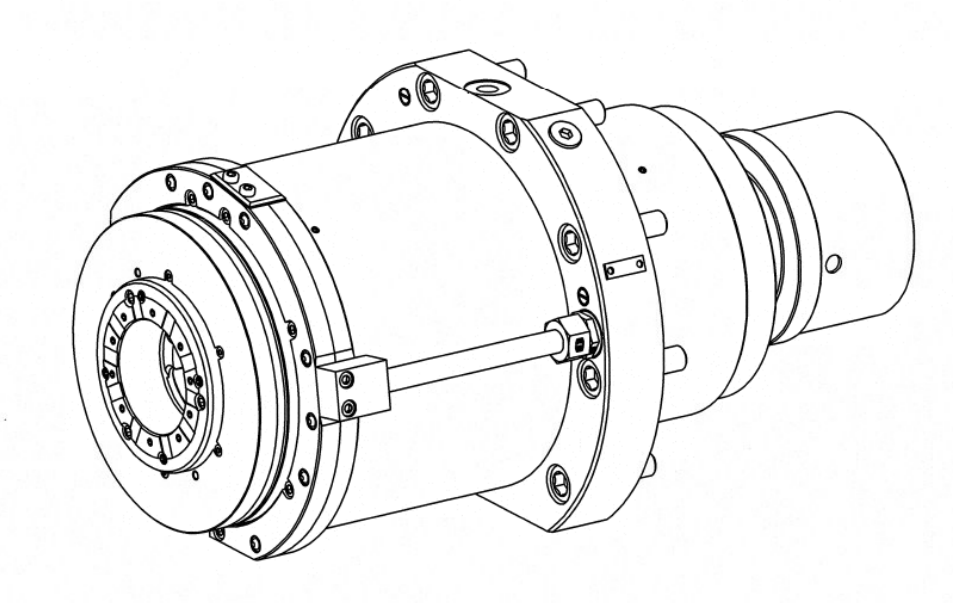


Fig. 17: Drawing Gearspindle(159580)

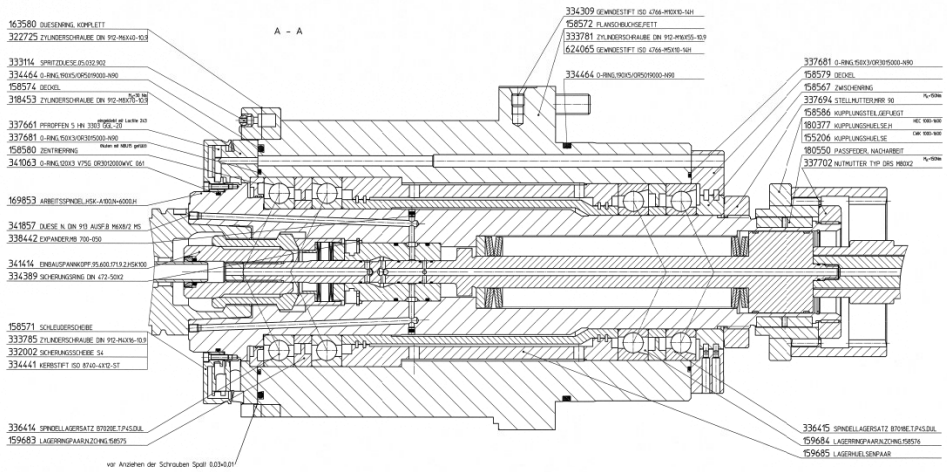


Fig. 18: Gear spindle (profile) (159580)

3.3 Tool clamping

The complete drawing shows, e.g.:

- Built-in clamping head HSK 100 (standard) or SK50, form A or form B (option);
- Built-in clamping unit with spring package;
- Tool clamping states “Open” and “Closed”;
- Setting dimension for the tool clamping fixture in the “Released” position;
- Stroke dimension for the tool clamping fixture in the Released” position;
- Coolant supply through the spindle center;
- Hydraulic release unit and rotary transmission leadthrough;
- Sensor of the tool clamping fixture.

Before removing the main spindle, always remove the coolant pipe first!

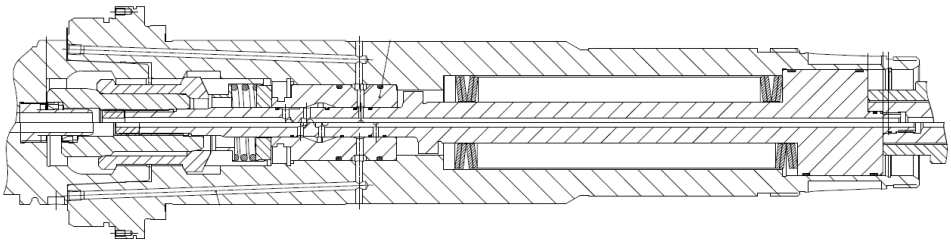


Fig. 19: Built-in clamp HSK100 (164168)

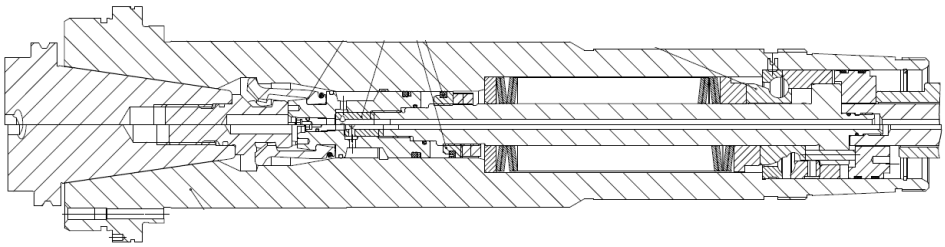


Fig. 20: Built- in clamp SK50 (164168)

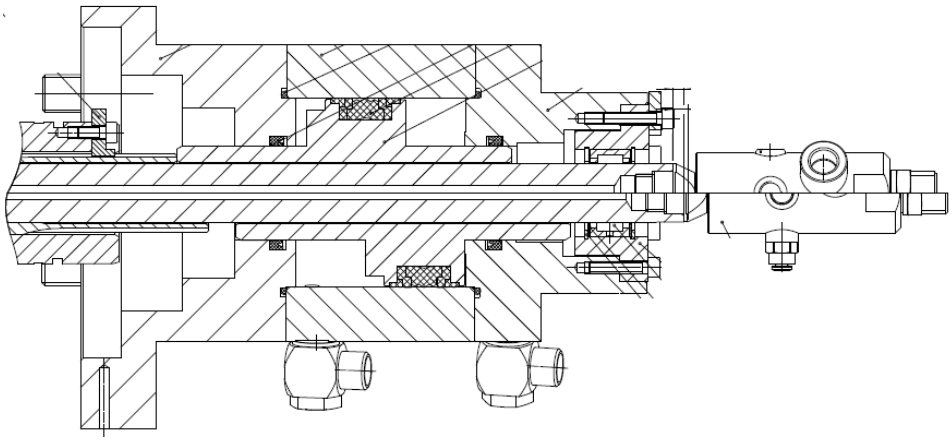


Fig. 21: Clamping cylinder tool

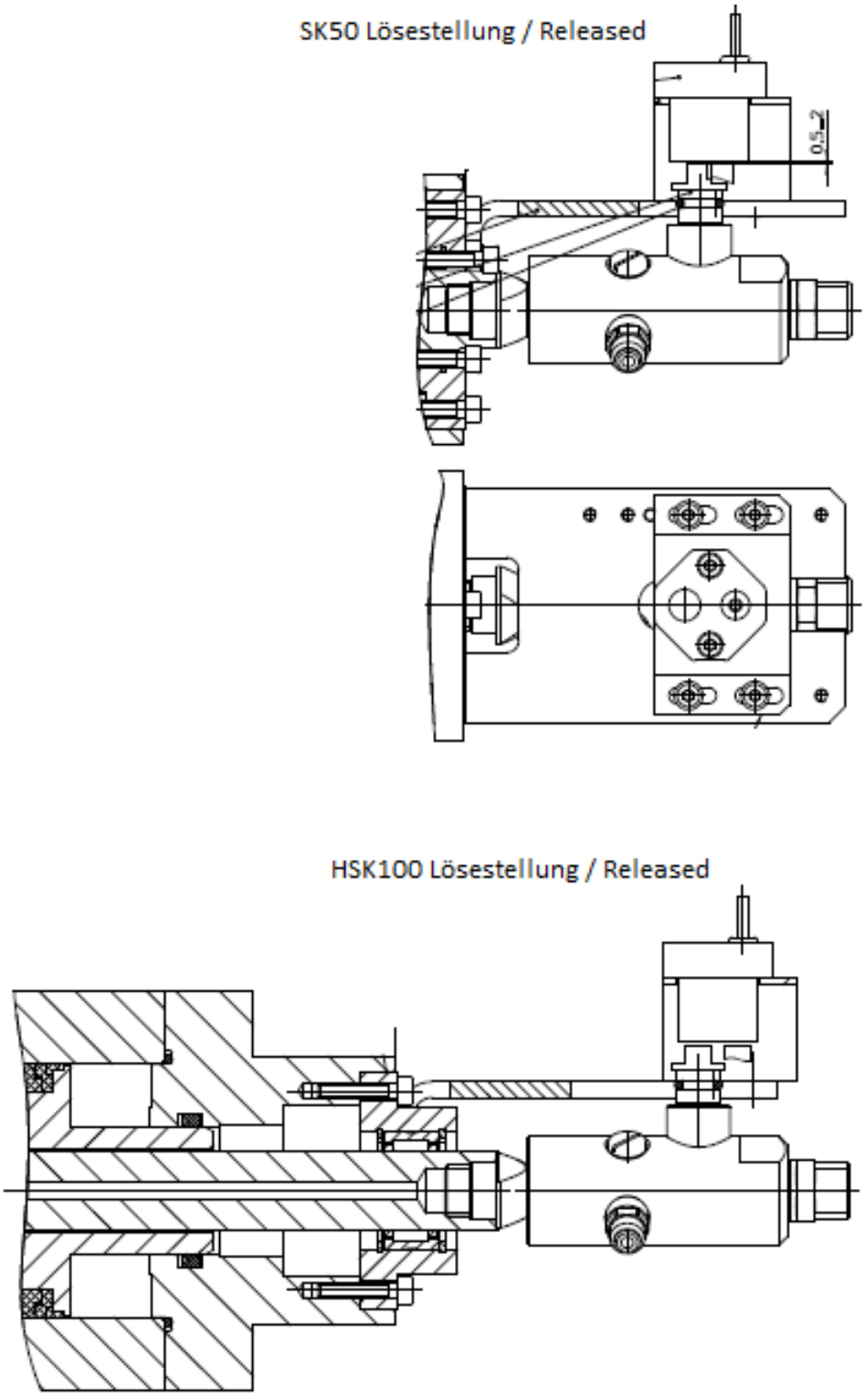


Fig. 22: Analog values sensor (164168)

3.4 Main gear box

The illustration below shows, e.g.:

- The gearbox housing with the fitting for mounting the main gearbox in the guide part;
- Shaft 01 with the coupling to the main drive motor;
- Shaft 02 in the two positions “Low” and “High” gear stage;
- Shaft 3 with the coupling to the main spindle;
- Supply and return of the gearbox lubrication;
- Pneumatic cylinder with the shifting dog;
- Shifting rod with shifter fork;
- Throttles and sensors on the pneumatic cylinder;
- Toothed belt and coupling on the rotary transducer.

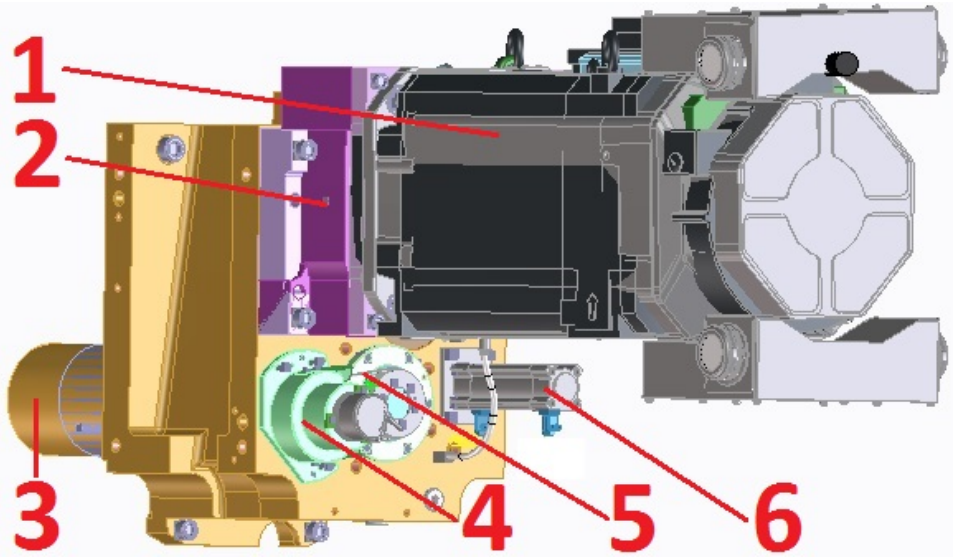


Fig. 23: Main gear (181852)

1 Main drive motor
2 Coupling housing with coupling between main drive motor and shaft 01
3 Coupling between shaft 03 and milling head
4 Housing with coupling to hold the measuring system
5 Toothed belt for driving the measuring system
6 Pneumatic cylinder to drive the switching shaft with switch claw

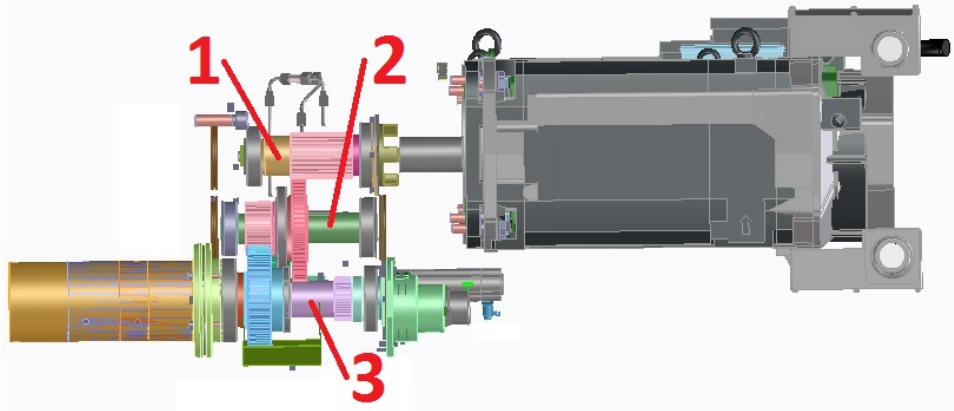


Fig. 24: Main gear shafts 1,2,3 (181852)

1 Shaft 01 (drive shaft)
2 Shaft 02 (switching shaft)
3 Shaft 03 (driven shaft)

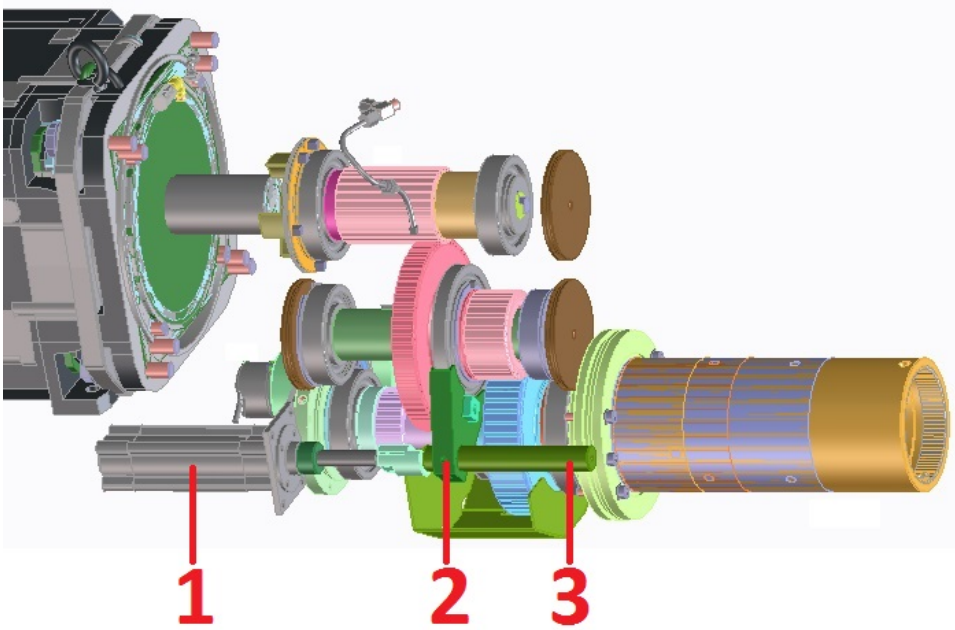


Fig. 25: Main gear gear shift (181852)

1 Pneumatic cylinder
2 Switch claw
3 Switch rod

4 NC Rotary table

4.1 NC rotary table DA 800

Assemblies

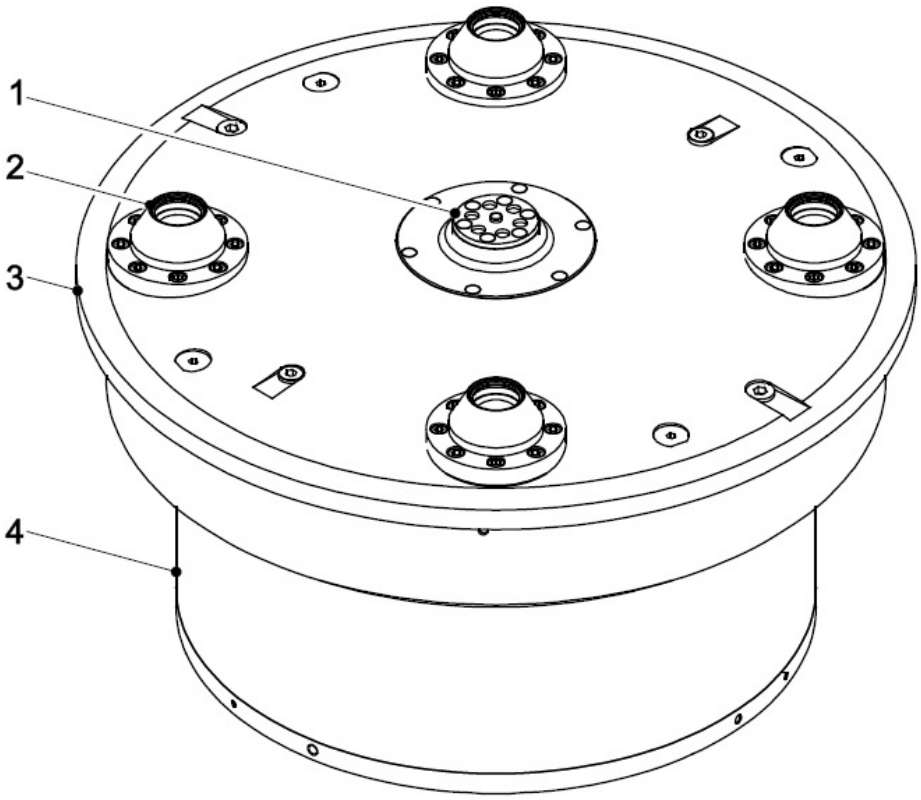


Fig. 26: Assemblies

1. Multiple coupling for transfer of hydraulics and pneumatics to pallet (optional)
2. Clamping heads for positioning and holding the pallet
3. Table
4. Housing with installations (integrated motor, clamping fixture, bearing, measuring system, rotary bushing)

Operating principle

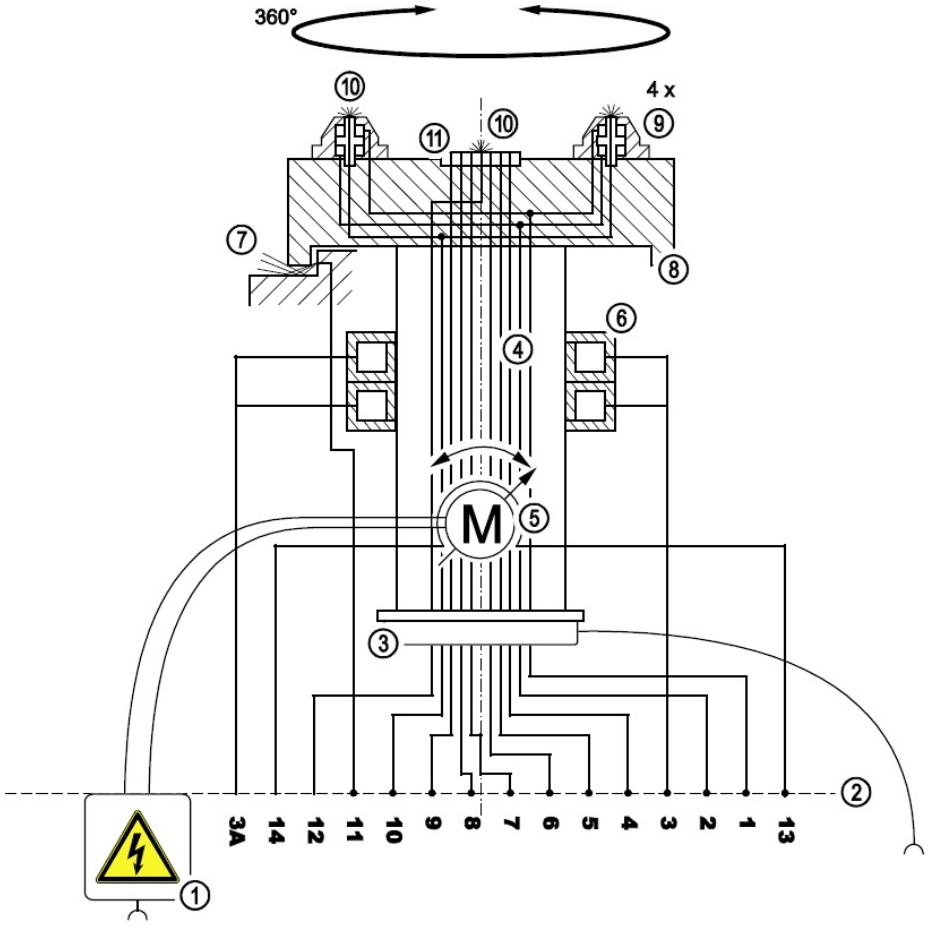


Fig. 27: Operating principle

1. Power socket
2. Connections on the underside of the housing
3. Measuring system
4. Rotary bushing
5. Integrated motor
6. Clamping fixture
7. Sealing air
8. Table
9. Clamping head
10. Cleaning air
11. Multiple coupling (optional)

Maintenance

General maintenance instructions

To maintain proper functioning and operational safety, it is essential to regularly perform the tasks specified in the maintenance schedule.

Any deviations from normal operation such as

- higher temperatures of the bearings
- higher power uptake
- unusual noises
- leaks
- material cracks and fractures and
- deformations

indicate that functioning and operational safety are impaired.

Procedure:

- Before starting maintenance, familiarise yourself with the work carried out with the machine.
- Switch the machine off during maintenance and secure it against being switched on again.
- Secure the machine so that unintentional movements are not possible.
- The machine includes hydraulic pressure storage units which are still active even when the pumps have been switched off. Release the pressure in the pressure storage units before starting maintenance work!
- Immediately remedy defects or plan to remedy them as soon as possible.

Maintenance schedule
The intervals given for the various activities are recommendations. Adapt them to your operating conditions.

⚠WARNING

Stored energy from tensed springs in the clamping elements.

Sudden release can cause serious injuries.

- Do not dismantle clamping elements.
- Only replace clamping elements as complete units.

⚠DANGER

Automatic or inadvertent machine startup.

If not observed, this can lead to death or extremely serious injuries.

- Switch off the machine completely.
- Secure it against being switched on again.

Work to be performed	Intervals [operating hours]	Note
Check perfect condition and leak-tightness	every 8 h or daily	Housing, bearing points, connectors
Check cleaning air	every 40 h or weekly	Air must exit at the cleaning point. (only if option selected)
Clean NC rotary table	every 40 h or weekly	Do not used compressed air on sealing gaps! Chips forced into sealing gaps could damage them.
Check sealing air	every 40 h or weekly	Check sealing air at ring gap between housing and table.
Replace coupling elements.	every 200,000 cycles or every 3 years	Cycle = coupling processes (only if option selected)
Replace seals of the rotary bushing and on the table	every 500,000 cycles or every 3 years	Cycle = start and stop of the rotary movement **Have work performed exclusively by the manufacturer.**

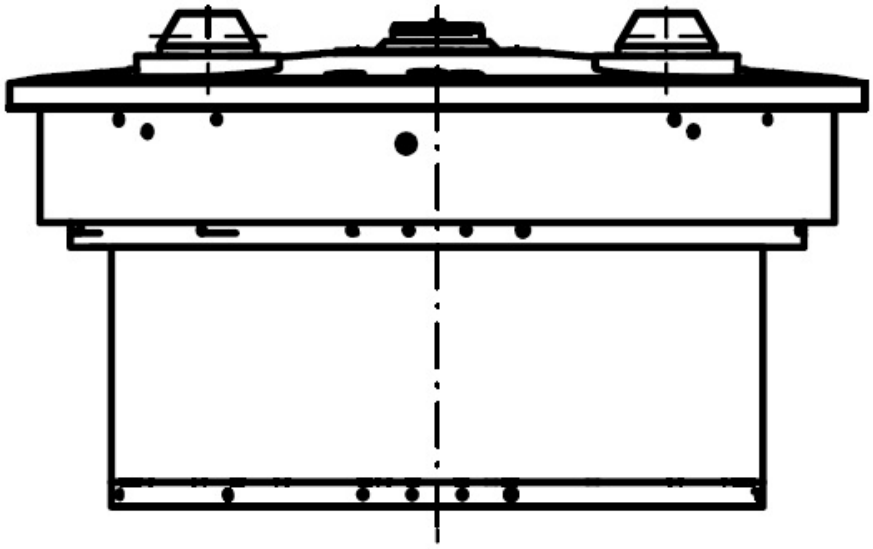


Fig. 28: Side view

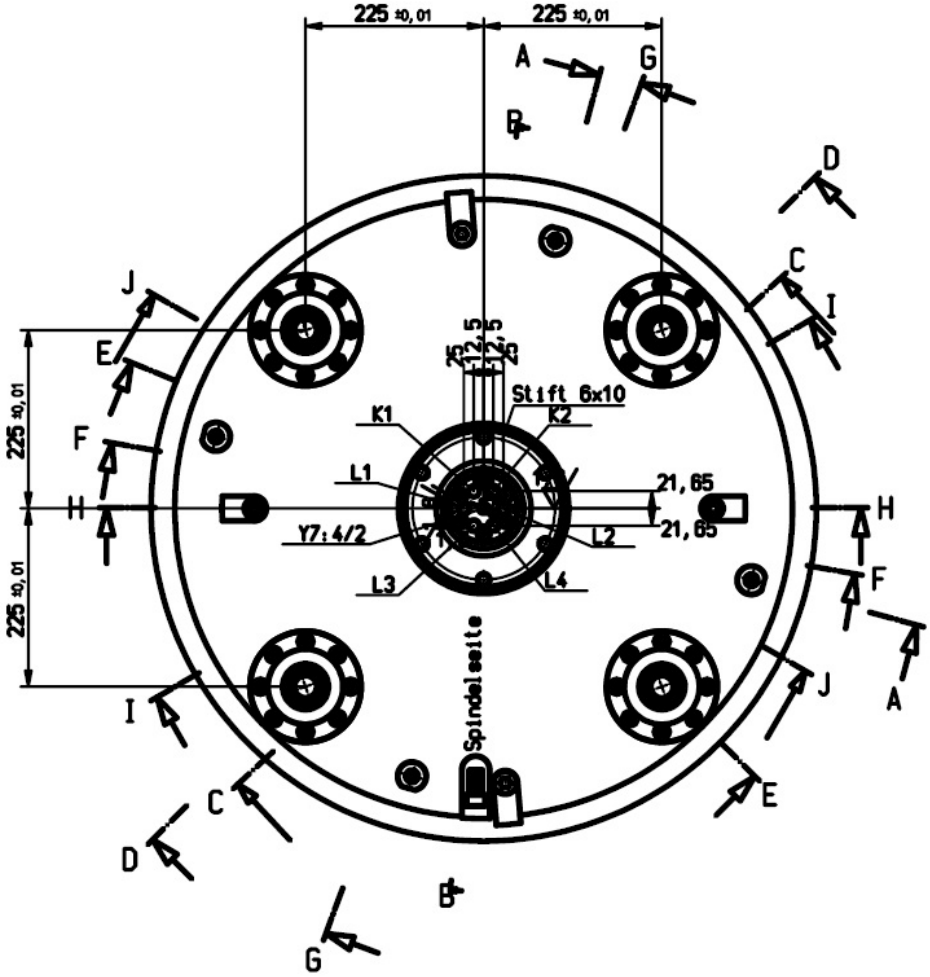


Fig. 29: View from above

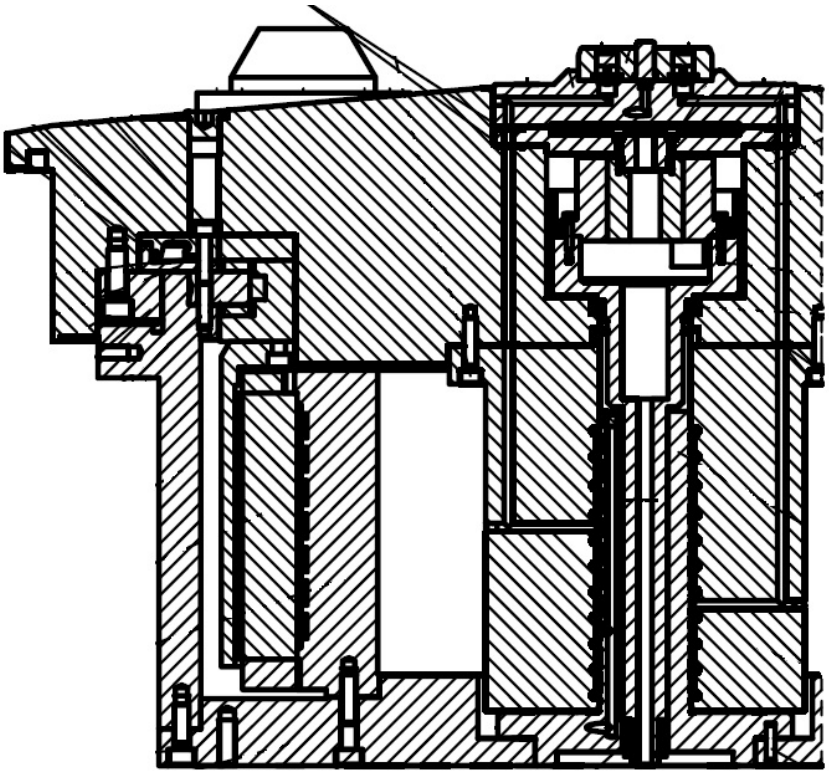


Fig. 30: Cross-section view

4.2 Extract from the documentation NC rotary table

In this chapter are selected parts of the supplier documentation for the NC rotary table. The selected parts are:

- Assembly groups;
- Functional principle;
- Dangerous locations;
- Transportation;
- Installation;
- Maintenance;
- Sectional view.



In this training documentation are only selected parts of the supplier documentation listed.

The complete supplier documentation for the NC rotary table is part of the manual. There are additional notes to the NC rotary table, especially environment-, work- and health protection.

Read the safety instruction from the supplier documentation careful before working on the NC rotary table!

4.3 Abschlussfragen zum Kapitel

- Kann die B-Achse nach dem Austausch in allen 4 Stellungen genullt werden? Begründe!

- Wie wird die Palette gelöst nachdem die B-Achse sich nicht mehr drehen lässt? (Kollision)

- Wie kann ein Taumelfehler der B-Achse behoben werden?

5 Pallet changer, Tool changer, Tool magazine

5.1 Pallet changer

The pallet changer view shows, e.g.:

- The lifting and swivel system for the lifting and swivel motions;
- The swivel plate with brackets for the pallets;
- The stops for the swivel motion;
- The related components of the central lubrication system;
- The load-unload station with the rest for the pallet with ball bearing and handle bar.

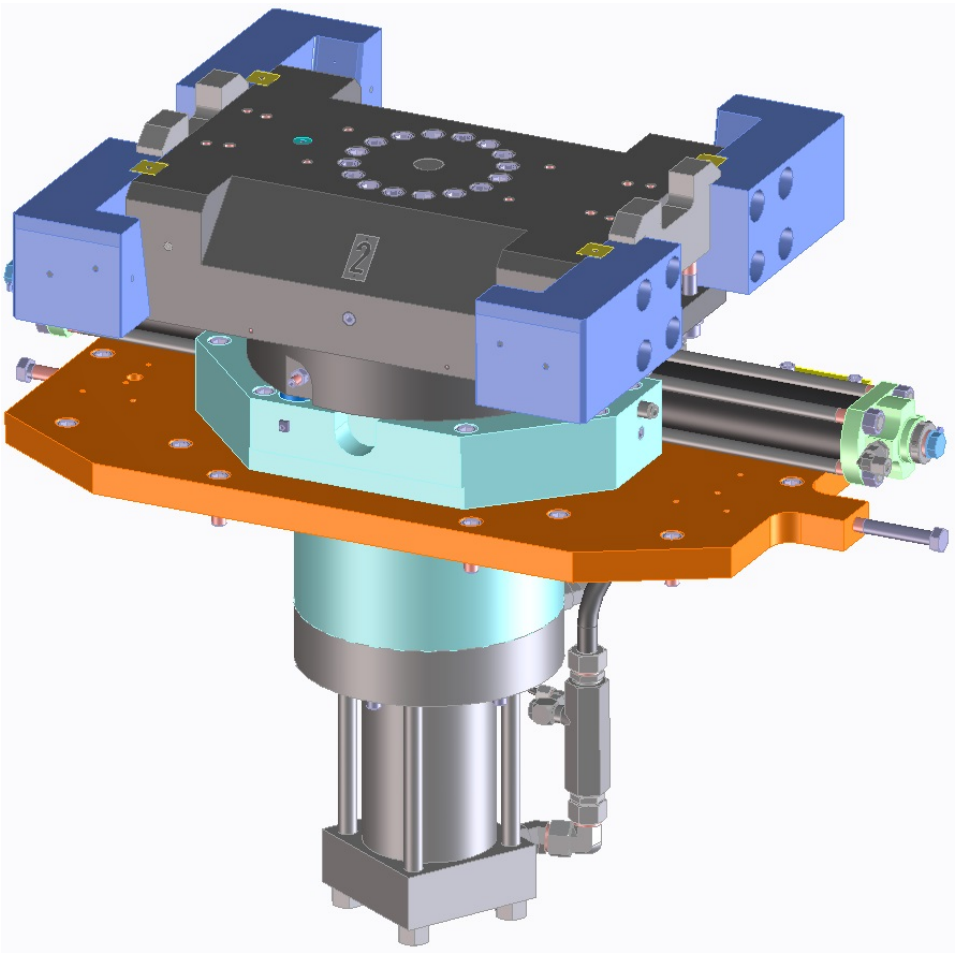


Fig. 31: Pallet changer HEC/STC 800 (1024108)

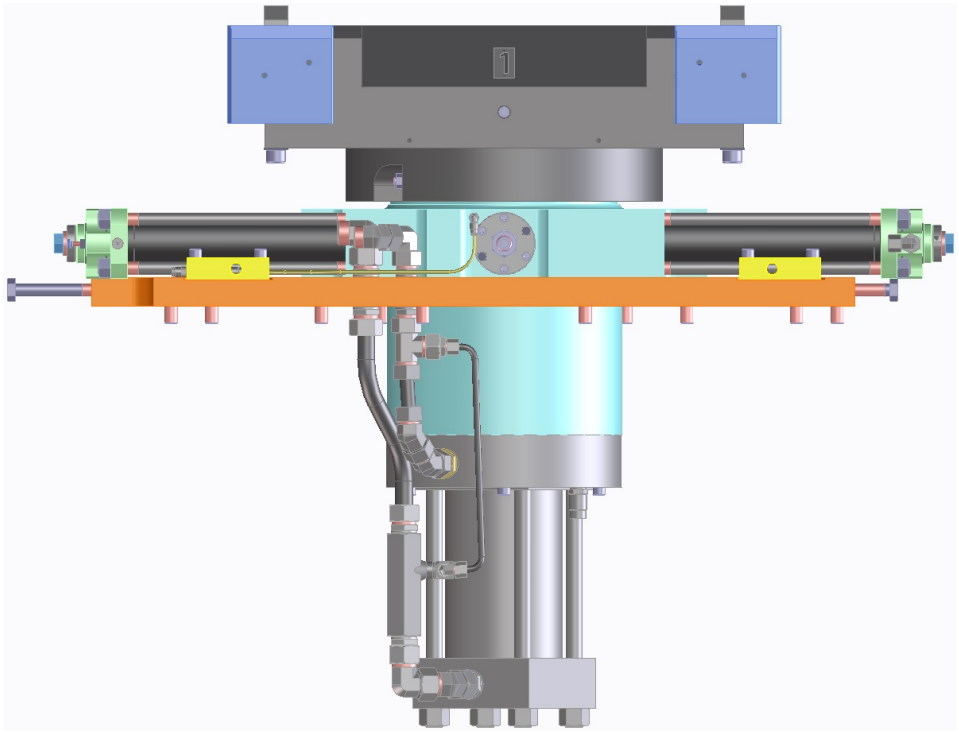


Fig. 32: Pallet changer HEC/STC 800 front view (1024108)

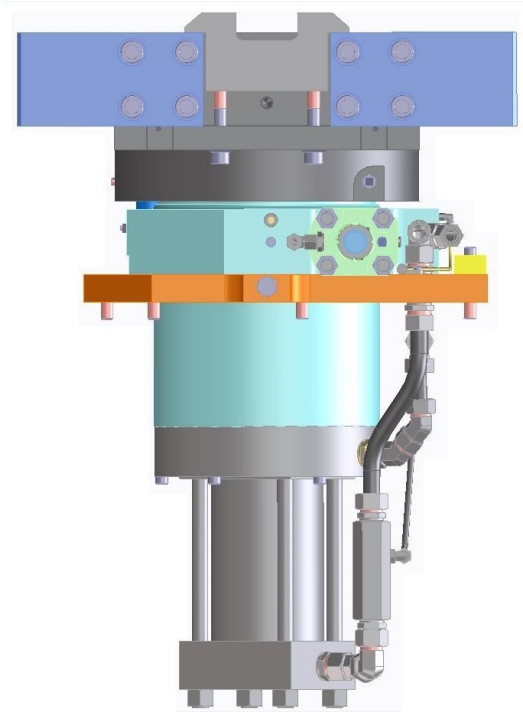


Fig. 33: Pallet changer HEC/STC 800 view from the left (1024108)

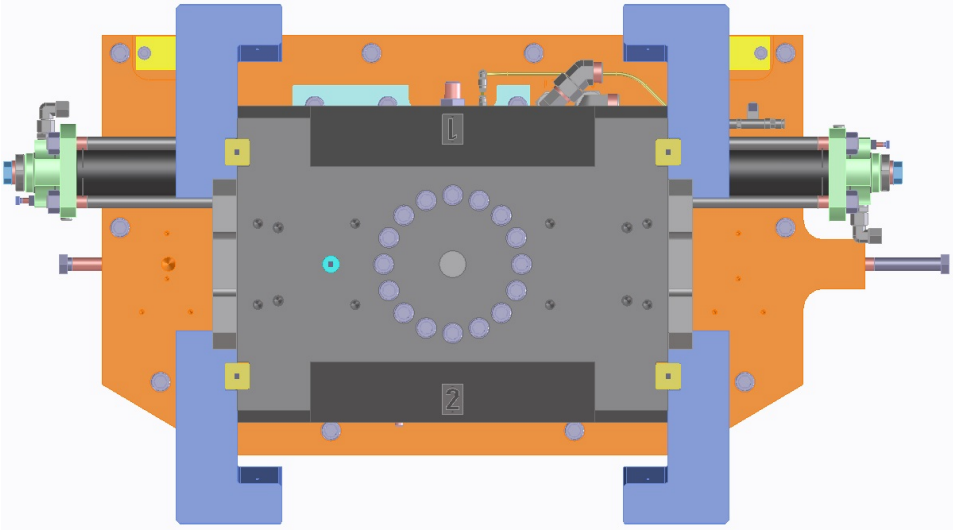


Fig. 34: Pallet changer HEC/STC 800 view from above (1024108)

Functioning of the pallet changer

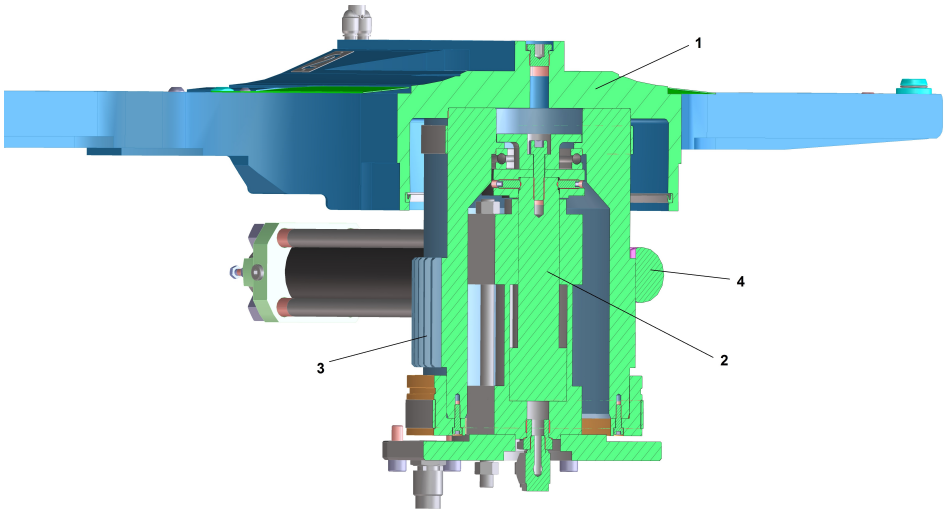


Fig. 35: Pallet_changer_lift_rotary_unit_labeled

1. Swivel plate with fork
2. Hydraulic lifting cylinder
3. Swivel shaft
4. Toothed rack

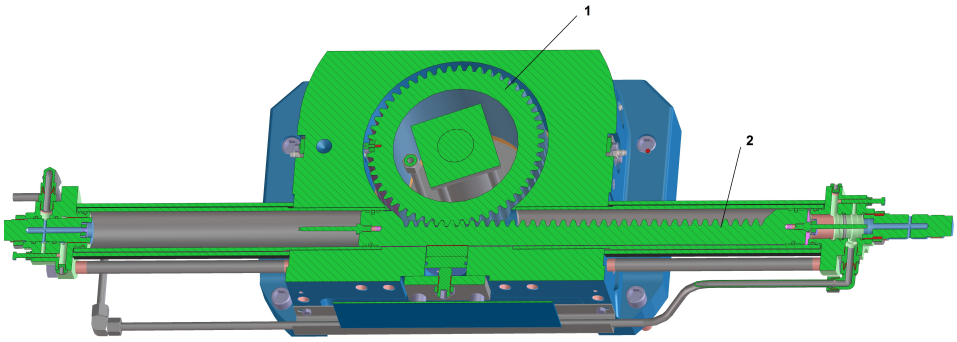


Fig. 36: Pallet_changer_rotary_unit

1. Swivel shaft
2. Toothed rack

Dampening of the rotary movement

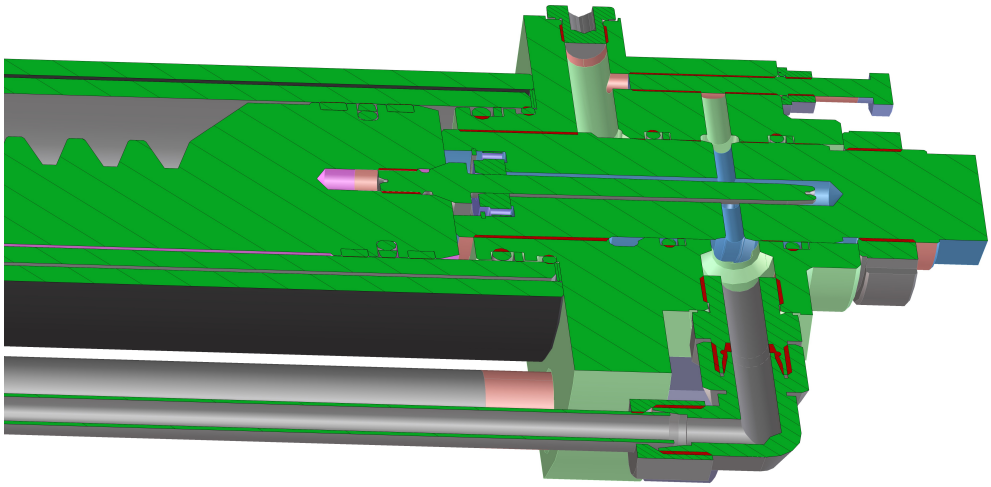


Fig. 37: Rotary_changer_dampening

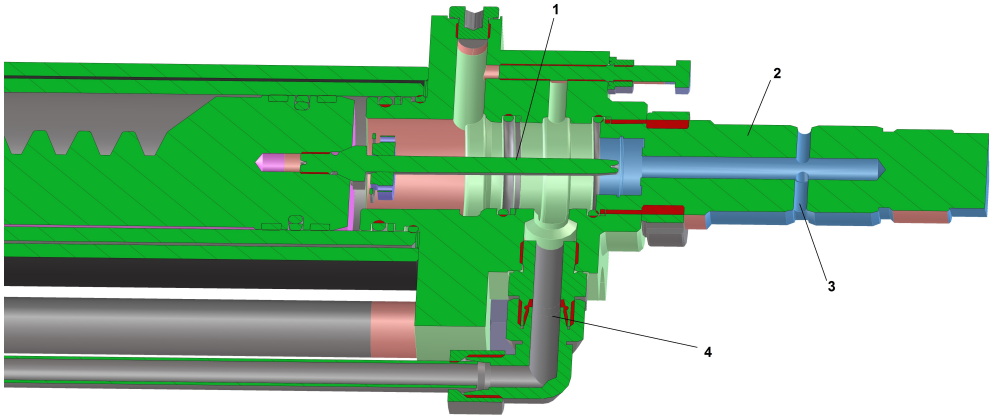


Fig. 38: Rotary_changer_dampening_labeled

1. Damping pin
2. Master setting piece
3. Oil channel
4. Hydraulic line

Sensor technology of the pallet changer

The pallet changer sensors are located on the machine roof.

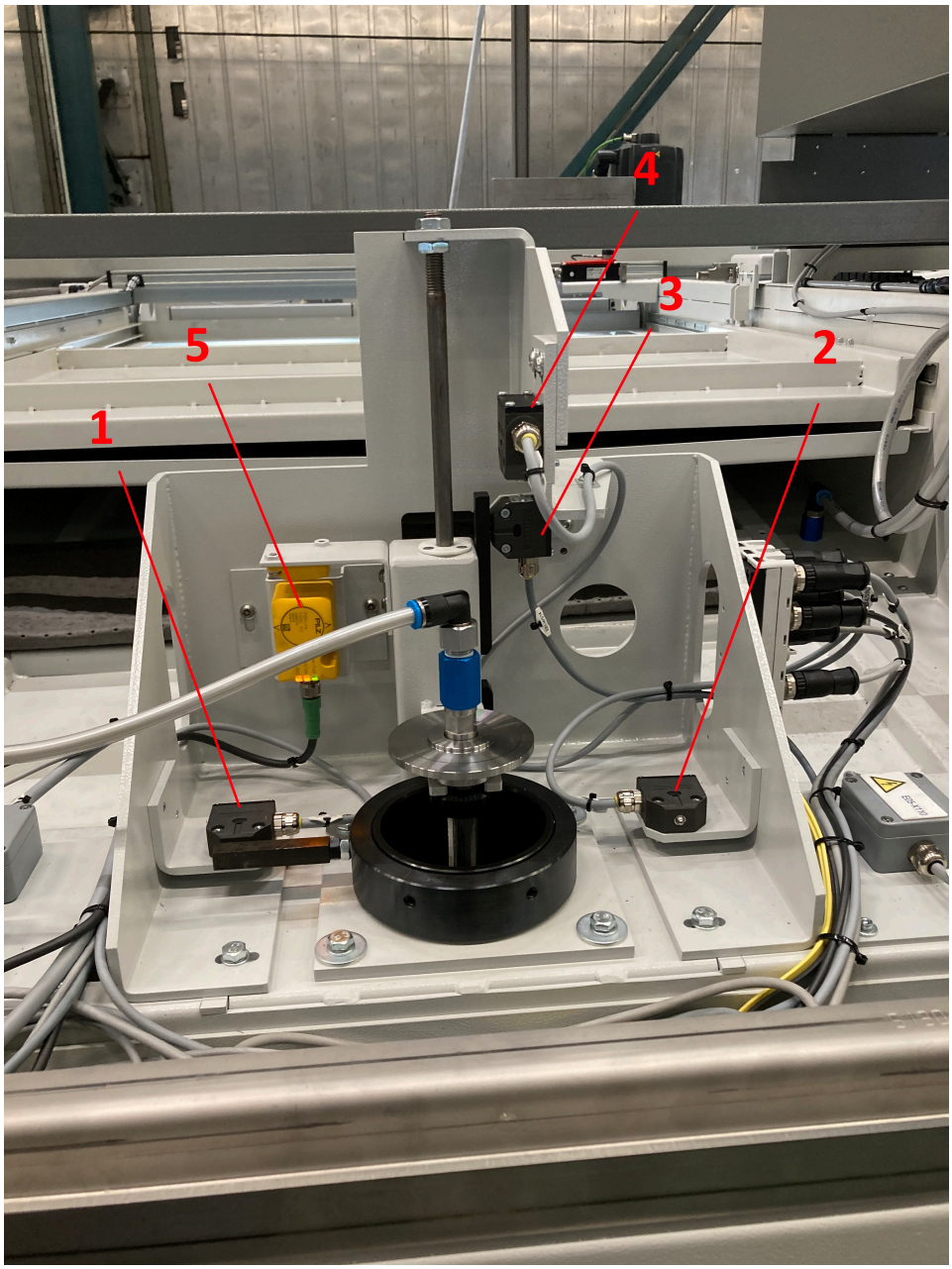


Fig. 39: pallet changer sensor

1.1 Pallet changer swiveled to the right

1.2 Pallet changer swiveled to the left

1.3 Pallet changer excavation in rapid traverse

1.4 Pallet changer lifted to swivel

1.5 Pallet changer lowered

5.2 Pallet

The pallet view shows, e.g.:

- Connecting link for coupling of the pallet to the pallet changer;
- Pallet surface for accommodation of the clamping fixture;
- Pallet underside for clamping on the NC rotary table.

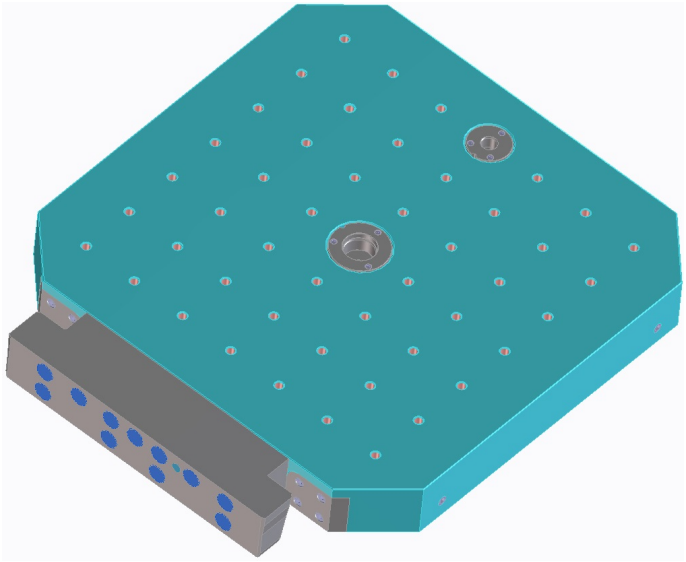


Fig. 40: Pallet HEC/STC 800 view from above

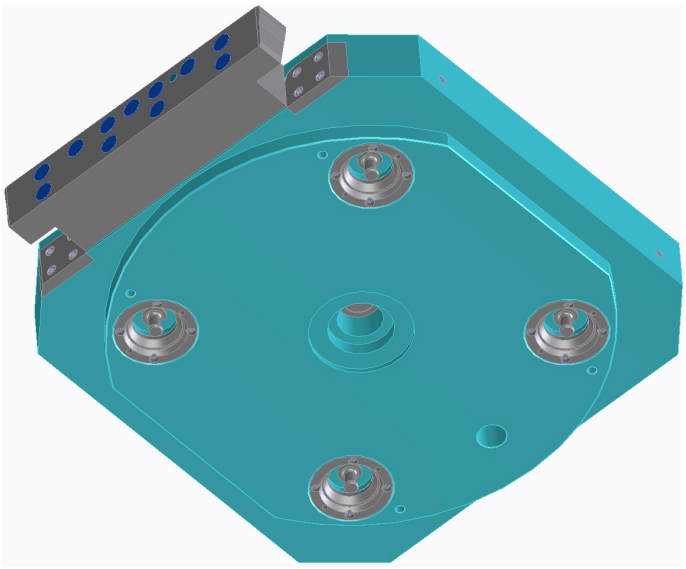


Fig. 41: Pallet HEC/STC 800 view from below

5.3 Load-unload station

The load-unload station view shows, e.g.:

- Pallet mounts on the load-unload station;
- Bearings for the rotary motion, ball bearing and handle bar.

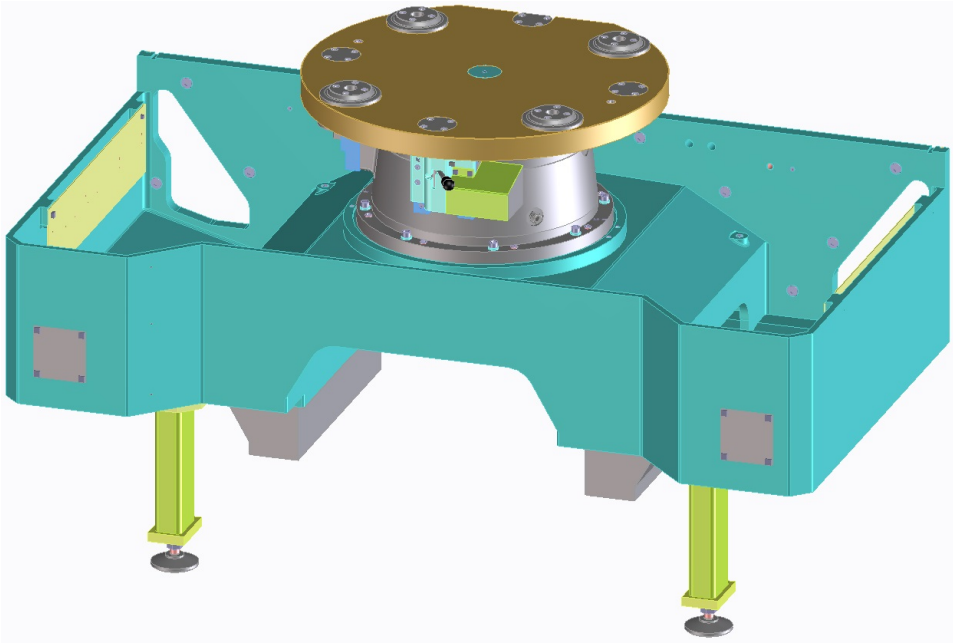


Fig. 42: Set-up station HEC/STC 800 (164587)

5.4 Tool changer

The illustration below shows, e.g.:

- The sectional rail guides, drive and sensors for the slide movement;
- The guides, hydraulic cylinder and sensors for lifting the gripper;
- The hydraulic motor and sensors for turning the gripper;
- The design of the dual gripper with the locking mechanism.

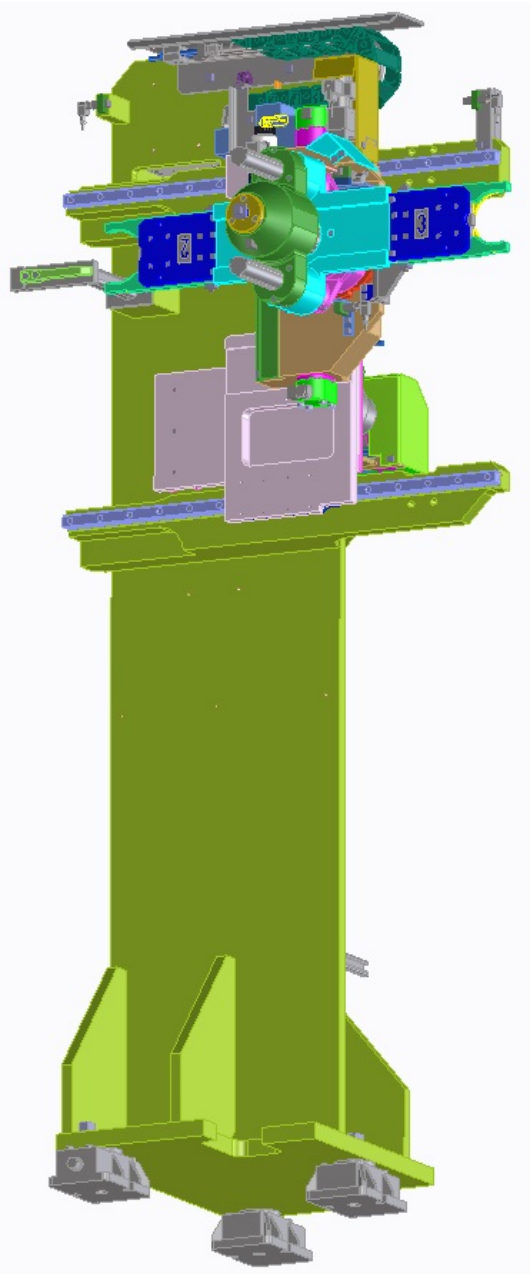


Fig. 43: Tool changer STC 800 with frame (185020)

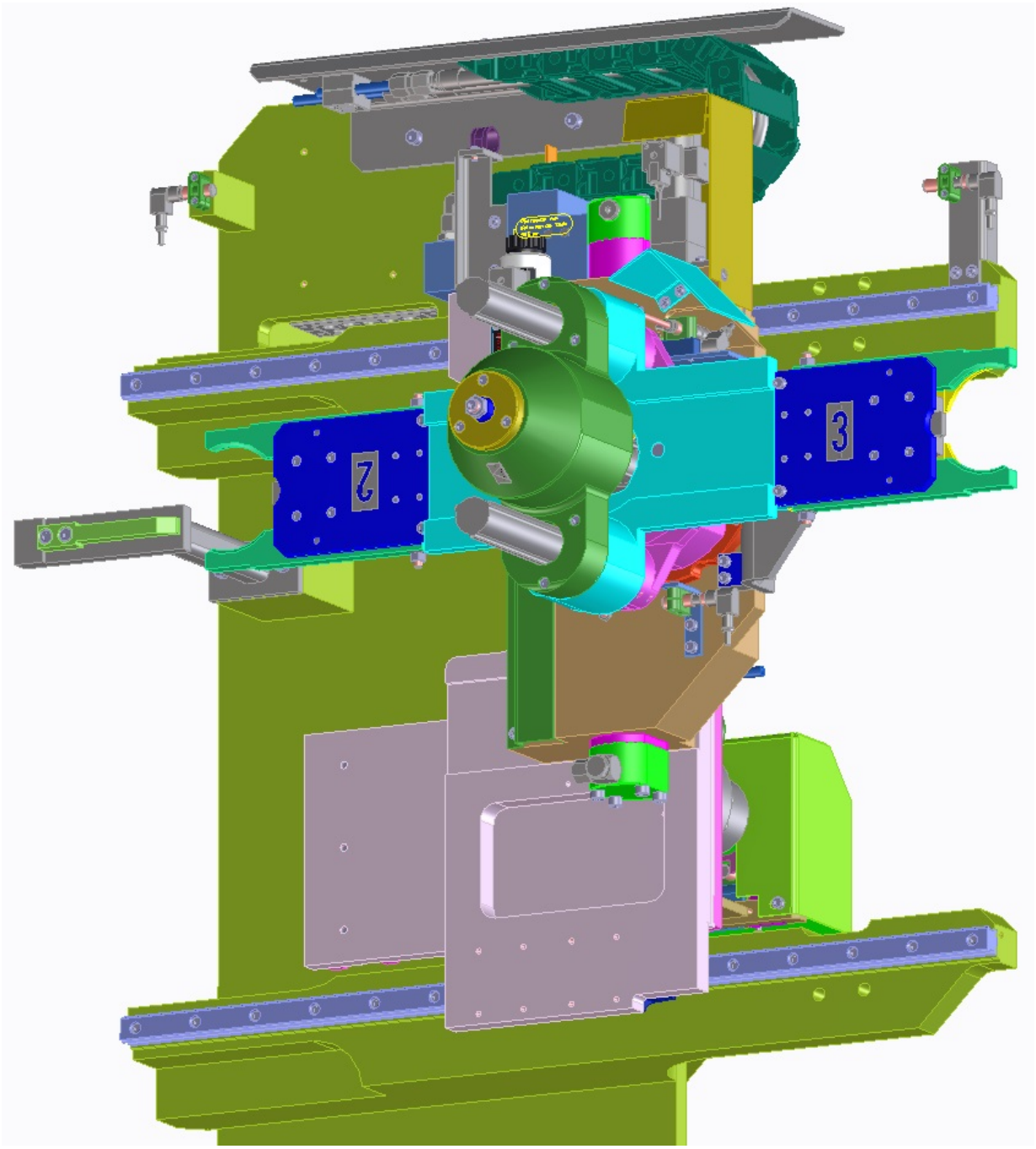


Fig. 44: Tool changer STC 800 (185020)

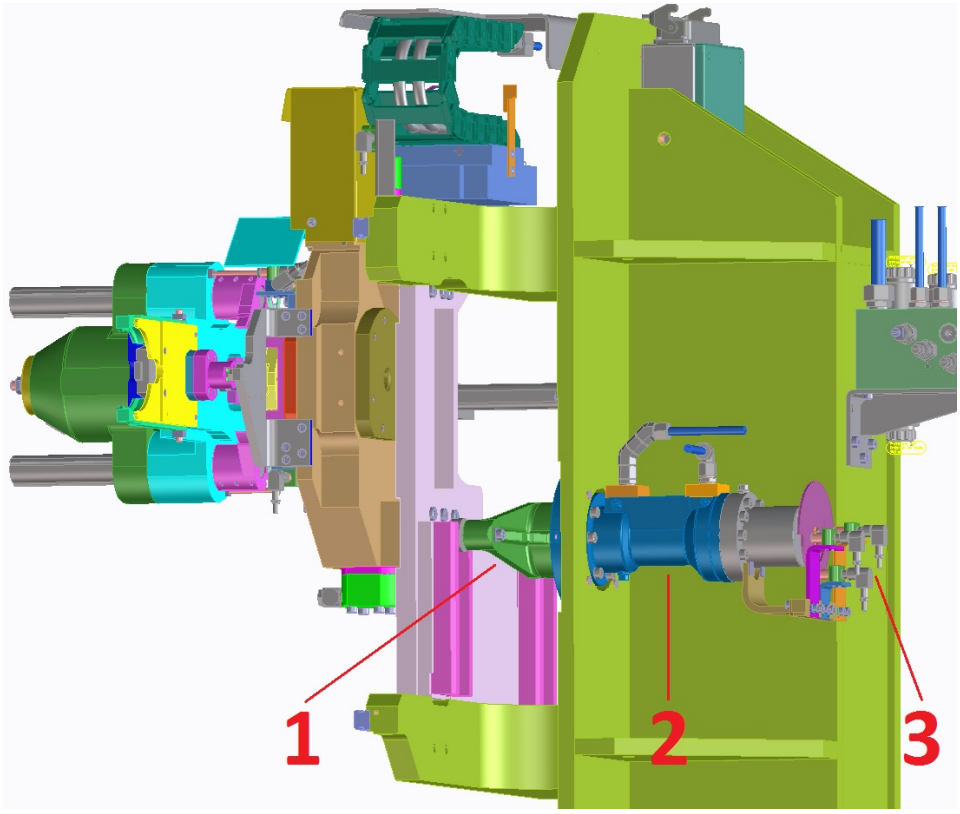


Fig. 45: Tool changer STC 800, drive for slide movement (185020)

1 Drive mechanism
2 Hydraulic swivel motor
3 Sensors and initiator disc

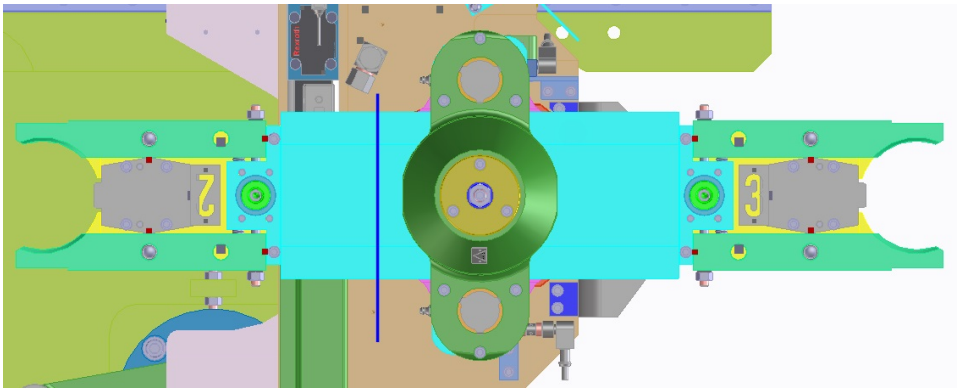


Fig. 46: Tool changer STC 800, double gripper (185020)

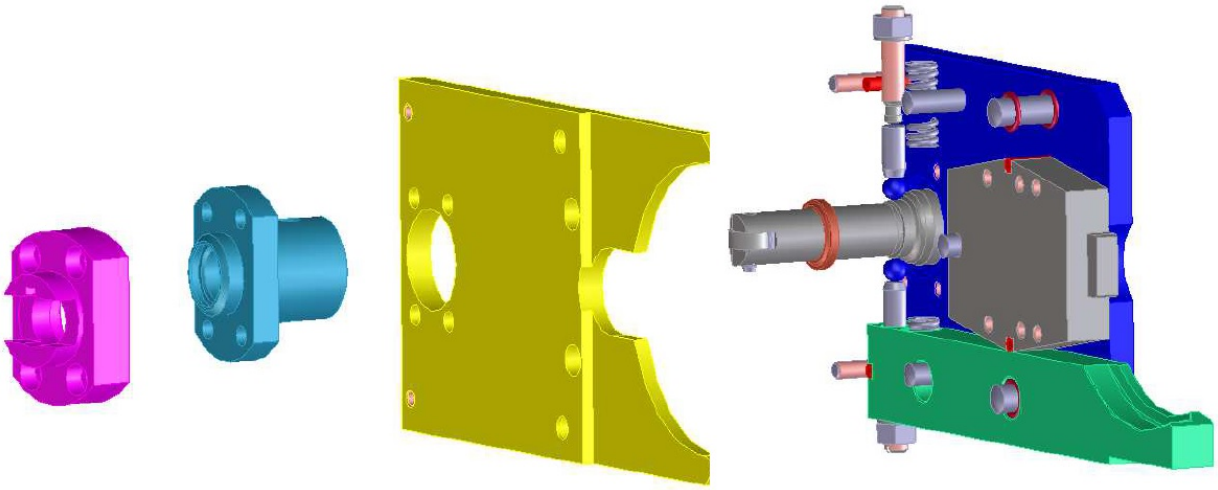


Fig. 47: Mechanical gripper lock

5.5 KMT 128 tool chain magazine

KMT 128 tool change magazines represent a good compromise between small supporting surface, low price, short setup time and easy operation.

The electric motor cuts the machine's energy consumption and reduces operating costs. Furthermore, it reduces susceptibility to failures and cuts maintenance costs compared to hydraulic drive solutions.

KMT 128 stands for a chain magazine with 128 mm spacing.

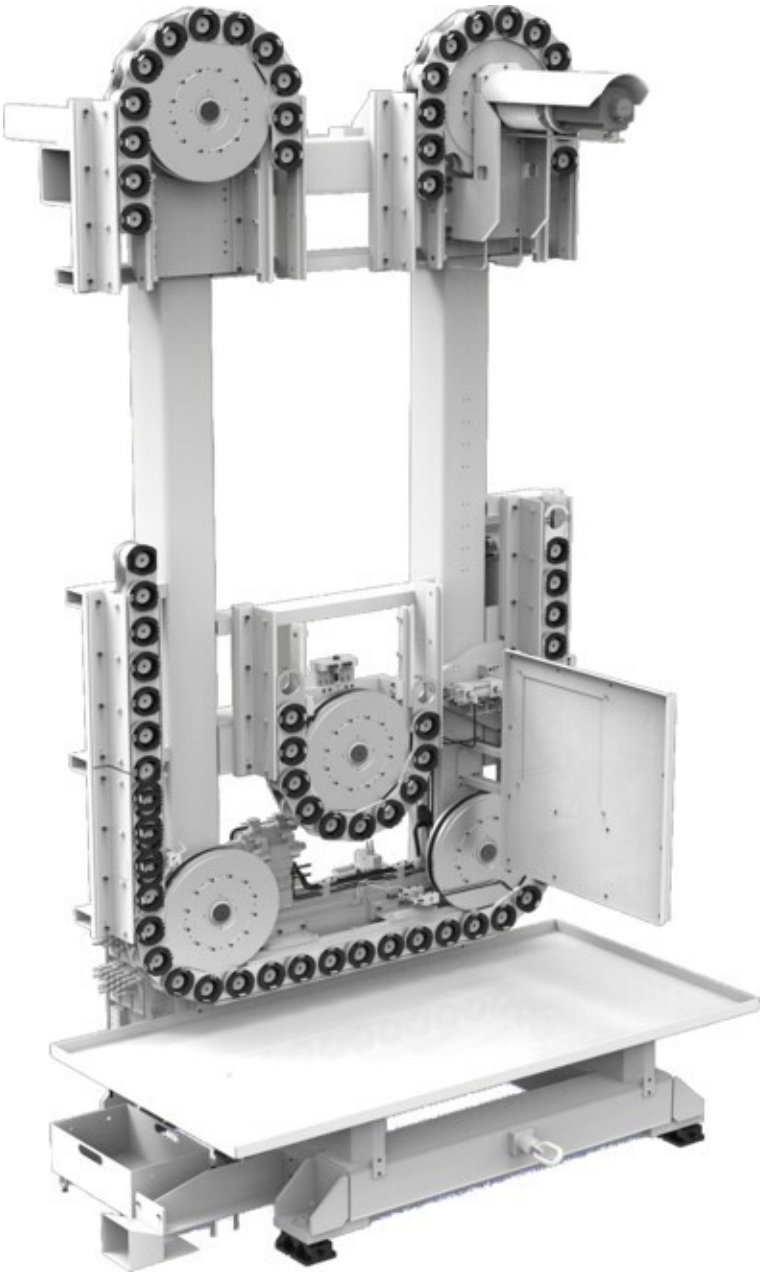


Fig. 48: KMT 128 tool chain magazine (1017354)

5.5.1 Overview

The following versions are available:

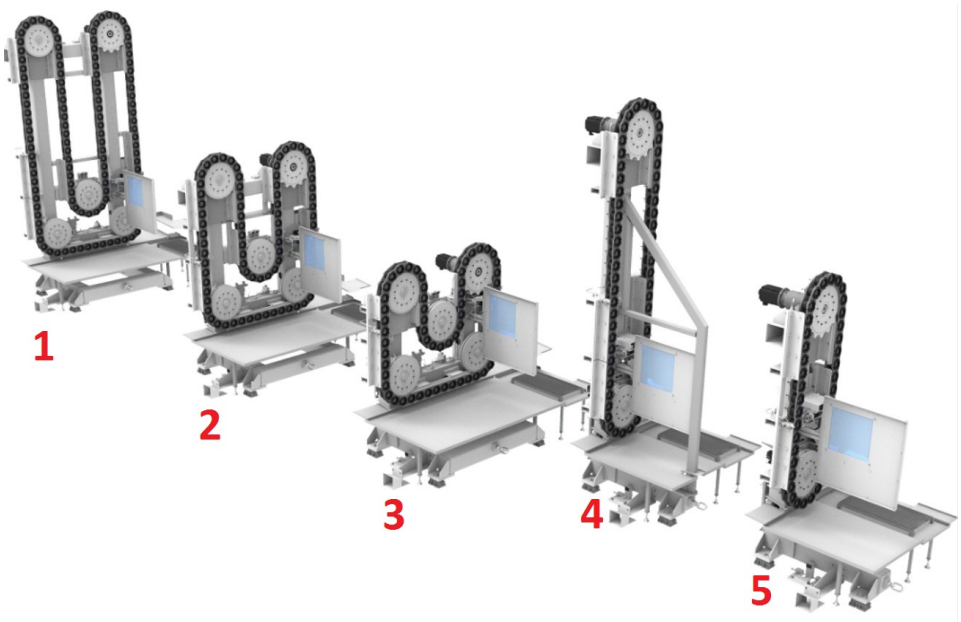


Fig. 49: KMT 128 chain magazine versions

1	120 spaces, meander	4	60 spaces, narrow
2	80 spaces, meander	5	40 spaces, narrow
3	60 spaces, meander		

5.5.2 Frame with chain guide and lubrication

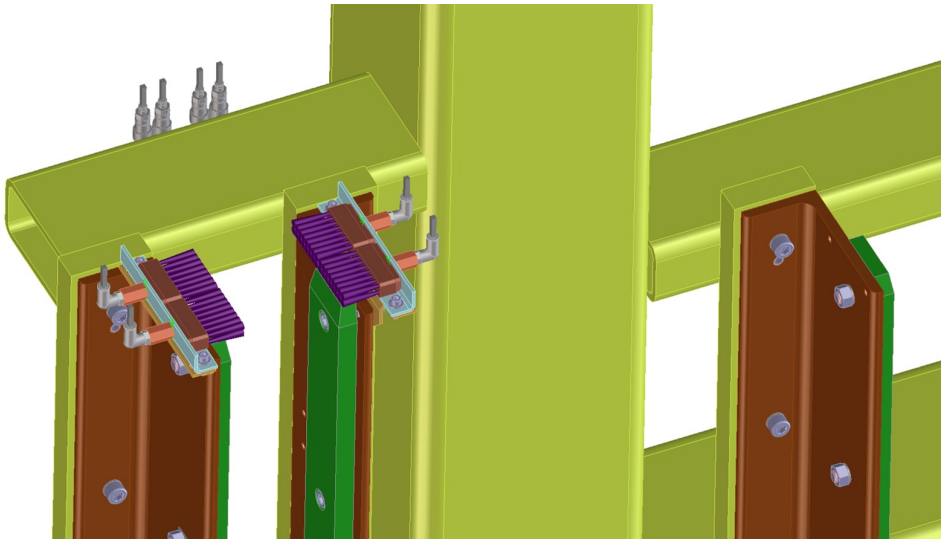


Fig. 50: Frame with chain guide and chain lubrication (1017354)

5.5.3 Magazine chain drive

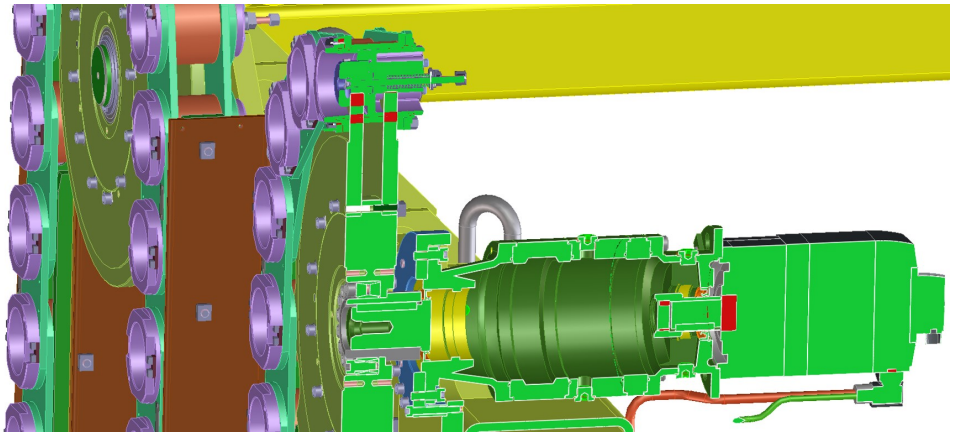


Fig. 51: Rear drive for HEC 500-800 and STC 800 (1017354)

- Siemens / Fanuc motor
- Bonfiglioli - planetary gear
- Clamping set
- Chain wheel

5.5.4 Chain space indexing

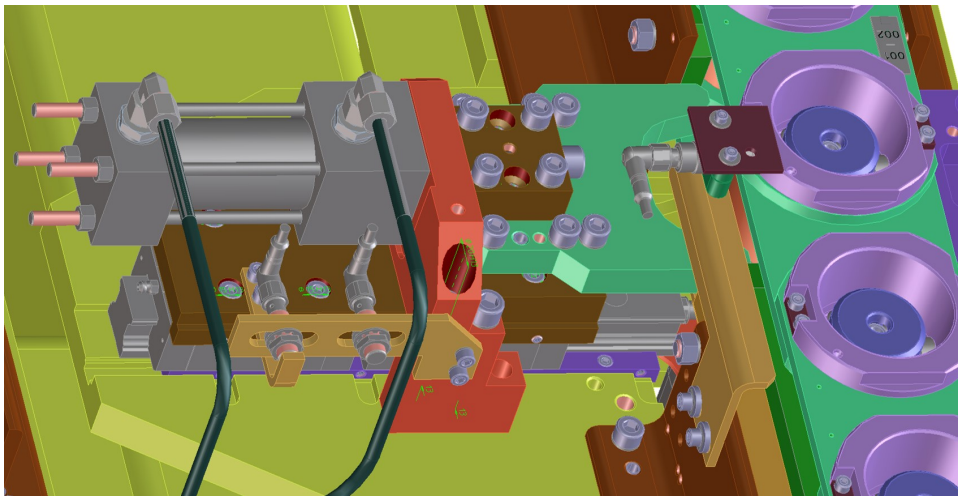


Fig. 52: Chain space indexing (1017354)

5.5.5 Control columns

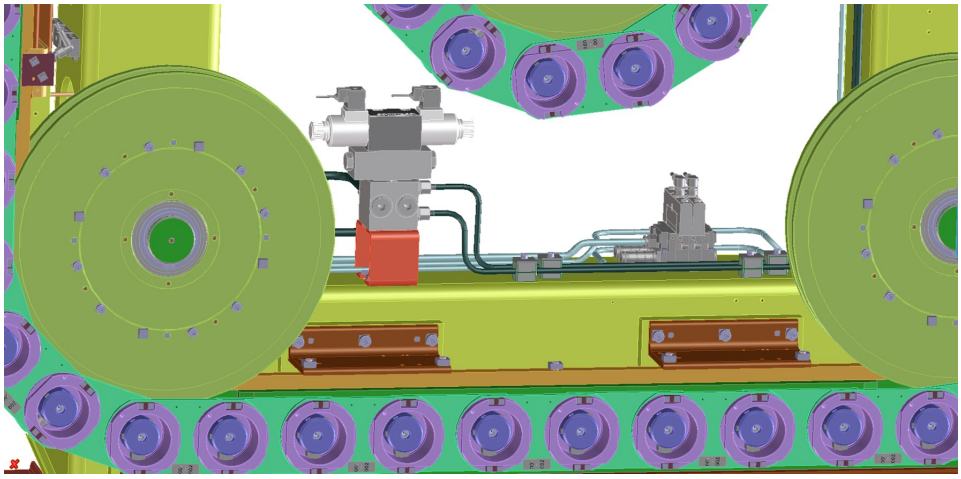


Fig. 53: Control columns (1017354)

5.5.6 Unlocking the loading bay

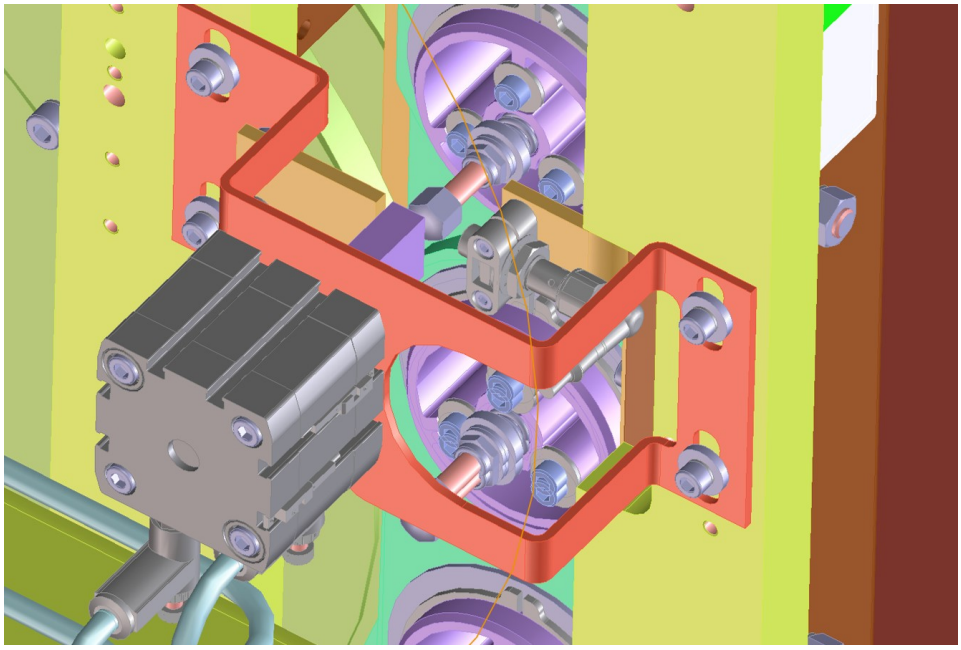


Fig. 54: Unlocking the loading bay

5.5.7 Tool chain space

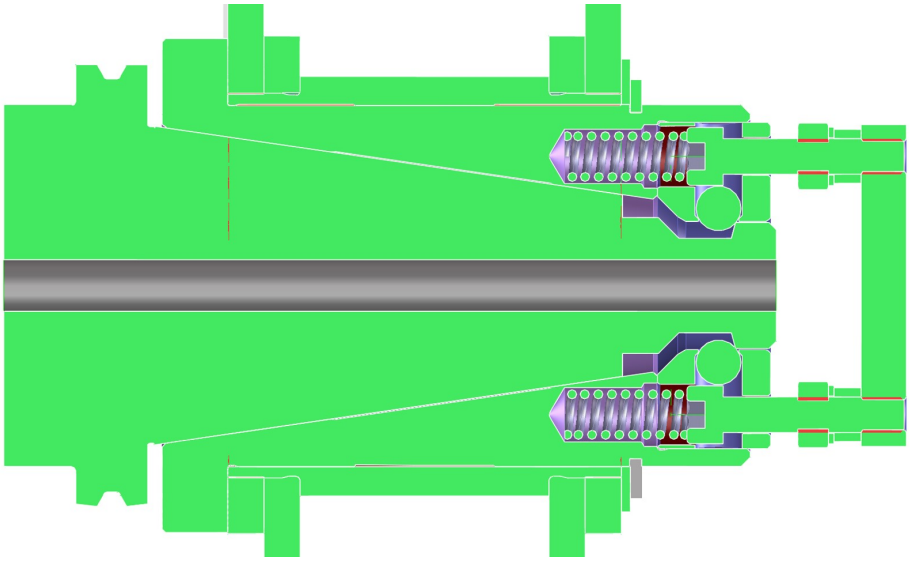


Fig. 55: Tool chain station SK 50

Positive locking with balls and locking units

5.6 Abschlussfragen zum Kapitel

- Wie Funktioniert die Bewegung des Palettenwechslers?
o Elektrisch
o Pneumatisch
o Hydraulisch

- Was ist der Unterschied zwischen Palettenauflagekontrolle und Palettenaufnahmekontrolle?

- Nenne drei Mögliche Fehlerursachen warum die Palettenaufnahmekontrolle auslöst

- Nenne drei mögliche Gründe für den im Video zu sehenden Werkzeugverlust:

- Welche Positionen müssen aktiv sein das der WZW Grundstellung meldet:

- Worüber wird die Endposition der Greiferdrehung definiert?

- Wo befindet sich der Referenzpunkt des WZ-Magazins?

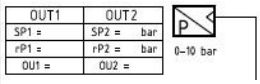
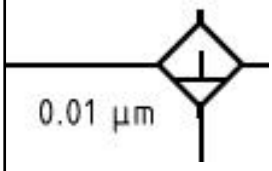
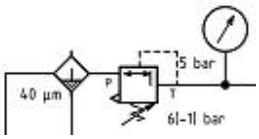
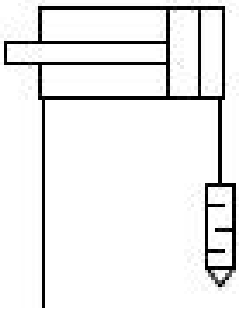
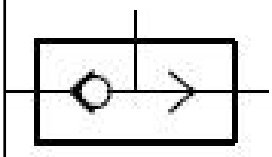
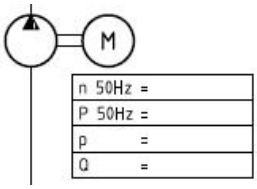
- Zeichne die Magazinachsen in die Zeichnung

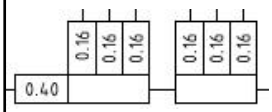
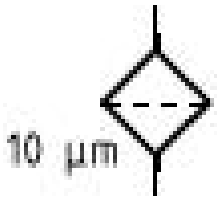
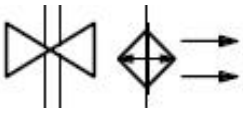
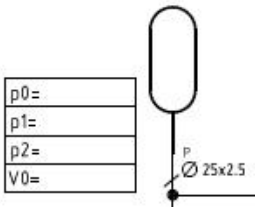
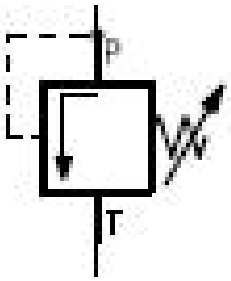
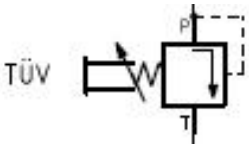
- Welche Antriebsart wird für das Magazin genutzt?
o Riemenantrieb
o Zahnrad – Zahnstange
o Kugelgewindetrieb
o INA Modul
o Planetengetriebe

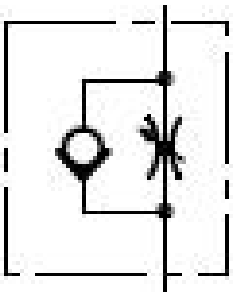
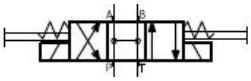
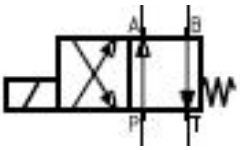
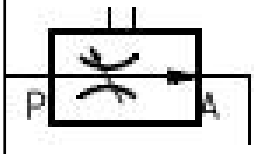
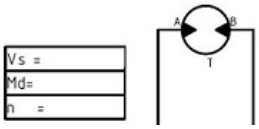
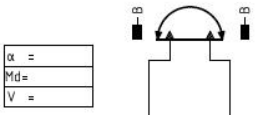
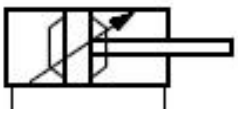
- Wo befinden sich die Sensoren um die Turmposition zu ermitteln?

6 Fluid systems

6.1 Description of the symbols

Symbol	Description
	Electronic pressure sensor with specification of the following variable values: • Switching point • Release position • Function See Pressure Sensor Workshop Instructions.
	Compressed air filter • With manual condensate drain • With specification of the filter fineness
	Compressed air service unit comprising: • Filter with automatic condensate drain • Pressure governor • Pressure gauge
	Pneumatic cylinder • Single-acting • With noise absorber
	Shuttle valve • OR function
	Motor with pump with specification of the nominal values for: • Speed • Power • Delivery rate • Flowrate

Symbol	Description
	Lubricant distributor • For central oil lubrication • With metering valves and volume specifications
	Oil filter • With specification of the filter fineness
	Oil cooler comprising: 1. Heat exchanger 2. Fan 3. Cooling by way of the ambient air
	Pressure accumulator for hydraulic oil With specification of: • Preset gas pressure • Minimum pressure • Maximum pressure • Oil volume
	Pressure relief valve
	Safety valve • Manually actuated (handwheel) • Sealed settings

Symbol	Description
	One-way restrictor • Settable
	4/3-directional control valve • Actuated directly via solenoid or auxiliary actuation by hand • Spring-actuated resetting
	4/2-directional control valve • Single-side-actuated via solenoid • Spring-actuated resetting If no signal is present, the valve switches to the central rest position.
	Flow control valve
	Hydraulic motor with specification of the nominal values for: • Flowrate • Torque • Speed
	Hydraulic motor • With adjustable dampening • With inductive sensors Nominal values specified for: • Adjusting angle • Torque • Volume
	Hydraulic cylinder • Double-acting • With adjustable dampening

6.2 Selected fluid diagrams

example page for fluid plan

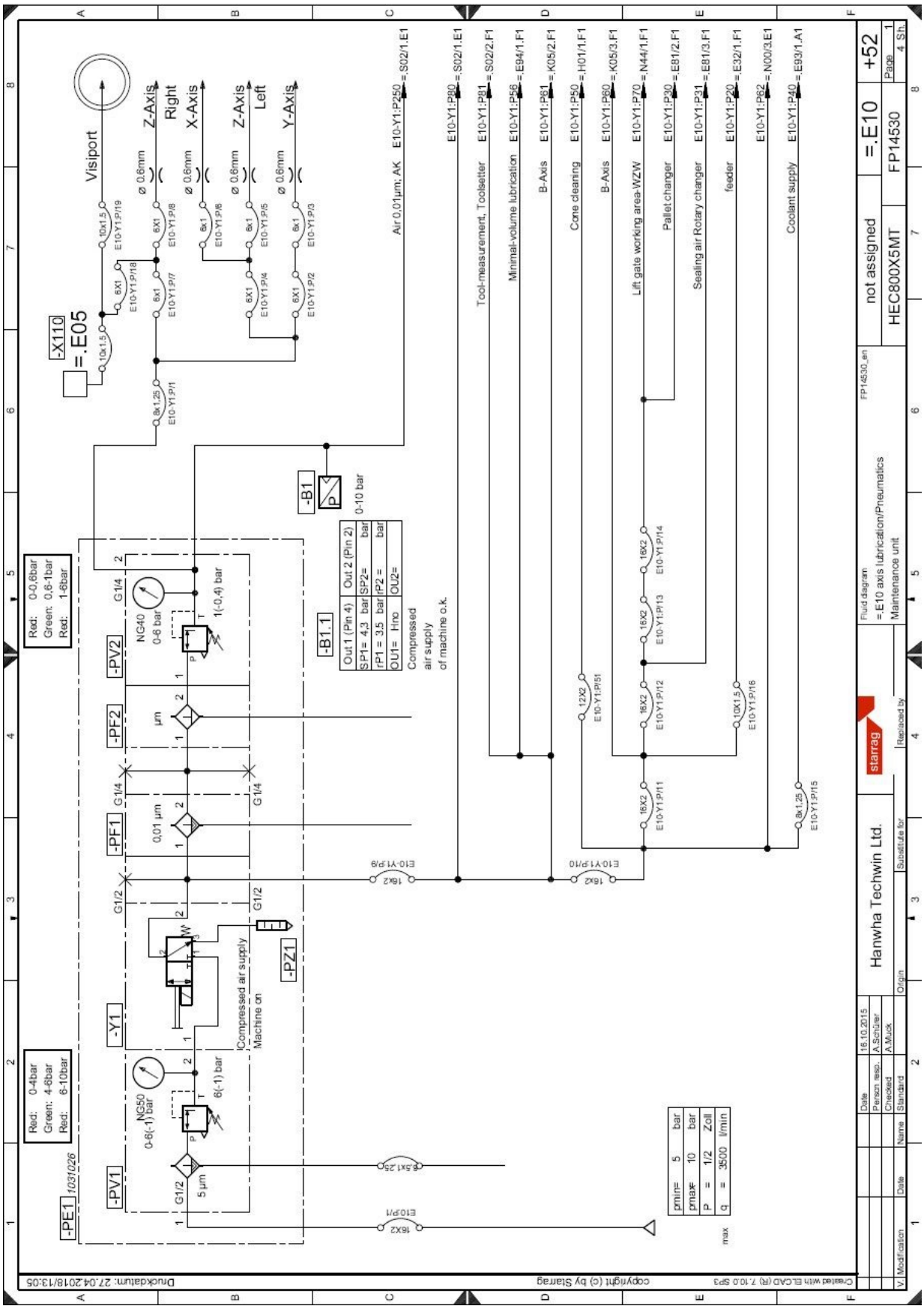


Fig. 56: Circuit diagram of pneumatic maintenance unit HEC 500-800

6.3 Cooling unit

Description

MOTOREX COOL X AW AW is a ready-to use cooling fluid with corrosion protection for high-performance spindles. The active ingredients passivate the various materials and provide lasting protection from corrosion.



Fig. 57: MOTOREX COOL-X AW in a 25 l canister

Advantages

- ready to use
- prevents electro-chemical corrosion
- low-maintenance

Instructions for use

Only use MOTOREX COOL X AW in non-diluted form; do not add water. An average operating temperature of 20 to 25 °C ensures very effective, long-term protection of elastomers susceptible to hydrolysis (e. g. PUR ether). A cooling unit can be used to create these advantageous conditions.

Maintenance

Change MOTOREX COOL X AW every two years.

Before changing, treat the cooling system with 3 % MOTOREX SWISSCARE SC if you are replacing another product with MOTOREX COOL X AW.

Only add COOL X AW in the interim period if liquid is required.

Storage

Store MOTOREX COOL X AW closed in the original container at 5 to 35 °C. At temperatures below -8 °C, the cooling fluid freezes. If this happens, heat the container to at least +5 °C and shake well before use.



Fig. 58: COOL X AW and SWISSCARE SC

⚠CAUTION

Risk of clogging of the machine's cooling circuits

Deposits can settle in MOTOREX COOL X when stored for too long.

- ▸ Do not store MOTOREX COOL X for longer than six months. Observe technical data sheet.

6.4 Cooling lubricant pressure stages (ASi)

A high-pressure pump pumps the coolant centrally via a rotary union through the work spindle to the tool. A proportional valve and a flow monitor are integrated in the line from the pump to the work spindle.

The cooling lubricant is fed centrally to the work spindle. It is guided via a rotary union into the extended tie rod of the tool clamping. Before the tool is changed from the spindle, the cooling lubricant remaining in the feedthrough elements and in the tool is blown out. This compressed air is also used to clean the spindle cone during changeover. With the HSK tool holder, the coolant is fed through the drilled tightening bolt directly into the centre of the coolant tube screwed into the tool holder. When working without a central cooling lubricant through the centre of the spindle, the contact surfaces of the rotary union lift off from each other.

It is possible to set different levels. Perform the settings as follows:

M command	Print value	MD parameters for setting	Example value
M7	30 bar		
M71	40 bar		
M72	50 bar		
M73	50 bar		
M74	25 bar		
M75	15 bar		
M76	10 bar		
M77	5 bar		

The proportional valve must be supplied with the corresponding setpoint value. This setpoint is provided by an ASi module.



Fig. 59: ASi module from Bihl+Wiedemann for controlling the proportional valve

The actual pressure value is read directly from the pressure gauge of the cooling lubricant system.

6.5 Coolant pressure stages (BCD)

With programmable coolant pressure stages, it is possible to set eight stages. The settings are made as follows:

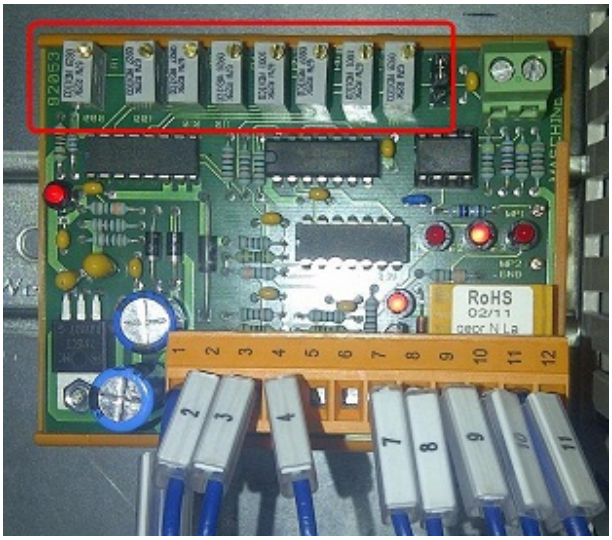
M command	Coolant system 50 bar	Coolant system 60 bar	Coolant system 80 bar	adjustable via potentiometer	Notes
M7	30 bar	30 bar	30 bar	R1	
M71	40 bar	40 bar	40 bar	R2	
M72	50 bar	50 bar	50 bar	R3	
M73	50 bar	60 bar	60 bar	R4	Can be set freely for a 50 bar system
M74	25 bar	25 bar	70 bar	R5	
M75	15 bar	15 bar	15 bar	R6	
M76	10 bar	10 bar	80 bar	R7	
M77	5 bar	5 bar	10 bar	R8	Special pressure stage (e.g. for taper flushing)

The settings in the table above are made using one potentiometer each on the BCD analog converter card supplied from Knoll.

The potentiometer is used to set the relevant setpoint for the vario-valve.

The pressure actual value is read directly from the pressure gauge.

View of the BCD analog converter card for adjusting the coolant pressure stages:



6.6 Abschlussfragen zum Kapitel

- Was bedeutet die Druckangabe „p0“ im Fluidplan (z.B. für die Druckspeicher)?

- Ein Druckschalter kann als Hnc & Hno programmiert werden, was bedeutet diese Bezeichnung?

- Kann man das Ventil E21Y1 Handbetätigt werden? Wenn ja, wie?

- Beschreibe das Befüllen eines Druckspeichers (mit korrekter Reihenfolge)

7 Options

7.1 Emission extraction

This training document contains selected extracts from the separate operating instructions of the extractor system.

The separate operating instructions for the specific extractor system are always an integral part of the complete machine manual. They contain further instructions on handling the specific extractor system as well as in particular instructions on environmental protection and occupational health and safety.

During all work on the extractor system, observe the separate operating instructions, in particular the safety instructions contained!

Siphon connectors

Please without fail observe the following instruction,
otherwise the devices will not function:
After installation, fill the siphons with cooling lubricant. This is also necessary after longer periods of standstill!
(Check the following:
During filling, fluid must run out of the hose or pipe at the bottom!)

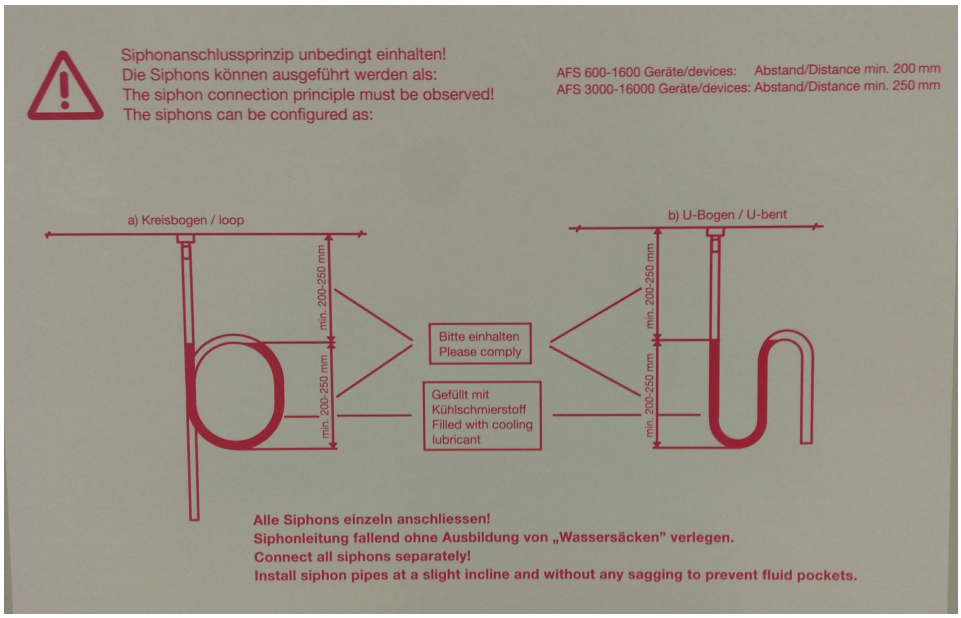


Fig. 60: Siphons filled with fluid

Separating and filter elements

For cleaning or replacement, the elements can be pulled out at the side. The service life is determined to a large extent by the contamination of the air extracted from the work space. Check the degree of contamination monthly. Clean or replace as required.

Do not change the arrangement, number and installation position of the separating and filter elements! Only use approved elements!

1. Pre-separators: The pre-separators are made of non-corroding metal mesh and are washable. Clean them with hot water and degreasing cleaning agents or with a high-pressure cleaner.
2. Pre-filter mats: Filter mats of filter classes G 3 - F 6 are used as pre-filters. Replace them when they are soiled. You can use commonly available filter mats with a thickness of 20 mm.
3. Main separator: Characteristic of the main separator is a high self-cleaning performance. It must be cleaned if it is visibly and very severely soiled. Clean the entire separator with hot water and degreasing cleaning agents. Do not open or remove the separator! Do not use organic cleaning agents! On installation, make sure you observe the airflow direction indicated by the airflow arrows on the separator frame.
4. After-filter: Use a particle filter of filter class H 13 as an after-filter. Replace it when soiled (saturated) and/or if soiling reduces the air suction performance. The after-filter cannot be cleaned. When replacing an after-filter, observe the separate operating instructions for the extractor system!

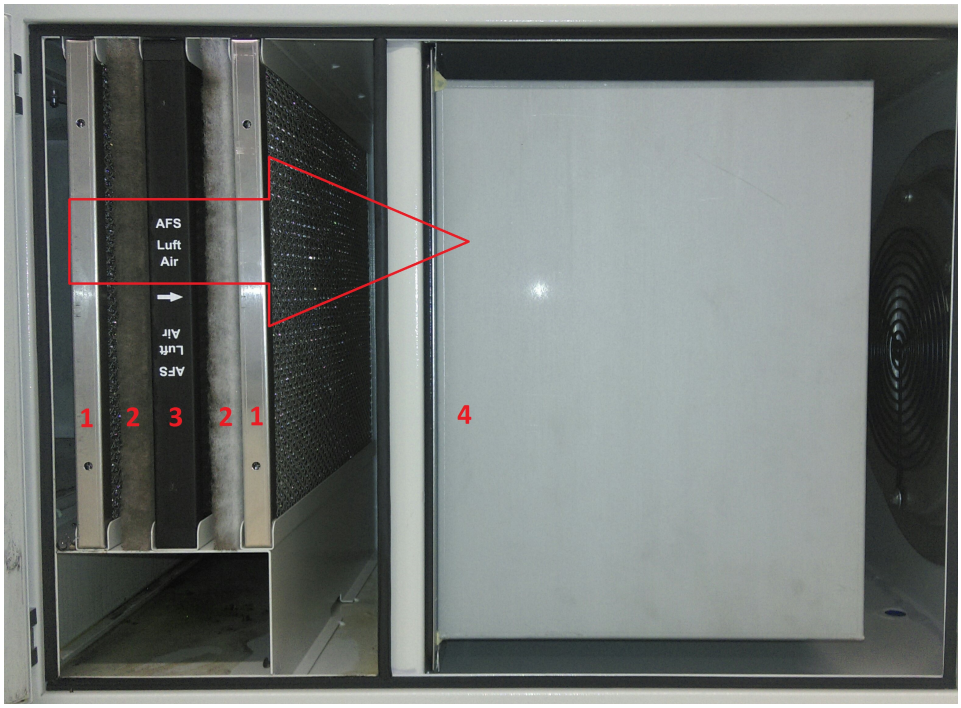


Fig. 61: Extraction with separator and filter elements

1	Pre-filters (2x)	3	Main separator (1x)
2	Pre-filter mats (2x)	4	After-filter (1x)

7.2 Abschlussfragen zum Kapitel

Wozu muss der Siphon an der Absaugung mit Wasser befüllt sein?

Wie funktioniert die BBK?

8 Maintenance and lubrication

See section 04 of the plant management.

In the training the maintenance schedule and the lubrication instructions of the specific machine are dealt with by means of the following questions:

- Which concrete recommendations for maintenance are there according to the operation of the specific machine?
- Which maintenance work can be carried out by maintenance personnel on site on their own responsibility?
- For which maintenance work is it better to contact Starrag?
  See chapter "Service products".

Learning objectives:

1. Those participating understand which maintenance work the maintenance personnel on site can perform independently and which equipment is necessary.
2. Those participating can perform this maintenance work on site in the required quality on the specific system according to manufacturer specifications.

See chapter "Recommended measuring and auxiliary equipment"

8.1 Service products

Service products

Service products	Contents	Customer benefit
Daily inspection	• Actual status acquisition • Assessment of wear condition • Evaluation and action plan	• low downtime • Overview of the status by an expert • Prevent failures • Proactive planning for component replacement
Geometry control	• Actual status acquisition geometry • Evaluation and action plan	• written evaluation of the condition • Detect any inaccuracy that may arise in advance
FingerPrint online course	• Frequency response analysis • Circularity test • Stromaufnahmen • Degree of contamination of the measuring systems • Spindeldiagnose (IFM) • Evaluation and action plan	• Assessment of the drives and axes • low expenditure of time • Detect damage early (spindle failures)
FingerPrint On-Site	• Frequency response analysis • Circularity test • Degree of contamination of the measuring systems • Spindle diagnosis (IFM) • Thermographic review • Quick Check • Evaluation and action plan	• Experte vor Ort • Beurteilung der Antriebe und Achsen • low expenditure of time • Detect damage early (spindle failures)
Preventive inspection type B	Consisting of: • Daily inspection • Geometry control	• Actual status acquisition • Axis condition detection
Preventive inspection type A	Consisting of: • Daily inspection • FingerPrint On-Site	• Actual status acquisition • Assessment of the drive and axis states without spindle values
Small maintenance	• Control of all transfer positions • Exchange of wear part package • Assessment of wear reserve / degree of wear • Daily inspection	• Values preserved • Reduce failures • reduce costs • Increase service life • Effective maintenance through prior inspection

Service products	Contents	Customer benefit
DynamicWartung	Consisting of: • Small maintenance • Preventive inspection type A / B • Exchange of all operating materials	• Values preserved • Reduce failures • reduce costs • Increase service life • Assessment of the drive and axis conditions
Major maintenance	Consisting of: • Geometry control • Small maintenance • Exchange of all operating materials	• Values preserved • Reduce failures • reduce costs • Increase service life • State of the axle geometry

Tab. 1: Serviceprodukte Starrag GmbH

If you have any questions, please contact customer service Starrag GmbH.

phone number:+49 371/8362368

e-mail address: *service.heckert@starrag.com*

8.2 Abschlussfragen zum Kapitel

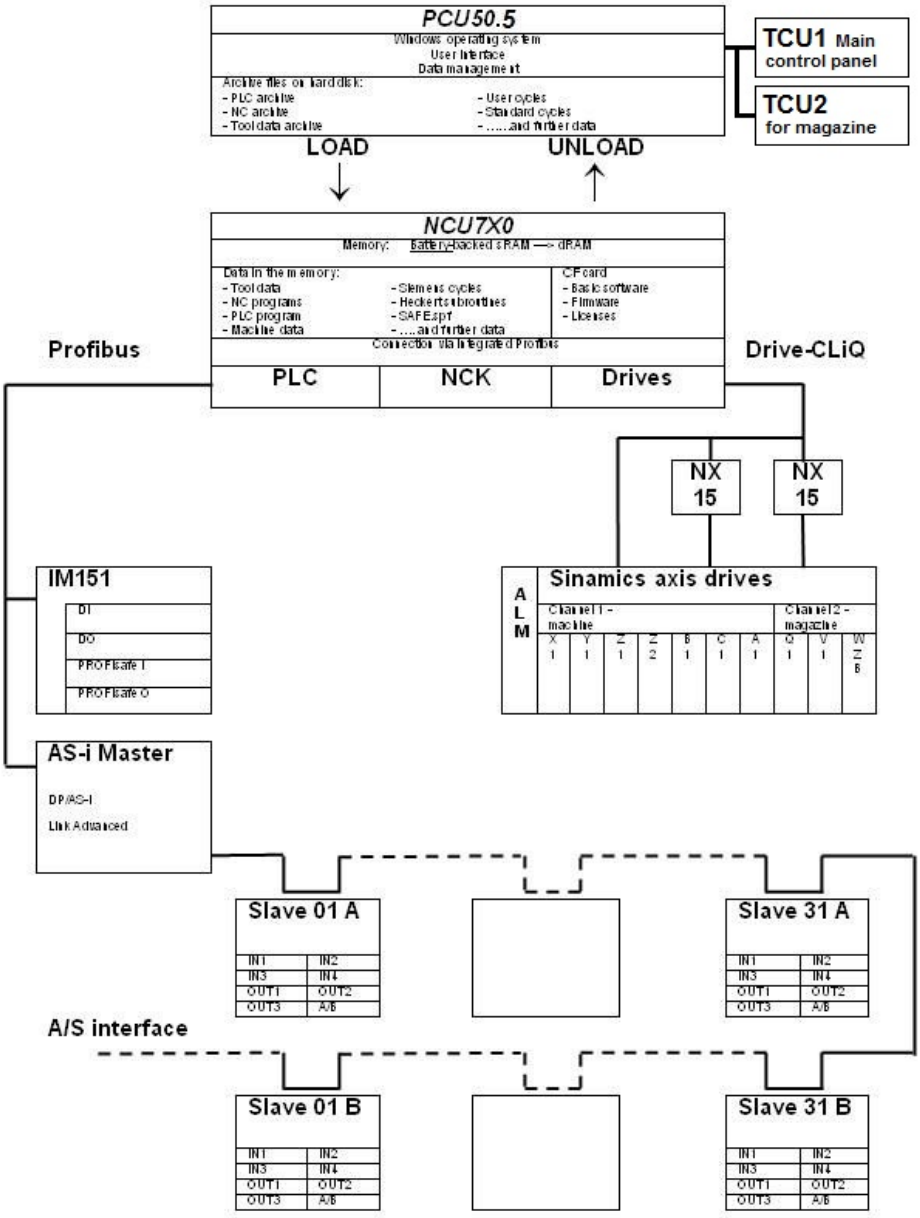
Welche Schmierstoffe werden verwendet?

Welches Wartungsintervall hat das Cool X AW?

9 Control and drive system

9.1 System Overview

9.1.1 General structure of Solution Line



9.1.2 System components

9.1.2.1 IPC

The Microbox PC Simatic IPC427E provides a compact PC platform for the machine- and process-oriented operation.

- Intel Core-i Processors
- Storage technology with ECC and DDR4
- Flexible storage concepts (SSD, CFast or HDD)
- Front LEDs for efficient self-diagnostics and headless operation

Maintenance-free:

- **No rotating parts (fan, hard drives)**
- **Battery-free operation possible**

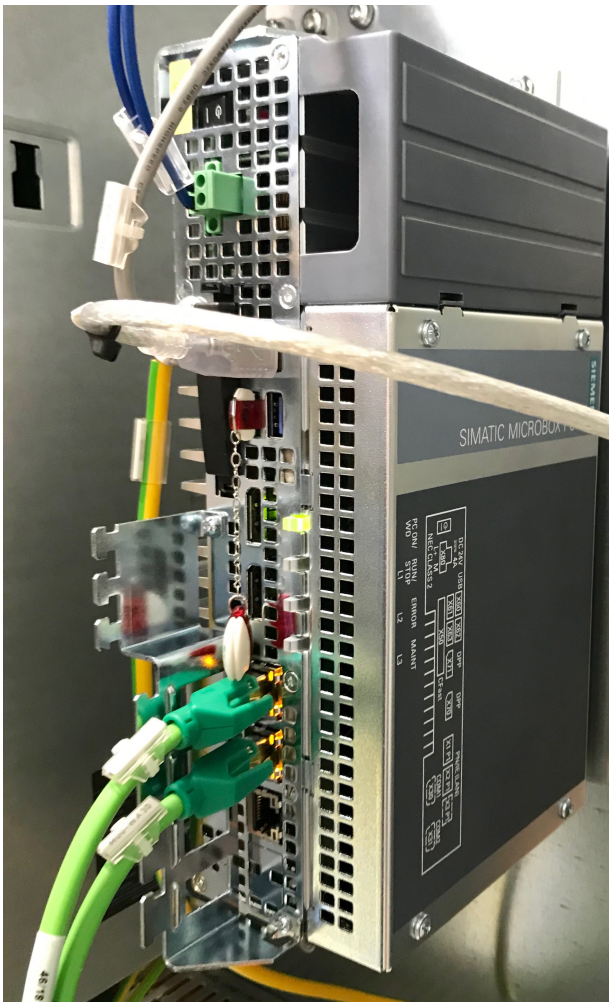
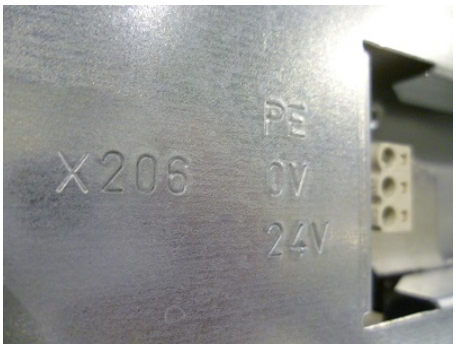


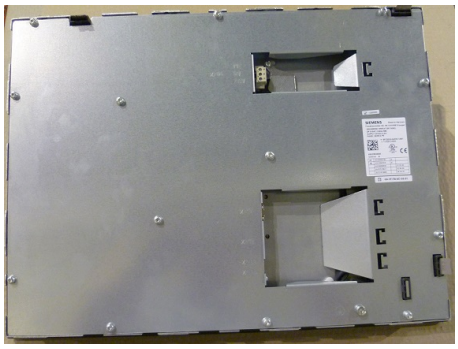
Fig. 62: Microbox PC SIMATIC IPC427E

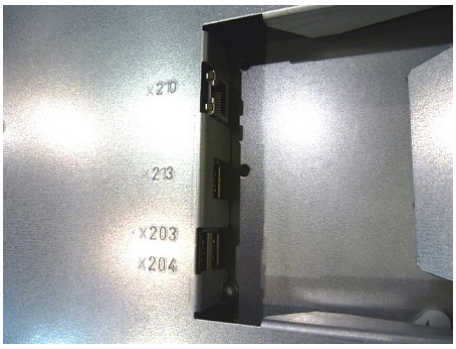
Interfaces

- 3 x LAN 10/100/1000 MBit/s connections, teaming-capable (permits redundancy of network cards)
- Onboard PROFINET interface (optional)
- 4 x High-Speed USB 3.0 Ports
- 2 serial interfaces (COM)
- Can be expanded with up to 2 PCIe slots
- On/Off switch

9.1.2.2 Interfaces of the OP 015 AT operator panel







X206	Power supply
X210	Ethernet
X213	USB interface
X203 X204	USB interface

9.1.2.3 NCU

General

The NCU720 is used as standard. The NCU (Numeric Control Unit) performs all CNC, PLC and communications tasks.

Interfaces

The NCU module provides the following interfaces

X101-105	6 x Drive CLiQ ports
X122, X132	8+8 digital inputs/outputs
X124	24V power supply
X120	Ethernet connection (connected to the HUB; for general use)
X127	Ethernet connection (not enabled)
X130	Ethernet connection (for free use)
X126	Profibus DP port DP1
X136	Profibus DP port DP2/MPI
X125, X135	USB ports
X131-134	3 x measuring sockets (to be configured via the STARTER start-up software)

Interfaces and operator controls of the NCU



The NCU module has the following interfaces

X101-105	6 x Drive-CLiQ ports
X122, X132	8+8 Digital inputs-outputs
X124	Power supply 24V
X120	Ethernet connection (Connected to HUB. For general use)
X127	Ethernet connection (Not approved.)
X130	Ethernet connection (Free for use.)
X126	Profibus DP port DP1
X136	Profibus DP port DP2/MPI
X125, X135	USB interfaces
X131-134	3 x measuring sockets (project planning via setup software STARTER)

Interfaces and operating elements of the NCU



Switches and displays

Valid for HEC and H5 series.



Fig. 63: Switches and indicators

Switch S3 (SIM/NCK commissioning switch)

Position 0	Normal operation
Position 1	NCK general reset
Position 7	NCK not started on booting
Position 8	Display of IP address at X130

Switch S4 (PLC operating mode switch)

Position 0	PLC in operating mode
Position 1	PLC in operating mode, protected
Position 2	PLC in STOP
Position 3	PLC general reset

LED (top row)

RDY	Write/read access to CF card (yellow)
RDY	NCK not active (red)
RUN	PLC RUN state (green)
STOP	PLC STOP state (red)
SU/PF	Force PLC active (yellow)

LED (bottom row)

SF	PLC error (red)
DP1	Error on Profibus (red)
DP2	Error on Profibus (red)
OPT	Error on option module (red)

7-segment display

6	Booting completed (ready)

Replacing battery and fan

The NCU is fitted with battery-backed SRAMs. The backup battery is monitored by the NCU. After the battery monitoring has tripped for the first time, the battery must be replaced within the next six weeks. The battery/fan module can only be changed when the module is switched off. The data is backed up for a time of approx. 15 minutes.

It is recommended to change the battery/fan module yearly within the framework of the machine maintenance.

To change the battery/fan module, proceed as follows:

- Press the module back at an angle. Thus, it is released from its front locking.
- Hold the module to the front at an angle. Pull the plastic strip off the cutout in the NCU.
- Remove the old battery using a screw driver. Remove the connector.
- Connect and insert the new battery.
- Hold the module tilted to the front, with the open side to the top.
- Reinsert the plastic strip into the cutout in the NCU.
- Tilt the module upwards until the upper locking snaps in.

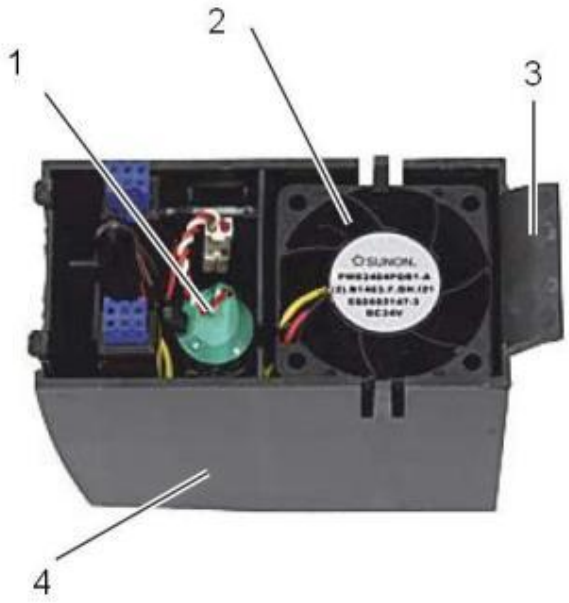


Fig. 64: Battery / fan module

1. Battery
2. Fan
3. Plastic bar
4. Battery/fan module

Compact flash card (CF card)

The CF card is imperative for operation of the NCU.

The following data is saved on the CF card:

- Basic software of the control system
- Firmware of the drives
- Drive parameters
- User data
- Version information
- License information



Fig. 65: CF card

9.1.2.4 NX15 expansion module

The NX15 expansion module provides the following additional interfaces:

X100-103	4 x Drive CLiQ ports
X122	4+4 digital inputs/outputs
X124	24V power supply

9.1.2.5 Machine control panel

An MCP483 is used as the machine control panel.

- 50 keys with assigned LEDs
- Spindle control with spindle override (16-position rotary switch)
- Feedrate control with feedrate/rapid traverse override (23-position rotary switch)
- Keyswitch with four different positions and three different keys
- EMERGENCY STOP control device



Fig. 66: MCP483

9.1.2.6 Power supply for the drives

The power supply to the drives is ensured by an Active Line Module (ALM).

- Self-commutated infeed/regenerative feedback unit.
- Generation of intermediate circuit voltage for motors.
- Mains feedback: the surplus intermediate circuit energy generated by the braking process is fed back into the mains.
- Connection to NCU via DriveCLiQ interface.



Fig. 67: Active Line Modules (ALM)

The network properties are to be re-calibrated when installing an ALM or following the conversion of the machine.

9.1.2.7 Motor modules

The motor modules are available as single and double-motor modules.

- “Single Motor Module”
- “Double Motor Module”

Features

- Compact design
- Integrated intermediate circuit and 24V bus bar system
- Diagnostics LED
- Short-circuit-proof, earth-fault-proof
- Integrated safety functions
- Integrated motor braking connection



Fig. 68: Motor modules

9.1.2.8 Connecting external measuring systems by way of sensor modules

Sensor modules are used to connect external measuring systems without Drive-CLiQ interface. This pertains, e.g. to:

- the Heidenhain linear measuring systems in the X1, Y1, Z1 etc. axis;
- the Heidenhain rotary encoders in the A1, B1, CSP1 etc. axis;.

Sensor modules of the types SMC20 and SME125 are used.

- SMC20: Sensor Module Cabinet-Mounted
  - for installation in the control cubicle;
  - for incremental and absolute encoders.
- SME125: Sensor Module External
  - for installation inside and outside the control cubicle
  - for absolute-value encoders
  - Integration of temperature sensor possible



9.1.2.9 Connecting the motor measuring systems

The encoders are integrated in the Siemens motors. (motor measurement systems)

The motor measurement systems are also connected via DriveCLiQ interfaces.

The DriveCLiQ interfaces are located on the integrated sensor modules. (Type SMI20)

This applies to, for example:

- The motor measurement systems in the linear axes X1, Y1, Z1, etc.
- The motor measurement systems in the rotary axes A1, B1, etc. (Exception: Torque motor!)
- The motor measurement system of the main spindle CSP1 (Exception: Motor spindle!)
- The motor measurement systems in the tower magazine axes V1, W1 and WZB.



The motor, the motor measurement system and the integrated sensor module SMI form one unit. This unit is completely replaced during service. The SMI sensor module stores data about the motor and the motor measurement system. This data must be transferred from the control system to the new SMI sensor module during service.

9.1.2.10 Distributed PLC I/O modules and safety technology

The PLC periphery of the Simatic ET-200SP type is connected to the NCU via Profinet. The IM151 interface modules allow a multi-line layout. The lines are also connected via Profinet. The electronic modules are plugged onto the IM151 interface modules.

The following electronic modules are used by default:

- Digital electronic module 8DI: 8 inputs, DC 24V
- Digital electronic module 8DO: 8 outputs, each 0.5A, short-circuit protection, DC 24V
- Digital electronic module 4DO: 4 outputs, each 2.0A, short-circuit protection, DC 24V
- Analogue electronic module 2AI U ST: 2 inputs for voltage measurement

Fail-safe modules are used for the safety functions (Safety Integrated):

- Digital electronic module 4/8 F-DI PROFIsafe: 4/8 inputs, DC 24V
- Digital electronic module 4F-DO PROFIsafe: 4 outputs, each 2.0A, DC 24V

The PM-E power modules for supplying power are also plugged on.



Fig. 69: Interface modules IM151, electronic modules

Power supply of the sensors

The sensors can be supplied with 24V either externally or internally.

The terminals VS1 and VS2 are used for internal supply. These provide two clocked supply voltages. This monitors the sensors for short-circuit.

The short-circuit monitoring is disabled in the event of external supply.

9.1.3 Electronic key system "PITmode”

9.1.3.1 Description

Scope

The Machinery Directive (MC) 2006/42/EC (Point 1.2.5. "Selection of control or operating modes") places increased demands on the safety of machines in accordance with the latest level of technology.

This refers not only to risks during production, but also to the phases of setting-up, measuring, loading, cleaning and service. One very important point in this connection is reduction of the likelihood of manipulation of the protective devices.

Tamper-proof safety switches, concealed installation and access systems are implemented to limit the possibilities for manipulation and to restrict the use of special functions to certain categories of persons.

Through the use of employee-related electronic access systems, it is possible to trace who has been active at the machine with which authorization level.

Special safety modes are defined in the appropriate standards (e.g. DIN EN 12417, DIN EN16090, EN ISO 12100…).

Modes of safe operation, functional modes and functions

The term "operating mode" is used in many ways. In addition, its use in the relevant standards has changed several times; in most documents in the German language, "BA" is used as the abbreviation for "Betriebsart", while OM = operating mode or SOM = safe operating mode in English texts.

The definitions currently in use are

SBA = German: "**Sicherheitsbezogene Betriebsart**" (English: MSO = mode of safe operation)

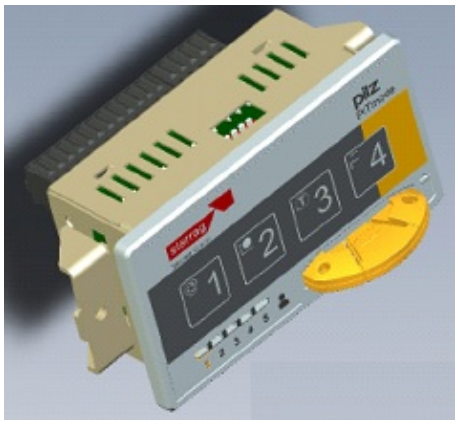
The term "Mode of safe operation" covers an available group of functions with common features which do not exceed a certain risk level. A mode of safe operation is itself not a function.

A **functional mode** specifies the mode of execution of a limited group of functions.

A **function** is the interaction of machine components with the objective of performing a certain task.

A **safety function** is a function of a machine that, in case of failure, may lead to an immediate increase in the risk of injuries.

9.1.3.2 Operating mode selector switch "PITmode"





The electronic key system "PITmode" replaces the operating mode selector switch on the machine control panel and the "Service switch" in the control cabinet of the NC control systems.



Fig. 70: Siemens CNC

General

Three electronic keys with the authorization levels 1 to 3 are handed over to the customer together with the machine in the basic configuration.

Further keys can be ordered in the sense of special options when the machine is sold or later through the service department.

Basic keys

- MSO 1 → key no. 1 (authorization for the automatic mode only)
- MSO 2 → key no. 2 (automatic and setting-up modes)
- MSO 3 → key no. 3 (automatic, setting-up and extended setting-up modes)

Each key possesses an unambiguous 9-digit ID.

When the key is inserted, the date, time, ID and the selected MSO are saved.

Both the assignment and management of the keys remain the responsibility of the customer.



The keys for the special operating modes MSO SP and MSO SE are only handed out subject to corresponding training (at the customer's expense) and after appropriate proof of training has been taken to the records.

Advantages

- Reduced risks during setting up, measuring, loading, cleaning and service
- Safety switch which cannot be manipulated or can only be manipulated with significant difficulty
- Tracing of who has been active at the machining center with which authorization level (only in agreement with the company operating the machine)

9.2 CNC / Drives

9.2.1 Machine and setting data

9.2.1.1 Concept of protection levels

Protection levels are provided from 0 to 7, with 0 being the highest and 7 the lowest levels. The protective levels are locked via the electronic key system Pit-Mode.

The operator is only granted access to information that corresponds to the appropriate protection level (and the correspondingly lower levels). The machine data are assigned different protection levels by default. To display machine data, at least protection level 4 (PitMode key 3) is required.

The commissioning generally requires the protection level which is enabled with the password "EVENING".



The password remains set until it is reset by selecting the DELETE PASSWORD softkey. POWER ON will NOT reset the password!

9.2.1.2 Handling machine data

Machine data are addressed either via their number or their name. Both the number and the name are displayed. Further subdivision of a number is possible via indices.

The machine data (MD) are divided into the following areas:

- General MD
- Channel MD
- Axis MD
- Control unit MD
- Incoming supply MD
- Drive MD
- Display MD

(The exact subdivision is dependent on the software version.)

To display machine data, at least protection level 4 (keyswitch position 3) is required.

Calling the machine data

- Main menu
- "Setup" softkey

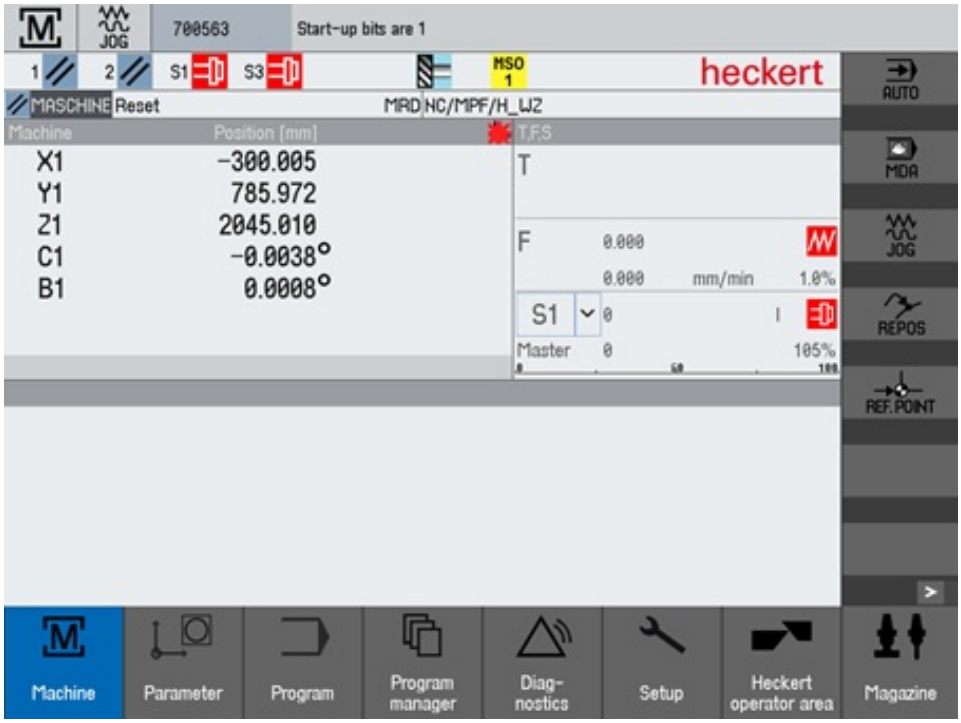


Fig. 71: "Machine" main screen

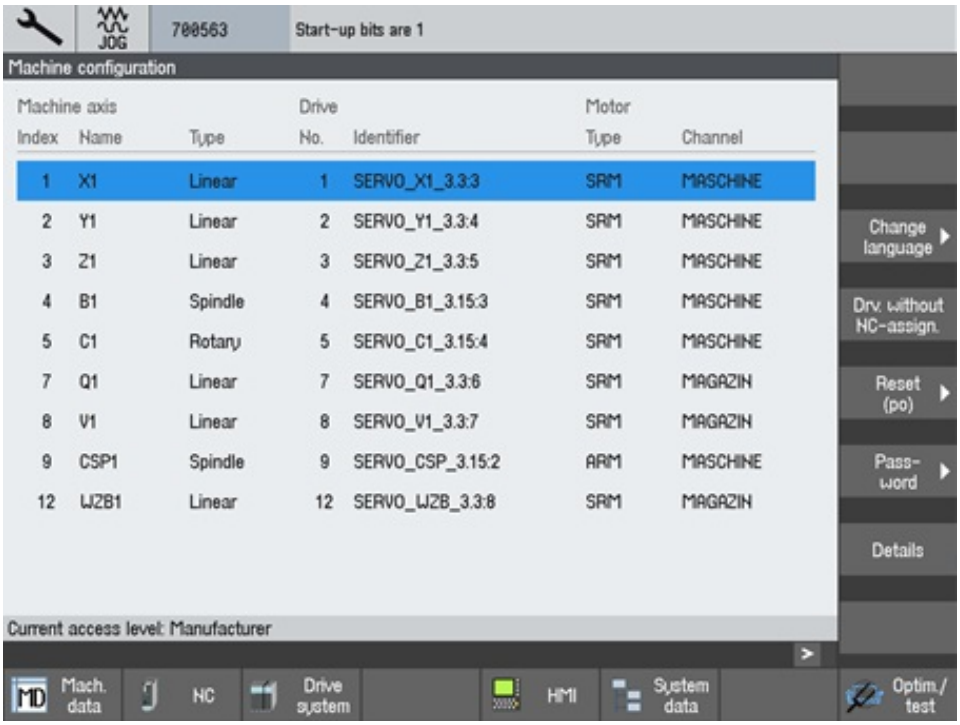


Fig. 72: "Start-up" main screen

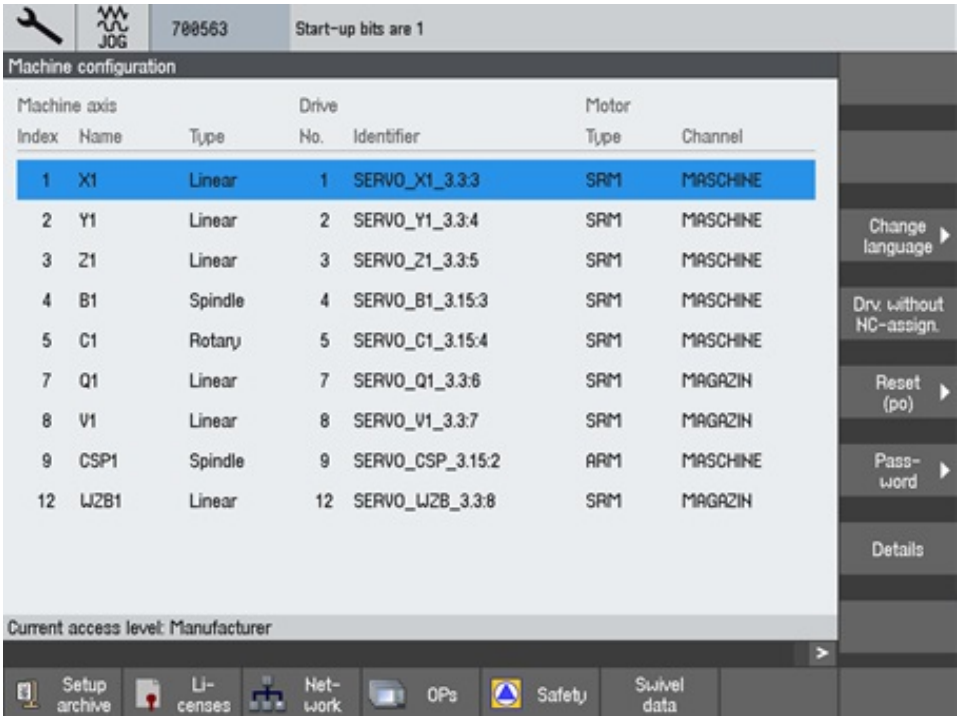


Fig. 73: "Start-up" main screen - extension of the softkey bar

To change machine data, the password for protection level ("EVENING") must be set at least.

The current access level is displayed, for example "Current access level: Service".

9.2.1.3 Activation of machine data

The methods for activation of the machine data are listed according to their priority. A change in the machine data is effective after:

po	> POWER ON	> NCK RESET
cf	> NEW_CONF	> "Activate MD" softkey > RESET key on MCP
re	> RESET	> RESET key on machine control panel
im	> IMMEDIATELY	> immediately after entering the value

"Setup" menu / "Machine data" menu / "Axis MD" area for X1 axis:

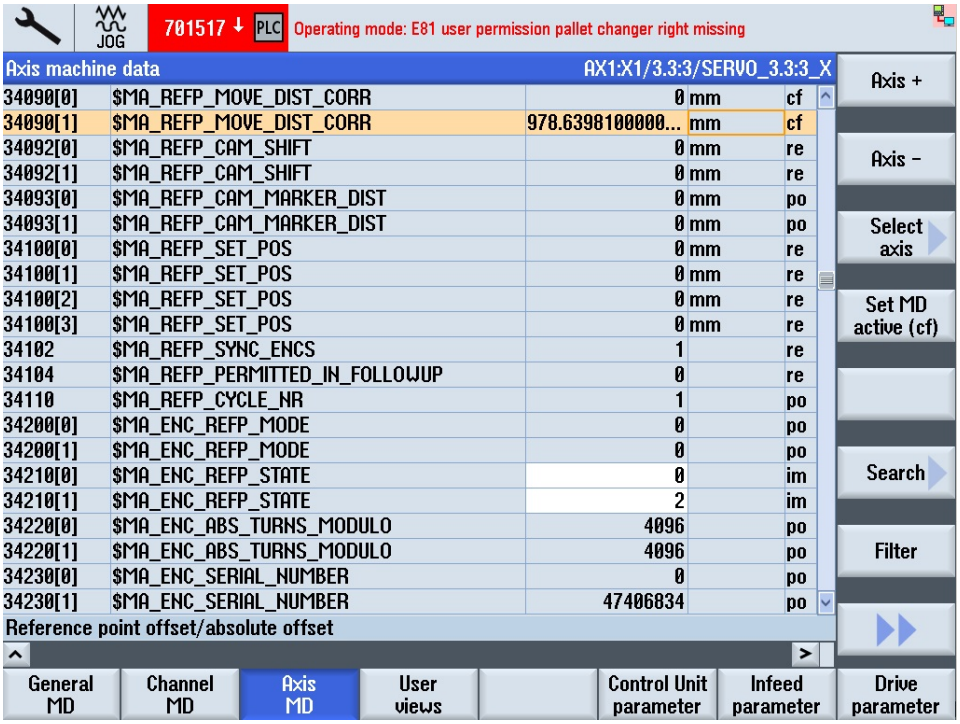


Fig. 74: Axis machine data

9.2.1.4 Data backup

Saving machine data

There are three main groups:

1. Machine data "md"
2. Setting data "sd"
3. SINAMICS parameters "snx"

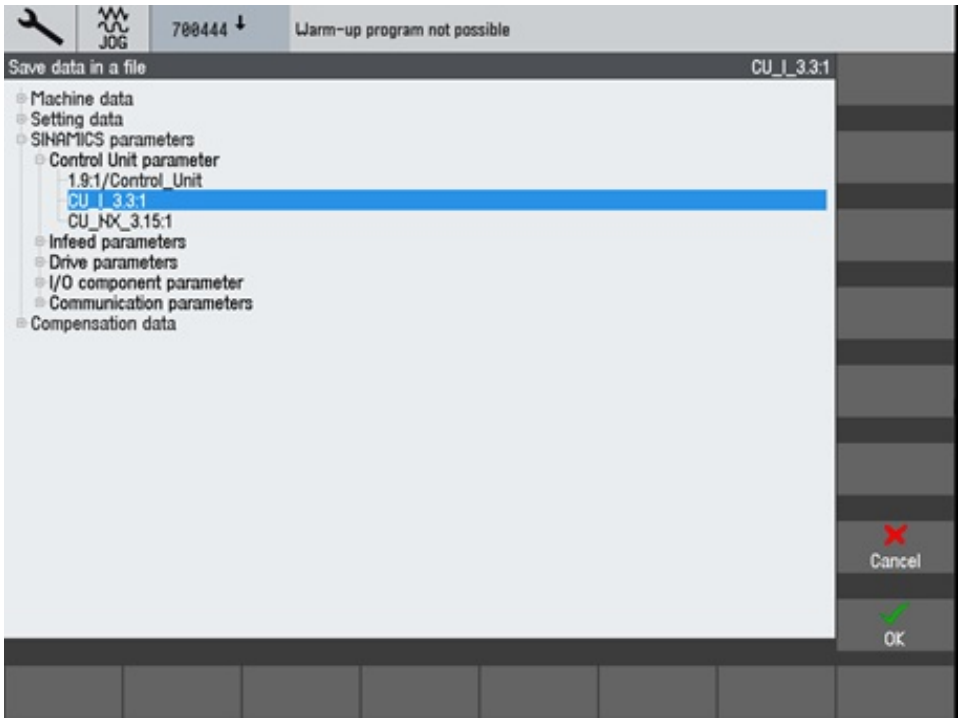
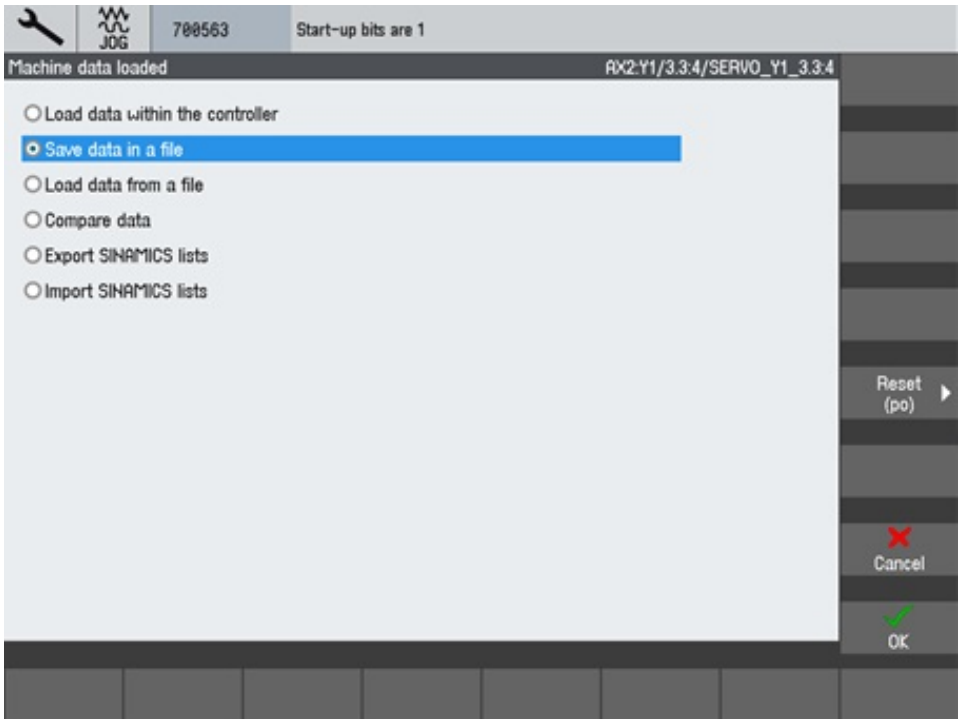


Fig. 75: Example for the control unit parameters

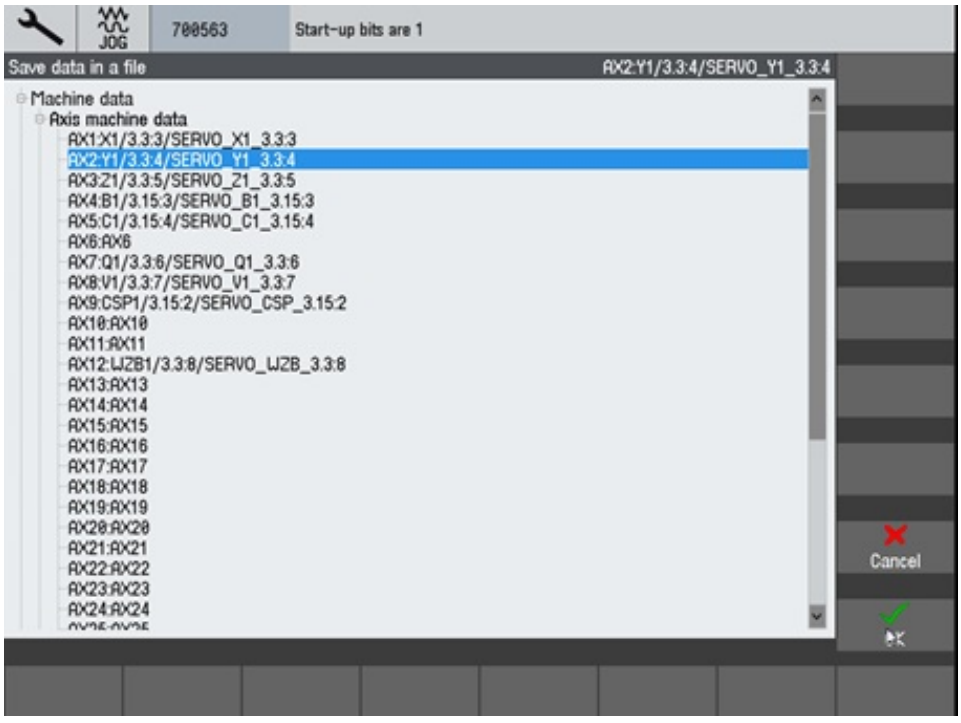
Machine data

After a successful function test, the changed machine data must be saved to the hard disk.

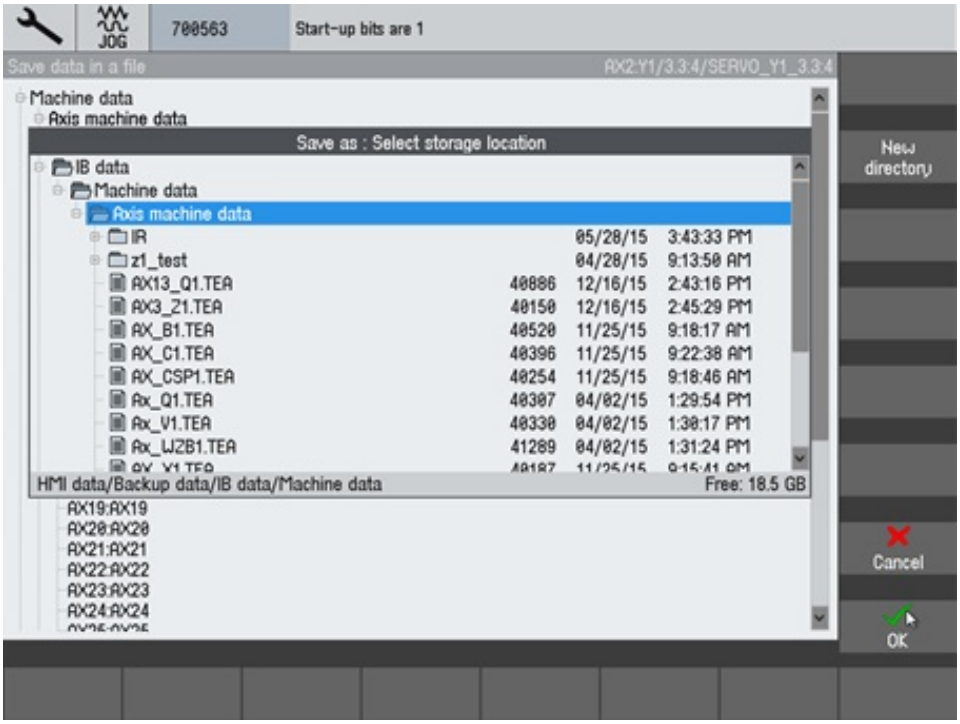
- Main menu / ">" key / "Start-up" softkey / "Machine data" softkey
- Softkey "Data management"
- Select the type of data management.



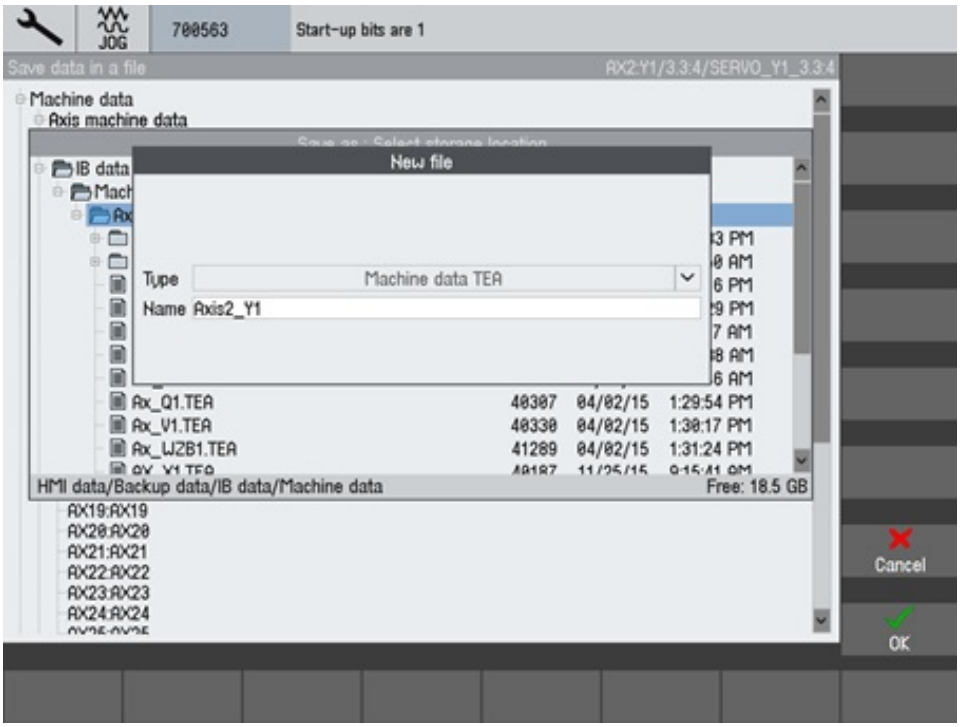
- Compare the folder to be saved with the selected axis.
- Select the OK softkey to confirm.



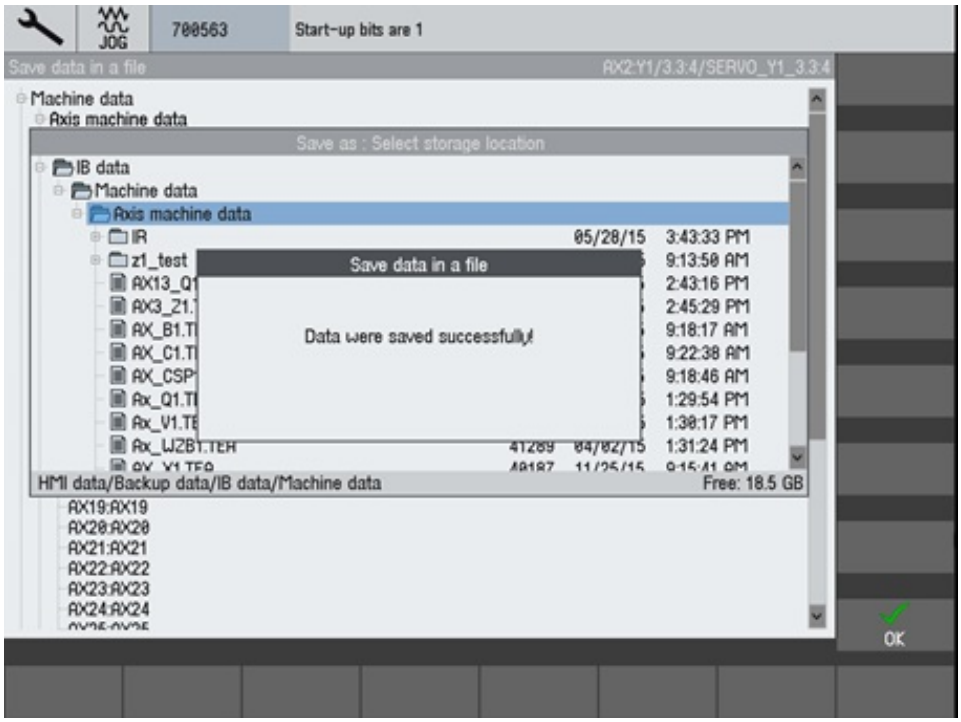
- Select a directory and then OK to confirm.



- Specify a file name and select OK to confirm.



- Finally, the result is displayed.



The saved data can be found under:

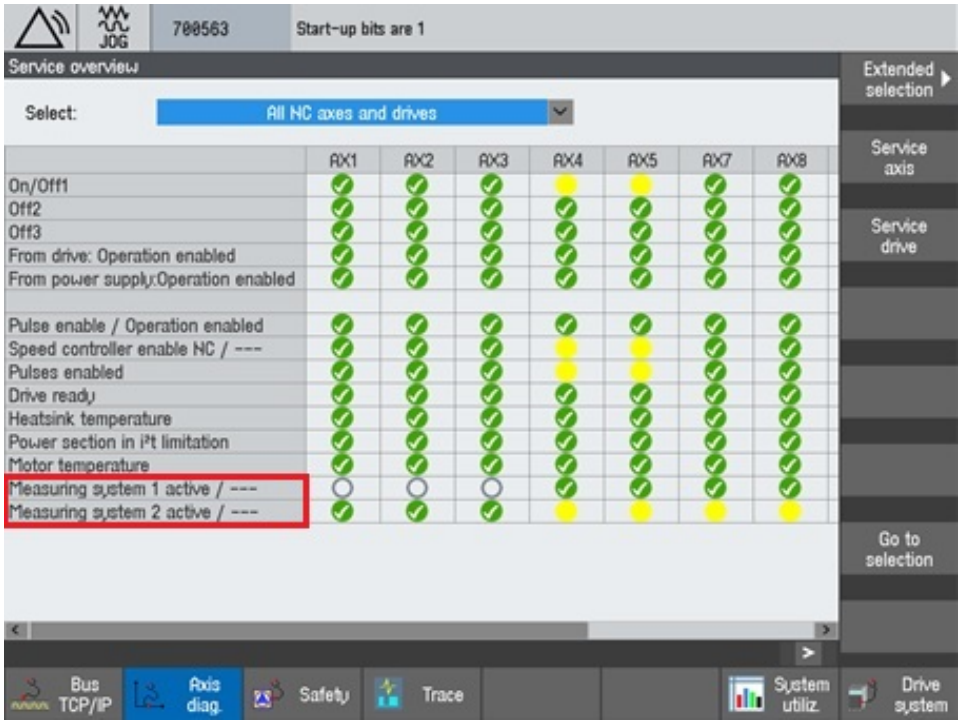
C:\ProgramData\Siemens\MotionControl\user\sinumerik\hmi\data\backup\mach-data\md*.*

ax	Axis machine data
ch	Channel machine data
hmi	Display machine data
nc	General machine data

9.2.2 Checking the active measuring systems

The active measuring systems must be checked when performing the axis diagnosis.

- Use the ">" softkey to extend the softkey bar.
- Select the “Axis diagnosis" softkey.



If measuring system 1 is active, the index is 0.

If measuring system 2 is active, the index is 1.

9.2.3 Zero points

9.2.3.1 Referencing absolute-value encoders

To set the reference point, make sure that the axis stands in a mechanically defined position, for example: B-axis table at 90 degrees.

User enable

Before changing a machine zero point, remove the "user enable".

Setting the reference point of the absolute measuring system

- Select "Start-up / Machine data / Axis-specific MD, and select an appropriate axis, e.g. B1.
- Write the mechanical position, e.g. 90.000 degrees, to MD 34100**[0]**
- Set MD 34210[x] from 2 to 1 in all axes (comes into effect immediately). (check active measuring system).
- Select JOG REF / Ref. point approach (e.g.: B axis); the axis will not move.
- MD 34210 is reset automatically from "1" to "2".
- The position stored in MD 34100, for example, 90.000 degrees, has been accepted.

User enable

Set "user enable" again after the change.

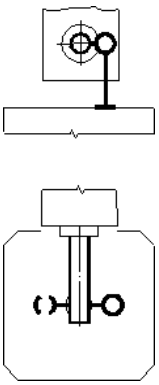
9.2.3.2 X axis zero point

The X/Y/Z axes possess absolute measuring systems. The procedure for setting zero is described in Section "Referencing absolute-value encoders".

Determining the zero point

Test object

Machine zero point X_M



Test equipment

- Dial gauge according to DIN 879 part 1
- Measurement stand
- Test mandrel
  Vmo 1608-1 (SK50)
  Vmo 2387 (HSK100)
  Vmo 1917 (SK40)
  Vmo 704 (HSK63)

Test Instructions

1. Test mandrel in working spindle. Test mandrel end at the middle (approx.) of centre bore.
2. Fix the measurement stand with dial gauge next to the centre bore on the pallet. Position the measuring pin of the dial gauge on the test mandrel and bring it to the centre position of the runout deviation.
3. Determine the X_1 position on the display (note the sign!). Reset the dial gauge.
4. Move the test mandrel freely in + Z direction, rotate pallet by 180°, move the tool/workpiece end slowly towards the measuring pin of the dial gauge (high point) so that the dial gauge position is 0.
5. Determine the X_2 position.
6. Calculate X: $X = X_1 + ((X_2 - X_1) : 2)$
7. Repeat the test (control measurement)
8. Correct the absolute offset (X_M)

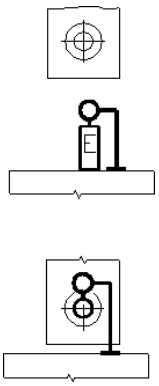
9.2.3.3 Y axis zero point

The X/Y/Z axes possess absolute measuring systems. The procedure for setting zero is described in Section "Referencing absolute-value encoders".

Determining the zero point

Object Under Test

Machine zero point Y_M



Test and Measuring Equipment

- Indicating caliper to DIN 879 Part 1
- Measuring stand gauge block
- Test arbor
  Vmo 1608-1 (SK50)
  Vmo 2387 (HSK100)
  Vmo 1917 (SK40)
  Vmh 704 (HSK63)

Test Specifications

1. Test arbor in workspindle. Traverse the test arbor end (Y motion) next to the center hole.
2. Fix the measuring stand with the indicating caliper next to the center hole on the pallet. Place the measuring pin of the indicating caliper against the test arbor and bring it to center position of the radial runout.
3. Put gauge block next to center hole on pallet.
4. Put measuring pin of indicating caliper against gauge block (E). Remove the gauge block.
5. Approach the test arbor slowly to the measuring pin of the indicating caliper (high point) so that the indicating caliper displays 0.
6. Determine the Y position from the display (Y_A) (observe the sign!) and calculate Y by adding the test arbor radius (R_D):$Y = Y_A - E + R_D$
7. Repeat test (control measurement).
8. Correct the absolute value offset (Y_M).

9.2.3.4 Z axis zero point

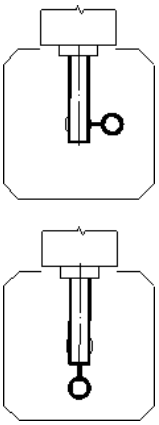
The X/Y/Z axes possess absolute measuring systems. The procedure for setting zero is described in Section "Referencing absolute-value encoders".

For adjusting the zero point with the HEC500D XXL and HEC500-800, please refer to Section "Gantry axes".

Determining the zero point

Test object

Machine zero point Z_M



Test equipment

- Dial gauge according to DIN 879 part 1
- Measurement stand
- Test mandrel
  Vmo 1608-1 (SK50)
  Vmo 2387 (HSK100)
  Vmo 1917 (SK40)
  Vmh 704 (HSK63)

Test Instructions

1. Test mandrel in work spindle.
2. Move the workpiece side in X direction to position X_M .
3. Move test mandrel end over the middle (approx.) of centre bore (Z movement).
4. Fix the measurement stand with dial gauge next to the centre bore on the pallet.
5. Position the measuring pin of the dial gauge on the test mandrel and bring it to the centre position of the runout deviation. Reset the dial gauge.
6. Move the test mandrel freely in + Z direction, rotate pallet by 90°, approach tool side in Z direction (-Z) at measuring pin of the dial gauge in such a way that the dial gauge position is 0.
7. Determine the Z position on the display (Z_A) (note the sign!) and calculate Z with L_E dimension and test mandrel radius (R_D): $Z = Z_A - L_E - R_D$
8. Repeat the test (control measurement)
9. Correct the absolute offset (Z_M)

9.2.3.5 B axis zero point

Pallet clamping area with threaded holes

Align the center and alignment holes of the pallets parallel to the traversing motion of the X axis. To do so, you will need the following: Indicating caliper, measuring stand, test arbor for the center hole and test arbor for the alignment hole.

Pallet clamping area with T slots

Align the alignment slot of the pallet parallel to the traversing motion of the X axis. To do so, indicating caliper and measuring gear are required.

NC rotary table with absolute measuring system

The following NC rotary tables possess absolute measuring systems:

- As of year of manufacture 2002, all CWK400D/500D possess directly driven NC rotary tables.
- HEC400/500D XXL - all NC rotary table
- HEC500-1600 - all NC rotary table

The procedure for setting zero is described in section "Referencing absolute-value encoders".

9.2.4 Spindle alignment position

Setting reference-point offset to "0":

- Start-up / Machine data / Axis MD / Select CSP1 axis
- MD34090[x] = 0 (check active measuring system)
- NCK-RESET

With SK40/SK50 toolholder only:

- Set the spindle horizontally to the change position; to do so, place the machine level (0.02mm/1m) on the driving blocks.
- Use the machine level (0.02mm/1m) to determine the spindle alignment position.

Only with HSK63/HSK100 toolholder:

- Insert the test tool into the spindle; when doing so, make sure that the tool comes into contact with the driving block on either the left or the right-hand side
- Use the machine level (0.02mm/1m) to determine the spindle alignment position.
- Then put the tool against the other stop and redetermine the position.
- The spindle alignment position is taken from the mean value of the two positions.

Correcting the reference-point offset:

- Start-up / Machine data / Axis MD / Select CSP1 axis
- MD34090[x] = Required position of the spindle determined for positioning of the spindle (check active measuring system)
- NCK RESET
- Then check again the spindle alignment position.
- Use the SPOS=0 instruction in the MDA mode.

9.2.5 Gantry axes

This function can be used to traverse two machines coupled mechanically with each other. During operation and programming, these axes are then treated as one machine axis. When traversing the gantry axes, the control system monitors the actual position values of the coupled axes continuously. If the actual position value deviation is too large, the gantry axes are stopped.

A distinction is made between leading axis and synchronized axis. Leading and synchronized axes cannot be traversed simultaneously. The leading axis is the gantry axis which exists from the point of view of the operator/programmer.

The synchronized axis does not exist from the point of view of the operator/ programmer.

9.2.5.1 Machine specifications

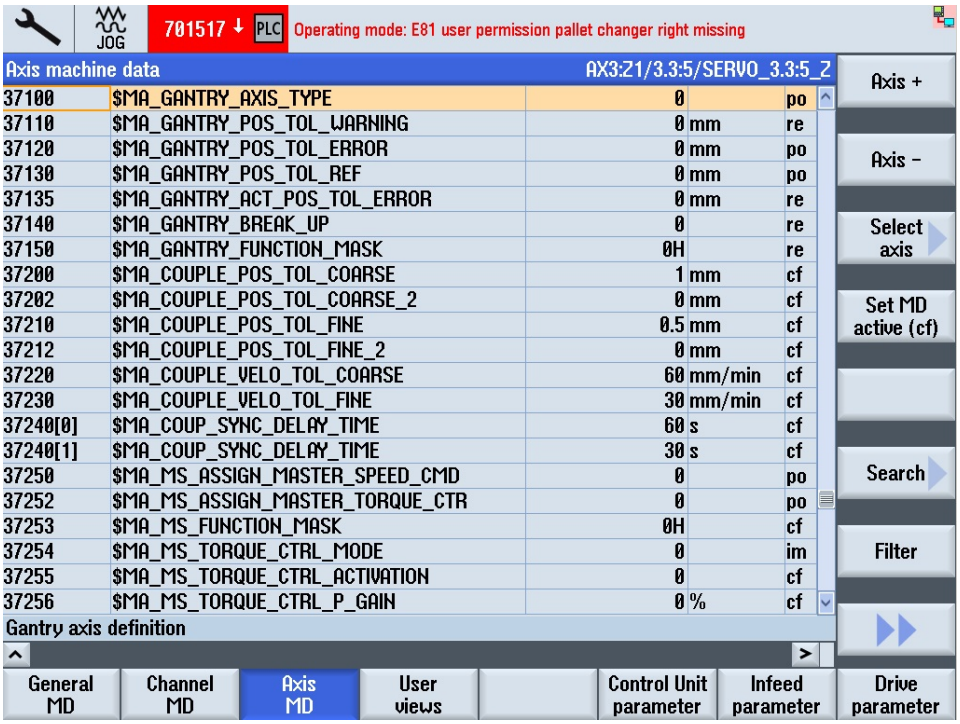


Fig. 76: Machine data Gantry-axis

9.2.5.2 Use on a HEC500-800 and on a HEC500D XXL

The HEC500-800 and the HEC500D XXL series require two feed drives for traversing the Z axis - one drive each with its own position measuring system on the magazine side and on the operator side of the Z axis slide. Due to the enforced coupling, both drives must be controlled absolutely synchronously to prevent the mechanical element (Z slide) from being canted.

The axis on the magazine side - Z1 - operates as the leading axis, and the axis on the operator side - Z2 - as the synchronized axis.

9.2.6 Change points with the HEC500-800

X axis

MD 30600 $MA_FIX_POINT_POS[0] = 723.60000000	; tool changer change position
MD 30600 $MA_FIX_POINT_POS[1] = 375.00000000	; palett changer change position

Y axis

MD 30600 $MA_FIX_POINT_POS[0] = 296.87000000	; tool changer change position
MD 30600 $MA_FIX_POINT_POS[1] = 180.00000000	; collision protection in Y/Z

Z axis

MD 30600 $MA_FIX_POINT_POS[0] = 1355.00000000	; tool changer retract position
MD 30600 $MA_FIX_POINT_POS[1] = 1549.20000000	; pallet changer change position

The change positions can be approached directly using the Pallet changer service / Tool changer service mode.



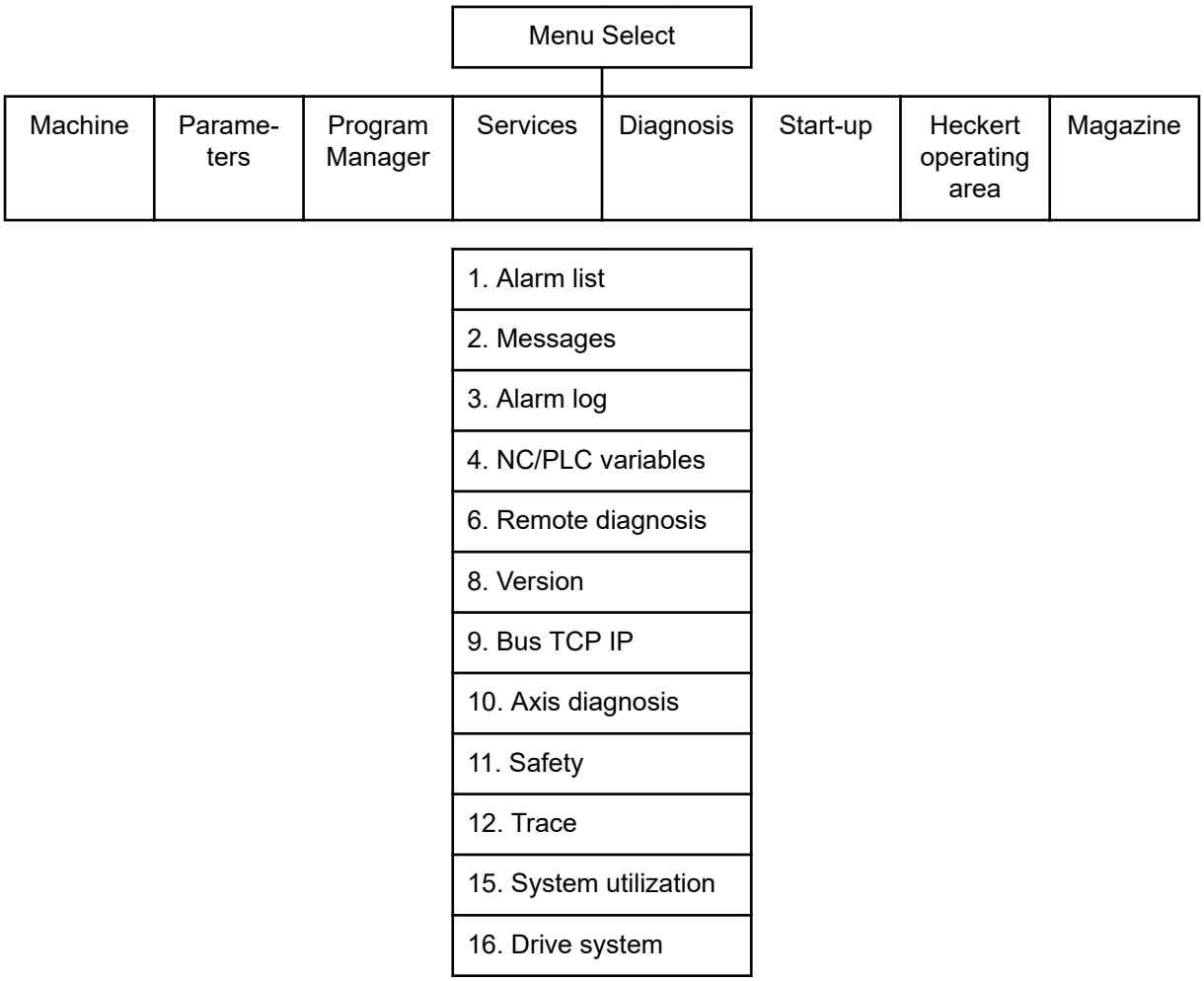
The entered values are only examples for the HEC800 Athletic!



The HEC500-800 Athletic series incorporates "Safety Integrated". For this reason, the "Safe cams" must be updated (see Chapter "Safety Integrated").

9.3 Diagnostics

Overview of the "Diagnosis" menu



9.3.1 The "Alarm list" softkey

It is possible to display alarms. Alarms can be acknowledged.

All alarms with alarm number, date, time, cancel criterion and a brief text are displayed in the "Alarms" overview.

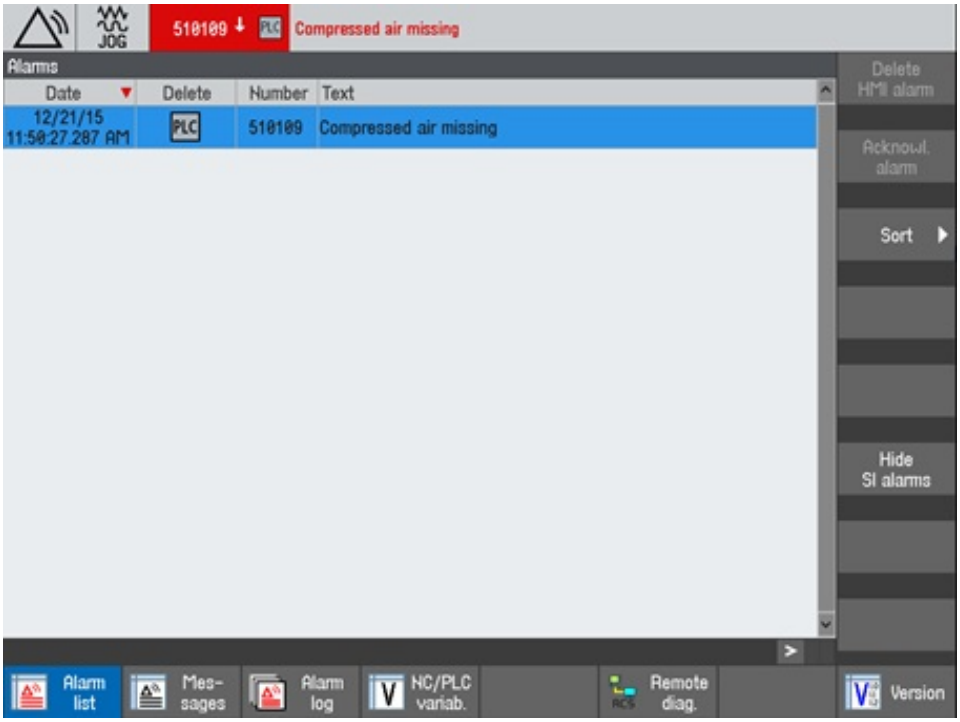


Fig. 77: Softkey "Alarms"

9.3.2 The "Messages" softkey

It is possible to display status messages.

This overview displays all messages with message number, date, time and a brief text. A cancel criterion is not required; the messages are reset automatically.

9.3.3 The „HELP" button

The integrated help function can be called for each alarm / message using the HELP key.

An example is message 700563:

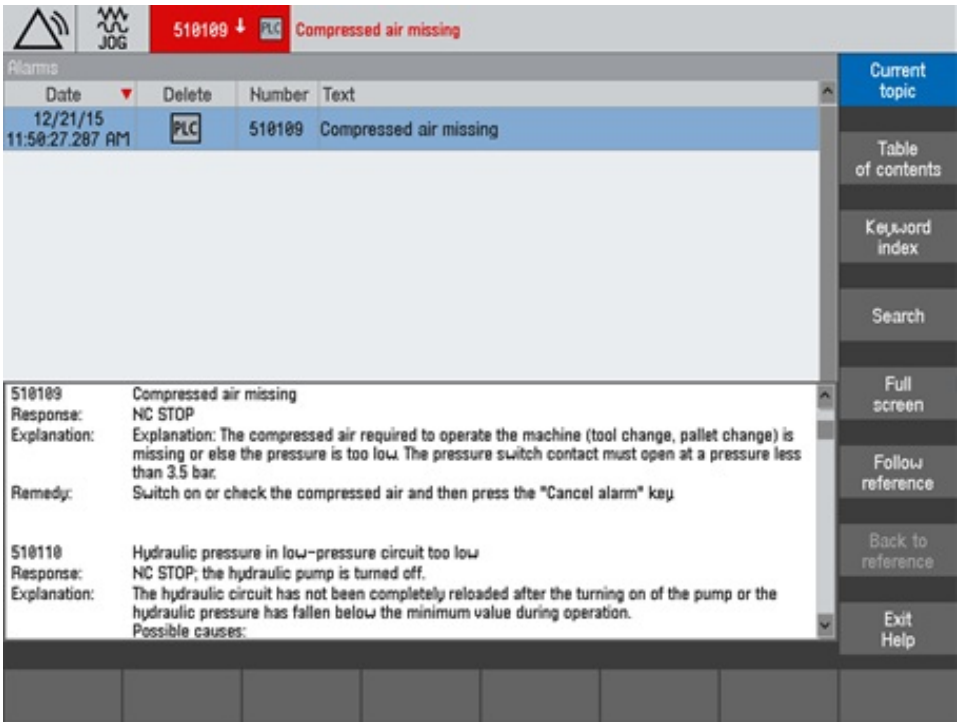


Fig. 78: HELP key - information about the alarm / message

9.3.4 The "Alarm log" softkey

A log with the alarms and status messages which have occurred to date is displayed, each message with alarm number, date and time of occurrence ("Raised"), as well as date and time of acknowledgment ("Cleared"), cancel criterion and brief text. In the alarm log, the alarms cannot be acknowledged.

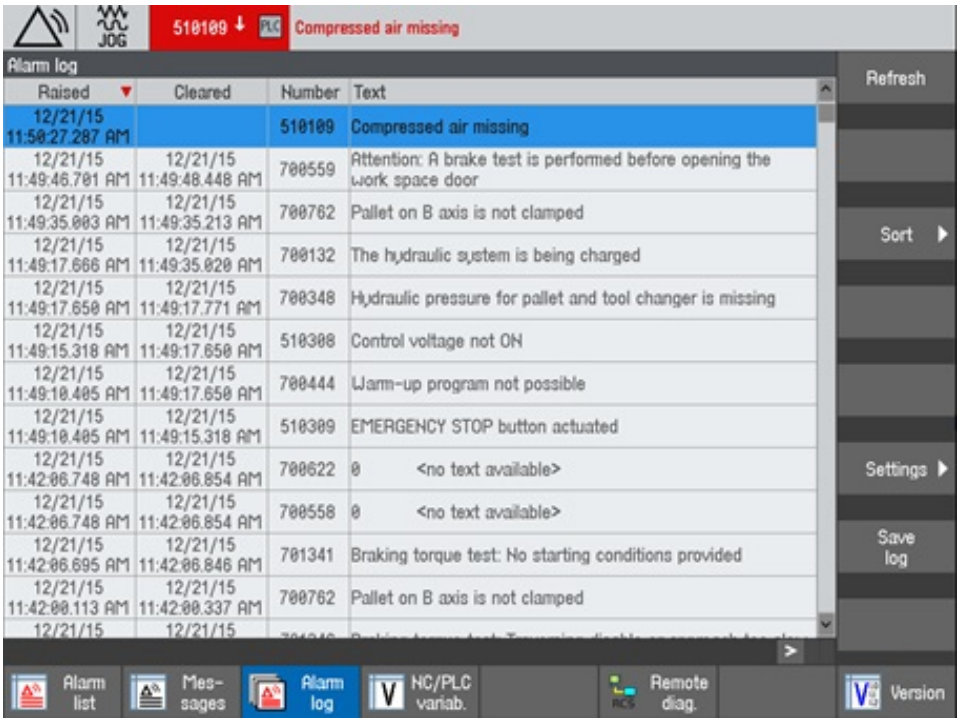


Fig. 79: Softkey "Alarm log"

9.3.4.1 The "Save log" softkey

Selecting the "Save log" softkey stores the alarm log so that it can be evaluated later.

The alarmlog.txt file is saved in the directory

C:ProgramData\siemens\MotionControl\user\sinumerik\hmi\log\alarm*.*

.

9.3.5 Softkey "NC/PLC variables”

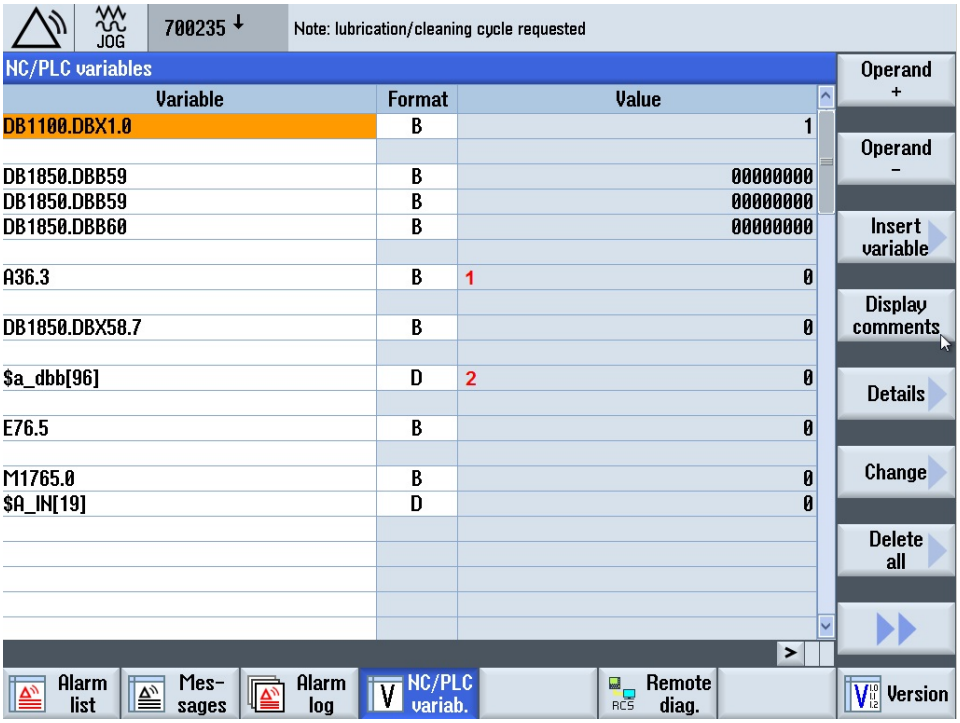
Displays NC and PLC variables

The following formats are offered to choose from:

- B: Binary (most common form of display for input and output signals)
- F: Floating-point number (e.g. pressure or compensation values)
- D: Decimal without sign (e.g. analog sensor for tool clamping)
- +/-D: Decimal with sign (seldom used in practice)
- H: Hexadecimal (seldom used in practice)
- A: ASCII character (seldom used in practice)

Overview of PLC variables

PLC variable	Example	Display in the B format
Input bit	I1.1	0
Input byte	IB1	00000000
Input word	IW	16 B
Input double-word	IDW	32-bit
Output bit	O1.1	0
Output byte	OB1	00000000
Output word	OW	16-bit
Output double-word	ODW	32-bit
Data block bit	DB101.DBX130.0	0
Data block byte	DB101.DBB130	00000000
Data block word	DB101.DBW130	16-bit
Data block double-word	DB101.DBD130	32-bit
Flag bit	F1.1	0
Flag byte	FB1	00000000
Flag word	FW	16-bit
Flag double-word	FDW	32-bit
Timer	T1	
Counter	C1	



1. Example for a PLC variable
2. Example for an NC variable

9.3.6 "Version" softkey

The software version and the NC version are displayed.

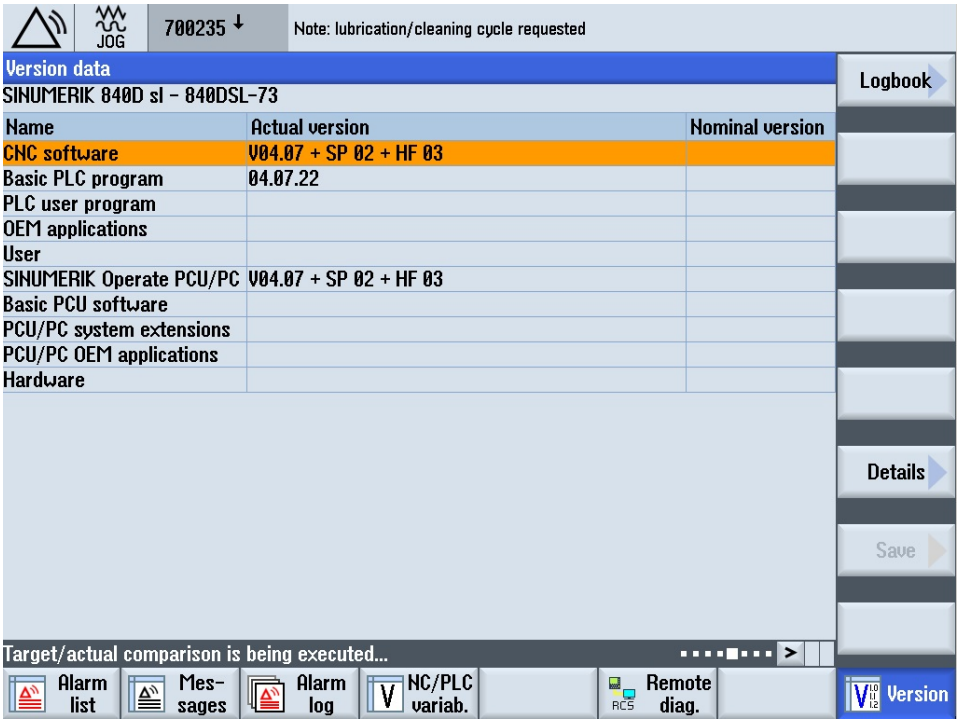


Fig. 80: "Version" softkey

9.3.7 Softkey "Axis diagnostics"

The following softkeys are available in the Axis Diagnosis menu:

- Service axis
- Service drive

Operating area Axis Diagnosis

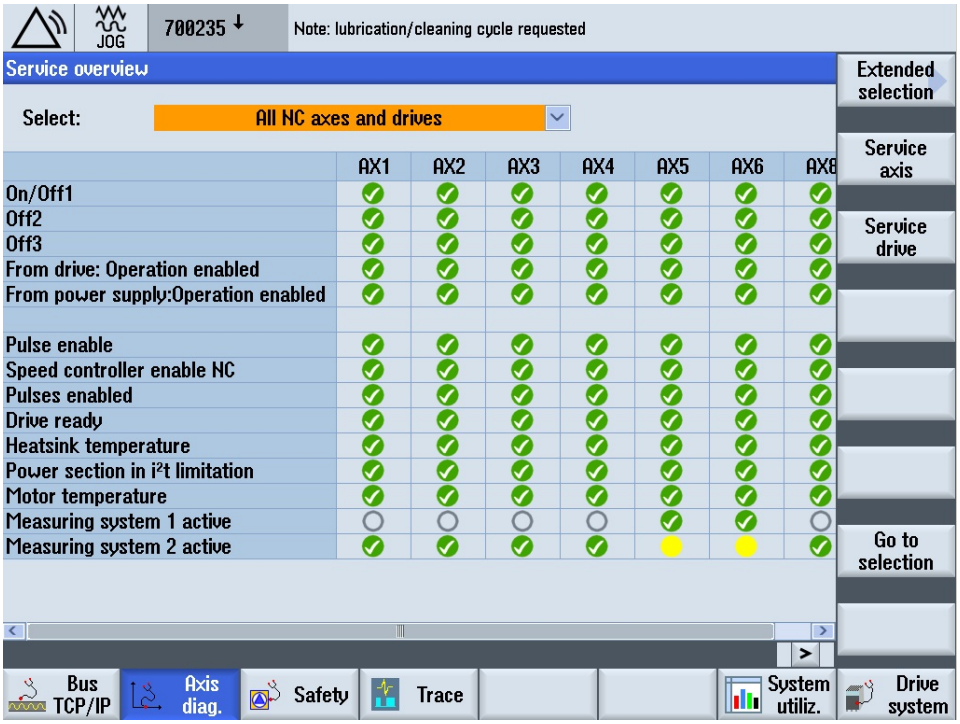


Fig. 81: Softkey “Axis Diagnosis”

9.3.7.1 "Service axis" softkey

The following information is displayed for start-up and diagnosis of the axes/ spindles (use the "Axis +" and "Axis -" softkey to select an axis):

- Following error, system deviation
- Contour deviation, servo gain
- Active measuring system
- Measuring system position actual value
- Measuring system compensation value
- and various further signals

This information serves to

- verify the whole closed-loop system of the axis (e.g. by comparing the position setpoint and actual value, as well as the speed setpoint and actual value)
- check hardware errors (e.g. check of the encoder: A mechanical movement of the axis must result in a change of the position actual value.)

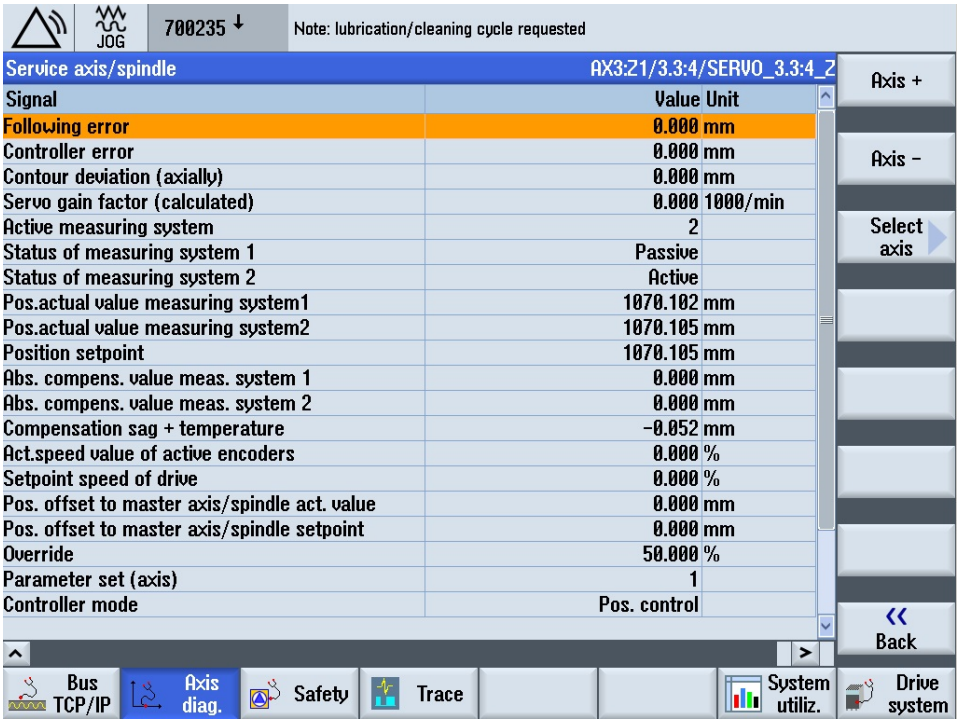


Fig. 82: Softkey “Service axis”

9.3.7.2 "Service drive" softkey

The following information is displayed for start-up and diagnosis of the drives (use the "Drive +" and "Drive-" softkeys to select a drive):

- Enabling signals
- Smoothed current actual value
- DC link voltage
- Motor temperature
- and various further signals

This information serves to

- check the status of enabling and control signals;
- check the drive status.

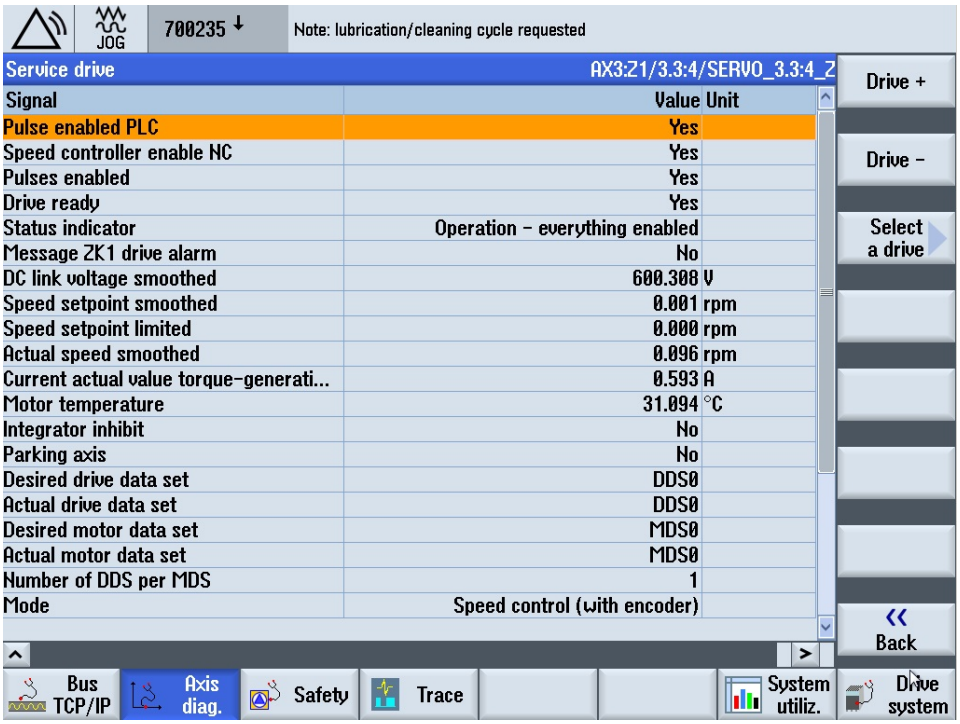


Fig. 83: "Service drive" softkey

9.3.8 Softkey "System utilization"

The softkey „System utilization“ displays the current system utilization of the control system.

- Channel +
- Channel -
- Select channel
- Start
- Stop

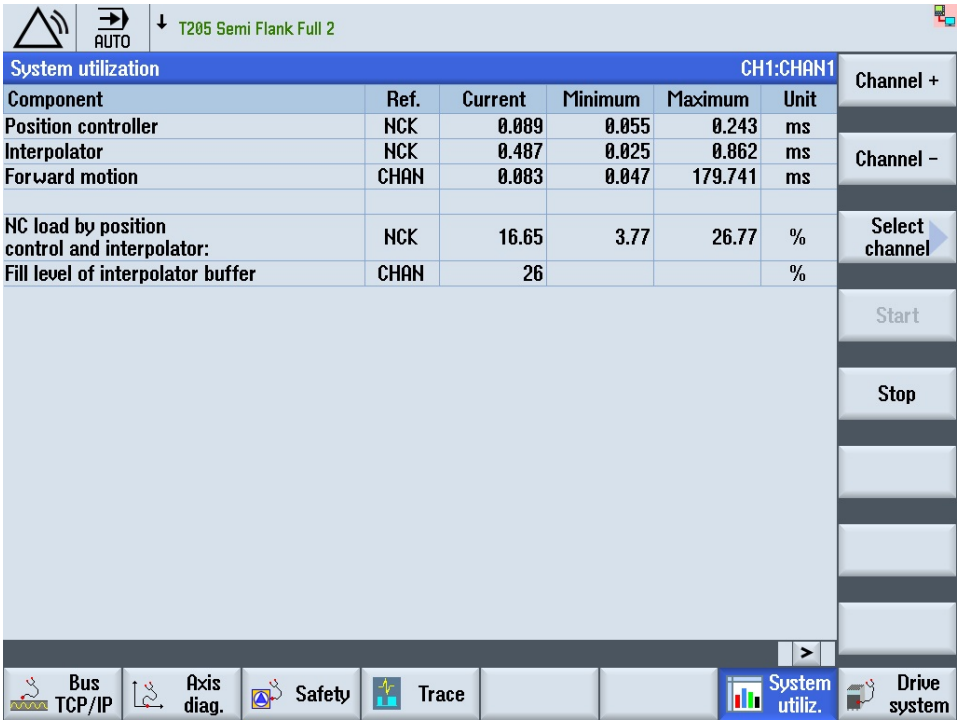


Fig. 84: Softkey „System utilization“

9.3.9 Softkey "Drive system"

Displays an overview of the current states of the drive objects.

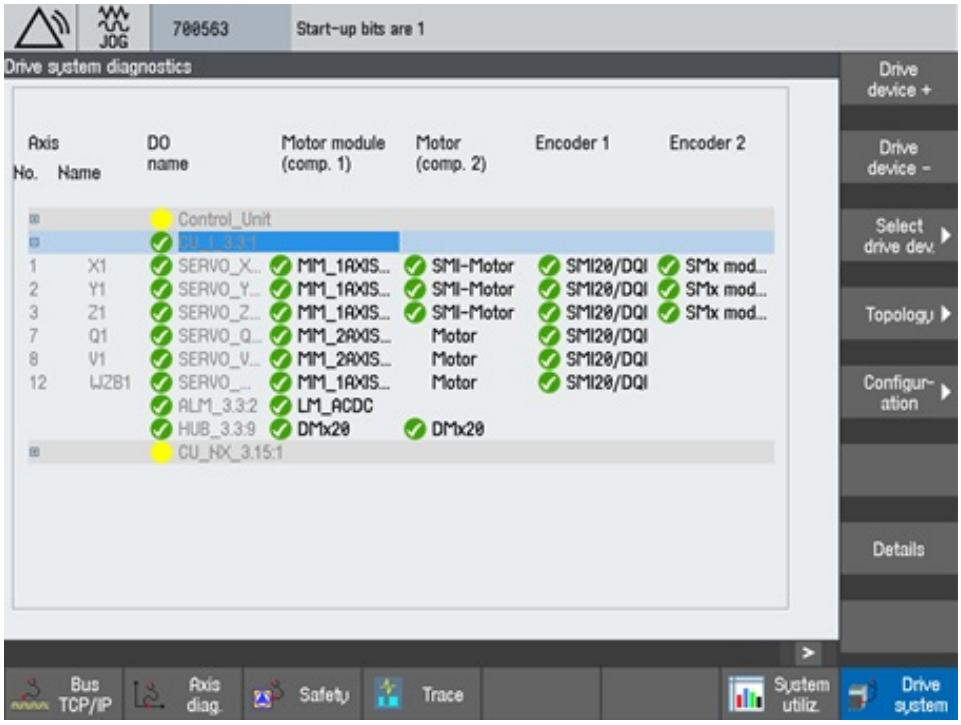
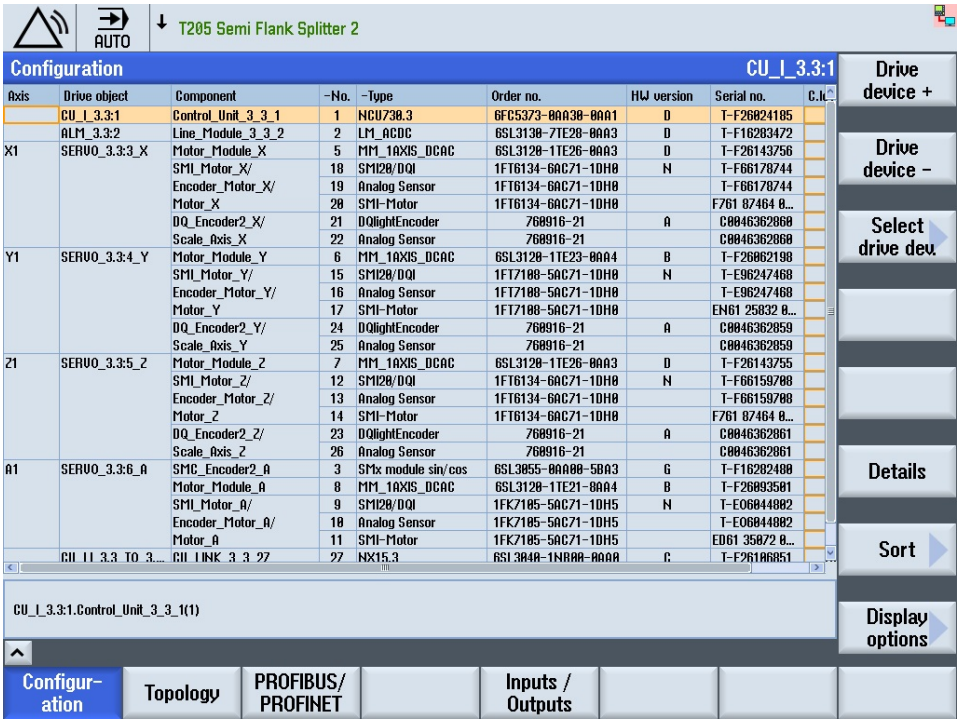


Fig. 85: Softkey "Drive system"

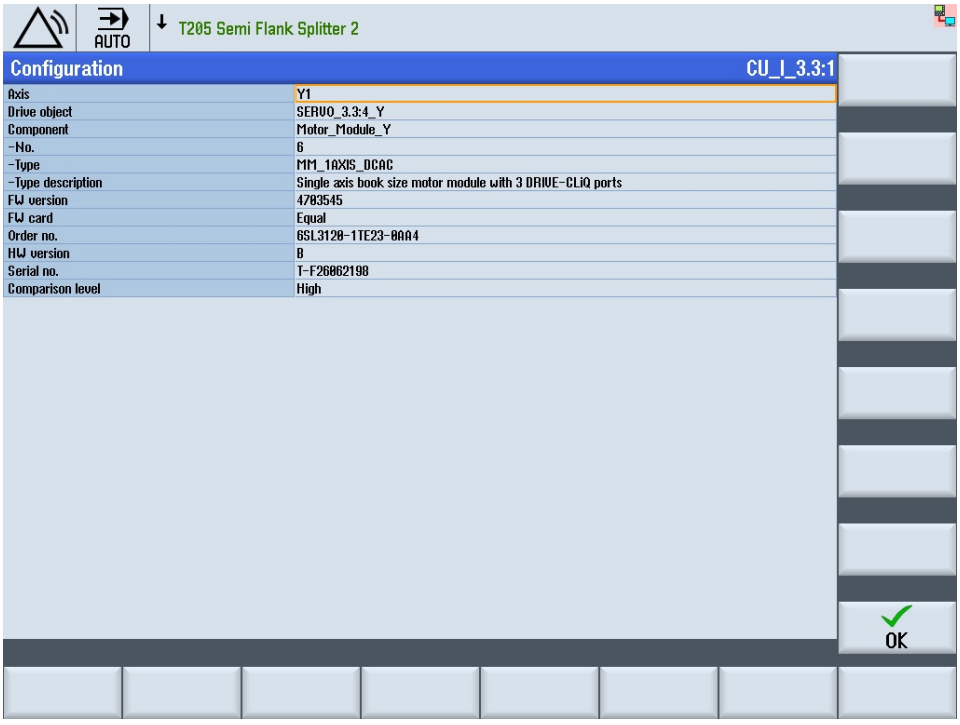
Pressing the "Details" softkey displays further information about the selected drive object. In case of a fault, the fault is highlighted and displayed. To this end, drive parameter r0046 is evaluated. The enable signals is assigned one bit each in drive parameter r0046. The bit is displayed in the form of plaintext. Thus, the missing enable signals can be found quickly.

9.3.9.1 "Configuration" softkey

Selecting this softkey displays the configuration of the drive system with a description of the drive object, the corresponding components and the firmware of the component.



Axis	Drive object	Component	-No.	-Type	Order no.	HW version	Serial no.
	CU_I_3.3:1	Control_Unit_3_3_1	1	NCU730.3	6FC5373-0AA30-0AA1	D	T-F26824185
	ALM_3.3:2	Line_Module_3_3_2	2	LM_ACDC	6SL3130-7TE28-0AA3	D	T-F16283472
X1	SERVO_3.3:3_X	Motor_Module_X	5	MM_1AXIS_DCAC	6SL3120-1TE26-0AA3	D	T-F26143756
		SMI_Motor_X/	18	SM120/DQI	1FT6134-6AC71-1DH0	N	T-F66178744
		Encoder_Motor_X/	19	Analog Sensor	1FT6134-6AC71-1DH0		T-F66178744
		Motor_X	20	SMI-Motor	1FT6134-6AC71-1DH0		F761 87464 0...
		DQ_Encoder2_X/	21	DQlightEncoder	768916-21	A	C0046362860
		Scale_Axis_X	22	Analog Sensor	768916-21		C0046362860
Y1	SERVO_3.3:4_Y	Motor_Module_Y	6	MM_1AXIS_DCAC	6SL3120-1TE23-0AA4	B	T-F26862198
		SMI_Motor_Y/	15	SM120/DQI	1FT7108-5AC71-1DH0	N	T-E96247468
		Encoder_Motor_Y/	16	Analog Sensor	1FT7108-5AC71-1DH0		T-E96247468
		Motor_Y	17	SMI-Motor	1FT7108-5AC71-1DH0		EN61 25832 0...
		DQ_Encoder2_Y/	24	DQlightEncoder	768916-21	A	C0046362859
		Scale_Axis_Y	25	Analog Sensor	768916-21		C0046362859
Z1	SERVO_3.3:5_Z	Motor_Module_Z	7	MM_1AXIS_DCAC	6SL3120-1TE26-0AA3	D	T-F26143755
		SMI_Motor_Z/	12	SM120/DQI	1FT6134-6AC71-1DH0	N	T-F66159708
		Encoder_Motor_Z/	13	Analog Sensor	1FT6134-6AC71-1DH0		T-F66159708
		Motor_Z	14	SMI-Motor	1FT6134-6AC71-1DH0		F761 87464 0...
		DQ_Encoder2_Z/	23	DQlightEncoder	768916-21	A	C0046362861
		Scale_Axis_Z	26	Analog Sensor	768916-21		C0046362861
A1	SERVO_3.3:6_A	SMC_Encoder2_A	3	SMx module sin/cos	6SL3055-0AA00-5BA3	G	T-F16282488
		Motor_Module_A	8	MM_1AXIS_DCAC	6SL3120-1TE21-0AA4	B	T-F26893501
		SMI_Motor_A/	9	SM120/DQI	1FK7105-5AC71-1DH5	N	T-E06844882
		Encoder_Motor_A/	10	Analog Sensor	1FK7105-5AC71-1DH5		T-E06844882
		Motor_A	11	SMI-Motor	1FK7105-5AC71-1DH5		ED61 35872 0...
	CU_LI_3.3_TO_3....	CU_LINK_3_3_22	22	NX15.3	6SL3040-1NB00-0AA0	C	T-F26186851



Axis	Y1
Drive object	SERVO_3.3:4_Y
Component	Motor_Module_Y
-No.	6
-Type	MM_1AXIS_DCAC
-Type description	Single axis book size motor module with 3 DRIVE-CLiQ ports
FW version	4703545
FW card	Equal
Order no.	6SL3120-1TE23-0AA4
HW version	B
Serial no.	T-F26862198
Comparison level	High

Fig. 87: Detail view of the softkey “Details”

9.3.9.2 "Topology" softkey

Displays the topology of the drive system.

The set and actual configurations are compared to each other.

The individual colors have the following meanings:

Black	o.k.	Set configuration = actual configuration
Gray	Error	The drive object only exists in the set configuration.
Red	Error	The drive object only exists in the actual configuration.

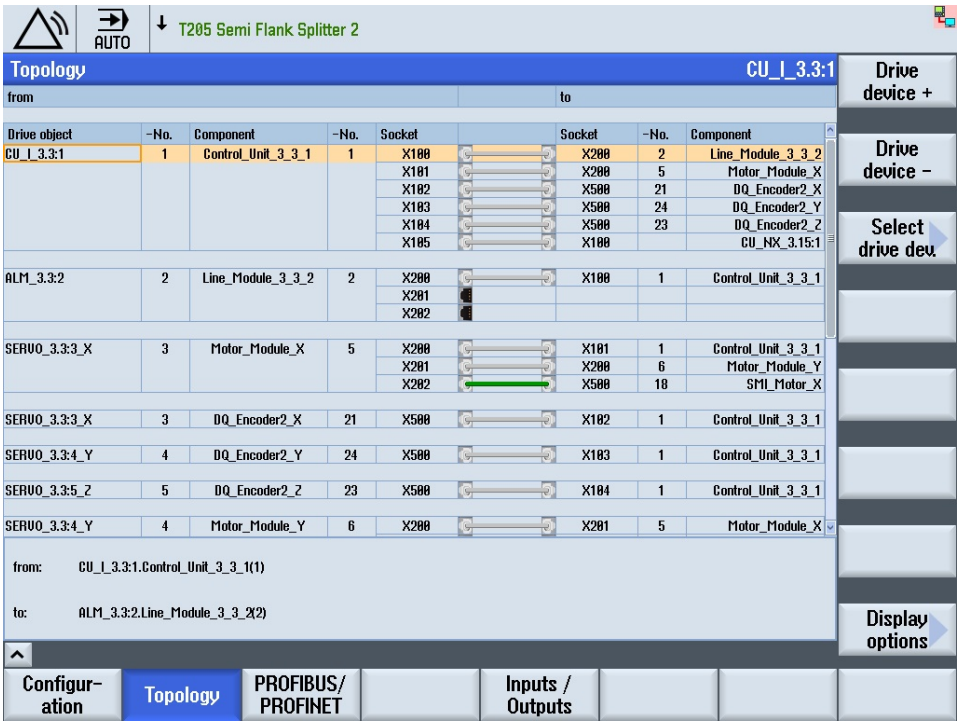


Fig. 88: Softkey "Topology" - graphical representation in accordance with the software version

9.4 Safety Integrated (SI)

9.4.1 Brief description

A detailed description of Safety Integrated, briefly "SI", is not possible here. Here we will only go into individual, selected aspects of this complex topic.

Safety Integrated provides highly efficient protection for persons and the machine.

It complies with the requirements of category 3 to EN 954-1. The safety of the system is not lost even after an error. In other words: A safety-related error must be detected reliably, and safe responses (e.g. a stop reaction) must be possible afterwards (so-called single-fault tolerance).

Furthermore, the requirements of SIL 2 acc. to IEC 61508 are met.

(SIL: Safety Integrity Level)

The existing multiprocessor structure forms a two-channel system structure. The safety functions are implemented redundantly in the NC, the drive and the internal PLC. A cross-check is performed for the process variables and the safety-relevant system data. Safety-related software and hardware functions are checked by an automated forced checking procedure at defined intervals of time.

9.4.2 Safety-related functions

The SIN840D provides the following safety-related functions:

STO	Safe Torque Off
SBC	Safe Brake Control
SS1	Safe Stop 1
SS2	Safe Stop 2
SOS	Safe Operating Stop
SLS	Safely Limited Speed
SSM	Safe Speed Monitor
SBR	Safe Acceleration Monitor
SLP	Safely Limited Position
SCA	Safe Cam

9.4.3 User enable

The control system "remembers" the positions of the axes when turning off the main switch. When turned on again, a check is carried out to determine whether the position after approaching the reference point, taking into account the travel covered when referencing, corresponds to the position when turned off. In case of deviation, an alarm message is output, and the user enable for this axis is deleted. It is then necessary to turn the main switch off and back on again.

At completion of referencing, the user enable must be set again for an axis for which no user enable is set (select the "User enable" softkey from the "Reference point approach" main screen and set the user enable using the key).



First, make sure that the acquired reference point approach position matches the real machine position.

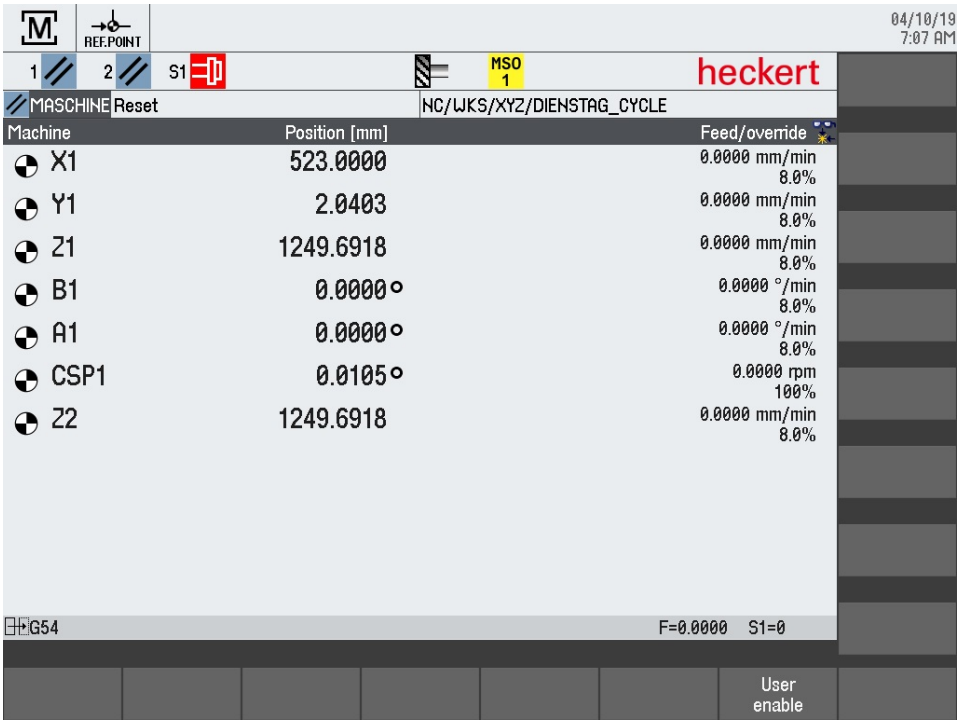


Fig. 89: User enable

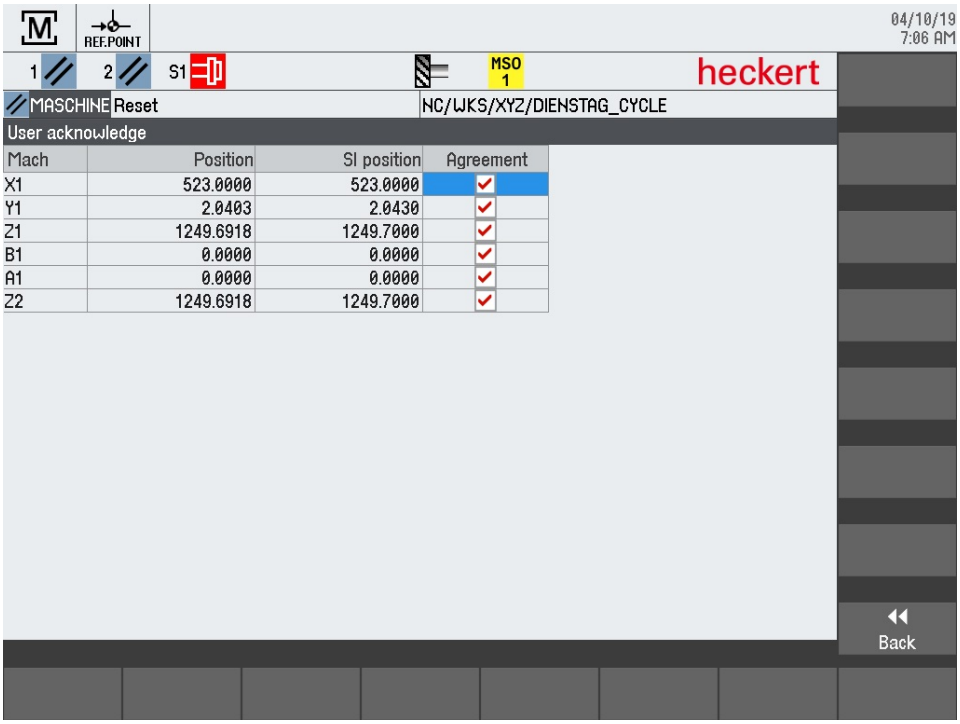


Fig. 90: User enable for the axes

9.4.4 Start-up functions

⚠WARNING

Any changes in the safety-relevant machine data must never result in impairment of the safety functions.

If necessary, the Safety Integrated acceptance by HECKERT is to be repeated and to be documented once more by way of the "Safety Integrated Acceptance Certificate".

- ▸ Changes in the safety-relevant machine data are therefore generally reserved to the manufacturer.

9.4.5 Safe programmable logic (SPL)

The SPL allows direct connection of safety sensors and actuators and logic operations between them.

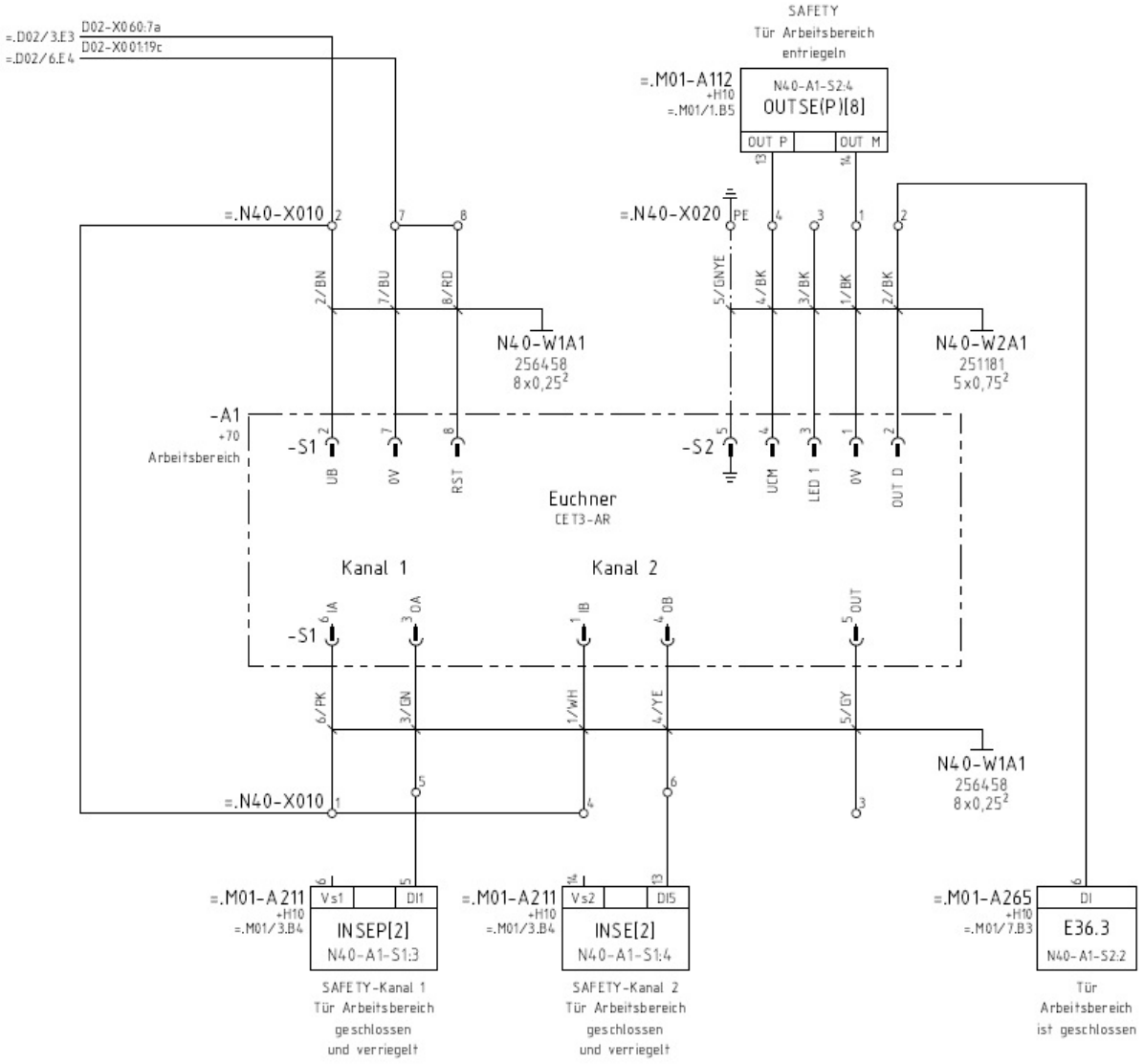
Thanks to SPL, the scope of the required external components is reduced. The gating logic is realized by way of a written program (SPL). The SPL comprises two parts - the PLC SPL (Safety channel 1) and the NCK SPL (Safety channel 2).

To test the operational reliability, a cyclic data comparison is carried out between the PLC and the NCK. This monitoring is performed by the NCK CPU and the PLC CPU independently of each other. To this end, a so-called cross-checking of the signals entering the SPL and of the safety-related signals generated by the SPL, as well as of internal states, such as flags, is carried out.

For software-controlled realization of the SPL, in addition, an NCK SPL program is stored at StarragHeckert in the standard cycles directory under the designation SAFE.spf. The SAFE.spf NCK SPL program is protected against manipulation by way of the machine data 11500[0] and 11500[1].

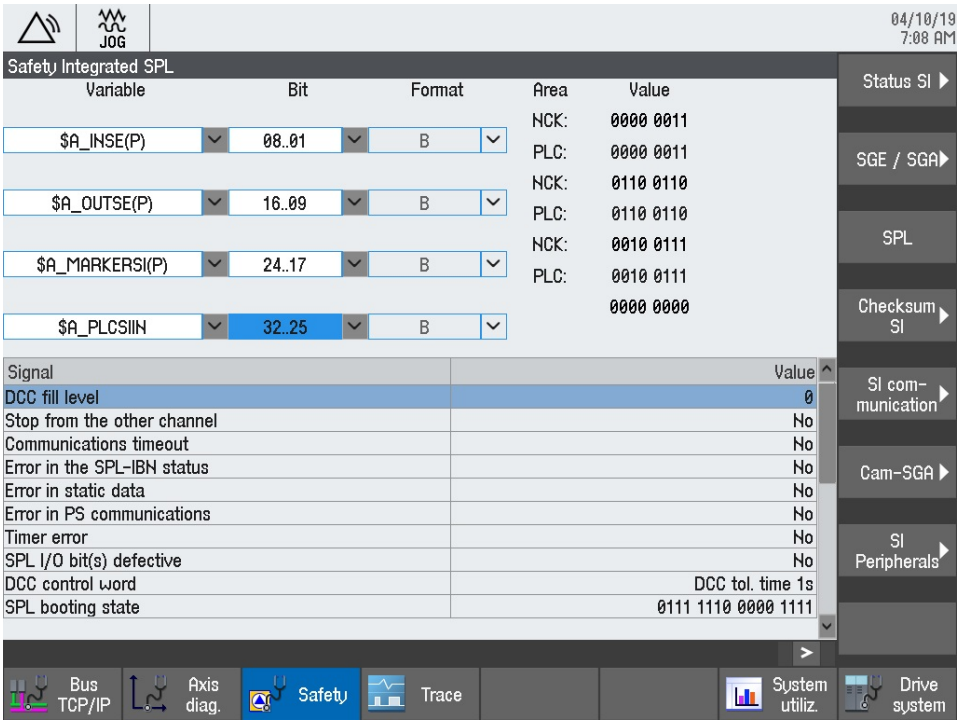
With the SIN840D Operate, the safety signals are transmitted from the sensors to the SPL and vice versa from the SPL to the actuators via PROFIsafe modules.

Annex: Extract from the Circuit Diagram for HEC series machines



Display of safety-related I/O signals

- Main menu
- Diagnosis
- >>
- Safety
- SPL


JOG
04/10/19
7:08 AM
Safety Integrated SPL
Variable
Bit
Format
Area
Value
$A_INSE(P)
08..01
B
NCK:
0000 0011
PLC:
0000 0011
$A_OUTSE(P)
16..09
B
NCK:
0110 0110
PLC:
0110 0110
$A_MARKERSI(P)
24..17
B
NCK:
0010 0111
PLC:
0010 0111
$A_PLCSIIN
32..25
B
0000 0000
Signal
Value
DCC fill level
0
Stop from the other channel
No
Communications timeout
No
Error in the SPL-IBN status
No
Error in static data
No
Error in PS communications
No
Timer error
No
SPL I/O bit(s) defective
No
DCC control word
DCC tol. time 1s
SPL booting state
0111 1110 0000 1111
Status SI
SGE / SGA
SPL
Checksum SI
SI com-munication
Cam-SGA
SI Peripherals
Bus TCP/IP
Axis diag.
Safety
Trace
System utiliz.
Drive system

9.4.6 Error determination when cross-checking

The safety-relevant input/output signals of the SPL are monitored continuously by the PROFIsafe module. In case of different signal states, the respective channel of the PROFIsafe module will be passivated and an alarm will be issued. The current signal states are directly displayed at the PROFIsafe module.

An example using the Circuit Diagram of the HEC series

If the keyswitch N01S14 "Setting-up mode" is turned on, both input INSEP[5] (SAFETY channel 1) and input INSE[5] (SAFETY channel 2) issue a "1" signal. If in case of an error, e.g. due to a line interruption, both channels issue different signals, the following alarm will be displayed:

"27254 PROFIsafe: F module 196, error at channel IN 0; INSE(P)[5] keyswitch, mode 2 (setting-up mode) (N01-S14)""

Interpretation

- Two safety-relevant signals had different signal states.
- INSE(P)[5]: Signal designation.
- N01-S14: Equipment identifier for finding components quickly in the circuit diagram.

9.4.7 Forced checking procedure (test stop)

Brief description

The shutdown of the drives is controlled redundantly from both NC and drive. An error in one of the shutdown channels would not be revealed during normal operation. For this reason, a forced checking procedure or forced dormant error detection is required to test vital stop functions.

For forced dormant error detection, each pulse disable path is controlled separately.

This process is called test stop and must be performed at an appropriate time.

After closing the main switch, a test stop is started with actuating of the CONTROL ON key. Pulse disables for the servo drives, the brakes of the drives at the current limit, the brakes of the drives with reference to the path, and the EMERGENCY STOP function are tested.

Test stop is also performed if the door at the work space is to be opened (the "Unlock work space door" key is actuated) and the last test stop was performed more than 8 hours ago. The door can only be opened after a successful test stop.

Status messages

The following status messages are issued in conjunction with test stop:

700560 Attention: A test stop is performed before opening the work space door!

700561 Test stop for Safety Integrated not successful..



Please always observe the explanations in the integrated help function.

9.5 Data backup

9.5.1 Introduction

Defects on the control system, backup batteries not replaced in time, or also serious operator errors may result in loss of data. These data may include NC programs, subroutines and cycles, user parameters, tool data, machine data, and the PLC program. Loss of data means first of all standstill of the machine.

How fast the control system and the machine are ready for operation again depends on the quality of the data backup carried out beforehand. Under certain circumstances, the restoring of data which was not backed up properly can mean considerable work and thus long idle times.

Data backups are always performed in two stages:

1. The data of the RAM in the NCU are saved on an appropriate medium. This is important for loss of data caused by a defective NCU backup battery or defective NCU. The data are saved to the medium in the form of archives. The saving of archives is relatively fast and simple and should therefore be carried out regularly after any changes in the data.
2. The data of the medium in the MMC/PCU are saved on an external storage medium. This is important for loss of data caused by a defective NCU backup battery or defective NCU. Saving to an external storage medium requires a certain amount of work and should therefore only be performed if absolutely necessary.

9.5.2 Start-up archives: NC, PLC and DP archives

9.5.2.1 Secure of NC archives

IBN-Archive

- Menu Select
- Softkey Setup
- set PIT-Mode key 3
- Extend Softkeyline with „>“

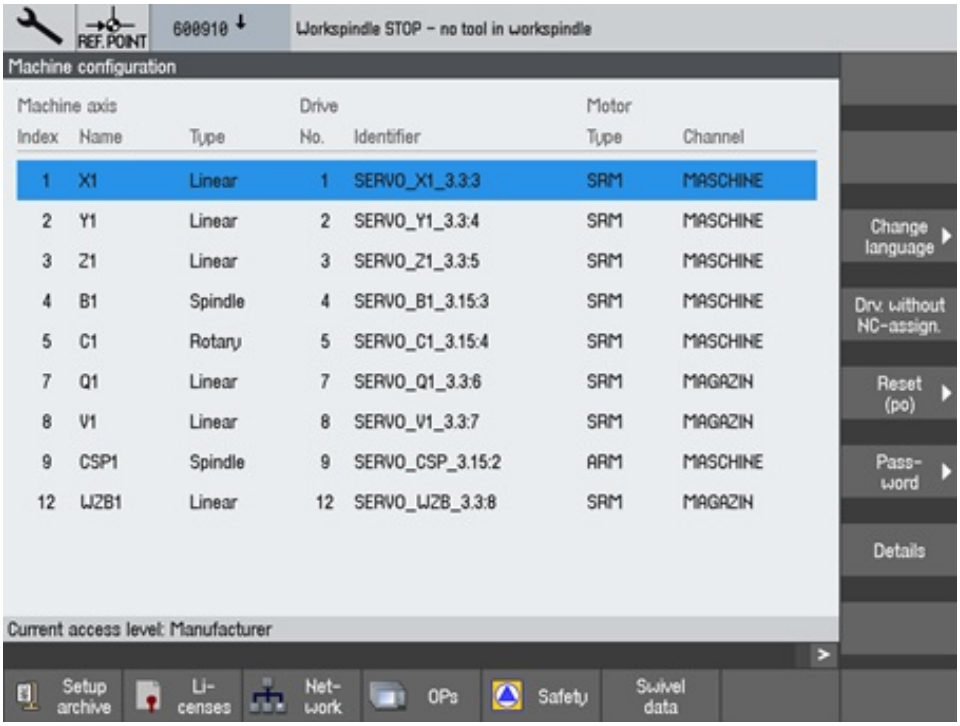


Fig. 91: setup archive

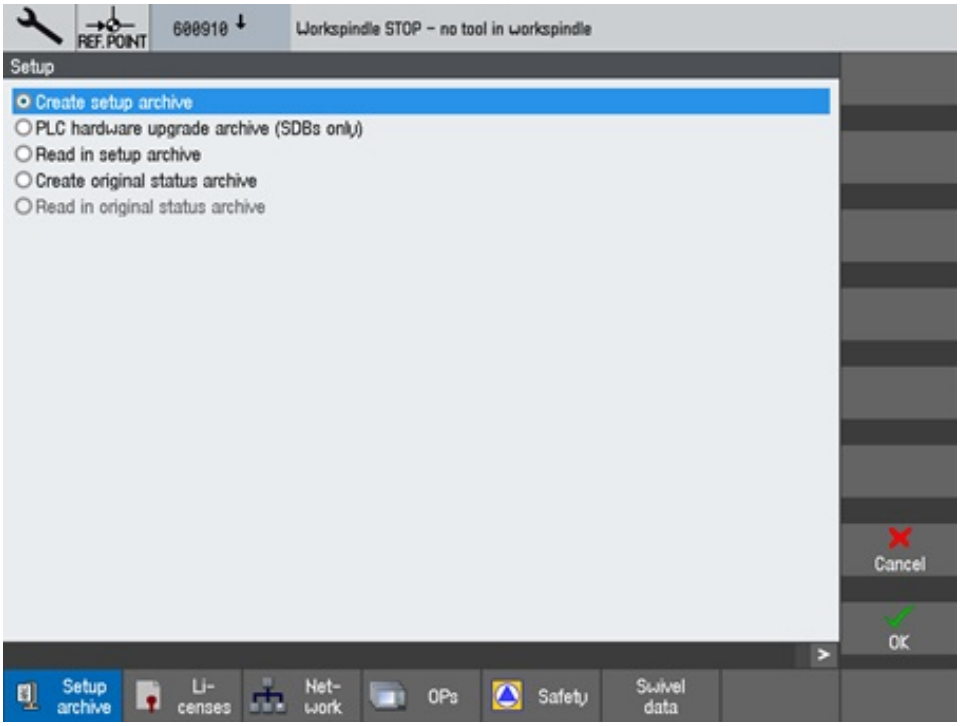


Fig. 92: mainmenu setup archive

- Select „Create setup archive”
- Confirm with „OK“

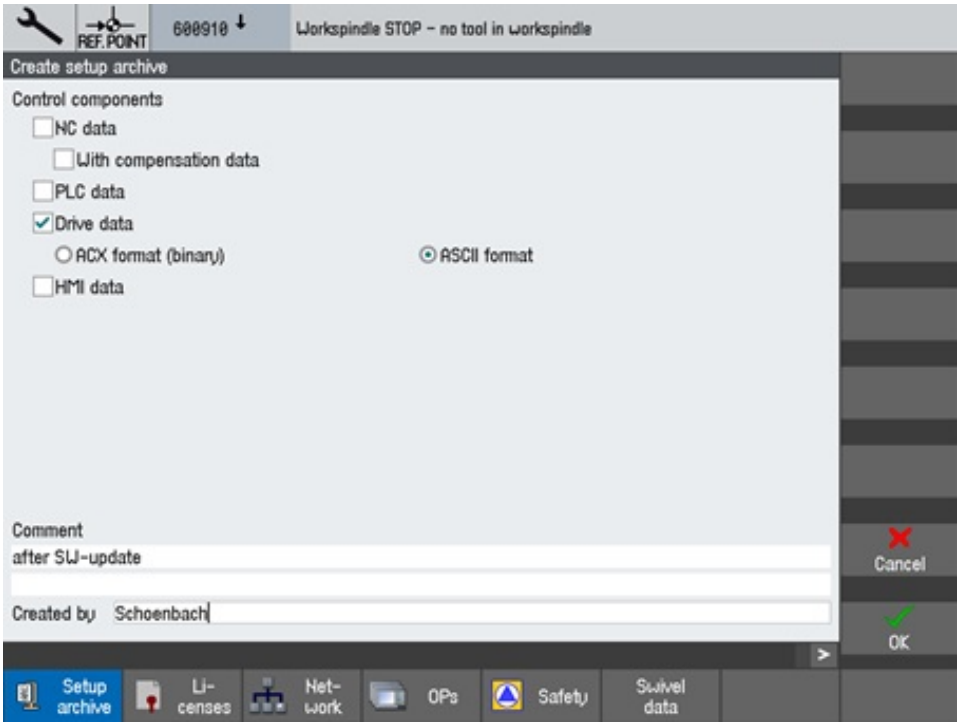


Fig. 93: choose archive

- Select archive
  - NC-data with compensation data (NC-Archive)
  - PLC – data (PLC-Archive)
  - Drive data (DP-Archiv)
  - HMI-data
- Give comment (if necessary)
- Created by:
- Confirm with „OK“

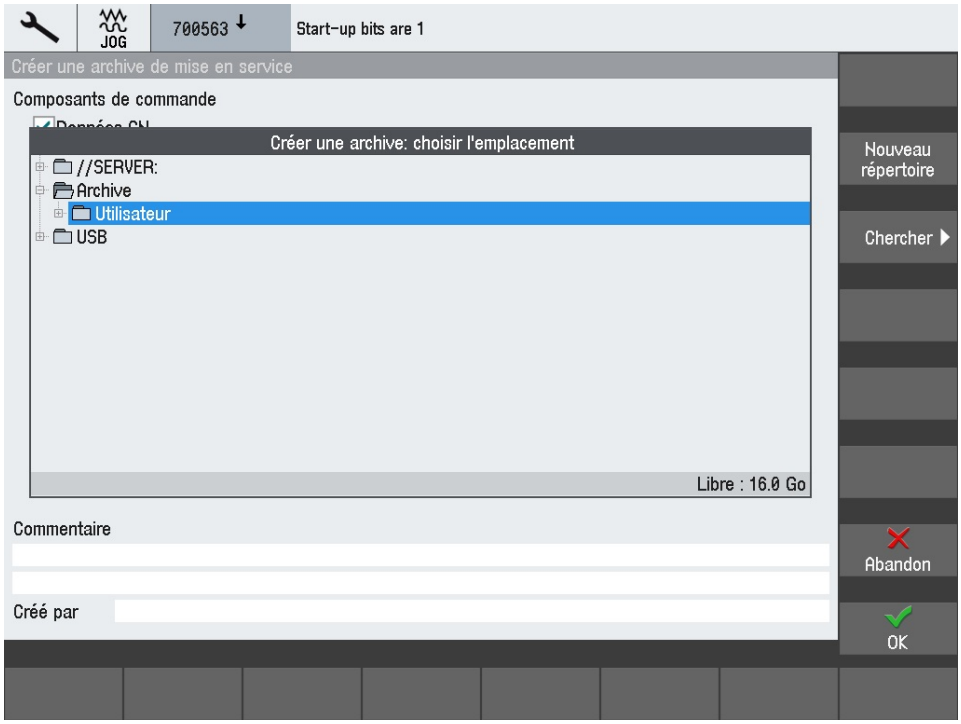


Fig. 94: Storage location

- select storage location
  - Customer = User (default)

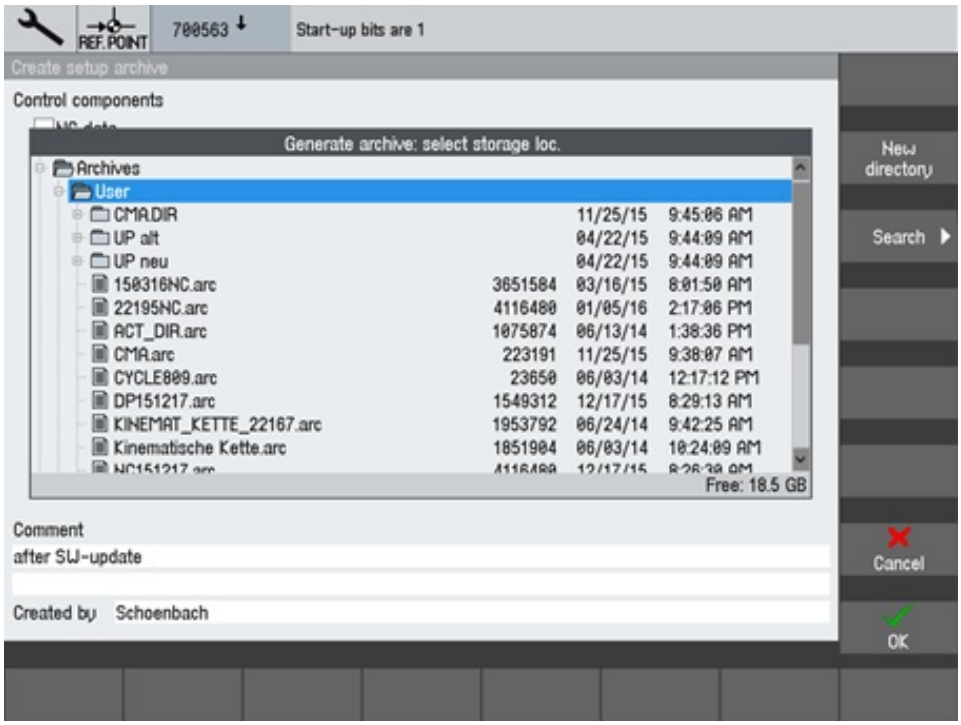


Fig. 95: enter storage location

- Confirm with „OK“

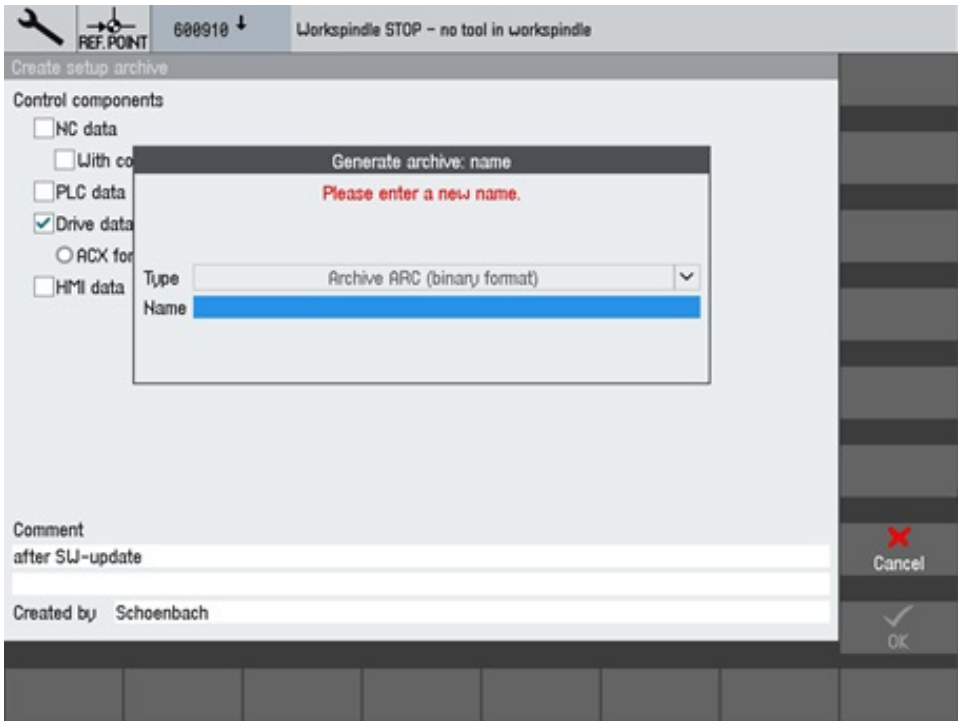


Fig. 96: file name

- Enter file name
- Confirm with „OK“

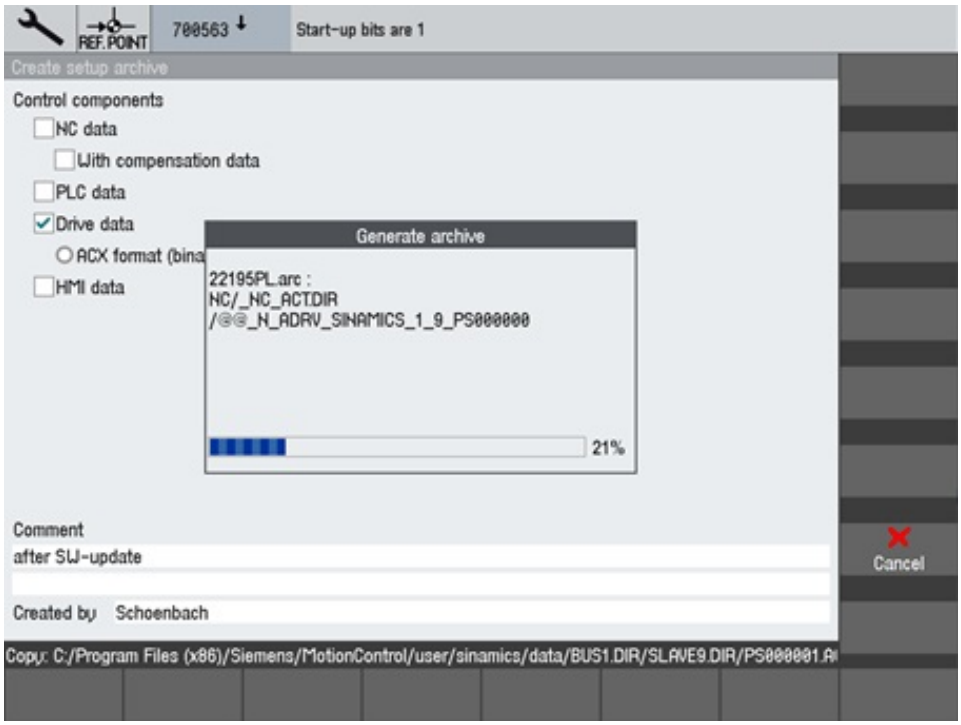


Fig. 97: generate archive

- generate archive

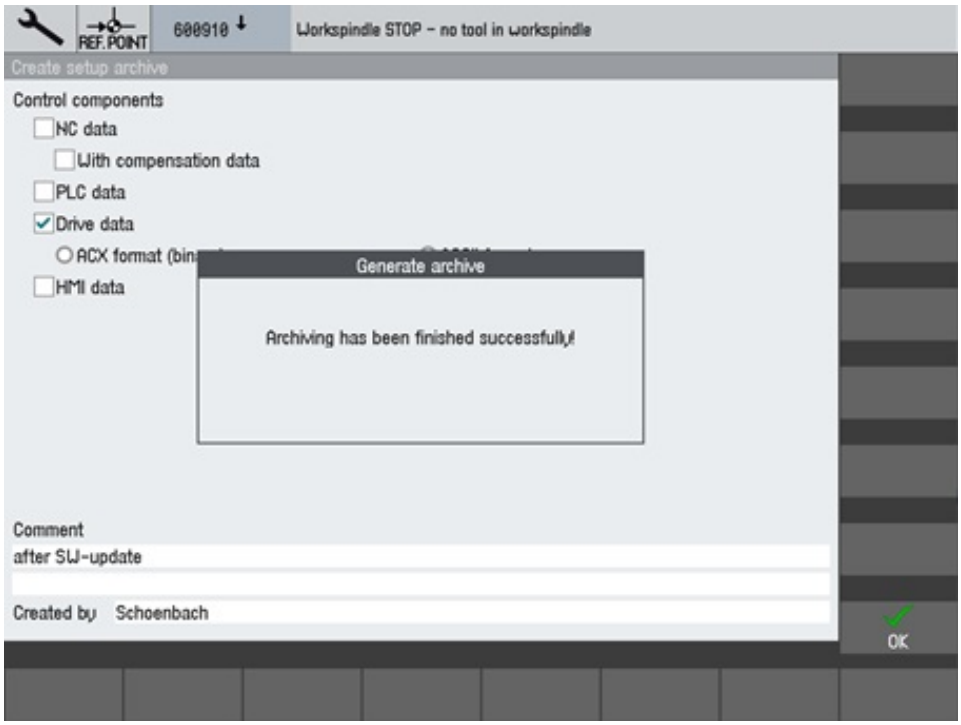


Fig. 98: archive end

- Message after sucessfully job
- Confirm with „OK“

Create other archives or select “cancel” to switch to MAIN MENU.
The archives are stored under:
C:\ \ProgramData\Siemens\MotionControl\user\sinumerik\data\archive*.*

9.6 Service operation

9.6.1 Service mode

basic programing commands HEC

G0 - max. feedrate

G1 - progr.feedrate (G1F10000 = 10000 mm/min)

G4 - dwell time (G4F2 = 2sec. dwell time)

G710 - program in metric

G700 - program in standard

M0 - programmed stop

M1 - programmed stop (disable)

M2 - End of program (channel reset)

M3 - spindle CW (M3S500 = spindle CW with 500 rpm)

M4 - spindle CCW

M5 - spindle stop

M6 - tool change

M19 - spindle orientation

SPOS=180

SPOS=0

TCH - ATC

PCH - APC

2345 as toolname

DRILL_DM1.234

e.g.

T2345

TCH

M2

T="DRILL_DM1.234"

TCH

M2

T0

TCH

M2

H2 - empty buffer location (Gripper, feeder)

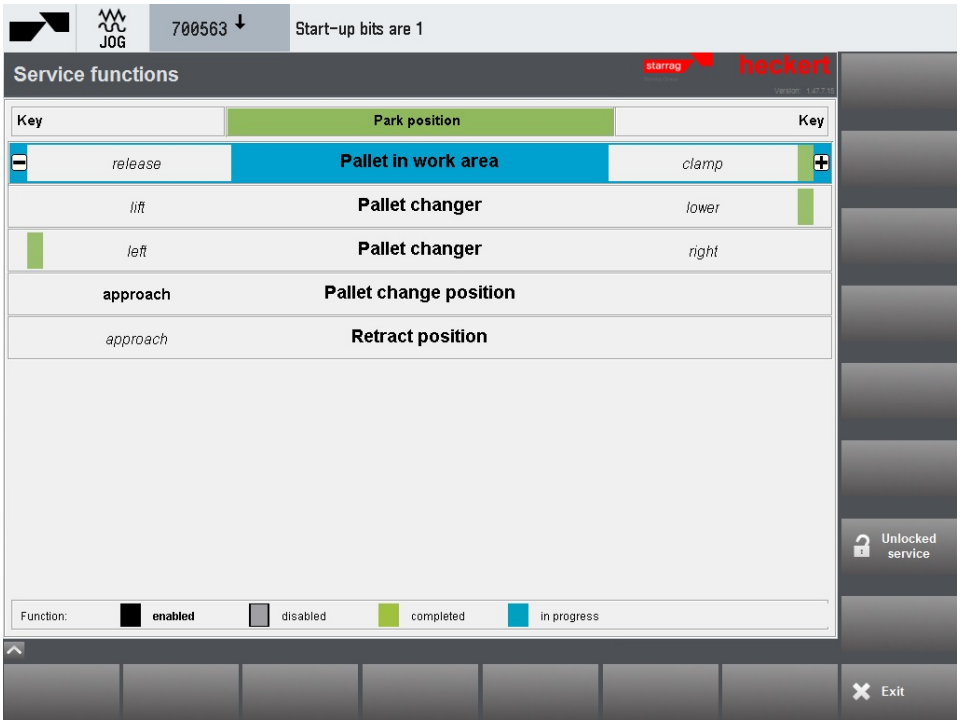


Fig. 99: Pallet changer service mode

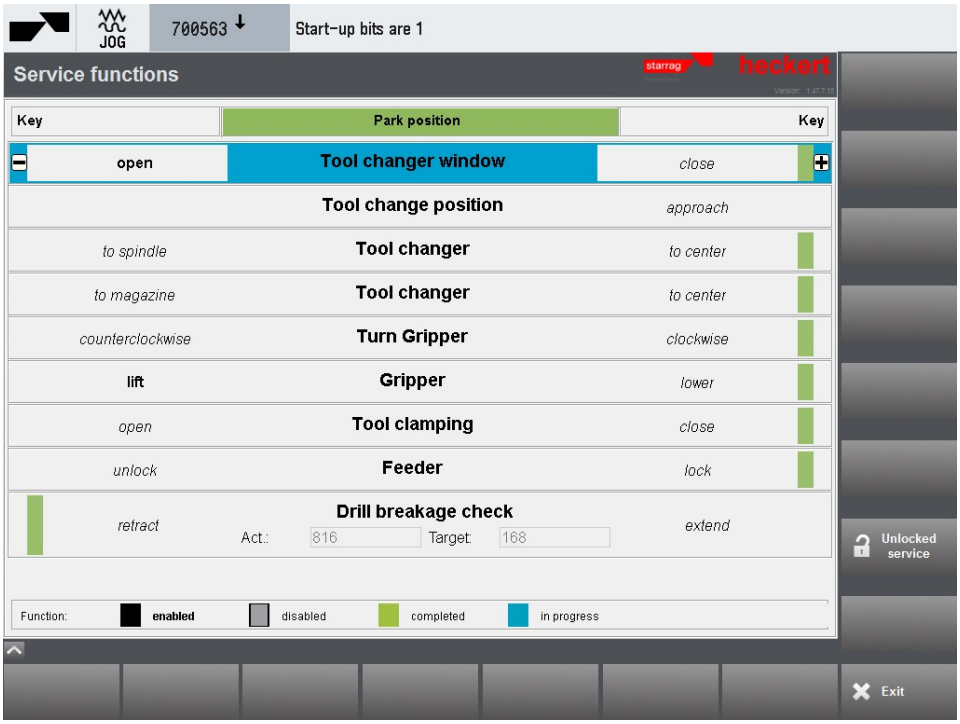


Fig. 100: Tool changer service mode

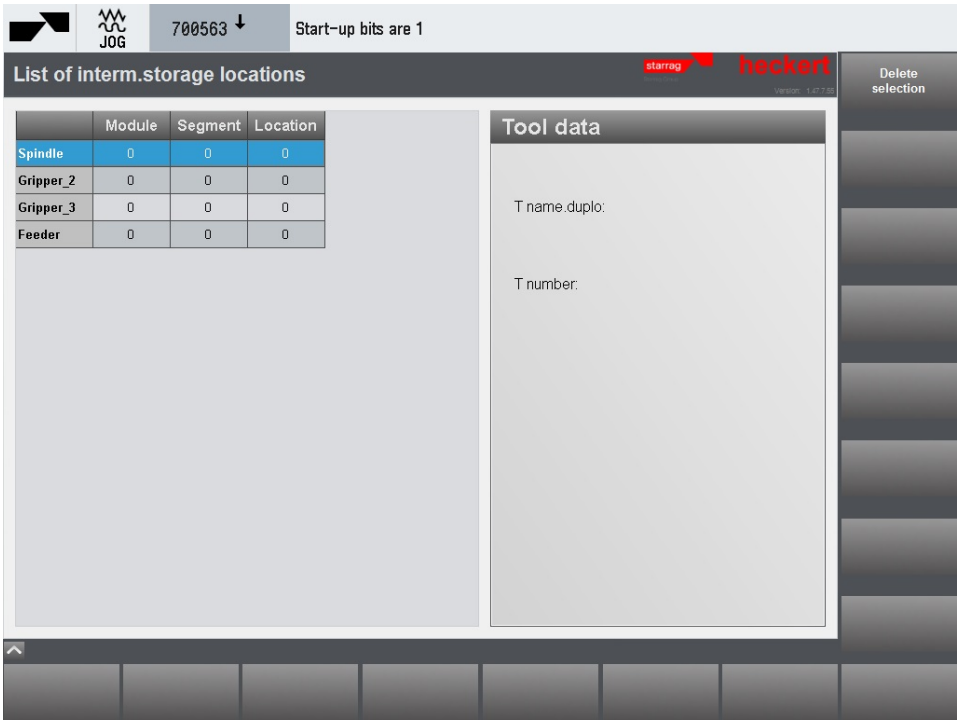


Fig. 101: Local accumulator service mode

9.7 Abschlussfragen zum Kapitel

- Welchen unterschied gibt es zwischen SBA2 & SBA3?

- Was lässt sich in der SBA 1 mit offener Arbeitsraumtüre bedienen?

- Wie wird das Inbetriebnahmebit für Kühlmittel gesetzt?

- Was ist beim Ausführen einer Komplett Datensicherung zu beachten?

- Welche Möglichkeiten gibt es das aktive Messsystem heraus zu finden?

- Wie kann die Motortemperatur bei Produzierender Maschine herausgefunden werden?
o Sicherheitsschalter manipulieren, Servicetüre öffnen um mit einer Wärmebild-kamera den Motor messen zu können
o In den Maschineninformationen
o In Parametern
o Im Diagnose Menü
o In der Parameterliste

- Wo können die Achspositionen des Magazins eingesehen werden?

10 Specific start-up tasks

10.1 Programmierbefehle

G0 – rapid feedrate
G1 – programed feedrate (G4F1000 = 1000mm/min)
G4 – dwelltime (G4F2 = 2 Sekunden)
G54-57 – work offset
G500-599 –extended work offset (Option)
M0 –programed stop
M2 –end of program
M3 – spindle rotation CW
M4 – spindle rotation CWW
M5 – spindle stop
M7 – coolant through spindle (1. pressure stage)
M8 –coolant through spindle ring
M9 – coolant OFF
M19 –spindle orientation
M41 – gear stage 1
M42 – gear stage 2
M55 – coolant shower ON
M56 – coolant shower OFF
S – spindle speed(S500M3 = 500 U/min)
H31 – start lubrication cycle
T –tool call (T123 / with letters T=“BOHRER123“)
PCH –pallet change
PCH1 – change pallet 1
PCH2 – change pallet 2
TCH –tool change
SPOS= –spindle orientation in degrees (SPOSs=12,355)
D0 – disable cutting edge
D1 – select cutting edge 1

LOOP –start of loop
ENDLOOP – end of loop

Aufgaben:

1. Tool change loop with 4 tools
- After each change, there should be a dwell time of 3 seconds
- Empty the buffer at the end and program a dwell time of 15 seconds
- With the tower magazine option: everyone gets an additional task from the trainer
- Test programs

2. create the warm-up program, move each axis up to 10mm before the end position
- Select a suitable tool with internal cooling
- Select an unused work offset group
- Deactivate cutting edge selection so that tool length 0 is displayed
- Operate internal cooling with 5Bar and in the next line with 40Bar
- Test and save MDA program

3. create spindle start up program
- Find out the maximum speed
- Select a suitable tool with maximum speed
- 1000rpm for one hour, 2000rpm for 30 minutes,
- Increase speed 5x in 10 minutes units up to maximum speed
- Test and save MDA program

4. Axis Z intensive greasing
- Execute pallet change with the service menu
- Take the Heckert bleeding program and start 10 lubrication cycles
- Then write a loop where the axis moves at 2000mm/min up to 10mm before the end position
- Trigger a lubrication cycle at both end positions and one in the middle
- Test program

10.2 Starting up the central oil lubrication system for the axes

There are two possibilities to manually trigger a lubrication pulse for start-up and service work (e.g. in case of the error "Central oil lubrication (timeout)".

- Press the keys CONTROL ON and ALARM CANCEL in the JOG NC mode simultaneously (Prerequisite: The pressure switch for monitoring of the lubrication pressure E10-B12 issues a "0" signal, i.e. no lubrication pressure present):
- Issue the H31 command in the MDA NC mode.

JOG SERVICE MODE	
ALARM CANCEL	

In both cases, a lubrication pulse is triggered, and the error "Central oil lubrication (timeout)" is reset.

This operating action may be repeated several times as necessary.

The manufacturer cycle ENTLUEFT.spf is provided for bleeding of the central oil lubrication system. This program can be used for commissioning of the central oil lubrication system or after repairs if air penetrated into the lubrication system. Normally, the program is started with a parameter in which the number of lubrication pulses to be executed is specified. While the program is running, the message "700453 Read-in disable if central oil lubrication system call is programmed" is displayed. Another message displays the number of the bleeding cycle, i.e. how many lubrication pulses have already been triggered by the program.

The program can be canceled with RESET (e.g. if the central oil lubrication operates correctly).

The number of all lubrication pulses triggered by now is displayed in DB100.DBD36 for diagnostic purposes.

Example for the program call: ENTLUEFT(20)

The program is executed 20 times, i.e. 20 lubrication pulses are triggered.

10.3 Replacement of defective slaves

10.3.1 Identification defective slaves on DP/ASi-Link (Solution Line)

Defective AS-i slaves can be identified. e.g. by way of the display of DP/ASi-LINK under "ASi → Lifelist"

10.3.2 Replacing a defective slave / automatic address programming

With the “automatic address programming” function, faulty ASi slaves can be very easily replaced.



Please observe that "automatic address programming" is only possible, if the ASi master ist in saved modus and just one ASi slave falled out.

If the AUP display lights up, the following is signaled:

- Exactly one slave is defective.
- Automatic address programming by the CP 343-2 is possible.

Now you can replace the defective slave as follows:

- Remove the defective slave from the AS-i line.
- Replace the defective slave by an identical slave with address zero (default setting). The CP 343-2 will now program the address of the originally defective slave for this slave.
- The AUP display goes out. The CP 343-2 displays the newly included slave by way of the LED.

The ASi master displays the newly added slave and adopts it into the configuration list.

10.3.3 Addressing

Each slave at the AS interface requires an address. This address is stored in the slave. The addressing unit is used to program the address of a slave.

This can be performed as follows:

- Offline by way of an addressing unit
- Online by way of the master of the AS interface system

Values between 1 and 31 (or 1A to 31A and 1B to 31B in the case of the extended addressing mode) are permissible as addresses.



Fig. 102: addressing unit

10.4 Abschlussfragen zum Kapitel

- In welcher Situation ist ein ASI Programmiergerät zwingend erforderlich?

- Beschreibe den Funktionsablauf der BBK / Werkzeugvermessung-Toolsetters:

11 Appendixes

11.1 Contact



Diagram Call Answering Service
Tel.: +49 371 836 2368
Mon - Fri: 07:00 - 18:00 CET
English, French, German
E-Mail: service.heckert@starrag.com

The following data are required

- Machine number
- Maschinennummer
- Description of the circumstances
- Callback number

11.2 Further training offers

In addition to the standard trainings in machine operation, CNC programming and maintenance, further training courses (modules) can also be attended.

Prerequisite for the participation in a module is a successfully completed maintenance training.

Further courses

Module	Learning objective
Module 01 Basics of CNC operation	Participants will be able to operate their specific machine safely and properly during service work.
Module 02 Basics of CNC programming	Participants will be able to safely use the zero offsets and standard cycles during service work and program the machine functions correctly.
Module 03 Mechanical components	Participants will be able to understand the basic structure and function of central mechanical components of their specific machine.
Module 06 SIN840D System/diagnostics	When carrying out service work, the participants will be able to safely use the commissioning and diagnostics functions on Starrag machining centres with SIN 840D.
Module 14 Status report (Fingerprint)	Participants will be able to professionally execute the status report (fingerprint) at Starrag machining centres according to the specifications and transfer the data to the service in the required form.
Module 17 Renishaw measuring components	Participants will be able to calibrate the Renishaw probe according to accuracy requirements and use it properly at the machining centres.
Module 18 5-axis measurement	Participants will be able to measure and compensate the machine kinematics on X5 and U5 machines properly and monitor the results.
Module 20 Fanuc system/diagnostics	When carrying out service work, participants will be able to safely use all relevant areas of the specific Fanuc control system at the machining centres.
Module 21 Systematic fault analysis	During troubleshooting, participants will be able to proceed systematically and methodically.
Module 25 Bus systems	Participants will be able to understand how bus systems work on HEC, LX and STC machines. They will be able to diagnose and eliminate faults.
Module 28 External systems	Participants will be able to carry out maintenance work on the specific pallet system independently according to the manufacturer's instructions.

Content and duration can be individually adjusted.

11.3 Recommended tools and equipment

Enclosed here is our recommendation for completing your service equipment with special auxiliary equipment.

We assume you are already equipped with standard tools for maintenance and service. That is why this equipment is not included in this list.

With the complete set of equipment, you can carry out most maintenance and service work.

Special service work may require additional special equipment which is not listed here. These tools are specified in concrete cases on written request.

11.3.1 Measuring device for measuring the belt tension

Type	Material number	Setpoint values
WF-TM NANO	1010525	In accordance with “Setting Guidelines Table” in the “Maintenance” section of the operating manual of the respective machine.



Fig. 103: WF-TM NANO

11.3.2 Taper wiper for cleaning of the internal taper of the workspindle

Type	Material No.
Taper wiper for SK40	1008864
Taper wiper for SK50	1008866
Taper wiper for HSK63	1008867
Taper wiper for HSK100	1008868

Design

- Large clearances for swarf and dirt;
- The fleece is oil- and emulsion-resistant;
- Dimensionally stable plastic body;
- Compared to wood, no shrinking; recyclable (no hazardous waste).



11.3.3 PowerCheck for measuring the pull-in force of the tool clamping fixture

Type	Order number	Pull-in force	
PowerCheck basic unit	361917	10 ... 75 kN	
Adapter HSK-A63	361916	HSK63	18.0 kN, Ott-Jakob 22.0 kN, Berg
Adapter SK40	361915	SK40	12.0 kN
Adapter HSK-A100	362183	HSK100	45.0 kN (standard) 72.0 kN (P150 quill)
Adapter SK50	362182	SK50	25.5 kN 35.0 kN (P150 quill)
		SK50 (HV)	25.0 kN with form A 22.0 kN with form B

The actually measured pull-in force should not be less than 70% of the nominal value.

Possible consequences of insufficient pull-in force are:

- Significantly increased tool wear.
- Tool vibration and marks from machining on the workpiece;
- Corrosion of the spindle cone due to micro-movements;
- Damage on the spindle and tool cones from corrosion particles;
- Tool breakage for no apparent reason;
- Reduced tool life.



11.3.4 Mounting tool for the tool clamping

Assembly tools for adjusting the SK tool clamping

Tool holder	Material number	Setpoint values
SK40	362179	93.6 ± 0.1 mm
SK50	362181	134.2 ± 0.1 mm Note the information on the H spindle!



Fig. 104: Assembly tools for adjusting the SK tool clamping

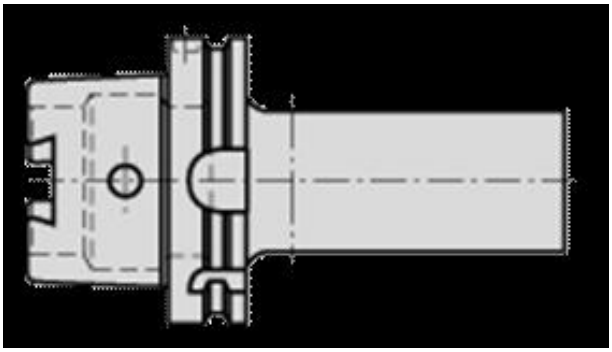
11.3.5 Assembly spray for maintenance of the tool clamping fixture

Lubricant	Material number
Metaflux Moly Spray No. 70 – 82, 1 bottle	120287
Metaflux grease paste No. 70 – 8508 (350 g tin)	
Metaflux grease paste No. 70 – 8575 (75 g tube)	



11.3.6 Run-out gauge

Type	Order No.
Reference/radial runout measuring arbor for SK40 with box	361750
Reference/radial runout measuring arbor for SK50 with box	361749
Fixed-value arbor for SK50 (short, for H/V head)	362204
Reference/radial runout measuring arbor for HSK63 with box	361751
Reference/radial runout measuring arbor for HSK100 with box	361752
Fixed-value arbor for HSK100 (short, for H/V head)	362377



11.3.7 Equipment for measuring the pull-in force of the clamping cones

Type	Order No.
Measuring device	–
Measuring device	–
Pull stud (for HEC400/500D)	–
Pull stud (for HEC500–800X5)	–

The complete scope of supply is packed in a suitcase.

11.3.8 Plug gauge and measuring disc for the adjustment of the tool change positions

Toolholder	Material number	Test dimension *	Remark
Test mandrel for SK40	359895	19.1 mm	
Measuring disc for SK40	359896		
Test mandrel for HSK63	361202	20.0	
Measuring disc for HSK63	361204		Tool gripper
Measuring disc for HSK63	361203		Tower magazine location
Test mandrel for SK50	361635	19.1 mm	
Measuring disc for SK50	361636		
Measuring disc for BT50	362196	38 ± 0.1 mm	
Test mandrel for HSK100	361200	25.0	
Measuring disc for HSK100	362453		Universal, for all CWK +HEC grippers

* Test dimension of external face side on measuring disc to measuring surface of test mandrel (axial position)
The dimensions are subject to production-related deviations. The actual dimensions are engraved on the appropriate fixture and must be taken into account in calculation.

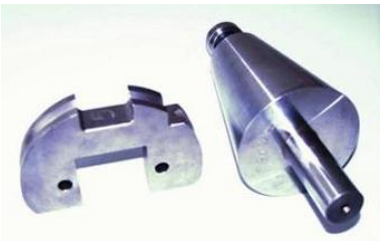


Fig. 105: SK

11.3.9 Adapter cable

Adapter cable for the handheld operator unit of HEC 500 - 800

Type	Material number	Intended for
Adapter cable for Handheld operator unit HEC 500 - 800	256653	Start-up of the tool changer Start-up of the tower magazine

For start-up purposes, the handheld operator unit can be used for start-up of both the
tool changer and the tool tower magazine.

The adapter cable serves the extension of the connection cable, allowing the handheld operator unit
also to be used in the range of the tool changer and the tool tower magazine
.

11.3.10 PP2001 Programming and Display Unit

Type	Material No.	Setting values
PP2001 Programming and Display Unit	256622	For the values to be set on the electronic sensors, please refer to the Fluid Diagrams. These are included in the Machine Documentation.
Cable, 2m	255727	



Fig. 106: PP2001 Programming and Display Unit

11.3.11 Repumping Unit for Filling the Hydraulic Unit via a Filling Coupling

Type	Material No.	Technical specifications
Hydac Filter unit OF7	342615	Pumping capacity: 15 l/min Filter size: 0160 Weight: approx. 12 kg
Adapter hose	1030204	Connection from OF7 to the hydraulic unit



Fig. 107: Hydac OF7

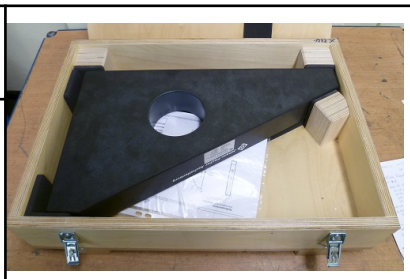
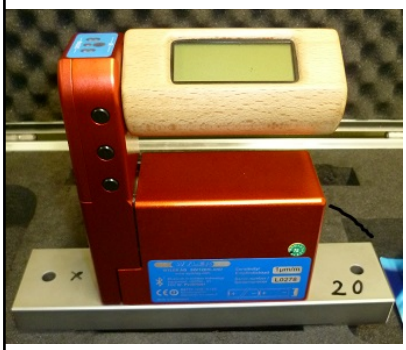
11.3.12 Filling equipment for filling the Hydac pressure accumulator

Type	Material number
FPU-1 testing and filling device	358830



Fig. 108: FPU-1 testing and filling device

11.3.13 Measuring equipment for static acceptance

Type	Material number	
Hard-rock bar with box, 500 mm	362185	
Hard-rock bar with box, 750 mm	362192	
Box 750 mm	362193	
Hard-rock bracket with box, 500mm x 300 mm	362186	
Hard-rock bracket with box, 600mm x 400 mm	362210	
BlueLEVEL (high-precision electronic inclination measuring instrument)	1014611	
Test column with box, 360 mm x 100 mm	362203	
Indicating caliper 50µ / 1µ	362194	
Magnet stand for indicating calipers	362195	
Measuring rods, universal	362349	
Measuring rods, reversal	362350	
Ball-cage encapsulated test mandrel D = 25 mm	362198	
Ball-cage encapsulated test mandrel D = 20 mm	362251	
Test mandrel for hydraulic clamping fixture D = 20 mm	362371	
Test mandrel for hydraulic clamping fixture D = 25 mm	362373	

Type	Material number
Ball-cage encapsulated test mandrel D = 50 mm	362197
Ball-cage encapsulated test mandrel, short, D = 50 mm	362372
Ball-cage encapsulated test mandrel D = 100 mm	362374

11.3.14 Further media and auxiliary substances

Medium/auxiliary substance	Material No.
ACMOS isolating spray	120239
Gleitmo 815 grease paste	981155
Loctite 243 thread lock	120150
Cutting oil spray	120028
Quick-cleaning spray	981341
Antirust spray	981132
P1 industrial paste	981239
Ceritol sealing grease	120147

11.3.15 Simatic PC USB-FlashDrive

Type	Material No.
Simatic, PC, USB FlashDrive, 1 GB	362981



Fig. 109: Simatic, PC, USB-FlashDrive, 1 GB

Requirements

The PCU50.3 uses the WINDOWS XP operating system and requires software version 7 or higher. The USB port is only fully supported from this software version onwards.

Conditions for use of a USB stick

1. Every new type of USB stick installs itself in the Windows XP operating system. Special drives may be necessary for this. Administrator rights are also necessary, which the operator does not have. Usually, at least a restart of the PCU is required. Then, more and more entries are logged in the registry. However, the operating system limits the registry to a maximum size. Installation can also result in the PCU50 no longer responding. In this case, it must be restarted. Incorrect drive access and faulty network connections can make operation extremely slow!
2. The port on the control panel is very narrow, and not every USB stick fits. Often, 5 V are available, and the USB signals this, but the data interface does not have any contact.

Which USB stick is recommended?

For the reasons mentioned above, exclusively a USB stick from Siemens is recommended.

Order no. 6ES7 648-0DC30-0AA0. The storage capacity is approx. 1 Gbyte.

The functionality is only guaranteed for this and no other USB stick.

11.3.16 AS interface addressing unit

Type	Material number
ASi addressing and diagnosis device	4314.3

Scope of supply

- Addressing device
- Operating instructions (German, English, French, Spanish, Italian)
- Addressing cable (1.5 m with jack plug)



Fig. 110: ASi addressing and diagnosis device

11.4 Final test

Task 01

The following subassemblies have been exchanged on the machining center.

Which machine zero points and which change positions ***have subsequently to be*** redetermined?

Please check! Specify reasons for your decision in brief.

	X1	**Y1**	**Z1**	**Z2**	**B1**	**C1**	**Tool changer**	**Pallet changer**
	Machine zero points						**Change points**	
Ballscrew of the X1 axis								
Reasoning								
Motor of the Y1 axis								
Reasoning								
Main spindle, complete								
Reasoning								
Measuring system for the B1 axis								
Reasoning								
Measuring system for the main spindle								
Reasoning								
Table subassembly, complete								
Reasoning								

Task 02

The surface quality of the machined workpiece is poor.

Specify possible causes!

Task 03

The B1 axis is pushed out of its position during machining.

How do you proceed?

Task 04

This task will be specified directly by your trainer.