

**HELLER**

# Operator Manual

H 8000 MC, H 10000 MC  
SINUMERIK 840D sl

BD.001337-EN-00

Contract data	
Designation	Machining centre
Machine type	H 8000 MC, H 10000 MC
Control	SINUMERIK 840D sl



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<b>Operator Manual</b>	The Machine Operator Manual describes the preparation of the machine for use and all activities during operation.
<b>Intended readership</b>	The Operator Manual is intended for the user (owner) of the machine and for all persons involved in operating the machine. It must be made available to this group of persons.
<b>Preconditions</b>	The operators of this machine should be trained or otherwise qualified to operate machine tools.

**Safety**

Throughout the document there are instructions regarding work safety, which are important for avoiding harm to health and loss of life.

Anyone required to work with this machine must have read and understood the chapter entitled SAFETY in this manual.



The Operator Manual is an integral part of the General Machine Documentation, which consists of several documents. An overview of the documentation can be found in the Section entitled "Components of the General Machine Documentation" in Chapter 1.

<b>Content</b>	The arrangement of this Operator Manual can be found on the following pages.
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**1. Information and technical support**

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**2. Safety**

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**3. Technical Description**

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**4. Operating and monitoring devices**

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**5. Operation for production**

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**6. Tool systematics**

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**7. Operation in setup mode**

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**8. Movement with open safety door**

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# CHAPTER 1

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Information and technical  
support

# 1 Information and technical support

## 1.1 Components of the General Machine Documentation

The complete General Machine Documentation for your machine consists of the following documents:

**Machine Operator Manual (BD)**

The Machine Operator Manual describes the preparation of the machine for operation and all activities during operation. The document contains the following information:

- Operating and monitoring devices
- Operation for production
- Operation in special situations
- Tool handling

**Operator Information (BI)**

Operator Information is supplied only upon request. These documents contain important additions or specific order-related details, which came to light after the copy deadline. The Operator Information supplied form part of the General Machine Documentation and must be observed accordingly.

**SINUMERIK 840D - Programming Short Guide**

The Programming Short Guide of Messrs. Siemens describes all the important programming steps. The document is intended to assist and jog the memory of the programmer, who would perhaps like to "brush up" on a command that is used all too infrequently or to look up the meaning of a parameter.

**SINUMERIK 840D sl - Operating Manual**

The Operating Manual of Messrs. Siemens describes the functionality of the standard scope of the control. The document supports the user of the machine during the following tasks:

- Setting the machine
- Machining workpiece
- Teaching programs
- Managing tool data
- Manage program



<b>SINUMERIK 840D sl - Diagnostics Manual</b>	<p>The Diagnostics Manual of Messrs. Siemens must be used as a reference work. The document supports the user of the machine during the following tasks:</p> <ul style="list-style-type: none"> <li>- Correctly assessing special cases during machine operation.</li> <li>- Understanding the reaction of the machine to special cases.</li> <li>- Using the possibilities for continued operation after special cases.</li> <li>- Following references to more detailed documents.</li> </ul> <p>The Diagnostics Guide describes alarms from the following areas of the control:</p> <ul style="list-style-type: none"> <li>- NC core NCK</li> <li>- User interface HMI</li> <li>- Drive system SINAMICS and drives</li> <li>- Programmable logic controller PLC</li> </ul>
<b>Supplementary control manuals (optional)</b>	<p>The package includes the following manuals of Messrs. Siemens:</p> <ul style="list-style-type: none"> <li>- SINUMERIK 840D - Programming Manual - Fundamentals</li> <li>- SINUMERIK 840D - Programming Instructions - Production Engineering</li> <li>- SINUMERIK 840D - Programming Instructions - Cycles</li> </ul>
<b>SINUMERIK 840D sl - HELLER Programming Instructions (PA)</b>	<p>The HELLER-Programming Instructions describe supplementary functions developed by HELLER and exceeding the standard scope of the SINUMERIK 840D sl control. The main contents are:</p> <ul style="list-style-type: none"> <li>- Variables for workpiece information and variable programming.</li> <li>- M and G functions</li> <li>- Tool functions.</li> <li>- Traversing range restrictions.</li> <li>- Compatibility between the series and its predecessors.</li> <li>- Cycles.</li> </ul>
<b>Maintenance Instructions (IA)</b>	<p>The Maintenance Instructions (IA) describe all inspection and maintenance work to be performed periodically in order to keep the machine ready for operation. The document provides the following information:</p> <ul style="list-style-type: none"> <li>- Checklists as a guideline.</li> <li>- Detailed instructions per maintenance item how to perform work safely and professionally.</li> </ul>
<b>Wear Parts List (VS)</b>	<p>The Wear Parts List provides an overview of all mechanical, hydraulic and electric wear and spare parts of the machine.</p>
<b>Subsuppliers' Information (ZI)</b>	<p>Subsuppliers' Information is a collection of selected original documents on components purchased by HELLER from other</p>

manufacturers. The selection focuses on documents containing information relevant to the end user.

**Transportation Information (TI)**

Transportation Information is available for the machine and for main components such as pallet magazine and rack-type tool magazine. The Transportation Information contains the information required to transport the machine or component by crane:

- Weight
- Lifting points
- Specified hook-up material

## 1.2 Using the General Machine Documentation

### Importance of General Machine Documentation

All persons employed or commissioned by the owner to carry out transport, set-up, installation, commissioning, operation and maintenance of the machine must read and adhere to all instructions provided in the General Machine Documentation.



In particular, all of them must have read and understood Chapter 2 headed "Safety" in this User Information.

Senior personnel must make all relevant documentation accessible to staff and ensure that such documentation is strictly adhered to.

Only by following the rules and instructions contained in the General Machine Documentation will it be possible to avoid mistakes, ensure error-free operation and get the maximum benefit from your machine.

### Changes

This technical documentation does not cover modifications made to the machine after delivery.

HELLER reserves the right to make alterations with respect to the information contained in this technical documentation due to technical progress and for the purpose of correcting errors.

### Applicable rules and regulations

The owner must ensure that in addition to the General Machine Documentation, all regulations concerning accident prevention and environmental protection valid at the site of machine use are observed.

### Subsuppliers' Information (ZI)

Note particularly the supplied manufacturers' documentation on external units and purchased parts.

HELLER cannot accept responsibility for the completeness and correctness of this documentation.

### Availability of General Machine Documentation

The General Machine Documentation is essential for the use of the machine. The General Machine Documentation should therefore always be kept near the machine and be accessible to the appropriate personnel at all times.

## 1.3 Abbreviations

### Machine-related designations

**Job No.** Five-digit job number, see machine nameplate.  
The job number corresponds to the machine number.  
Option: In the case of rebuilds, the order number is extended by a two-digit rebuild number.

	Modification status	Job No. example
New machines	--	12345
1nd rebuild	01	12345.01
2nd rebuild	02	12345.02

The combination of job number and rebuild number can also be found on the spine of the documentation folders.

**ED** Duty cycle (in performance data)  
Example: Spindle power with ED S1 - 100%

**HSK** Hollow taper shank tool holder DIN 69 893

**SK** Steep taper tool holder DIN 69 871

### User information

**BD** Machine Operator Manual

**BS** CNC Operator Manual

**BI** Operator Information

**IA** Maintenance Instructions

**PA** Programming instructions

**PU** Programming instructions for sub-programs

**TI** Transportation Information

**VS** Wear and spare parts list

**1 Information and technical support****1.3 Abbreviations**

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ZI Subsuppliers' Information

**Drawings, plans**

AP	Operation layout
AZ	General layout
EP	Wiring Diagram
FZ	Installation plan
HP	Hydraulic diagram
KP	Coolant diagram Cooling water diagram
PP	Pneumatic diagram
SA	Lubrication Instructions
SP	Lubrication diagram

## 1.4 Symbols and codes for text identification

The following symbols and codes appear in this user information.

### Warning and safety precautions



The warning triangle denotes warnings and safety precautions.



For definitions of various warning levels see:  
"Warning and safety precautions" **page 32**

### Codes in guidance texts

- Precondition for an action or action sequence.
- Action you are to carry out.
- Behaviour of the machine (process or condition) that can be expected as the result of the previous action.



Help in the event that you cannot complete an action or achieve the expected result.

Diagnostics: Symptom and (possible) cause.

- Remedy: Actions required to solve the problem.

Names of operating elements are in *italics*. Example :  
The *Pre-set start* key.

Symbol suffixes that you must enter exactly, appear in the *Courier* font. Example :  
Enter `unix`.

1	Information and technical support
1.4	Symbols and codes for text identification

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## Other remarks



Background information or references to peculiarities and exceptional cases.



Information on environmental protection.

## Cross-references



Cross-reference to another point in this user information.



Cross-reference to another user information.



Cross-reference to a drawing or diagram.

## Component item numbers

- [x.y]** Position number of a component on a plan and in the corresponding equipment list. Example :
- SP [24.1]            Item 24.1 in the Lubrication Diagram (SP).
- (-x/y)** Position number y of a component in the x Figure of the same subchapter. Example :
- (-1/3)            Fig. n.n.n-1, Item 3.

## 1.5 Customer service

<b>Before contacting customer service</b>	Providing detailed information and specific questions will help solve problems quickly, facilitate spare parts ordering and ensure that the correct parts are supplied. Before contacting customer service, make a note of the following information.
<b>Machine information</b>	<p>The following information should be supplied with all queries and orders:</p> <ul style="list-style-type: none"><li>- Type</li><li>- Job No.</li><li>- Year of construction</li></ul> <p>This data appears on the nameplate. The nameplate is located near the machine's main switch.</p>
<b>Fault information</b>	<p>Additional information is required in the case of a fault:</p> <ul style="list-style-type: none"><li>- Nature and extent of the problem</li><li>- Related circumstances</li><li>- Presumed cause</li></ul>
<b>Spare parts information</b>	<p>Additional information for spare part orders:</p> <ul style="list-style-type: none"><li>- Number of duty cycles</li><li>- 8 digit HELLER item number from Wear Parts List. In the case of production parts, this number is stamped into the part itself.</li></ul>
<b>HELLER ServiceCenter, Nürtingen</b>	<p>Technical service and spare parts sales Telephone: +49 7022 77-9999 Fax: +49 7022 77-5419 Email: <a href="mailto:servicecenter@heller.de">servicecenter@heller.de</a></p>



## 1.6 HELLER Addresses

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**1 Information and technical support****1.6 HELLER Addresses**

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# CHAPTER 2

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Safety

## 2 Safety

### 2.1 Designated use

<b>State of technology</b>	At the time of delivery the construction of the machine reflects the state of technology as well as recognised standards, rules and regulations. There is, however, a risk of hazards for the user or third parties and of damage to the machine or other equipment associated with its operation.
<b>Using the machine</b>	The machine must be used only in fault-free condition and only for its design purpose. Safety issues must always be kept in mind as described in the General Machine Documentation. In particular, faults that affect the safety of the machine must be immediately rectified or their rectification be arranged.
<b>Correct use</b>	The machine is intended exclusively for cutting operations on metal workpieces.

#### **Machineable materials**

All standard materials can be machined: steel, castings, non-ferrous metals and alloys, with the exception of magnesium.  
It is **not permitted to machine magnesium material** on the machine!

#### **Permissible operating modes**

This machine permits all standard machining methods with defined cutting geometry: surface and circular milling, drilling, countersinking, tapping and boring. **Grinding is not permissible.**

#### **Permissible cooling lubrication methods**

The following cooling lubrication methods are permissible on this machine:

- Wet machining with water-soluble cooling lubricant
- Machining with minimum quantity lubrication
- Dry machining of grey cast iron or of other workpiece materials in combination with suitable cutting materials

**Non-water-soluble cooling lubricants are not to be used.** Exceptions to this rule are minimum volume lubrication systems, which are designed in such a way that the coolant lubricant cannot form an ignitable mixture in the work area.

### Technical data

For application range of machine, workpiece and tool limit data, performance data and environmental conditions, see General layout (AZ) and Technical Data (57.). The documents always appear in the Chapter headed "Drawings, Plans" in the Machine Operator Manual (BD).

#### Improper use

The use of the machine for any other or additional purpose is deemed improper. HELLER does not accept liability for any injury or damage resulting from improper use. The owner carries the sole risk. To determine damage due to improper use, serious errors caused by a mechanical overload of the machine are permanently recorded.

Machine operation in potential explosive or residential areas is not permitted. Machine operation in water conservation areas is permitted only if the relevant structural requirements are satisfied or if the machine is fitted with the appropriate optional equipment.

#### Observation of General Machine Documentation

"Proper use" includes observation of the complete General Machine Documentation and the specified maintenance intervals.

#### Maintenance

Routine maintenance is to be carried out at the specified intervals. All relevant information can be found in the Maintenance Instructions!

#### Liability

HELLER accepts no responsibility for damage or equipment failures arising from failure to observe the instructions provided in the General Machine Documentation.

## 2.2 Warning and safety precautions

### Warnings

Warnings appearing within guidance documents refer to dangers of which you must be aware when executing the next working step, in order to avoid damage to yourself, other people or property.



#### **DANGER**

Warnings with this wording indicates immediate danger that will cause death or serious personal injury if the warning is not observed.

Follow the instructions.



#### **WARNING**

Warnings with this wording indicates potential danger that may cause death or serious personal injury if the warning is not observed.

Follow the instructions.



#### **CAUTION**

Warnings with this wording indicates potential danger that might cause moderate to slight personal injury or damage to property, if the warning is not observed.

Follow the instructions.

### Safety instructions



Safety warnings that precede an instruction refer to dangers of which you must be generally aware when carrying out the following work, in order to avoid damage to yourself, other people or property.



## 2.3 Safety regulations for the machine owner

### 2.3.1 Organisational safety measures

<b>Availability of General Machine Documentation</b>	The General Machine Documentation must be permanently kept in the proximity of the machine and made accessible to the operating and maintenance personnel.
<b>Regulations in addition to the General Machine Documentation</b>	In addition to the General Machine Documentation, all statutory and local regulations relating to accident prevention and environment protection must be available; conformance with these regulations must be checked regularly.
<b>Safety and hazard information</b>	All safety and hazard information on the machine must be maintained in a legible condition and must not be removed.
<b>Interference immunity</b>	Fault-free operation of the machine is guaranteed only when the control cabinet doors are closed. The use of mobile and radio telephones, receivers or other high-frequency devices in the direct proximity of an open control cabinet is forbidden.
<b>Safety equipment</b>	The machine owner must provide the necessary protective clothing and equipment. Furthermore, it is the owner's responsibility to ensure proper use of the required protective clothing and equipment by personnel.
<b>Password</b>	<p>Passwords guarding access to protected control settings are to be kept secret. They may only be revealed to those persons who are entitled to change default settings and are specially trained for this work.</p> <p>Protected settings must only be changed depending on certain maintenance and repair work. Passwords are not necessary for normal machine operation. Extreme caution must be exercised when working with password-protected settings. Incorrect input may trigger malfunction, which may endanger persons and cause damage.</p>

<b>Safety keys</b>	<p>Safety keys are to be kept by persons trained and authorised to work on the related equipment. This applies to keys for the following equipment:</p> <ul style="list-style-type: none"><li>- Key switches</li><li>- Machine operating panels</li><li>- Electrical control cabinets</li><li>- Terminal boxes</li><li>- Adjustable hydraulic and pneumatic devices and equipment</li><li>- Safety equipment</li></ul>
<b>Virus protection</b>	<p>The owner must ensure that only virus-free equipment and data carriers are used on the machine.</p>
<b>Operating materials and consumables</b>	<p>For the selection of operating materials and consumables such as grease, lubrication oils, hydraulic oils, cooling lubricants, emulsions and cleaning agents, the maximum values applicable on site for substances hazardous to health must not be exceeded.</p> <p>Any statutory regulations and impositions relating to waste disposal and environment protection must be observed.</p>

### 2.3.2 Permissibility for modifications

<b>Have modifications approved</b>	<p>The machine must not be modified without HELLER's written approval. This applies particularly to fitting with additional equipment or conversions, welding on structural parts of the machine, functional modifications as well as modifications of safety equipment, for example the installation and the adjustment of safety devices and safety valves.</p>
<b>Fixtures</b>	<p>Hydraulic workpiece clamping fixtures must be designed in accordance with the HELLER construction guideline.</p>
<b>Consequences of unauthorized modifications</b>	<p>Any modifications performed by the owner without written approval by HELLER will render warranty null and void for all parts affected by the modification. HELLER does not accept liability for any injury or damage resulting from unauthorized modifications.</p> <p>On machines with EC marking, new evaluation due to the Machinery Directive becomes necessary after any modification which may reduce safety. The manufacturer's declaration of conformity expires if the requirements of the machinery directive are no longer met.</p>

2 Safety  
2.3 Safety regulations for the machine owner

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**Measures for protection of employees** All modifications require that the owner follows the applicable regulations for the protection of employees. In the EU member states, the Material/Tools For The Work Place Directive is decisive, and in Germany the "Betriebssicherheitsverordnung" (operational safety directive).

**Transport** If lifting equipment is to be used to transport machine parts, the safety instructions relating to transport of the machine and its components must be adhered to.



See also:  
"Safety during transport work" **page 55**

### 2.3.3 Permissible spare parts

**Technical requirements** Spare parts must meet the technical requirements specified by HELLER. These requirements are always met by genuine HELLER spare parts.

**Liability** HELLER does not accept liability for damage caused through the use of Third Party Spare Parts.

### 2.3.4 Requirements to be met by operating and maintenance personnel

**Observation of General Machine Documentation and "Safety" Chapter** Before working on or with the machine, all persons involved in its transport, erection, wiring, commissioning, operation or maintenance must have read and fully understood the General Machine Documentation, in particular this chapter on safety.

**Service personnel** The machine must be operated only by suitably qualified and trained persons.

**Maintenance personnel** Maintenance work on the machine must be undertaken only by suitably trained persons.

**HELLER Training** On completion of the installation work, the persons that are to operate the machine will be instructed by qualified HELLER employees or representatives in the correct operation of the machine.

More extensive training can be provided through training courses held by HELLER.

**Training of new personnel** The owner undertakes to train and instruct any new operating and maintenance personnel to the same extent and with the same care in the operation and maintenance of the machine, taking into account all safety regulations.

**Operator supervision** Any staff involved in training of a general or specific nature must be under constant supervision by a fully trained person while operating the machine.

**Clarification of responsibilities** If several persons carry out work on the machine, their respective tasks and responsibilities must be clearly defined and followed. In the interest of safety there must be no ambiguities regarding areas of responsibility.

## 2.4 Safety regulations for personnel

### 2.4.1 General safety-conscious behaviour

<b>Observation of General Machine Documentation and "Safety" Chapter</b>	Before working on or with the machine, all persons involved in its transport, erection, wiring, commissioning, operation or maintenance must have read and fully understood the General Machine Documentation, in particular this chapter on safety.
<b>Principle of operation</b>	No operation or procedure that may compromise personal or equipment safety must be carried out.
<b>Virus protection</b>	Only virus-free equipment and data carriers may be used on the machine.
<b>No program modifications</b>	Program changes in the machine's programmable control systems are not permitted if they affect safe machine operation.
<b>Safety and hazard information</b>	All safety and warning signs on the machine must be observed and maintained in a legible condition at all times.
<b>Workplace organisation</b>	The operator's working area and machine access areas must be kept free from tools, materials and other objects. A clean and orderly working area at and around the machine must be maintained.
<b>Operation of controls and actuators</b>	Controls and actuators must not be operated wilfully or without due care and attention. This can result in injury or machine damage.

### 2.4.2 Entering and leaving the machine

<b>Stay in the hazard area</b>	Before performing any work or observations in the machine's hazard area, clarify which moving parts of the machine are in the area and what functions and range of movements these parts have. Ensure that there is always a safe escape route from the hazard area.
<b>Secure against lock-in</b>	Before entering the machine, any movable guards must be secured against closure. It is imperative to prevent the possibility of a safeguard being closed from the outside while a person is inside the danger area.

<b>Slip hazard</b>	Exercise caution when entering the work area. Ensure a firm footing. Slip hazard!
<b>Don't leave anything behind</b>	Never leave tools or other objects in the work area, as this may cause severe damage to the machine.

### 2.4.3 Safe use of the machine

<b>Operate only with operational safety devices</b>	The machine may be used only when all safety devices and safety-related devices, such as guards, EMERGENCY STOP devices, silencers and exhauster units are installed and fully functional.
<b>Do not disable any safety devices</b>	<p>Under no circumstances must safety devices be removed, disabled, or their function be impaired. Manipulation of safety devices can result in serious or fatal injury.</p> <p>The function of interlocking guards must not be bypassed by using dummy actuating elements, e.g. loose actuators of safety switches.</p>
<b>Interference immunity</b>	Fault-free operation of the machine is guaranteed only when the control cabinet doors are closed. The use of mobile and radio telephones, receivers or other high-frequency devices in the direct proximity of an open control cabinet is forbidden.
<b>Persons in hazard area?</b>	<p>Before closing any movable guards of the machine, ensure that no persons are in the hazard area.</p> <p>Before switching on or starting the machine, ensure that this will not compromise the safety of any persons.</p>
<b>Special operating modes</b>	Some control elements allow to select special operating modes such as movement with open safety door or setting work. These are described in the Machine Operator Manual.
<b>Fault handling procedure</b>	In case of changes to the machine that have an impact on safety and in the case of general faults, the machine is to be stopped immediately and secured against a renewed commissioned. The fault must be reported immediately to the responsible person or department and remedied without delay.

#### 2.4.4 Safe tool handling

<b>Danger of injury</b>	Tools have sharp edges and can easily cause injury.
<b>Observation of permissible speed</b>	Every tool must be used only up to its individual maximum speed. Excessive peripheral speeds can result in tool breakage representing a risk of accident to the operator.
<b>Balancing of tools</b>	All tools must be balanced according to the instructions of the machine and tool manufacturers. If data differ, always the highest balance quality required is decisive.
<b>Correct fitting of tools</b>	Ensure that tools required for machining are inserted and positioned correctly in the machine.
<b>Correct tool change position</b>	If specific tool changing positions have been defined for the machine, tools must only be changed manually if the corresponding operating unit is in the tool change position.
<b>Securing the machine</b>	During a manual tool change, the machine must be secured against accidental start-up and the movable guards secured against accidental closure.

#### 2.4.5 Safe fixture change

<b>Fitting a fixture</b>	Ensure that the correct fixture has been selected and correctly fitted. The use of an unsuitable fixture or the incorrect installation of a fixture can put the operator at risk and/or cause serious damage to the machine.
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#### 2.4.6 Safe workpiece change

<b>Mounting workpieces</b>	The workpiece must be placed correctly in the fixture or clamped onto the pallet. Where an fixture is clamped manually, all securing elements must be properly tightened. An incorrectly loaded machine presents a risk of injury to the operator and damage to the machine.
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## 2.5 Safety equipment

**Accident prevention** To prevent accidents, always wear tight fitting clothes. Remove ties, scarves, rings and necklaces as they can become caught in moving machine parts. Long hair must be covered by suitable headwear.

**Wear protective clothing** Operating and maintenance personnel are required to wear the following protective equipment:

Goggles/glasses	Flying metal chips, compressed air and water jets can cause serious eye injury or loss of eyesight. When working on a machine it is therefore necessary to wear unbreakable safety glasses with side protectors.
Footwear	Safety shoes with steel toe caps must be worn to prevent crushing injuries of the feet.
Gloves	High temperatures and sharp edges occur on workpieces during machining. Do not touch workpieces, tools or chips with an unprotected hand. Wear appropriate protective gloves. Similarly, wear suitable gloves when handling operating materials and consumables. When working close to moving machine parts, do not wear gloves as they can easily become trapped.
Ear protection	Prolonged exposure to loud noise causes hearing damage. Ear protectors must be worn if noise emission levels at the machine exceed the permissible maximum value.
Safety helmet	A safety helmet must always be worn if there is a danger of head injury, in particular caused by falling tools or workpieces, when performing overhead assembly or dismantling operations and when working with lifting equipment.



## 2.6 Safety and control elements

<b>Master switch</b>	<p>Before starting any maintenance work on the machine or on the control cabinet, the main switch must be turned off and secured against being turned on providing nothing to the contrary has been specified in the Maintenance Instructions for the individual case. Components that are still live when the main switch is turned off carry a notice to that effect.</p> <p>Before switching the machine off at the main switch, carry out the shutdown procedure as described in the machine operator manual (BD).</p>
<b>Emergency stop device</b>	<p>Operating the EMERGENCY STOP stops all machine movement.</p> <ul style="list-style-type: none"><li>- Only use the emergency stop in case of a real danger.</li><li>- Do not use the emergency stop function to terminate an operation or to turn off the machine!</li><li>- Operating the "Emergency stop" while machining is in progress can cause tool breakage!</li></ul>
<b>Stop button</b>	<p>Operating the stop button stops all feed movements immediately. There is a delay before the spindle runs down. Which allows the tool to run chip clearance and to clear the chips.</p>
<b>MOTORS OFF</b>	<p>Operating the <i>Motors off</i> button shuts all motors down. Once the spindle motor has been stopped, the safety door can be unlocked. Safety doors that are opened in the normal course of operation will unlock automatically.</p>
<b>"Open safety door" preselect switch</b>	<p>Apart from the following exceptions, this switch must be set to normal operating mode 1 (automatic) and locked at all times.</p> <p>The special operating mode 2 (setup) enables workpieces to be machined with the safety door open. Due to the high risks involved, the individual responsible for machine application may hand the key to this switch only to authorised individuals and only for setup and testing activities that cannot be carried out in normal mode.</p> <p>On completion of the work, the instructed individual must immediately switch back to normal operating mode 1 (automatic), remove the key and hand it straightaway to the person responsible for machine application for safe-keeping.</p>
<b>Safety doors</b>	<p>The task of safety doors is to protect operators from moving machine parts. Whilst a drive is running, the relevant safety doors are electrically locked and cannot be opened. If the safety door is</p>

unlocked, the drives are normally disabled. Under certain conditions however, axis and main spindle movements are possible at reduced speed.

If persons need to enter the work area to carry out work, the open safety doors must be secured against accidental closure. This is achieved by placing a padlock in the actuator of the safety switch or an appropriate holder on the safety door. The key must then be removed and carried on your person. This means that the safety door can not be closed. The machine can now only be operated under particular preconditions and only at low speed.

**Brake on vertical and oblique axes**

When the feed drive is shut down, the vertical and oblique slide units are held in place by a brake. Since the drives are not self-locking, the slide unit can, when the brake is released, move downwards under its own weight and cause a collision. When carrying out maintenance work, secure the slide unit before releasing the brake.

**Compressed air shut-off valve**

The compressed air maintenance unit of the machine is equipped with a shut-off valve. The compressed air from the site supply can be shut off by manually operating the valve.

**Cooling lubricant shut-off valve**

If cooling lubricant is supplied by the customer, the feed line is equipped with a manual shut-off valve. This shut-off valve is normally connected at the feed line connection to the machine.

## 2.7 What to do in an emergency

### 2.7.1 Emergency stop

#### Initiate the emergency stop

The EMERGENCY STOP should be operated in the following situations:

- When life is at risk.
- When the machine or the workpiece is in danger of being damaged.

#### Activate the EMERGENCY STOP function

The following controls will activate the EMERGENCY STOP function:

- Emergency stop switch
- Emergency stop ripcord (if installed)

Activating the EMERGENCY STOP function will stop the machine as fast as possible. Workpieces and tools may be damaged.

The EMERGENCY STOP function does not completely shut down the machine.

#### Unlock emergency stop device

Unlocking the EMERGENCY STOP device will not cause the machine to be restarted automatically.

### 2.7.2 First Aid

#### Precautions

The following issues must be clarified promptly:

- Who is the responsible first aid person?
- Where is the nearest first aid kit?
- Where is the nearest accident reporting facility?
- Where is the nearest telephone?
- What is the emergency number for first aid/medical emergencies?

**Accident emergency procedure**

Always proceed as follows:

1. Take immediate action. If necessary, stop the machine.
2. Report the accident. When reporting an accident, give the following information:
  - Where did the accident take place?
  - What happened?
  - How many people are injured?
  - What type of injuries?
  - Who is raising the alarm?
  - Await further questions.
3. Provide first aid.
4. Direct emergency services to the scene of the accident.

### 2.7.3 Person in constrained position

**Precautions**

The following issues must be clarified promptly:

- Where can persons become pinched or trapped?
- What action can be taken to ensure release?

**Accident emergency procedure**

Always proceed as follows:

1. Take immediate action. If necessary, stop the machine.
2. Establish:
  - Where precisely are the persons in such constrained positions?
  - What type of constrained position is it?
  - Are the persons injured?
  - How urgently should the persons be rescued?
  - How can the persons be released from the constrained position quickly without sustaining further injury?
3. Report the accident. When reporting an accident, give the following information:
  - Where did the accident take place?
  - What happened?
  - How many people are injured?
  - What type of injuries?
  - Who is raising the alarm?
  - Await further questions.
4. Assess the situation.
5. Agree rescue measures with all involved.
6. Implement rescue measures.

### 2.7.4 Fire fighting

#### Precautions

The following issues must be clarified promptly:

- Where is the nearest fire extinguisher located?
- Where is the nearest fire alarm located?
- Where is the nearest telephone?
- What is the emergency number for the fire brigade?

#### Fire emergency procedure

Always proceed as follows:

1. Take immediate action.
2. Report fire. When reporting a fire, give the following details:
  - Where is the fire?
  - What is on fire?
  - How many people are injured?
  - Who is raising the alarm?
  - Await further questions.
3. Turn off the machine:
  - Press the emergency stop button.
  - Switch off main switch on control cabinet.
4. Provide first aid.
5. Extinguish fire. Only attempt to extinguish the fire or stop it from spreading if this is possible without personal risk.
6. Direct the fire brigade to the fire.

## 2.8 Special hazards

### 2.8.1 Electrical hazards

#### Voltage

Electrical voltage can cause death if not treated with care. Do not operate the machine if the control cabinet doors, terminal boxes or operating panels are open.

#### Electrical connections

The connection from the machine to the electrical power supply and any work on the electrical equipment or control cabinet may be carried out only by qualified specialist personnel. The conditions and guidelines applicable to the installation site must be respected when setting up and operating electrical equipment.

#### Inspection of electrical equipment

The electrical equipment of the machine must be checked at regular intervals. Any defects, such as loose connections or burned cables, must be rectified immediately.



See also:  
"Safety when working on electrical equipment" **page 52**

### 2.8.2 Hazards from hydraulic and pneumatic compressed media and cooling lubricants

#### Regular inspection of fittings

Media escaping at high pressure can cause injury, explosion or fire. If damage such as abrasion or leaks are detected on pressure hoses, pressure lines and connections, immediately shut down the machine, even if the defects are minor. Only put the machine back into operation after the fault has been rectified.



See also:  
"Safety when working on hydraulic, pneumatic, lubrication or lubricating coolant supply systems" **page 50**

### 2.8.3 Hazards from auxiliary materials and consumables

<b>Hidden dangers</b>	Grease, lubrication oils, hydraulic oils, cooling lubricants, emulsions and cleaning agents are hazardous to health and the environment. Substances can have any of the following properties: <ul style="list-style-type: none"><li>- They may ignite easily.</li><li>- They may form vapours damaging to health.</li><li>- They may cause skin ailments and allergies.</li></ul>
<b>Observation of applicable regulations</b>	Limit values for health or environmentally damaging substances must not be exceeded. Any statutory regulations and impositions relating to waste disposal and environment protection must be observed.
<b>Prevention of hazards</b>	The operating materials must satisfy the following conditions: <ul style="list-style-type: none"><li>- No explosive mixtures must be allowed to form.</li><li>- All substances used must be compatible with each other.</li><li>- Machine components (especially cables, connectors, seals) must not be exposed to attack. This may happen in particular if the original product has been replaced.</li></ul> <p>To avoid risk of slipping, operating and auxiliary materials must not be placed near the machine.</p>

### 2.8.4 Hazards from gases and vapours

<b>Extract.</b>	Extraction or ventilation equipment must not be switched off or removed during machine operation.
<b>Health hazards</b>	When safeguards are opened, gases, vapours and suspended matter such as cooling lubricant mist and dust from castings may escape and cause a health risk. Adequate ventilation or an other means of extraction must therefore be provided.
<b>Oil mist</b>	Do not inhale oil mist. Oil mist damages health and may contain carcinogenic substances.

### 2.8.5 Noise hazards

<b>Noise protection</b>	The silencing equipment on the machine must be in the protective position during machine operation.
<b>Ear protection</b>	Ear protectors must be worn if noise emission levels at the machine exceed the permissible maximum value. Prolonged exposure to loud noise causes hearing damage.

### 2.8.6 Laser radiation hazards

<b>Potential eye and skin injury</b>	<p>Laser radiation occurs in machines using laser technology with tool break monitoring or to measure tool position. Laser radiation can cause irreparable eye injury and damage to the skin.</p> <p>Safeguard yourself from risks as follows:</p> <ul style="list-style-type: none"><li>- Do not look straight into the beam or at reflections on bright surfaces, not even when using optical equipment.</li><li>- Avoid prolonged direct exposure of the skin to radiation.</li><li>- Operate the machine only when all safeguards is operational and the guard panels are fully in place.</li></ul>
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### 2.8.7 Hazards posed by dry machining or Minimal quantity lubrication

<b>No explosive dust/air mixture</b>	No explosive dust/air mixture may be generated during the machining of workpieces. Adequate air recirculation must be provided in the work area.
<b>No ignition sources</b>	Sparks or burning chips must never occur during machining.


### 2.8.8 Hazard in case of power failure

<b>Spindle after-run</b>	A power failure can cause the tool spindle to run on. With safety doors that do not lock under off-circuit conditions the machining area might be accessed too early. Make sure, especially if the power fails, that the tool spindle stops before the safety door is open.
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## 2.9 Safety during maintenance

### 2.9.1 Safety precautions for maintenance work

<b>Qualified personnel</b>	Maintenance work may be carried out only by personnel with the appropriate specialist training.
<b>Observation of General Machine Documentation</b>	The maintenance activities and intervals regarding replacement of consumables and wear parts, as specified in the General Machine Documentation, must be adhered to.
<b>Appointment of supervisory personnel</b>	The operating personnel must be notified prior to commencement of any maintenance work. A head supervisor is to be appointed.
<b>First steps</b>	<p>The following safety precautions must be taken before carrying out any maintenance work:</p> <ul style="list-style-type: none"> <li>- Position the machine parts in such a way that the part to be serviced is easily accessible.</li> <li>- Before removing any guard panels, make sure that the machine is in the appropriate operating status and secure it against being switched on.</li> <li>- Provide support for vertical slides or similar machine parts prior to all work in their area.</li> </ul> <p>If necessary, demarcate the maintenance area as appropriate and place warning signs.</p>
<b>Exercise caution when carrying out maintenance work</b>	<p>In the following cases, no persons must be in the machine's danger area.</p> <ul style="list-style-type: none"> <li>- If machine movements can be carried out.</li> <li>- If any pressure lines or vessels are under pressure.</li> <li>- If any electrical components are live.</li> </ul>
<b>Transport of sub-assemblies</b>	When replacing larger sub-assemblies, these must be carefully attached and secured to lifting gear.
	See also: "Safety during transport work" <b>page 55</b>
<b>Use of working aids</b>	For assembly work above floor level, use appropriate steps and working platforms that comply to applicable safety standards. Do not use machine parts as steps or working platforms. For maintenance

work at greater heights, safety harnesses must be worn. Keep all handles, treads, railings, platforms, and ladders free from dirt and lubricants.

**Use of appropriate tools** Appropriate workshop equipment is essential for carrying out maintenance work.

**Completion of work** After work at vertical slides or similar machine parts, provided supports must be removed.

If, in the course of maintenance work, guard panels and safety devices were removed, these must be refitted immediately after completion of the work and their functionality tested.

Loosened screw connections must be re-tightened to the correct torque and screw retainers put back in place.

### 2.9.2 Cleaning the machine

**Detergents** The machine must not be cleaned using substances that cause irritation or are harmful to health or the environment, such as chlorinated hydrocarbons (PER, TRI etc.).

Ensure that cleaning agents are disposed of in an environment friendly way.

**Do not use cleaning devices** Under no circumstances should steam or water jets or compressed air be used for cleaning, as there is a risk of dirt or cleaning agents getting into the guideways or seals. This can impair the function of switching elements or measuring systems.

**Removing swarf** Remove chips using an appropriate tool such as a hand broom. Do not touch swarf with bare hands: wear suitable protective gloves.

### 2.9.3 Safety when working on hydraulic, pneumatic, lubrication or lubricating coolant supply systems

**Applicable regulations and skilled personnel** Work on hydraulic, pneumatic, lubrication or cooling lubricant systems is to be carried out only by suitably trained persons; applicable regulations and codes of practice must be adhered to.

<b>Releasing pressure</b>	<p>Before disconnecting any line or removing a control or drive unit, the system must be relieved from pressure.</p> <p>Procedure:</p> <ul style="list-style-type: none"><li>- Lower or support any loads.</li><li>- Switch off pump.</li><li>- Release pressure from vessel.</li></ul> <p>Even on machines equipped with an automatic pressure release facility, the pressure gauges should be checked to ensure that there is no residual pressure in the system.</p>
<b>Pressure accumulator</b>	<p>Accumulators are equipped with safety valves. The safety valves are pre-adjusted and sealed.</p> <p>Any adjustment to the safety valves results in danger to life and is prohibited.</p>
<b>Checking accumulators</b>	<p>Accumulators must be checked and serviced in accordance with statutory regulations.</p>
<b>Filling accumulators</b>	<p>Accumulators must only be filled with nitrogen.</p> <p>Observe the nitrogen bottle fill pressure. If the fill pressure is greater than the maximum operating pressure of the accumulator, a tested safety valve must be inserted in the connecting line.</p>
<b>Regular inspection of fittings</b>	<p>The integrity of pressure lines and connectors must be checked at regular intervals and replaced even if only slight damage is apparent. Fluids escaping under high pressure pose a risk of injury, explosion and fire. Any leaks and damages to hoses and pressure lines must therefore be rectified immediately.</p>
<b>Pressure hoses</b>	<p>Pressure hoses must be replaced regularly according to applicable regulations.</p>
<b>Professional connection</b>	<p>Hydraulic and compressed air lines must be routed and connected correctly. It must be ensured that connectors are not mixed up. All fittings, as well as the length and quality of the hose lines must comply with technical requirements.</p>
<b>Correct venting of lines</b>	<p>If, during re-commissioning after repairs or moving of the machine, any air remaining in the hydraulic system is not purged, damage to tubing, hosing and machine components may result.</p> <p>Escape of oil into the ground must be prevented under all circumstances.</p>

### 2.9.4 Safety when working on electrical equipment

<b>Applicable regulations and skilled personnel</b>	Work on electrical equipment and in the control cabinet should be carried out only by qualified engineers. The guidelines and regulations for setting up and operating electrical equipment applicable to the installation site must be respected.
<b>Isolating the machine</b>	<p>Machine and installation components on which maintenance work is to be carried out must - if specified - be isolated from the electrical power supply.</p> <p>First ensure that the isolated components are voltage free and then earth and short-circuit them and isolate them from adjacent, live modules.</p> <p>Note that the control cabinet is still live when the main switch has been turned off.</p>
<b>Interference voltage circuits</b>	<p>If interference voltage circuits are present, these must be isolated separately.</p> <p>Note that the control cabinet is still live when the main switch has been turned off.</p>
<b>Stored electrical charges</b>	Watch out for residual or stored electric charges. Use a measuring device to check that components are not live.
<b>Working on high-voltage assemblies</b>	Before working on high voltage assemblies, connect the mains cable to earth after isolating the power supply. Capacitors must be short circuited with an earth rod.
<b>Guarding the danger area</b>	The danger area must be guarded and identified with a warning sign.
<b>Original fuses</b>	Use only original fuses with the specified current strength and the specified time response behaviour.
<b>Handling of faults</b>	If a fault occurs in the power supply system, switch off the machine immediately.
<b>Earthed tools</b>	When working with earthed tools, such as soldering irons and electric hand drills, the machine main switch and, if applicable, any external power circuits must be switched off.
<b>Printed circuit boards and connectors</b>	<p>Isolate the machine from the power supply before removing printed circuit boards or connectors.</p> <p>Protect unused connectors from dirt by using blanking covers and plugs.</p>

### 2.9.5 Safety during troubleshoot and fault rectification

<b>Act with special caution in the event of fault</b>	If a fault occurs on the machine, special caution must be exercised. The fault as well as improper interventions by staff can cause consecutive errors. Especially in the event of error burst, the machine's reaction is unpredictable.
<b>Initial precautions</b>	<p>Urgent measures to be taken:</p> <ul style="list-style-type: none"><li>- Immediately interrupt active automatic programs.</li><li>- Switch off motors.</li><li>- If required, press EMERGENCY STOP, or switch off the machine's main switch and secure against switching on again.</li></ul> <p>Inform responsible persons:</p> <ul style="list-style-type: none"><li>- Strict compliance with scheduled workflow is required.</li><li>- Immediately inform the person having a key to enable special operating modes. Special operating modes that allow fast axis and spindle movements with the work area safety door open must not be enabled on faulty machines.</li></ul>
<b>Working inside the operating machine</b>	If entering the machine in ON state during troubleshooting or fault rectification is unavoidable, all applicable measures to avoid

machine movements and automatic operations must be taken while persons are in the hazard area:

- Clarify what movable parts are present in the work area and what function and travel range these parts do have. Ensure that there is always a safe escape route from the hazard area. Block any hazardous, movable machine parts using timber beams.
- Ascertain whether the machine or individual parts possibly can start up automatically. Typical cases:
  - Times at which the warmup programme starts
  - Times at which the washing programme of a rack-type magazine starts
  - Machine parts with inherent power supply and/or control (pallet magazine, automatic loading system, linked machines, cooling lubricant unit, chip conveyor)
- Ascertain whether there are further risks, for example due to pressurised media or electric tensions.
- Call in a second person, who activates the EMERGENCY STOP device or turns the main switch off in an emergency. Ensure that involved persons are able to make themselves understood to each other.
- Keep unauthorised persons away from the machine. Cordon off access to the machine and attach warning signs.
- Ensure that motors are switched off.
- In order to prevent unauthorised persons from triggering fast axis movements accidentally, open the work area safety door and secure it against being closed by means of a hook padlock. But note that, under certain conditions, axis movements at reduced speed can still be triggered even with the work area safety door open.
- Leave the danger zone before machine movements are activated.

## 2.10 Safety during transport work

<b>Recognising danger</b>	Never stand under a suspended load, as this can cause loss of life.
<b>Observe Transportation Instructions</b>	<p>The Transportation Instructions (TA) include the following information relating to the machine and its components:</p> <ul style="list-style-type: none"> <li>- Weights</li> <li>- Lifting points</li> <li>- Slings points</li> <li>- Specified lifting gear (if applicable)</li> </ul> <p>When transporting the machine and its components, the Transportation Instructions must be strictly adhered to. Do not use any other method for transporting the machine or any of its components.</p>
<b>Qualified personnel</b>	Securing of loads and instructing goods vehicle drivers must be carried out by qualified persons. The person issuing instructions must be in visual and verbal contact with the crane driver.
<b>Lifting gear</b>	<p>All lifting equipment must be in perfect condition and must be designed for the weight to be carried. Chains, slings, hooks and lifting bolts must be of sufficient carrying capacity.</p> <p>If you use the existing transport threads for the transport of the machine and its components use only eye bolts which are rotatable when tightened.</p>
<b>Securing traversing slides</b>	Any traversing slides must be moved to a point where their weight is neutralised and secured.
<b>Securing lifting rods</b>	Lifting rods must be secured with retaining collars. The sling or the machine component must not be allowed to slip on the bar/rod.
<b>Transport stays</b>	Transport securing devices must only be removed after final erection.
<b>Protection of sensitive parts</b>	If the component to be lifted has sharp edges, use a cushion to avoid damage to the rope or the component.
<b>Correct lifting of loads</b>	<p>Machine components must never be lifted suddenly or jolted with a crane or lifting gear. Start lifting slowly.</p> <p>When selecting the point at which to suspend the load, ensure that the weight is correctly balanced and suspended horizontally.</p>





# CHAPTER 3

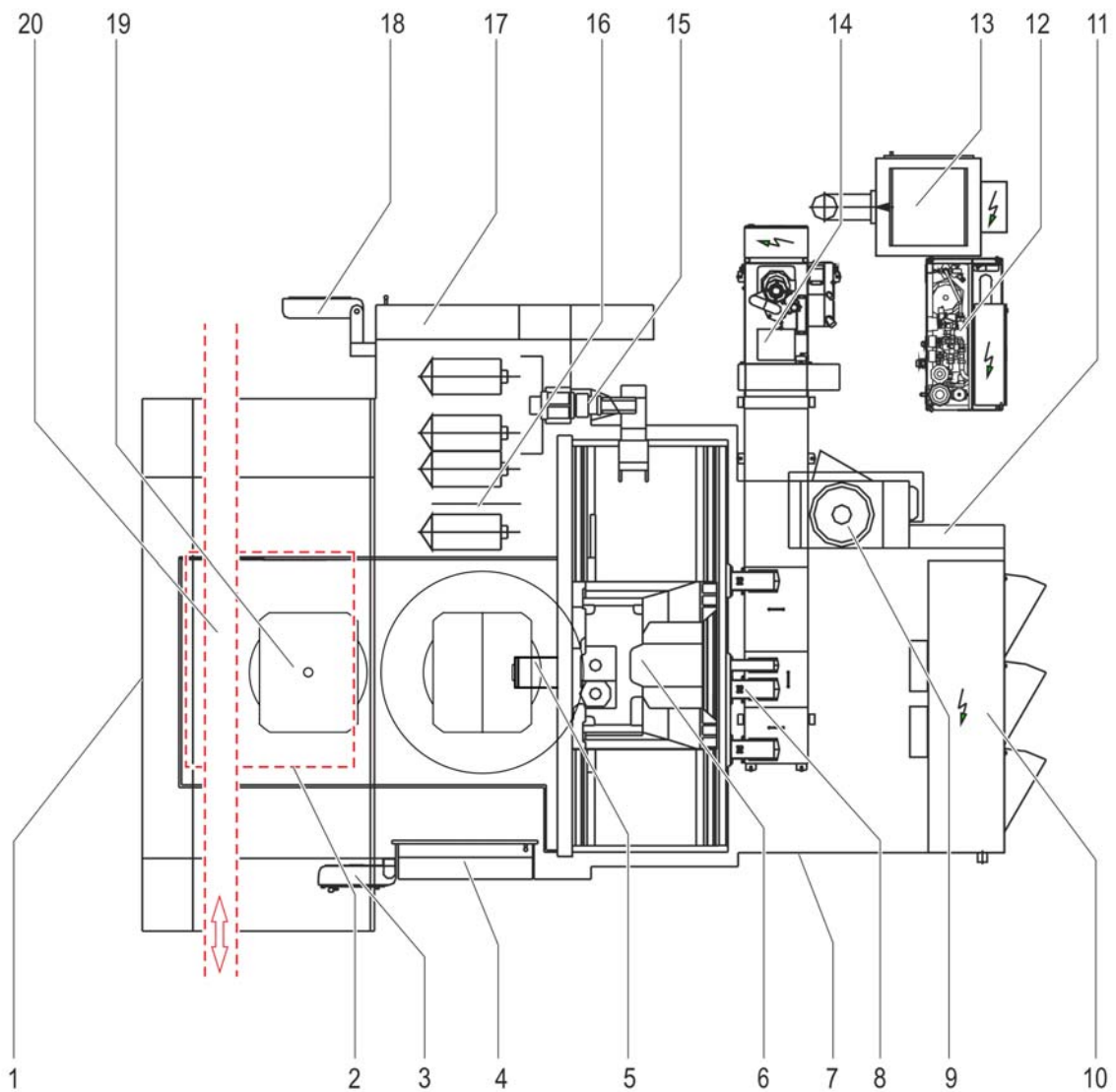
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Technical Description

## 3 Technical Description

### 3.1 Machine overview

The following figure shows the machine at a glance.



3.1 - 1 Machine viewed from top

### 3 Technical Description

#### 3.1 Machine overview

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Pos.	Function
1	Workpiece setting station safety door (emergency loading)
2	Loading hatch
3	Main operating unit
4	Work area safety door
5	Tool spindle
6	Machining unit, drive spindles
7	Maintenance door
8	Gantry column (X slide)
9	Cooling unit, below hydraulic unit
10	Electrical cabinet
11	Assembly wall pneumatic system, Compressed air shut-off valve
12	Pressure boosting system
13	Emulsion mist exhaust system
14	Chip conveyor, recirculating station
15	Chain-type magazine drive
16	Chain-type magazine
17	Tool setting station
18	Control unit, tool setting station
19	Rotary table (B axis) with fixture
20	Gantry loader

## 3.2 Machine concept

### 3.2.1 Technology of the machine tool

#### Designated use

The machine is designed to perform cutting operations on cubic components made of standard materials such as steel, cast iron, aluminium and non-ferrous metals. For the machining of magnesium-containing materials, the machine must have a specific design.



See the details in the Chapter headed Safety:  
" Designated use" **page 30**



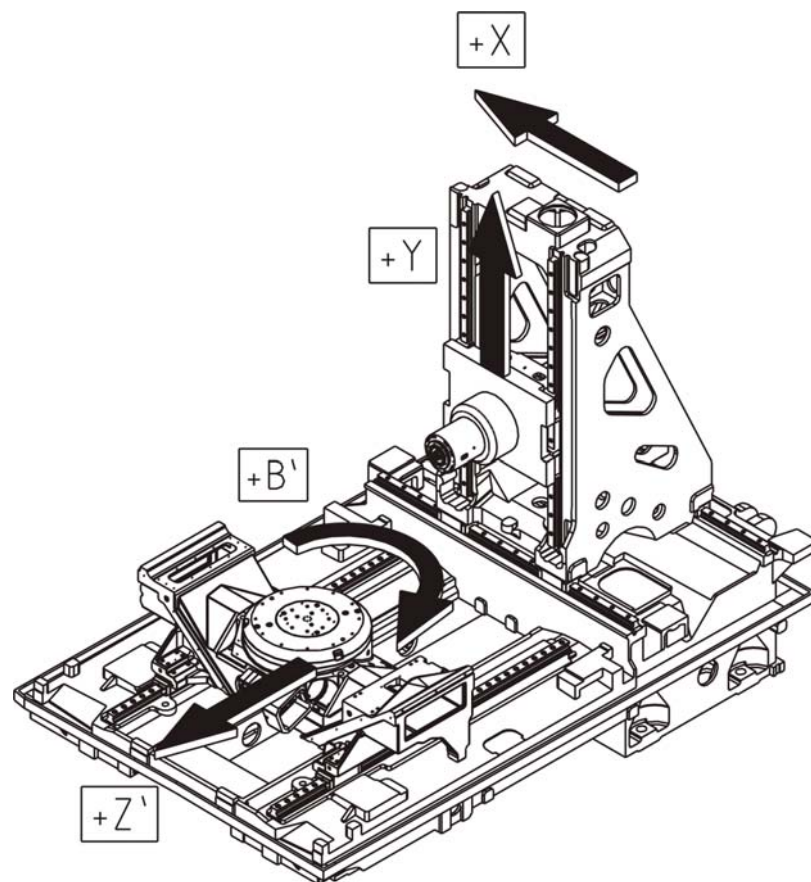
Further details on the application range of the machine can also be found in the Chapter headed Safety:  
" Designated use" **page 30**



For application range of machine, workpiece and tool limit data, performance data and environmental conditions, see General layout (AZ) and Technical Data. The documents appear in the Chapter headed "Drawings, Plans".

### 3.2.2 Identification of machine axes

The figure below shows the machining axes of the machine type with rotary table (B axis).



- X Machine column travels along X direction (longitudinal stroke)
- Y Machining unit travels along Y direction (vertical stroke)
- Z Z-slide travels in Z'-direction (transverse stroke)
- B Rotary table, rotates around the B'-axis (rotary table rotation 360°)

Co-ordinates with apostrophe (Z' and B') denote workpiece movements.



For detailed information about the co-ordinate system, see Programming Instructions (PA).

### 3.2.3 Machine functionality

This is a "direct loading machine". This means that the workpiece is loaded directly into the work area where it is processed.

The machine offers optimum access to the work area, thus allowing large workpiece geometries and masses to be loaded quickly and easily. The clamping device is mounted on the rotary table in the work area and holds the workpiece during machining.



Details on the setup and components of the machine can be found in the next Chapter.



For data relating to the machining sequence, such as speeds and idle times can be found in the General layout (AZ).

#### machining the workpiece

Machining is automatic according to the selected program.

#### Linear axis movement

The rotary table moves along the Z-axis from the change position, bringing the workpiece into the machining position. The horizontal machining unit carries the tool in the rotating tool spindle. It executes the axis movement in the Y-direction and (with the assistance of the machine column) - in the X-direction. The rotary table executes the Z' co-ordinate movement.

#### Rotational movements for rotary and multi-sided machining

The rotary table allows the workpiece to be machined on all sides. The rotary axis is called B-axis. In connection with the swivel and tilting head, the upper side can also be machined.

#### tool change

In general, several tools will be required in the course of a machining sequence. The tool change operation is prepared during ongoing machining: the tool magazine prepares the tool that is required next.

The changeover between provisioning place and tool spindle is carried out by a tool changer which takes the form of a twin gripper attachment.



For the precise tool change sequence, see:  
"Tool change, overall sequence" **page 70**

## 3.3 Machine components



An overview of the axis designations is provided in chapter:  
 "Identification of machine axes" page 60

### Machine frame

The one piece machine bed is cast in a T shape and carries the guide for the gantry column in the X direction and the Z guide for the rotary table. To ensure highest positioning accuracy and true circular machining, all guideways are equipped with rolling guideways.

### Guard panels

#### Safety doors

The safety doors are manually operated. They are electrically protected and fitted with a deadlock so that they cannot be opened inadvertently. The deadlock closes by spring action and is opened electromagnetically. The behaviour of the deadlock depends on the initial status of the deadlock and the status of the main switch. For precise behaviour, please refer to the table:

	Machine main switch is on	Machine main switch is off	Machine main switch is switched on again
Initial status:	—————→		
Door deadlocked	deadlocked	deadlocked	deadlocked
Door not deadlocked	not deadlocked	not deadlocked	deadlocked (Door snaps into the lock)

### **i**

#### Note the exception "Tool setting station safety door"!

With the control unit switched on, the safety doors can be locked and unlocked from the appropriate control unit. The control unit monitors the machine status and processes the instructions in accordance with the safety system.

The work area safety door can be secured in the open state using a padlock so that it cannot be closed.

<b>Tool setting station safety door</b>	In terms of deadlock behaviour, the tool setting station safety door is an exception to the safety doors described above: <ul style="list-style-type: none"> <li>- With the control unit switched off, the closed safety door is locked and cannot be opened. A safety door is always locked after it is closed.</li> </ul>
<b>Maintenance openings</b>	Depending on the expansion stage, the machine features one or several maintenance openings. The maintenance openings are bolted and not electrically interlocked.
<b>Safety pane of work area safety door</b>	The safety pane in the work area safety door comprises two layers: an inner layer of single pane safety glass and an outer layer of polycarbonate. The outside of the polycarbonate pane is protected against cooling lubricant vapour, solvents and oils by a film coating. The safety pane is robust enough to withstand any impact from debris in the event of tool breakage. HELLER cannot, however, accept liability for damage caused by undue overload to the system or improper operation or use of the machine.



Further information on checking the safety pane can be found in the Maintenance Instructions. Please refer to the Section entitled "Checking the safety pane of work area safety door in the Chapter on "Inspection and Maintenance".

## Machining unit

The machining unit vertical Y movement is carried out in the gantry column. The special arrangement of the X-guide and the compact design of the machining unit carriage afford the moving machine components a rigid structure, despite the large Y-stroke.

The machining unit is available in various designs to suit the machine size and type:

- The machining unit in sizes 1000 - 4000 is executed primarily as a hollow shaft motor. With this fast drive form, the tool spindle is driven directly by the motor.
- In addition to the fast drive form, size 5000 - 8000 motors with intermediate gears are available for high cutting capacities.
- The type with motor spindle is available only for certain sizes.

<b>Tool clamping system</b>	The tool is mechanically clamped via a disk-spring assembly and is unclamped hydraulically. During the tool change, the tool shank is cleaned with compressed air. For wet machining, the cooling lubricant is additionally extracted from the clamping system. The
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### 3 Technical Description

#### 3.3 Machine components

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clamping distance is monitored. The monitor detects when clamping is incorrect or has failed.

##### Motor spindle cooling

The motor is cooled with water. The cooling water is re-cooled in a cooling unit. The front spindle bearing is equipped with a temperature sensor for monitoring purposes and to provide temperature compensation along the Z direction. A second temperature sensor monitors the motor coil temperature.

##### Lubrication of motor and spindle bearings

All motor and tool spindle bearings are connected to the central lubrication system and are oil and air lubricated. Precisely dosed oil droplets are injected into the bearings by filtered compressed air. The air in the oil/air lubrication system escapes through a labyrinth at the spindle nose and prevents the ingress of chips and cooling lubricant even when the spindle is stationary.

##### Cooling lubricant supply to the cutting point

External and internal cooling lubricant supply is provided as standard to lubricate and cool the tool and workpiece. The cooling lubricant for external cooling flows through channels in the stationary part of the spindle and is sprayed onto the workpiece through nozzles in the spindle head. The cooling lubricant for internal supply enters the rotating part of the work spindle through a rotary distributor at its rear and flows through a central pipe in the built-in clamp to the collet. In the case of steep taper tool holding fixture, the cooling lubricant can be channeled in the tool either through a centre hole or through holes in the collar. In the case of hollow taper shanks tool holding fixture, the tool must have a central pipe.

Coupling elements in the spindle head also supply cooling lubricant and compressed air for a multi-spindle head.

#### Chip removal

The machine is designed so that the chips in the centre of the machine can fall freely. The powerful chip conveyor is a further component for efficient chip disposal. This makes the machine well suited to both wet and dry machining.

The totally enclosed, electrically interlocked doors protect both machine and operator.

#### Rotary table and pallet

The rotary table (B-axis) traverses to the Z-axis. The pallets with DIN clamping surface are aligned on the rotary table. Further features of the rotary table/pallet system are: the large round workpiece collision

path, the central hydraulic workpiece clamping system (optional) with integrated check line.

## Control

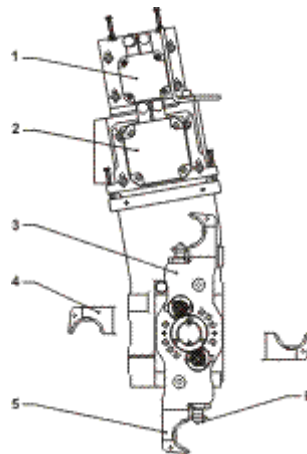
### Version display

The version display indicates which software and the version of this software that is installed on the machine.

### Calling up the version display

To select the version display, press the "Diagnostics" softkey on the machine's basic menu and then the "Version" softkey. A list of the used versions is displayed.

### 3.3.1 Tool changer



3.3.1 - 1 Tool changer

- 1 Servomotor for lifting movement
- 2 Servomotor for swivelling movement
- 3 Double gripper in home position
- 4 Gripper in machining position for unloading and loading stroke
- 5 Gripper jaws
- 6 Tool fixing cam

### Design and method of operation

The tool changer is mounted on a console fitted on the machine bed. The tool changer has a fully-mechanical double gripper for picking up the tool to be changed.

This gripper executes swivelling and lifting movements.

The swivelling movement is executed by a servomotor via a slip-on gear mechanism with toothed belt.

The lifting movement is executed by a servomotor with toothed belt and ball screw drive.

The gripper jaws are open on one side and grip the tools with a 90° swivel motion. The tools are fixed in the grippers by a spring-loaded cam. During the change-over movement, a bolt locks the cam and secures the tool. Heavy tools must be changed at reduced speed.

A pneumatically operated lift door closes the tool changer and the built-on tool magazine to the work area and protects the device from cooling lubricant and chips. The lift door opens automatically for a tool change.

## Tool magazine

### Chain-type magazine

The tool magazine is a revolving chain-type magazine driven by a three-phase synchronous motor. There are different sizes to choose from.

The tool magazine is able to run in both directions thus moving the tools to the position required by the shortest route possible. An absolute position encoder with measurement gearbox, incorporated in the motor, sends the actual tool magazine position to the machine control system.

### Magazine places

The individual magazine places are fitted with tool holders which are attached to two parallel chains. Each tool holder accepts one tool cartridge, which in turn holds the tool. The cartridges used will depend on the particular tool holding fixture.

### Tool loading position

For manual loading of the magazine, a tool loading station is provided on the side of the tool magazine facing away from the machine. The "tool loading station safety door", a manually operated, electrically isolated and magnetically locked lifting door, provides access to the tool loading position, a position in the tool magazine where tools can be inserted and removed individually.

The basic version enables tool change during machining under the following conditions: while the tool magazine is moving or the lift door on the tool changer is not closed, the safety door cannot be opened. While the safety door is open, tool magazine movement and further tool changes are inhibited.

For loading and clearing the tool magazine, the operator moves the magazine place required to the tool loading position, pulls the

cartridge out of the tool holder into the loading position, removes the tool, inserts the new one and pushes the cartridge back into the tool holder. A reflection-type light barrier recognises when a new tool has been inserted. The data for the loaded tool must be entered into the control.



For the insertion and removal of tools, see chapter "Tool Management System", section: "Handling at the tool setting station" **page 253**

**Usable tool cross-sections**

If you are only using tools with a "Size 1" diameter, all magazine places can be populated. You may also use larger tools, though in this case the adjacent magazine places have to be left free. How many magazine places have to be left free and how you can use the subsequent magazine places depends on the size category of the tool.



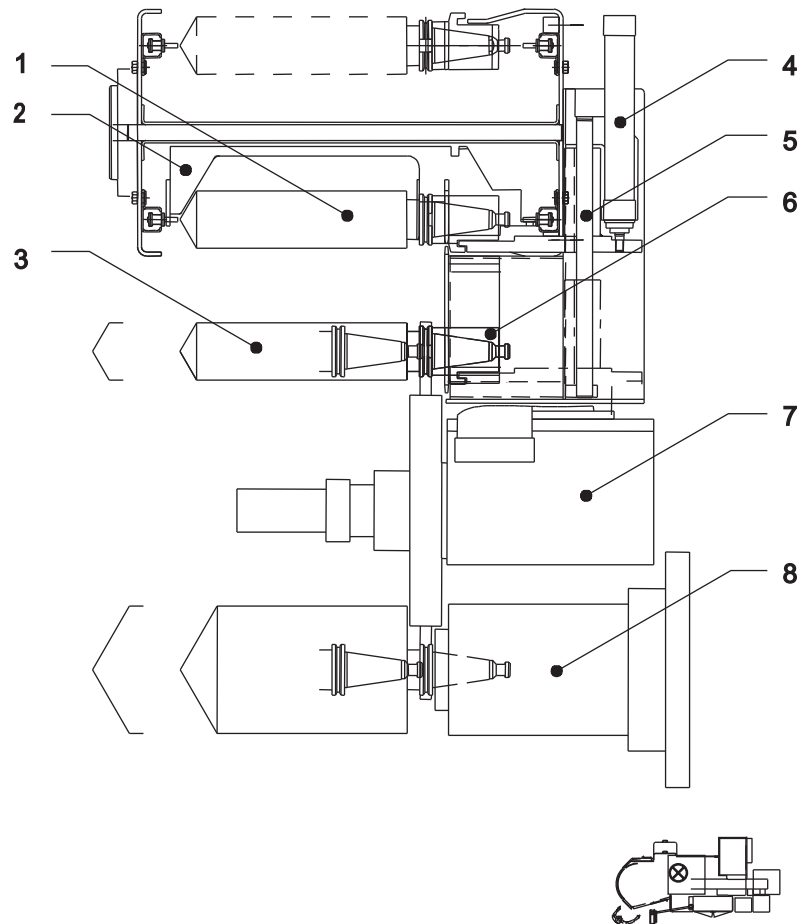
For details on the size groups of the tools, please see the plate at the tool loading station of the machine.



Where the magazine chain has to make a turn, the gap between adjacent tools will be narrower than along straight stretches. Loading by sight can lead to collisions!

Keep the specified positions free whatever you do!

### Traverse attachment



3.3.1 - 2 Traverse attachment with tool magazine and tool changer, plan view

- |   |  |
|---|--|
| 1 | Tool in transfer position of tool magazine           |
| 2 | Tool holder  |
| 3 | Tool in provisioning place                           |
| 4 | Hydraulic cylinder of traverse attachment            |
| 5 | guide  |
| 6 | Cartridge for accommodation of tool in tool magazine |
| 7 | Tool changer   |
| 8 | Tool spindle   |

#### Task

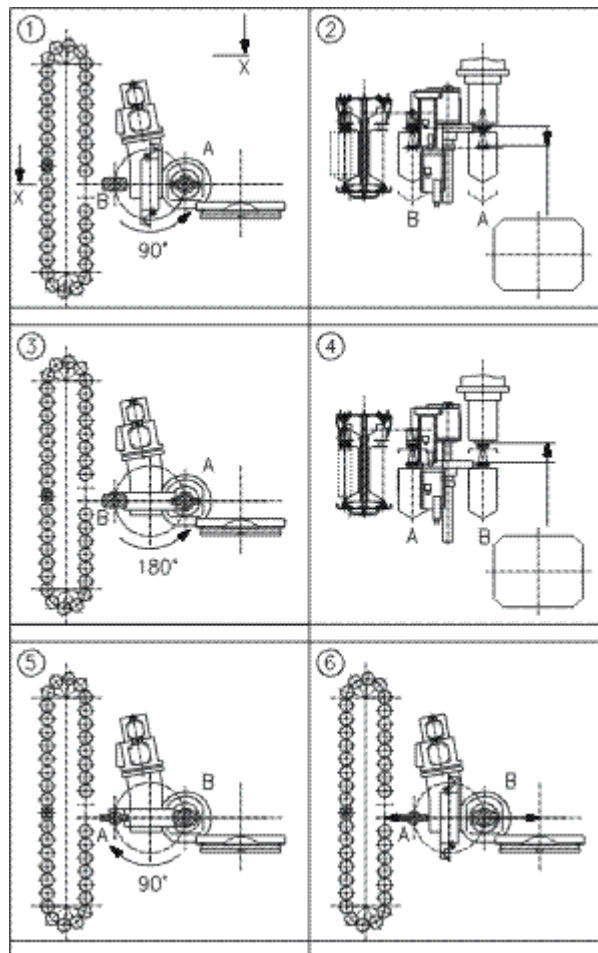
The traverse attachment moves the tool to be used from the tool magazine into the provisioning place and returns the previously used tool to the tool magazine after the tool change.

#### Design and method of operation

The traverse attachment consists of a driving tenon that is pushed forward and backward by a hydraulic cylinder.

The tools are placed in cartridges in the tool magazine. The traverse attachment pushes the cartridge, which is positioned in the tool magazine's transfer position, complete with the tool, to the provisioning place where it waits until the next tool change is completed. After the tool change, the traverse attachment waits until the tool magazine has brought the empty location for the returned tool into the transfer position. The traverse attachment then pushes the cartridge with the returned tool back into the tool magazine.

### 3.3.1.1 Tool change, overall sequence



Figures 1 to 6 correspond to steps No. 1. to 6. in the following description.

Figures 2 and 4 show section X-X in Figure 1

#### Operating principle

The tool change sequence consists of six steps:

1. In the starting position, the new tool B is positioned ready for mounting in a cartridge at the provisioning place. The machining unit with the used tool A moves into the transfer position. The tool changer double gripper is in the vertical position. The double gripper swings through 90° and at the same time grasps both tool A in the tool spindle and tool B at the provisioning place. Tool A is released by the tool spindle.
2. The double gripper simultaneously pulls tool B out of the cartridge and tool A out of the tool spindle. At the beginning of this unloading stroke, the two gripper jaws are mechanically locked.
3. The double gripper swings through 180°. At this point in time, the magazine place for the used tool A is already in position for transfer towards provisioning place (figure 3). The tool magazine was able to carry out this step immediately after transfer of tool B to the provisioning place.
4. The double gripper pushes tool A into the cartridge in the provisioning place and tool B into the tool spindle. During this procedure, the location surfaces of the tool spindle and of tool B are cleaned with compressed air from air nozzles in the tool spindle. At the end of the loading stroke, the two grippers are mechanically unlocked.
5. Once tool B has been clasped by the tool spindle, the double gripper swings back through 90° and releases the two tools.
6. The machining unit, complete with tool B, moves into the machining position and tool A is pushed into its place in the tool magazine. Following the preparation of tool B, the tool magazine had sufficient time to bring the magazine place for tool A into the transfer position towards provisioning place.

### 3.3.2 Optional tool break detection and tool length measurement

#### Fast tool break monitoring (SBBK), optional

##### Break detection

The "Fast tool break monitoring" option allows tools to be checked for breakage during a tool change. Only complete broken tools are detected, not breaks in individual cutting tips. Length changes of 2 mm and more (tolerance), which may result in a tool break, are detected.

**Tools up to 5 mm diameter**

Drilling tools with the following geometric data can be reliably checked, i.e. with no previous reference measurement:

- Tool length: 70 mm to 600 mm
- diameter: 1 mm to 5 mm
- Point angle: up to 118°

**Optimised for time-critical NC machining**

Fast tool break monitoring is intended particularly for time-critical NC machining, which involves predominantly those tools listed below.



**Suitable for the monitoring of: ...**

The following tool types can be monitoring particularly effectively with the "Fast tool break monitoring" option.

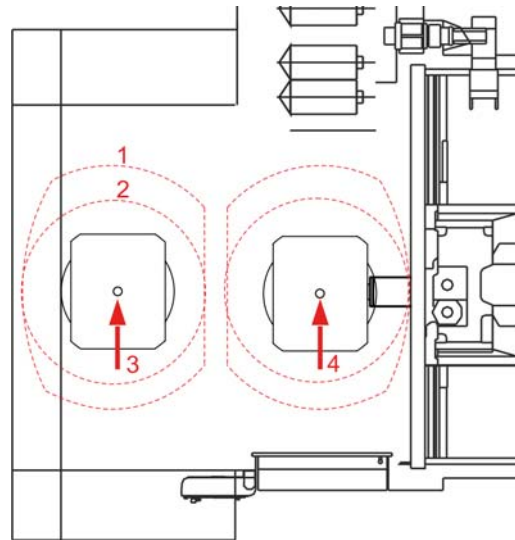
- Drilling tools diameter up to 5 mm, e.g.
  - HSS drills
  - Coated drills
  - Solid carbide drills
  - Step drills
- Tap up to M6



## 3.4 Workpiece collision path

- Collision-free machining** For collision-free machining, in particular of large workpieces, the workpiece collision path of the machine is of great importance.
- Large workpieces are workpieces that exceed the pallet dimensions (including the workpiece clamping fixture).
- Workpiece collision path** The workpiece collision path defines the collision-free area during transport and machining. It is specific to each machine. The workpiece collision paths are defined as boundary faces (such as circles). Workpieces must be placed only within the outside contours of these boundary faces.
- For rotary movements, the workpiece collision path is indicated by its diameter values. For linear movement, the workpiece collision path is given, for example, by a stroke limit value of the NC axis.
- Contour comparison** By comparing known workpiece collision paths with the workpiece contours, the possibility of a collision-free transport can be determined. To determine the individual contour behaviour during rotational and lifting movements, the maximum workpiece dimensions (workpiece clamping fixture) are used.
-  Depending on the size of the machine, different workpiece collision paths must be taken into consideration.
- Size strategy** Starting with these basic conditions, appropriate measures must be taken for workpiece machining. This includes, for example, the workpiece position during clamping and limiting rotation and maximum lifting movements during machining. The sequence of movements should also be considered in establishing a size strategy.
-  The exact values for the particular machine type are contained in the General layout (AZ).

### 3.4.1 Collision paths in work area



3.4.1 - 1 Rotary table rotation (Top view)

- 1 Max. workpiece collision path
- 2 Workpiece collision path
- 3 Upper traverse area of Z-axis
- 4 Lower traverse area of Z-axis

#### Upper traverse area of Z-axis

##### Rotary table rotation

After moving the workpiece into the work area it is positioned on the rotary table.

The ability of the rotary table (B-axis) to rotate depends on the workpiece size and the Z-position. For rotations at the upper end of the traverse stroke the following collision paths are defined:

##### Pallet collision path

An arrangement (workpiece with clamping fixture) can be rotated through 360° if its diameter is within the pallet collision path.

##### Workpiece collision path

An arrangement (workpiece with clamping fixture) can be rotated through 360° if its diameter is defined as follows:

- outside the pallet collision path and
- inside the workpiece collision path.

##### Max. workpiece collision path

Rotation of an arrangement (workpiece with clamping fixture) is limited when the resulting contour lies:

- outside the workpiece collision path and
- within the maximum workpiece collision path.

An arrangement whose contour outside the maximum workpiece collision path is not rotatable.



Large workpieces (outside the workpiece collision path) can usually be rotated after clear traversing the Z-axis.

### Lower traverse area of Z-axis

#### Z axis stroke restriction

At full utilisation of the max. workpiece collision path, a restricted stroke that depends on the rotational position of the rotary table can occur for the Z-axis.



#### CAUTION

B-/Z-axis collision.

With large workpieces (max. workpiece collision path), the rotational movement of the Z-axis may result in stroke restrictions of the Z-axis.

The stroke restriction is not monitored by the control system and must therefore be observed by the operator.

When the rotary table is rotated in the lower traverse area, the sequence of movements must be strictly maintained:

1. Clear traversing to a suitable Z position (in accordance with the General layout)
2. Carry out B axis rotation.

#### H 8000 / H 10000 machine types

Utilisation of the max. workpiece collision path and potential 360° rotation of the B-axis result in the following stroke restrictions of the Z-axis depending on the machine type.



The use of large tools (Ø400 mm, length 600 mm) may also result in stroke restrictions on one or several of the axes.

Observe general layout!

## 3.5 SINUMERIK Safety Integrated

<b>Personal and machine safety</b>	"SINUMERIK Safety Integrated" offers type-tested safety functions that guarantee efficient personal and machine safety. All safety functions satisfy the requirements of Safety Category 3 in accordance with EN 954-1.
<b>Fundamental features</b>	The SINUMERIK safety concept exhibits the following features: <ul style="list-style-type: none"><li>- Dual channel structure with at least two independent computers (different hardware and software).</li><li>- Cross-wise result and data comparison with forced dynamic sampling for detecting internal errors, even in rarely used functions (latent errors).</li></ul>
<b>Safety functions</b>	The safety functions are available in all operating modes that communicate with the process via safety-related input/output signals (SGE/SGA). Examples of safety functions are: <ul style="list-style-type: none"><li>- Safe Stop (SH)</li><li>- Safe Operational Stop (SBH)</li><li>- Safe reduced speed (SG)</li><li>- Safe Break Ramp (SBR)</li></ul>
<b>Safe Stop (SH)</b>	The purpose of the "Safe stop (SH)" function is to safely isolate the energy supply from the drives in the event of an error or in conjunction with a machine function. This function is axis-specific and contactless. "Safe stop" is based on the pulse cancel function integrated into the drive modules.
<b>Safe Operational Stop (SBH)</b>	The purpose of the "Safe operational stop (SBH)" function is to reliably monitor the shut down position of an axis/spindle. The drives remain fully operable in position or speed control.  When the monitoring function is active, the work area may be accessed while the machine is in setup mode without having to shut the machine down.  When the monitoring function responds, specific stop reactions (STOP B, STOP A) are triggered and displayed as messages on the screen. For continued operation, the machine must be switched off briefly and then restarted.
<b>Safe reduced speed (SG)</b>	The purpose of the "Safe reduced speed (SG)" function is to reliably monitor the speed of a drive on the load side. During the monitoring cycle, the current speed of the drive is periodically compared with

the speed limit value selected. The speed limit values are defined in the machine data.

Various operating statuses on the machine are monitored with the four speed limit values for SG1, SG2, SG3 or SG4.

**Safe Break Ramp (SBR)** The "Safe brake ramp (SBR)" function is based on the expectation that the actual speed has to be reduced after a stop request (speed progression monitoring). When a stop request is triggered, the current speed plus a speed tolerance specified by the machine datum is activated as a speed limit. This limit is compared to the current speed (must remain less than or equal to) and is adjusted in cycles. Hence, a new axis acceleration during the braking operation is detected and a reaction to it is triggered.

**Safe shutdown** Safe shutdown is not an autonomous function, it is a combination of various SINUMERIK Safety Integrated functions.

Safe shutdown safely brings the drives from a potentially dangerous movement to a standstill when a monitoring session is triggered. The power is swiftly isolated from the drives.

The drives are always stopped in line with the operating status of the machine.

**Test stop** The test stop is used to test the potentially accessible axes. For each monitoring channel, the entire shutdown path with the external wiring circuits is tested. The test is based on the comparators and stop modules of the two monitoring channels responsible for the stop function being run consecutively.

A step stop is activated:

- After 8 hours and when the work area safety door opens.
- When the safety door is unlocked.
- By a keystroke on the main operator panel. Another test stop after 8 hours

**Emergency stop** The EMERGENCY STOP buttons are located on the main operator panel, at the tool setting station, at the workpiece setting station and at the hand-held operating unit.

Pressing an EMERGENCY STOP button triggers a Stop D for all axes. A "Safe stop" SH (Stop B/A) is then initiated. Peripheral function groups on the machine such as pallet changer, workpiece setting station and tool magazine are safely shut down via safety outputs (SGA) on the SPL when an EMERGENCY STOP button is pressed.

- Opened safety door** When the safety door (e.g. to work area) has been unlocked by the relevant key, the door can be opened manually.
- The machine axes then switch to "Safe operational stop". Hazardous movements are safely shut down via "Safety input/output signals (SGE/SGA).
- Special operating modes 2 and 3** In special operating modes 2 and 3, axes movements can be executed when the safety door is open. In addition to a *Direction key* or the *NC-Start* key, the *Approval* key must be pressed. The axes movements are then released at reduced speed:
- The linear axes are traversed at a correspondingly reduced speed. The spindle is rotated at a correspondingly reduced speed.
  - The spindle can also be rotated manually at a correspondingly lower speed of rotation. In this case, the approval key must not be pressed. The "Spindle Stop" function must be activated.





# CHAPTER 4

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Operating and monitoring  
devices

## 4 Operating and monitoring devices

### 4.1 General

#### Working safely

The operators of this machine should be trained or otherwise qualified to operate machine tools. Anyone required to work with this machine must have read and understood the "Safety" Chapter.



See Chapter 2 "Safety".

#### Reduction to one-key operation

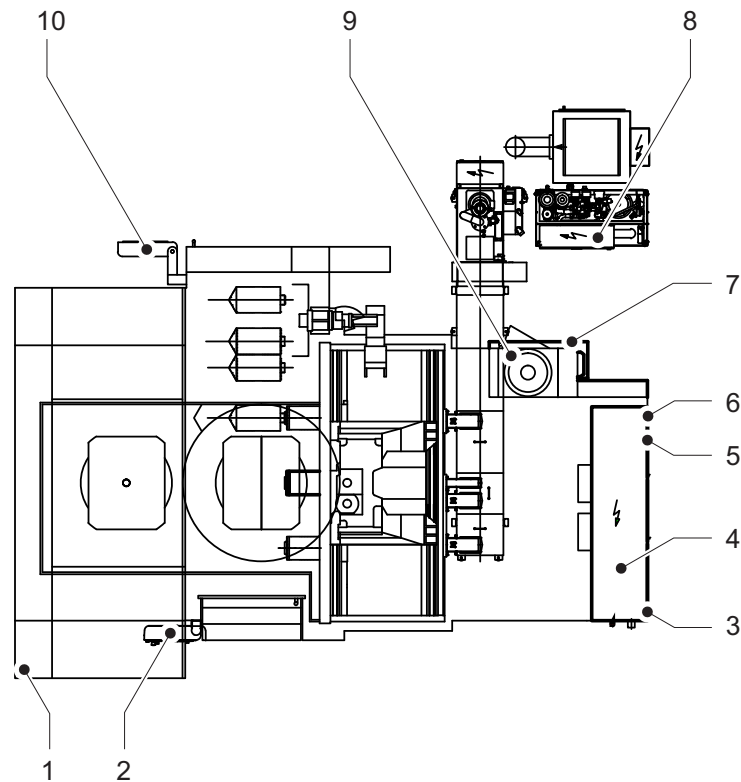
Since this machine is equipped with a large tool magazine and an automatic tool changer, workpieces can be completely machined without operator intervention. This reduces operator intervention during machining to just one operation: re-clamping the workpiece. This operation is confirmed with just one key.

#### Brief description

In this chapter the mounting position on the machine and the method of operation of all elements are briefly described. The description sequence is based on mounting position. Later chapters describe the connection of the respective elements to the operational sequence in greater detail.

## 4.2 Overview of operating devices

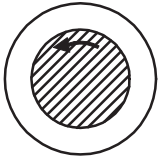
The machine has the following machine areas and operating devices:



### 4.2 - 1 Display and control elements

- 1 Status lamp
- 2 Main operating unit
- 3 Temperature display on control cabinet
- 4 Connection HT8 in control cabinet
- 5 SENTRON PAC 3200 multi-function measuring device
- 6 Master switch
- 7 Compressed air shut-off valve
- 8 Operating and display devices on pressure boosting system
- 9 Cooling unit display
- 10 Control unit, tool setting station

## 4.3 EMERGENCY STOP device



### EMERGENCY STOP

All operator stations have an EMERGENCY STOP button.

Only use the "EMERGENCY STOP" button in emergency situations:

- When life is at risk.
- When there is a risk of damage to the machine or workpiece.

"EMERGENCY STOP" must not be used for production breaks or to switch off the machine.

Pressing the EMERGENCY STOP key:

- Stops every movement immediately.
- Switches off the hydraulic motor.
- Stops spindle and feed drives.
- Shuts off hydraulic and pneumatic valves.
- Displays the "EMERGENCY STOP" message in on the main control panel.



Operating an EMERGENCY STOP key during a machine operation can result in tool breakage!

**Release EMERGENCY STOP switch**

EMERGENCY STOP buttons are unlocked by turning them to the left. Releasing the EMERGENCY STOP switch will not automatically restart the machine.



The function of the EMERGENCY STOP facility must be tested manually every 1000 hours!

## 4.4 Cooling lubricant unit, chip disposal

### Return pump and pressure boosting system

The machine is supplied with cooling lubricant by a central cooling lubricant unit.

For local processing of the cooling lubricant, a return pump and pressure boosting system from Knoll company is used. The system also contains a scraping conveyor for the required chip transport.

In production mode, the system is controlled from the machine (remote operation). At the switch cabinet of the return pump and pressure boosting system, there are only operating elements for switching on and off, as well as control elements for troubleshooting and maintenance:

- Area switch (Disconnect Switch).
- Signal lamp "Error Motor Protection Switch Lifting Pump"
- Signal lamp "Interruption Filling Level Chip Conveyor"
- Keys *Control Voltage on /off*
- Switches *Operating Mode*
  - Position "Remote" for production mode
  - Position "Local" for test and maintenance purposes
- *Lifting Pump - Manual Tap* key
- *Error Reset* key
- *Lamp Test* key



For further information, see manufacturer's documentation: Supplier instruction, tab "Knoll".

### Chip conveyor

A rotary switch Chip Conveyor with 3 positions is located on the main operator panel of the machine:

- "On": Chip transport forwards (default setting).
- "Off": Switch off chip transport.
- "Return": Chip transport backwards in jog mode.



Risk of injury from reversing chip conveyor.

Do not reach into the discharge opening!

Before the chip conveyor starts reversing, ensure that nobody can reach into the discharge opening.

In case of a blockage (build-up of chips), the scraping conveyor can be moved free via the rotary switch:

- Toggling between position "Return" and "On".

## 4.5 Main switch - basic machine



### Main switch

The main switch is used to turn the power to the machine and controls on and off. The main switch is located on the control cabinet of the basic machine. In the Off position, secure the Main switch with a padlock to prevent unauthorised switch-on.



Before turning off the main switch, always press the *Power OFF* key.

### Circuits independent of main switch



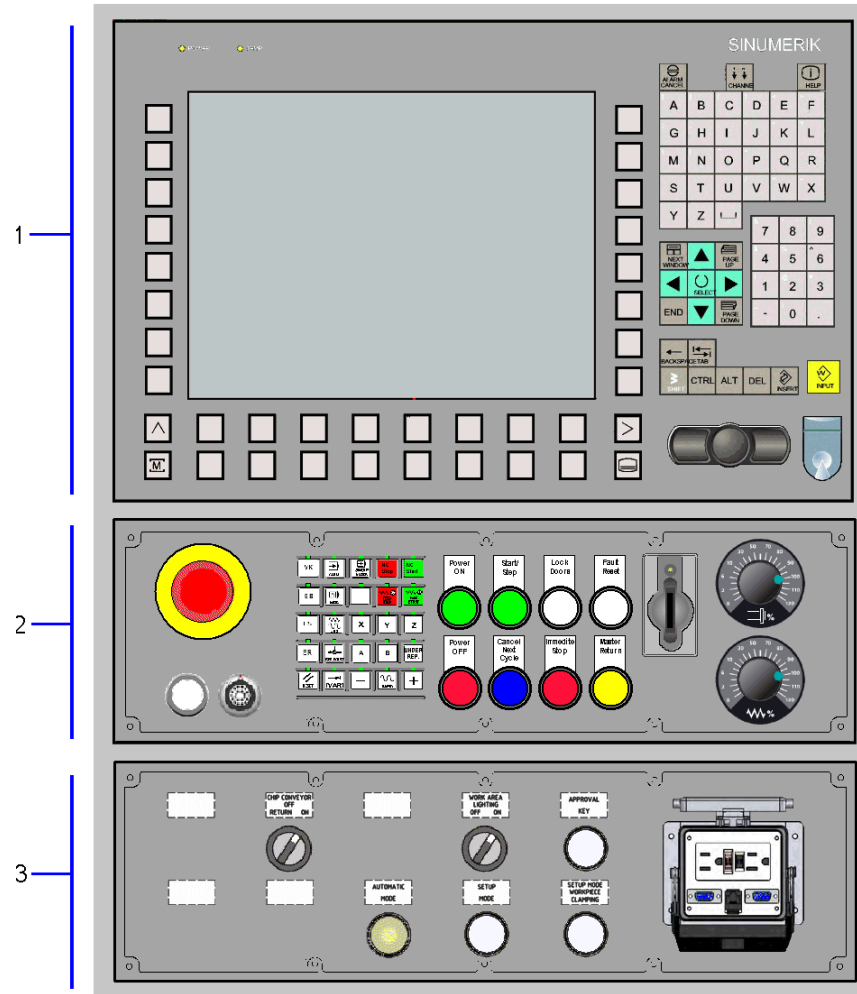
Danger of electric shock.

Turning off the Main switch does not ensure that the control cabinet contains no live circuits.  
Other circuits independent of the Main switch may also be available: external circuits, work area lighting, control cabinet illumination, cooling unit for electrical cabinet, uninterruptible power system (UPS) or separate power supply to the controls.

Before starting any work, check that the components are voltage free.

## 4.6 Main operating unit

### 4.6.1 Overview



- 1 Operating panel for control functions**
  - Area changeover, menu control
  - Alphanumeric character entry, cursor movement
  - Connection for full keyboard
- 2 Machine control panel**
  - EMERGENCY STOP handheld operating unit
  - Operating modes, program control, safety doors
  - Motors on/off, start/stop machine, home position
- 3 Operating panel for machine functions**
  - Preselect "Open safety door", socket/interface



## 4.6.2 Operating panel for control functions

### Request operation

If you have previously operated the machine from the terminal operator panel (tool setting station operator panel), the screen will appear blacked out on the main operator panel.

If you want to operate the machine from the main operator panel, you must first request operation. Do this by pressing the cursor key. The screen will become bright and you can now operate it from the main operator panel as usual. At the same time, the screen on the terminal operator panel will appear blacked out.

### Data menu operation, menu control

All main menus of the machine can be accessed using the main operating panel.



#### Recall

Return to the higher-level menu. The current window is closed using *Recall*.



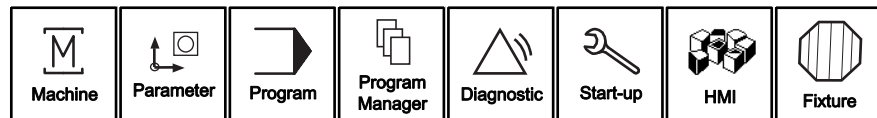
#### etc.

Menu extension of horizontal softkey bar. Pressing *etc* displays further functions in the menu bar.



#### Data menu key

From each main menu and each operating situation the basic menu can be called by operating the *Data menu key*. Pressing the key twice changes from the current to the previous main menu and back.



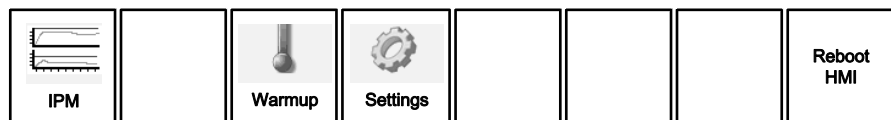
**Basic menu (1)**

The basic menu is branched using the horizontal softkey bar to the main menus:

- **Machine** - processing of part program, manual control.
- **Parameter** - Tool management and tool data, R-parameter, user variables.
- **Program** - Editor for creating and adapting part programs.
- **Program Manager** - input and output of programs and data.
- **Diagnostic** - alarm indication, service indication.
- **Start-up** - adaptation of NC data to machine, system setting.
- **HMI (Human Machine Interface)**- User interface for central and local machine functions.
- **Fixture** - Fixture and workpiece management.

**Basic menu (2)**

Pressing the *etc. key* expands the basic menu in a horizontal direction.



The expanded basic menu is branched using the horizontal softkey bar to the main menus:

- **IPM** - Integrated tool monitoring.
- **Warmup** - Manage warm-up program.
- **Settings** - Manage machine data (commissioning).
- **Reboot HMI** - Restart control.

**Vertical softkey bar**

The basic menu is branched using the vertical softkey bar to the NC operating modes

- **AUTO** - automatic processing of programs.
- **MDA** - processing of an NC block.
- **JOG** - conventional movement of the machine.

The basic menu is branched using the vertical softkey bar to the machine functions:

- **REPOS** - return to contour.
- **REF** - referencing.

**Machine area key**

Direct branch to the "Machine" main menu.

## Softkey bars

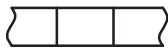
### Horizontal softkey



A function is assigned to the softkeys via a menu bar on the screen.

- With the horizontal softkeys any main menu in further main menu levels can be reached. For each horizontal menu point there is an associated vertical menu bar/softkey assignment.

### Vertical softkey



The vertical softkeys are assigned functions to the currently selected horizontal softkey. Pressing a vertical softkey calls the function. The assignment of the vertical softkey bar can change again if further sub-functions can be selected under a function.

## Alphanumeric keypad



### Alphanumeric keys

Dual-function keys:

- *Numeric keys* to input numbers, directly accessible.
- *Alphabetic keys* to input text, accessible via *Shift*.



### Shift

Pressing the *Shift* key activates the upper key function.



### Space

You can enter spaces with the *Space* key.

## Screen control



### Alarm cancel

Pressing the *Alarm acknowledgement* key clears the error.



### Information

Pressing the *Information* key in the Diagnostics/Alarms main menu automatically calls up the Help function.



### Channel changeover

Pressing the *Channel changeover* key switches the screen to an alternative channel.

**Page up**

Pressing the *Page-up* key allows you to scroll one page up or to the beginning of the list.

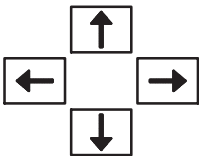
**Page down**

Pressing the *Page-down* key allows you to scroll one page down or to the end of the list.

**Tab**

The *Tab*(ulation) key is used to move on one block, for example to the end of the line or to the next table column.

### Selection and input keys

**Cursor keys**

*Cursor keys* for moving the highlight.

- Cursor left/right keys:
  - Highlighting to the left or right.
  - To the previous or next input field.
- Up/down cursor keys:
  - Highlighting upwards or downwards
  - To the previous or next input field.

**Highlight**

Pressing the *Highlight* key

- initiates the highlighted selection or
- marks the highlighted list element or
- turns on or off the highlighted radio button or
- turns on or off the highlighted checkbox or
- open the next menu.

**Backspace**

Pressing the *Backspace* key deletes characters from the right in an open input field.

**Insert**

Pressing the *Insert* key allows certain entries in the input fields to be edited (e.g. decade of a figure). Following the selection of the entry field, all the marking is removed and the cursor can be moved to the desired position.

## 4 Operating and monitoring devices

### 4.6 Main operating unit

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#### **Enter**

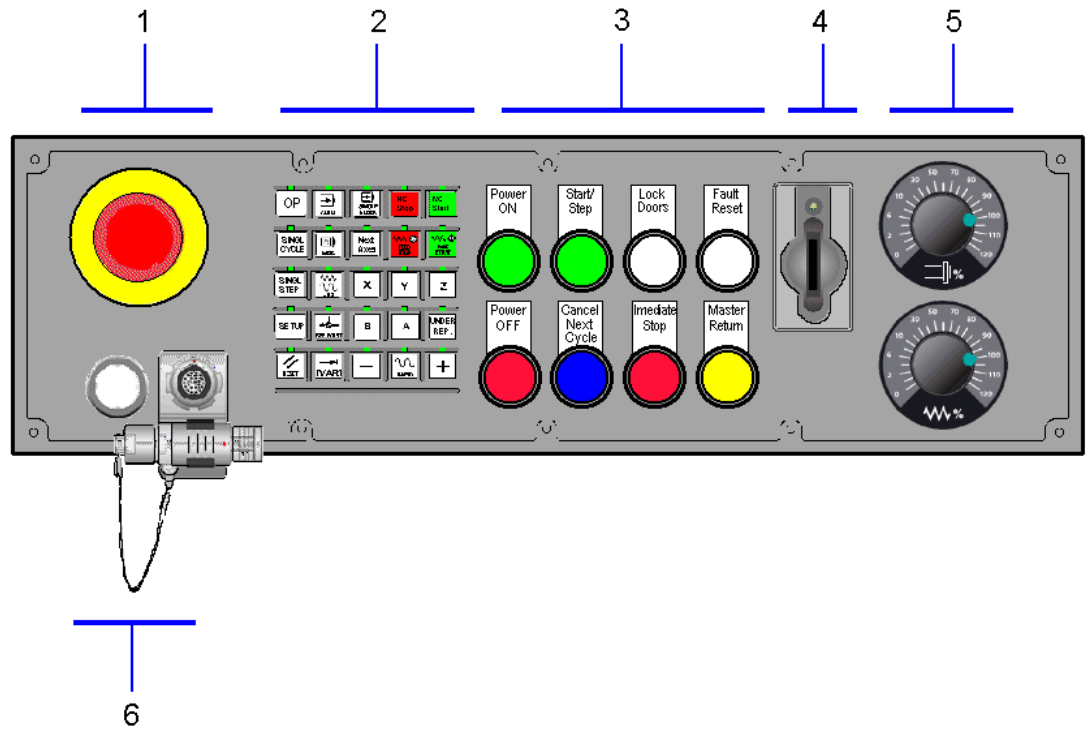
Pressing the *Enter* key (input) starts an action, e.g. accepting changed tool data block.

#### **Full keyboard**

Alternatively, the PC standard keyboard MFII can be connected.

### 4.6.3 Machine control panel

The machine control panel is divided into the following main menus:



1	EMERGENCY STOP Mushroom Button
2	"Left" key field - membrane keyboard - Machine modes - NC modes - Axis pre-selection - NC reset
3	"Right" key field - illuminated push buttons - Machine (motors) on, off - Unlock/lock safety doors - Start/jog - Acknowledge fault - Stop at cycle end - Immediate stop - All units back/home position
4	Electronic Key System (Option)
5	Override switch
6	EMERGENCY STOP bypass, handheld operating unit connection

### 4.6.3.1 Operating modes

Basic settings such as operating mode selection are made using the left key field. Each key has a LED that illuminates when the corresponding function is selected.

Actions within a control area (machine, loader), such as unlock safety door, manually traverse NC axes or start programs can also be carried out at the left key field.

#### Machine modes

Four different operating modes can be selected

- "Interlinked Operation (OP AUTO)" mode
- "Single Cycle" mode
- "Single Step" mode
- "Setup" mode

OP  
AUTO

#### Interlinked Operation Mode (OP Auto)

In interlinked mode, the system operates fully automatically in combination with all control areas

- Machine(s)
- Loader (central controller)
- Conveyors in the load or unload station

This operating mode is reserved for production. With all associated operating units, the *OP AUTO* key must be switched on; the corresponding LED illuminates.

Pressing the *Start/Step* key starts the fully automatic mode. The *Start/Step* key can be actuated by any operating unit.

Effect of the *OP AUTO* key on other functions:

- The "AUTO" NC mode is also automatically selected. "MDA" or "JOG" are now disabled.
- Single Block cannot be selected.
- Switching on the motors automatically sets feed start. Switching off the motors resets a "Feed Start".

SINGLE  
CYCLE

### Single Cycle Mode

Pressing the *Single Cycle* key removes the station from the system interlinkage. A machining cycle is started locally (unit cycle).

- The "AUTO" NC mode is also automatically selected. "MDA" or "JOG" are now disabled.
- Single Block cannot be selected.
- Switching on the motors automatically sets feed start. Switching off the motors resets "Feed Start".

To activate single mode, the access authorisation must be satisfied by the password.

SINGLE  
STEP

### Single Step Mode

Pressing the *Single Step* key removes the station from the system interlinkage. "Single Step" mode is activated. The programs can be executed step by step on a single machine (unit).

- The "AUTO" NC mode and Single Block is automatically selected.
- "MDA" or "JOG" are disabled.

Single block is started using the *Start/Step* key.

To activate "Single step" mode, the access authorisation must be satisfied by the password.




**Setup**

Pressing the *Setup* key removes the station from the system interlinkage. "Setup" mode is activated.

"Setup" mode can be used to trigger individual movements, even when the safety door is open. Select the required movement from the HMI screens of the "Manual functions" area.

The left and/or right vertical softkeys of the corresponding screen line are used to trigger the individual movements. (With the HT8, the two softkeys are arranged to the right of the screen).

Initial situation:

After the controller has run up, the affected machine (unit) will initially be in "Setup" mode. NC modes "JOG" and "REF" are also effective.

Effect of "Setup" mode on other functions:

- NC modes "MDA" and "AUTO" can be selected.
- Single Block can be selected.

The following preconditions must be met before setup mode can be activated:

- Movement with safety door closed:
  - *Preselection Open Safety Door* switch in "Automatic" position.
- Movement with open safety door:
  - Specific access rights granted by password.
  - *Preselection Open Safety Door* switch in "Setup" position.

## HT8

With the HT8, machine operating modes are selected via touchscreen fields. The touchscreen fields can be called up with the *U (User)* key.

## NC operating modes

**Automatic**

Use the key to change to "Automatic" NC mode, also frequently known as "AUTO".

The "Automatic" NC mode is used for the fully automatic execution of part programs. In this operating mode, part programs are selected, started, corrected, selectively influenced (for example in "Single block") and executed.

**MDA**

Use the key to change to the "MDA" operating mode, also known as "MDI (Manual Data Input)".

This operating mode enables you to control the machine by processing an NC block or a sequence of NC blocks. The NC blocks

are entered into the "MDA program" sub-window of the MDA basic screen.

Part programs can be created and processed block by block here, in order to then store the tested NC blocks in part programs. With "Teach In", movement sequences can be incorporated into the MDA program by approaching and storing of positions.



### JOG

Use the key to change to the "JOG" NC operating mode, also known as Jogging, Setup mode or Inching mode.

Conventional movement of the machine by:

- Continuous movement of the axes using *Direction keys*.
- Incremental movement of the axes using *Direction keys*.
- The handwheel.

The "JOG" NC mode is used for manual movement mode and for setting up the machine. For settings there are the machine functions referencing, repositioning, handwheel or movement in specified incremental dimensions and redefinition of control zero point (preset).

In NC-mode "JOG", no automatic pallet transport takes place.

## Machine functions



### Ref Point

The machine function "Referencing" is called up with *REF*.  
The NC mode JOG is essential here.



### Inc Var

With the INC function (incremental dimension), the preselected axis is moved in fixed increments in the appropriate direction in manual mode whenever a direction key is pressed.

Incremental Feed Variable.

Incremental movement with variable increment width.

The adjustable value for the variable increment is preset in the menu "Machine" in NC mode JOG using the softkey "Inc".

## Reset



### Reset

#### Reset

On pressing the *Reset* key

- Processing of the current part program is aborted.
- Messages from monitoring are deleted (except for acknowledge alarm, POWER ON and NC Start alarms).
- The channel is moved to the "Reset" state, meaning that:
  - The NC control remains synchronous with the machine.
  - The control is in the default setting and is ready for a new program sequence.

### 4.6.3.2 Control elements for setup mode

Settings for setup mode are made using the left keypad. Each key has a LED that illuminates when the corresponding function is selected.

## Program control



### NC Start

When the *NC start* key is pressed, the selected part program is started with the current NC block and the associated LED illuminates.



### NC Stop

When the *NC stop* key is pressed, the current part program is stopped and the associated LED illuminates.

Machining can then be resumed by pressing *NC start*.



### Single block

This function offers the possibility of processing a part program NC block by NC block. The "Single Block" function is activated in the "Automatic" or "MDA" NC mode. If "Single Block" is activated, the associated LED on the machine control panel comes on.

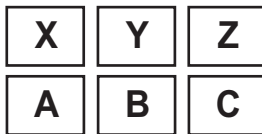
If "Single Block" is effective:

- The screen displays (in the line channel status display) SBL 1 or SBL 2.
- The text "Stop: Step terminated in single block" is output in the channel operating message line (in interrupted status).
- The current NC block of the part program is not processed until the *NC start* key is pressed.
- Machining is stopped after processing of an NC block.
- The following NC block is processed by pressing the *NC start* key again.
- "Single Block" is used in particular for running in new or modified programs.

The function depends on the setting under "Program Influencing" in the main menu "Machine".

"Single Block" is deselected by pressing the *Single Block* key again.

### Axes keys, direction keys



#### Axes keys

The *Axes keys* are used to select a NC axis that is to be traversed in manual mode.

The following keys are available for directly selecting the main axes.

Key	Axis name	Explanation	present
<b>X</b>	M_X1	Column (horizontal axis)	x
<b>Y</b>	M_Y1	Column (vertical axis)	x
<b>Z</b>	M_Z1	Z slide with A/B axis	x
<b>B</b>	M_B1	Rotary table	-
<b>C</b>	M_C1	spindle	x

NEXT  
AXES

#### Next Axes

The Next Axes key opens a dialogue window from which other NC axes of the machine can be selected. The selected NC axis is activated for manual mode as soon as the selection is acknowledged with the Enter key.

**i**

Manual mode is suitable for the following activities:

- The machine is set up in manual mode. The machine control panel can be used to manually trigger movements at the machine.
- During the interruption of a part program, hand-controlled movements at the machine are triggered at the machine control panel.



Risk of collision

No monitoring of the movement.

**Direction keys plus/minus**

*Direction key +* or *Direction key -* - move the axis preselected using the *Axis key* until the *Direction key +* and *Direction key -* are released.

**Machine functions****Ref Point**

The machine function "Referencing" is called up with *REF*.  
The NC mode JOG is essential here.

**Rapid traverse overlay**

The *Rapid traverse overlay* key substitutes rapid traverse for the programmed feed rate.

- *Rapid traverse overlay* is effective in JOG mode and in incremental mode.
- *Rapid traverse overlay* is pressed in addition to *Plus direction key* or the *Minus direction key*.
- *Rapid traverse overlay* is used for quick, rough, manual positioning of NC axes.

**Inc Var**

With the INC function (incremental dimension), the preselected axis is moved in fixed increments in the appropriate direction in manual mode whenever a direction key is pressed.

Incremental Feed Variable.

Incremental movement with variable increment width.

The adjustable value for the variable increment is preset in the menu "Machine" in NC mode JOG using the softkey "Inc".



### Reset

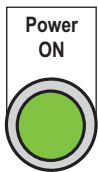
Reset

On pressing the *Reset* key

- Processing of the current part program is aborted.
- Messages from monitoring are deleted (except for acknowledge alarm, machine on and NC Start alarms).
- The channel is moved to the "Reset" state, meaning that:
  - The NC control remains synchronous with the machine.
  - The control is in the default setting and is ready for a new program sequence.

### 4.6.3.3 Control elements for production mode

Frequently occurring settings, especially in linked production mode, can be made using 8 illuminated pushbutton keys.



#### Power ON

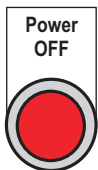
The media to the machine are switched on using the *Power On* key.

Precondition:

- The machine has been switched on at the main switch. Control run-up is finished.
- EMERGENCY STOP is unlocked.

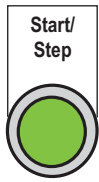
Status display:

- The lamp flashes when the function can be selected.
- The lamp remains lit constantly when all media are switched on.



#### Power Off

The media and the load voltage for the machine are switched off using the *Power Off* key.



### Start/Step

The *Start/Step* key is used to start processes in dependence of the selected machine operating mode "OP Auto" or "Single Cycle" or "Single Step".

- The machine sequence is started in machine operating modes "OP Auto" and "Single Cycle".
- The next machining step is initiated in machine operating mode "Single Step".

In principle, the following preconditions must be met when starting sequences:

- EMERGENCY STOP switch unlocked.
- Media switched on.
- Safety doors locked

The key lamp identifies the statuses:

- Lamp on: Machine start is active.
- Lamp blinks: machine start initiated but not yet active.



### Cancel Next Cycle

The *Stop at end of cycle* key ends fully-automatic operation of the machine: The current workpiece is completed and the machine then stops without transporting the workpiece any further.

- The machine stops.
- Spindle and all movements are brought to a halt.
- The load voltage remains switched on.

The key lamp identifies the statuses:

- Lamp on: "Stop at end of cycle" has been reached. The machine is stationary, spindle and all movements have been halted. The lamp goes out if the machine is re-started or the operating mode is changed.
- Lamp flashing: Function selected although "Stop at end of cycle" has not yet been reached.

**Lock Doors**

The *Lock safety door* key is used to unlock or lock all safety doors of the affected control area.

The lamp identifies different statuses:

- Lamp on: Safety doors to the affected control area are unlocked.
- Lamp flashing: Function requested although not all safety doors are unlocked.
- Lamp off: safety doors to the affected control area are locked.

Precondition:

- The "NC Stop" function must be active.

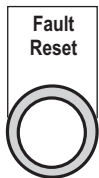
**Immediate Stop**

Sequences within the respective control area are stopped with the *Immediate stop* key, regardless of the selected operating mode.

- Spindles and all movements are brought to a halt immediately.
- The load voltage remains switched on.

The key lamp identifies the statuses:

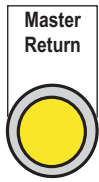
- Lamp on: the machine is stationary.
- Lamp blinks: function has been selected although not all switch-off routines are finished.

**Fault Reset**

If the lamp on the *Fault Reset* key flashes, a machine alarm is queued.

To reset the machine alarm (after correcting the cause!), press the *Fault Reset* key. The lamp goes out.





### Master Return

The *Home position* key triggers movements only on the machine on which the key was pressed. When the key is pressed, the following movements are triggered in sequence:

1. NC stop is triggered.
  2. Reset is triggered.
  3. The tool changer moves to its home position. After leaving the release position of the tool gripper, it moves forwards to its home position. Before this position it moves backwards to its home position.
  4. The machining axes move to their home position as programmed in the "Home" jump marker.
- The LED flashes whilst the home position is being approached.
  - The LED comes on when the home position is reached.

#### Preconditions:

- Axes are referenced.
- Motors on
- Emergency Stop must not be active.
- NC operating mode "Automatic" and machine operating mode "OP Auto" must be selected.
- No defective sensors.
- Any desired, but defined setting of tool changer.
- "Home" jump marker must be present in the machining program.
- On rotary indexing the B axis must always be programmed after the "Home" jump marker.

## **i**

If the machining program is changed, the return of the machining axes must also be adapted in the "Home" jump marker.

#### Abort and restart:

- You can abort the "Move to home position" by pressing the *NC stop* button.
- You can restart the "Move to home position" by pressing the *NC start* button.

#### The move to home position will not be executed:

- when thread cutting is active.
- when gear switching is active.
- when M750 is active.
- when a tool change is active.



When the relevant function or process is completed, the "Move to home position" automatically becomes active.

#### 4.6.3.4 Access level concept - Electronic Key System

##### Access level concept

The unit controls use an access level concept for access to data areas and the special operating mode (setup). Access levels 1, 4, 6 and 7 have been declared for the access level concept on this system.



##### Electronic Key

These access levels are enabled by the Electronic Key System (EKS) in the machine control panel and the corresponding electronic keys. The colour-coded keys contain the access codes for the entitled group of persons concerned.

When the machine is installed locally, the owner can have access to the special operating mode (setup) managed, e.g. by assignment to access levels 1, 4 and 6. These three access levels require a EKS key, whereas access level 7 does not. In the case of the latter, only normal operating mode (automatic) would be selectable.

Access lvl	User	Electronic Key colour	Access rights
1	OEM	Blue	All rights ↓
1	Maintenance	Red	
4	System manager	Black	
6	Operator with additional access right	Green	
7	Ordinary operating person	None necessary	Lowest access rights level

##### Electronic Key System

The Electronic Key System comprises two components:

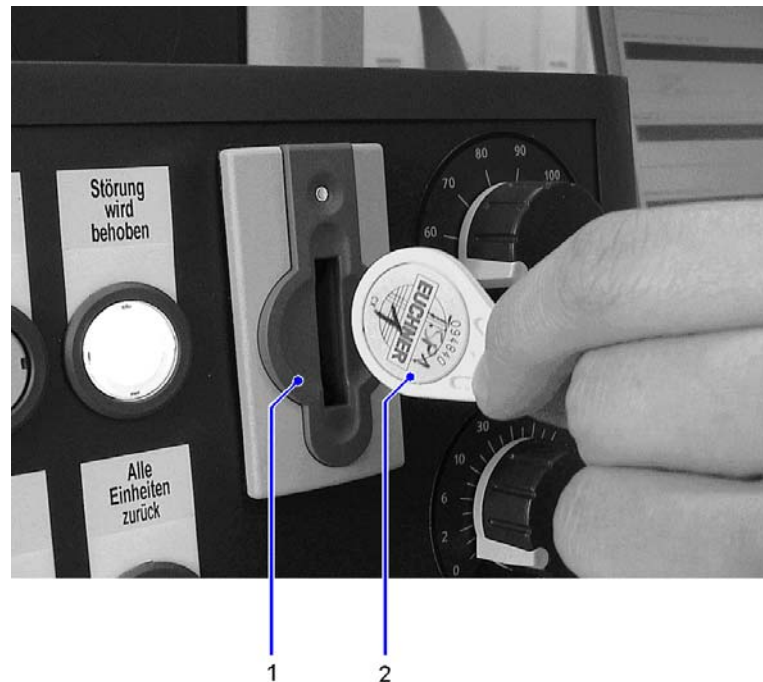
- the key holder
- the electronic key

The data carrier in the electronic key is fitted with a combined write/read and fixed code memory area:

- 116 bytes E<sup>2</sup>PROM (programmed access level)
- 8 bytes ROM (serial number)

## 4 Operating and monitoring devices

### 4.6 Main operating unit



#### 4.6.3 - 1 Electronic Key System (EKS)

- 1 Key holder
- 2 Electronic key

The key holder is a write/read system with integrated evaluation electronics and interface.

For operation, the electronic key is inserted into the key holder and held in place by a spring clamp. The power for the transponder and the data is transmitted without physical contact between the key holder and the electronic key.

#### Electronic Key Manager

The key is managed for various access levels by the "Electronic Key Manager (EKM)" software at a separate PC workstation.

#### Disabled collision monitoring

Main menus with switch on/switch off collision monitoring, e.g. individual functions, are exposed to a higher risk. Particular care and a rigid procedure are required when working with these functions.

Therefore, the machine display and selection windows have been removed from the general protection stage concept (see "Operating in special situations" Chapter).

When the machine is being installed on-site, the operator can arrange to have a special protection stage set up for this sensitive function, which only allows collision monitoring to be switched off under certain conditions.

If you have to switch off collision monitoring for your particular task, let your supervisor know so that access to the function can be authorised. Ensure that on completion of the task, the access right to the machine is reset to its basic status.

#### 4.6.3.5 Feed and spindle control



##### Feed override

The *Feed override* is a rotary switch which is used to adjust the feed rate of an axis between 0 (no motion) and 120% of the programmed feed rate.

The switch can be used in both manual and automatic modes. It is used to limit the feed rate for greater accuracy during manual positioning. It is also useful when commissioning new or modified programs in Single Block mode.

During normal operation, this switch should be set to 100%.



##### Spindle override

The *Spindle override* switch is a rotary switch used to vary the spindle rotation speed between 50 and 120% of the programmed setting.



##### Feed/Spindle Start

When the *Feed/spindle start* key is pressed:

- The part program is resumed in the current NC block.
- The feed and the spindle speed is accelerated to the value preset by the program.
- The associated LED comes on as soon as Feed/spindle start has been accepted by the control.



##### Feed/Spindle Stop

When the *Feed/spindle stop* key is pressed:

- Processing of the current program is stopped.
- The axis drives and the spindle rotation are shut down in a controlled manner.
- The associated LED comes on as soon as Feed/spindle stop has been accepted by the control.

## 4 Operating and monitoring devices

### 4.6 Main operating unit

#### 4.6.3.6 Handheld operating unit connection

BYPASS  
E-STOP



##### Bypass E-Stop

Key to bypass the emergency stop device, if the Approval unit or the Handheld terminal is to be connected and the bypass socket has been removed. A machining program that is already running is not interrupted when the button is pushed. The *Bypass E-Stop* key can be released as soon as the approval unit/handheld operating unit or bypass connector is connected.

HT8  
CONNECTION



##### HT Connection

Connection for the approval unit or for the handheld terminal. Normally, the connection is closed with the bridge connector.

#### 4.6.4 Operating panel for machine functions

CHIP CONVEYOR  
STOP  
BACK ON



##### Chip transport

The switch actuates the conveyor helixes in the machine bed. The switch has 3 positions from which the following functions can be executed:

- Conveyor helixes (forward)
- Conveyor helixes off
- Conveyor helixes in sensing mode so that it can move the helix free in the event of a chip build-up.

WORK AREA  
LIGHT  
OFF ON



##### Work area lighting

Switches the work area lighting on and off.

APPROVAL  
KEY



##### Approval key

"Traverse with safety door open" function:

In conjunction with special operating modes 2 and 3, the *Approval key* key permits axis movements and spindle rotations with the safety door open.

The *Approval key* key is pressed in addition to the + / -(direction keys) keys, or the *NC-Start* key.



Refer also to  
"Machine axis movements in manual mode" **page 227**

"Collision monitoring off" function:

In certain exceptional situations, it is necessary to switch off collision monitoring when using the individual functions. To initiate an axis movement when collision monitoring is off, you must also press the *Approval key* key.

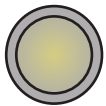


Refer also to

Use the following key functions to define the basic operating mode in combination with the EKS system on the machine control panel.

### Normal operating mode - Traversing with safety door closed

AUTOMATIC  
MODE



#### AUTOMATIC MODE

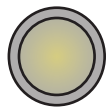
Pressing the *AUTOMATIC MODE* illuminated pushbutton activates the normal "AUTOMATIC" mode if the key switch is set to the right position. The associated key lamp now lights up.

Permissible functions:

- Traversing with work area safety door closed.
- Fully-automatic machining of workpieces in production mode.
- Automatic workpiece change (machines in linkage).

### Special operating mode - Traversing with safety door open

SETUP  
MODE



#### SETUP MODE

Pressing the *SETUP MODE* illuminated pushbutton activates the special "SETUP" mode if the key switch is set to the right position. The associated key lamp now lights up.

Permissible functions:

- Traversing at reduced speed when the work area safety door is open.
- Use of mobile handheld operating unit.
- Axis movement in inching mode (JOG) continuous or step by step.

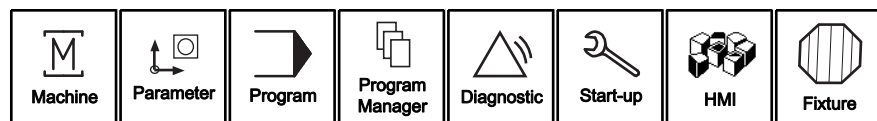
The *Approval key* must be pressed at the same time as the movement-triggering control element.

## 4.6.5 HMI Pro User interface

### 4.6.5.1 Changing between SINUMERIK standard and HMI Pro

#### Basic menu

In addition to the softkeys for the SINUMERIK standard menus (machine, parameters, ...) the "HMI" (Human Machine Interface) softkey is available in the basic menu.



#### HMI



Pressing the "HMI" softkey opens the HMI screen last displayed:

<b>TC</b>	WPC			Add. funct.		Workpiece	Service fct.
Prepare	<b>Handfct.</b>	Diagnostics	Tools	Process	Special scr.	Maintenan.	Document

Actual display may differ.

The lower horizontal softkey bar shows the callable functions. The HMI screens available within a function are shown in the upper horizontal softkey bar.

The following HMI screens can be selected from the "Manual functions" function area in line with the displayed softkeys:

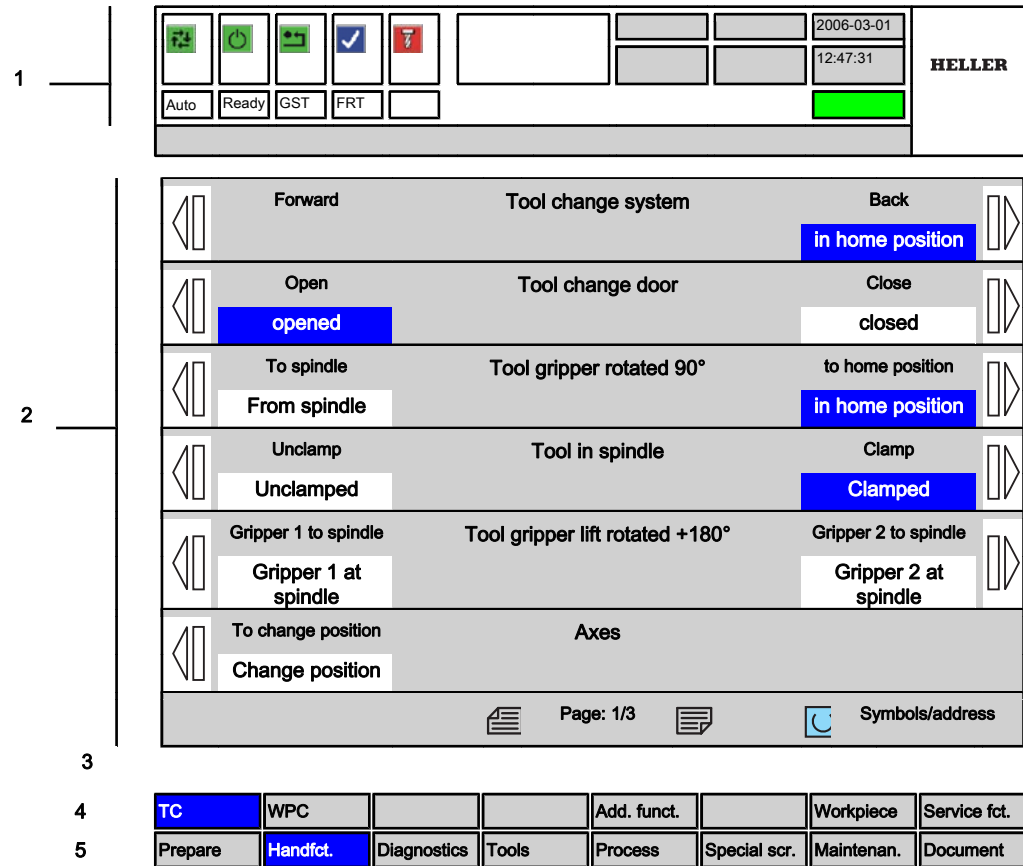
- TC - Tool Changer
- WPC - Workpiece Change
- Additional functions
- Workpiece
- Service functions

#### Example: "Tool Changer" HMI screen

Press the "Manual functions" softkey first before opening the "Tool changer" HMI screen. The "TC" softkey will be displayed for you to press.

The "Tool changer" HMI screen is opened.

4.6.5.2 Structure of the HMI-Pro operating screen



- 1 HMI header information
- 2 Screen function
- 3 Operating note
- 4 Submenu bar
- 5 Main menu bar

**HMI header information**

**Overview**

The header identifies various machine statuses and consists of several fields.

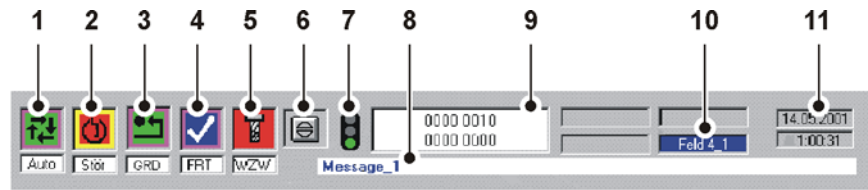
Information such as operating mode, axis positions, change positions etc. are shown by symbols or plain text entries.

Colour shading can differentiate between various levels of importance for certain symbols, depending on the situation (Warning - Alarm).



## 4 Operating and monitoring devices

## 4.6 Main operating unit



## 4.6.5 - 1 HMI header (header information)

- 1 Operating modes
- 2 Machine status
- 3 Home position
- 4 Ready message
- 5 tool change
- 6 Lamp test and/or group acknowledge
- 7 WinTPM light
- 8 Messages, alarms
- 9 Cycle mode
- 10 Header text
- 11 Date, time

## Operating modes



Linked mode

- Linked mode on - bold frame



Auto mode selected

- grey background: selected, not started.

- green background: started automatically.



Auto mode started

- grey background: selected, not started.

- green background: started automatically.



Single mode



Single step

Setup and/or manual mode  
(Safety door not locked)Setup and/or manual mode  
(Safety door locked)










## Machine status



Ready - no fault



Tool changing position

		Warning
		Logistical fault:
		Fault - local alarm
		Fault - entire machine alarm
Home position		Local home position
		Home position, entire machine.
Ready message		Local ready message
		Entire machine ready message
tool change		Tool change:
		- yellow background: Warning - red background: Alarm.

### Screen function

The screen function contains up to 6 individual functions. Each individual functions is identified by a screen line with both a right-hand and a left-hand display field. Pressing the right-hand softkey allows you to initiate a function or trigger a movement in a positive direction. Pressing the left-hand softkey allows you to deactivate the function or trigger a movement in a negative direction.

### Main menu

**HMI areas** One HMI function area comprises all aspects of the same subject or function. The 7 HMI functions can be selected using softkeys on the

lower horizontal softkey bar; these functions represent the main menu.

### Sub-menu

#### HMI screens

Pressing a softkey in the main menu serves to refine the relevant HMI function in a sub-menu (upper horizontal softkey bar). One or several softkeys are activated depending on the scope of the function (marking). Each of these softkeys opens a specific HMI screen. The following section provides an overview of the available HMI screens.

#### Individual functions on several pages

More than 6 individual functions can occur within one function group for the setup functions in the "Operate" function. As one HMI screen can represent up to six individual functions and/or screen lines, further individual functions are accommodated on a 2nd (or 3rd) screen page. Pressing the *Page-up* key opens the second page and so on. Pressing the *Page-down* key enables the operator to scroll back through the screen pages.

### 4.6.5.3 Overview of the HMI-Pro operating screens

#### Prepare

You can change settings to prepare for production for auto mode using the "Prepare" function area in the HMI screen below:

- Power-up conditions
- Cycle types
- Type Setup
- Clean cycle

#### Hand functions

The "Manual functions" function area is used to setup the machine. Use this function area for commissioning, troubleshooting and repair. Single step transport and machine movements, as well as

switching processes can be initiated using the following HMI screens:

- TC (Tool changer)
- WPC (Workpiece change)
- Additional functions
  - Safety doors
  - Acknowledge
  - General
- Workpiece
- Service functions

**Diagnostics**

The "Diagnostics" function area is used to check internal and external communication modules, e.g. in the event of an error. The following HMI screens are available:

- Alarm History
- Profibus Diagnostics
- Alarms
- Messages
- TCP/IP diagnostic
- WSSP (Workpiece clamping)

**Tools**

The "Tools" function area contains the often needed "Tool wear" HMI screen, which gives a quick overview of the condition of the tools in the tool magazine.

**Process**

The following operating screens are available in the "Process" function for inspecting the production-relevant variables:

- Machine overview
- Workpiece counter
- Cycle time
- Qs Data (DMC)
- Test time
- SPC

**Special Screens**

Additional operating screens are available for the "Special Screens" function area:

- Utilization
- Shifts

**Maintenance**

Additional operating screens are available for the "Maintenance" function area:

- PLC Status
- Interface
- Lamp Test

## 4 Operating and monitoring devices

### 4.6 Main operating unit

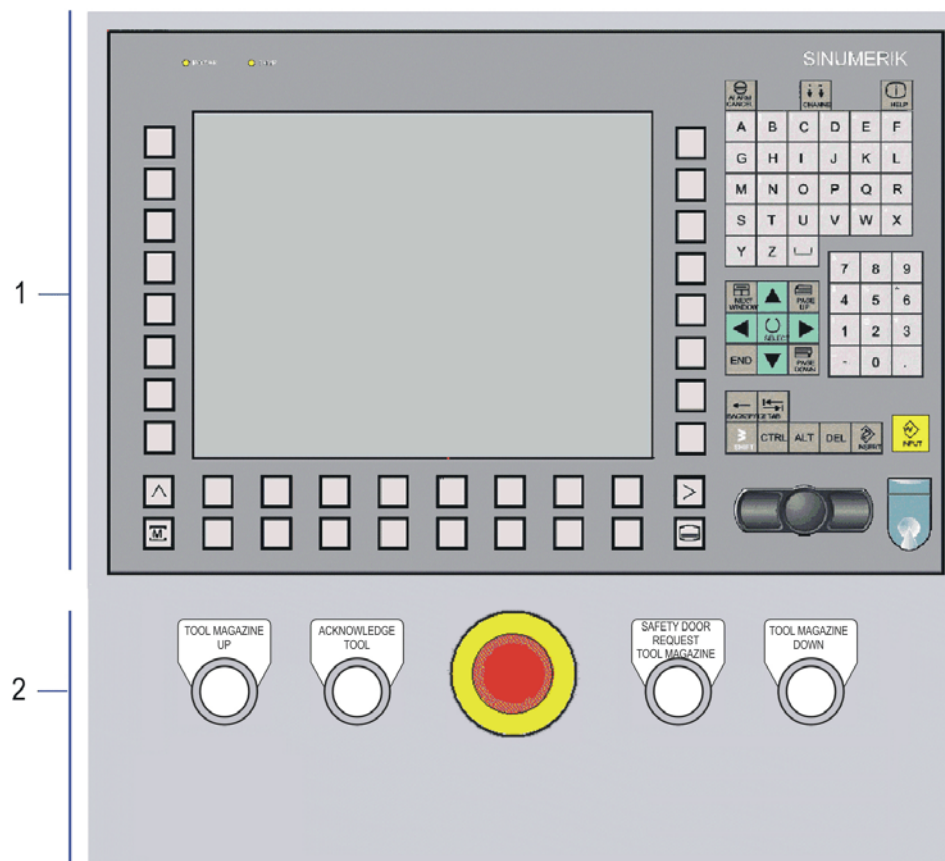
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**Document**                    The "Document" function area provides additional operating screens for documenting the operating statuses:

- Version
- Safety Integrated

## 4.7 Control unit, tool setting station

### 4.7.1 Terminal operator panel



- 1 Operating panel for control functions**
  - Area changeover, menu control
  - Alphanumeric character entry, cursor movement
  - Connection for full keyboard
- 2 Operating panel for machine functions**
  - Emergency stop
  - Magazine control
  - Info. and help window, entry confirmation

### 4.7.1.1 Screen function

#### Data menu keys

The terminal operating unit is used to control the following functions in particular

- Tool magazine management
- Tool data



#### Recall

Return to the higher-level menu. The current window is closed using *Recall*.

The *Recall* key can be pressed to abort an action at any time without changed data being saved. Example: changes in the "tool data record" are to be rejected. Settings made using the *Marker key* are retained.

Return to the basic display by pressing *Recall* repeatedly.



#### etc.

Menu extension of horizontal softkey bar. Pressing *etc* displays further functions in the menu bar.



The display on the terminal operating unit is the mirror image of the display on the main operator panel.

The entries on the main operator panel and the terminal operating unit are the same. This means that entries are shown on the two control panels directly, irrespective of the place of entry.

#### Tools



Press the "Tools" softkey in order to skip to tool magazine management and tool data menu.

The explanation for the other softkeys can be found in the "Operating station on Main operator panel" Section.

#### Softkeys

##### Horizontal softkey



A function is assigned to the softkeys via a menu bar on the screen.

With the horizontal softkeys any main menu in further main menu levels can be reached. For each horizontal menu point there is an associated vertical menu bar/softkey assignment.

**Vertical softkey**

The vertical softkeys are assigned functions to the currently selected horizontal softkey. Pressing a vertical softkey calls the function. The assignment of the vertical softkey bar can change again if further sub-functions can be selected under a function.

**4.7.1.2 Operating panel for control functions****Alphanumeric keypad****Alphanumeric keys**

Dual-function keys:

- *Numeric keys* to input numbers, directly accessible.
- *Alphabetic keys* to input text, accessible via *Shift*.

**Shift**

On keys with two functions, pressing the *Shift* key activates the upper function or switches to lower-case letters.



Input help can be called-up by pressing *Shift* + *?* to assist with completing the input fields.

**Space**

You can enter spaces with the *Space* key.

**Screen control****Alarm cancel**

Pressing the *Alarm acknowledgement* key clears the error.

**Information**

Pressing the *Information* key in the Diagnostics/Alarms main menu automatically calls up the Help function.

**Channel changeover**

Pressing the *Channel changeover* key switches the screen to an alternative channel.



## 4 Operating and monitoring devices

## 4.7 Control unit, tool setting station

**Page up**

Pressing the *Page-up* key allows you to scroll one page up or to the beginning of the list.

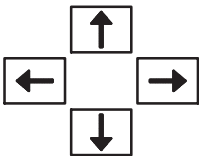
**Page down**

Pressing the *Page-down* key allows you to scroll down a page or to the end of the list.

**Tab**

The *Tab*(ulation) key is used to move on one block, for example to the end of the line or to the next table column.

### Selection and input keys

**Cursor keys**

*Cursor keys* for moving the highlight.

- Cursor left/right keys:
  - Highlighting to the left or right.
  - To the previous or next input field.
- Up/down cursor keys:
  - Highlighting upwards or downwards
  - To the previous or next input field.

**Highlight**

Pressing the *Highlight* key

- initiates the highlighted selection or
- marks the highlighted list element or
- turns on or off the highlighted radio button or
- turns on or off the highlighted checkbox or
- open the next menu.

**Delete**

Pressing the *Delete* key deletes the entry in an open input field.

**Backspace**

Pressing the *Backspace* key deletes characters from the right in an open input field.

**Insert**

Pressing the *Insert* key allows certain entries in the input fields to be edited (e.g. decade of a figure). Following the selection of the entry field, all the marking is removed and the cursor can be moved to the desired position.

**Enter**

Pressing the *Enter* key (input) starts an action, e.g. accepting changed tool data block.

### 4.7.1.3 Operating panel for machine functions

**TOOL MAGAZINE UP**

Move tool magazine upwards in JOG mode towards ascending place numbers.

Pressing the key briefly moves the magazine up by one place.

If the key is pressed for a longer time, the magazine will continue moving up until the key is released.

**ACKNOWLEDGE TOOL**

The *Acknowledge tool* key provides two different functions, depending on whether the key is pressed shortly or pressed and held for more than 1.5 seconds.

**Press key shortly:**

After a tool change, you can briefly press the key to reset the tool life or quantity values to the setpoint and set the wear values to "0".



For further information on the key function, see "Handling at the tool setting station" **page 253**

**Press and hold key for more than 1.5 seconds:**

A reset in the area of the tool changer is performed.

All pending functions in the area of the tool changer are aborted. This function does not affect the rest of the machine.

- The lamp shortly lights up when the function has been executed.

## 4 Operating and monitoring devices

### 4.7 Control unit, tool setting station

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#### SAFETY DOOR REQUEST TOOL MAGAZINE

The tool setting station safety door key unlocks/locks the rotary station. When unlocked, the rotary station can be swivelled manually through 180°.

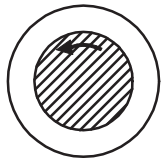
- Lamp flashes during action.
- Lamp illuminates when the rotary station is unlocked.



#### TOOL MAGAZINE DOWN

Move tool magazine downwards in JOG mode towards descending place numbers.

Pressing the key briefly moves the magazine down by one place. If the key is pressed for a longer time, the magazine will continue moving down until the key is released.



#### EMERGENCY STOP

All operating stations have a mushroom type Emergency stop button.

Only operate the red button in emergencies:

- When life is at risk.
- When there is a risk of damage to the machine or workpiece.



For detailed information, see Section:  
"EMERGENCY STOP device" **page 84**

## 4.8 Mobile handheld operating unit (HT8)

The mobile handheld operating unit is the screen control panel and the machine control panel combined.

The operating concept of the mobile handheld operating unit is the same as the main operator panel. Therefore, the statements made on the main operator panel apply also to the mobile handheld operating unit.

### 4.8.1 General

#### Difference to main operator panel

The key differences between the mobile handheld operating unit and the stationary operator panel are as follows:

- No access to access levels.
- Partial touchscreen operation instead of key operation
  - Machine modes
  - Axis selection (dialogue box)
  - Start/Step, Cancel Next Cycle, Master Return

#### Screen

The screen of the HT8 is a so-called CCFL backlight unit with touchscreen functionality. All application-specific functions appear in the touch-sensitive display. Lightly pressing a touchscreen field with the finger triggers the corresponding function.

Dimming the brightness of the screen extends its lifespan.



Do not touch the display with sharp or hard objects. This may significantly reduce the life of the display.

#### User interface

The mobile handheld operating unit (HT8) operates according to the Thin Client principle and therefore does not have its own user interface software. The user software is located in the stationary operator panel to which the mobile handheld unit is connected.

For safety reasons, operation with the main operator panel is disabled when operation with the mobile handheld operating unit is active.

4 Operating and monitoring devices  
 4.8 Mobile handheld operating unit (HT8)

### 4.8.2 Overview of operating elements, connections

Front side



4.8.2 - 1 HT8 user interface

- 1 Machine control panel buttons
- 2 Emergency stop switch
- 3 Handwh
- 4 Screen without touchscreen functionality
- 5 Override rotary switch
- 6 Buttons for triggering HMI functions (Hand functions)
- 7 Screen control panel keys
- 8 User key (axis selection dialogue box etc.)
- 9 -/+ axis traversing keys

Rear



- 1 Rating plate
- 2 Support handle
- 3 USB connection (closed with dummy plug)
- 4 Protective collar
- 5 Approval key (both sides)
- 6 Connection cable with push-pull round connector

### 4.8.3 Connection of the mobile handheld operating unit



Connecting or disconnecting the cable during machine operation will result in faults with the operating sequence, possibly resulting in tool and workpiece damage.

Do **not** connect or disconnect the cable during machine operation!

The handheld operating unit can be connected to the operator side of the machine on the main operator panel.  
The handheld operating unit can be connected at the machine rear above the hydraulic unit to control the tool magazine.

### Preconditions

The following preconditions must be satisfied to avoid problems while connecting and disconnecting.

- Terminate automatic program execution;
- No tool provisioning active,
- NC stop condition, NC stop indicator illuminated;



### Exercise caution when connecting a different HT8.

If a different HT8 to the one last used is connected to the stationary operating unit, it must be re-commissioned! The following steps are obligatory once the HT8 is inserted:

- Wait for the HT8 to run-up. A blue screen showing the logged on TCUs (Thin Client Units) appears on the HT8.
- Select the TCU called "HT8". The message "replacing HT8" will appear. The HT8 is running up.
- The new HT8 is logged on with the same parameters as the last HT8 to be used.

An improper logon, e.g. if an incorrect TCU number is selected, may cause a serious malfunction that will require a repair to the system.

## Connecting the HT8

Please observe the following sequence when connecting the HT8:

1. Press and hold down the *Pendant Release* key to bypass the Emergency Stop device.
2. Remove the bridge connector (push-pull mechanism).
  - Provide the bypass connector in a safe place for later use. Notify all persons operating the machine about the location of the bridge connector.
3. Insert the connector on the mobile handheld operating unit into the interface (push-pull mechanism).
4. Release the *Pendant Release* key.
5. Place the HT8 in a suitable location.

## Request operation

Touching the screen on the mobile handheld operating unit moves the focus from the main operator panel to the portable handheld operating unit. Operation of the main operator panel is now inhibited.

#### 4.8.3.1 Removing the mobile handheld operating unit

When you have finished working with the mobile handheld operating unit, remove it as follows:

1. In the "Manual function" HMI function area, call up the "Extra functions" HMI screen. In the "Mobile handheld unit focus change" screen line, select "Enable".
2. Press and hold down the *Pendant Release* key to bypass the Emergency Stop device.
3. Remove connector on the handheld operating unit from the interface (push-pull mechanism).
4. Insert bridge connector into the interface.
5. Release the *Pendant Release* key.

#### 4.8.4 Approval keys

##### ... On the rear

In addition to the control function itself, one of the approval keys located on the rear of the mobile handheld operating unit must also be actuated before work can be carried out with the safety door open.

- In "Jog" mode, the Approval key is also pressed before the direction key (approval key remains pressed).
- In this case, the axis feed rate is restricted

As soon as the Approval key is released, all machine movement is stopped.

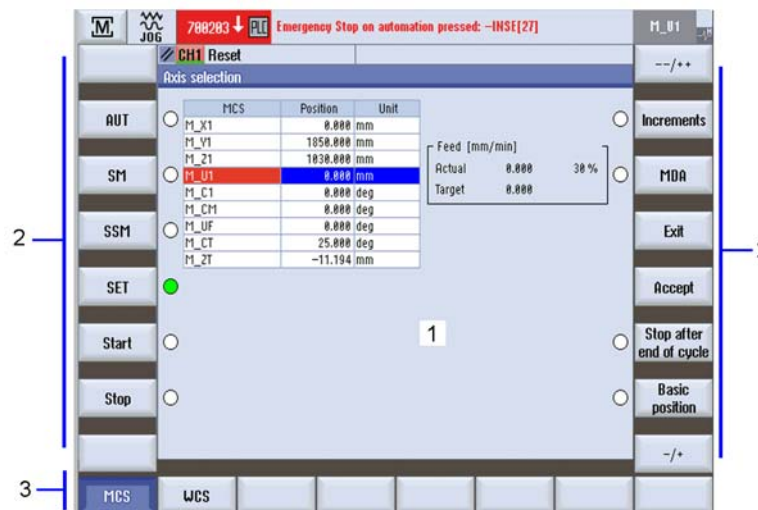
Although the handheld operating unit has two approval keys, only one has to be pressed to trigger the required function when the safety door is open. The symmetrical arrangement of the buttons allows both left- and right-handed people to easily operate the handheld operating unit.



### 4.8.5 Operating concept

#### U (User) key

Pressing the *U (User)* key to change screen and call-up important machine control panel functions:



4.8.5 - 1 HT8 screen after pressing the *U (User)* key

- 1 Axis selection
- 2 Machine modes
- 3 Machine functions
- 4 Coordinate-system

Axis selection in dialogue box (1)

- Select the axis line using the *cursor keys*.
- Press the "Accept" softkey.

Select machine operating mode and start/stop (2):

- Press the desired touch screen field.

Select machine function (3):

- Press the desired touch screen field.
  - Rapid traverse direction keys -- / ++
  - Increment
  - MDA input
  - Stop at end of cycle
  - Home position
  - Feed direction keys -- / ++

- Select coordinate system (4):  
 - Press the desired touch screen field.

### Screens of "840D" Standard menu

All main menus of the "840D" Standard can be selected via HT8 by pressing the appropriate softkey.

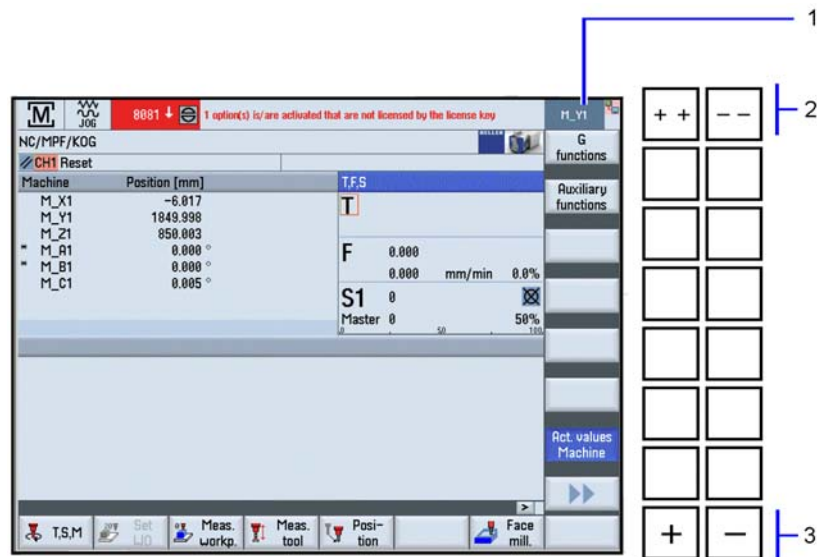
**Example: "Machine" function**

In the "Machine" menu, the individual NC axes can be traversed in "Jog" NC mode.

In principle, the axes are selected using a dialogue box as shown in the previous Chapter. When the dialogue box is exited, the "Jog" basic screen known from the stationary operating unit is displayed, see Figure below.

The currently selected axis is displayed in the screen at the top (1). Use the  $-/+$  direction keys (2, 3) to move the axis in Jog mode. If the axis is moved with the safety door open, one of the approval keys on the back of the HT8 must also be pressed. The movement stops when one of the direction keys or the approval key is released.

The functions relevant to the "Jog" NC mode are available as touchscreen fields to the right and below the operating screen.



4.8.5 - 2 "Jog basic screen" example

- 1 Display of active axis
- 2 Rapid traverse direction keys -- / ++
- 3 Feed direction keys -- / ++

## HMI function screens

The "HMI" main menu contains the operating screens of the Automatic menu as well as a large number of setup screens with individual functions for additional axes (hydraulic, pneumatic).

With the Handheld Terminal HT8, the 2-line HMI menu is replaced by a horizontally-expanded single-line menu. Pressing the *etc.* key allows you to toggle between the main menu and the sub-menu (toggle function).



The projected HMI screens can be selected after the "Hand functions" area has been preselected from the HMI main menu bar. The menu bar changes its assignment (HMI submenu bar).

Pressing the required touchscreen field (1) opens the corresponding HMI screen, which offers several individual functions (2). Each individual function is represented by a screen line, which comprises a right and a left-hand display field.

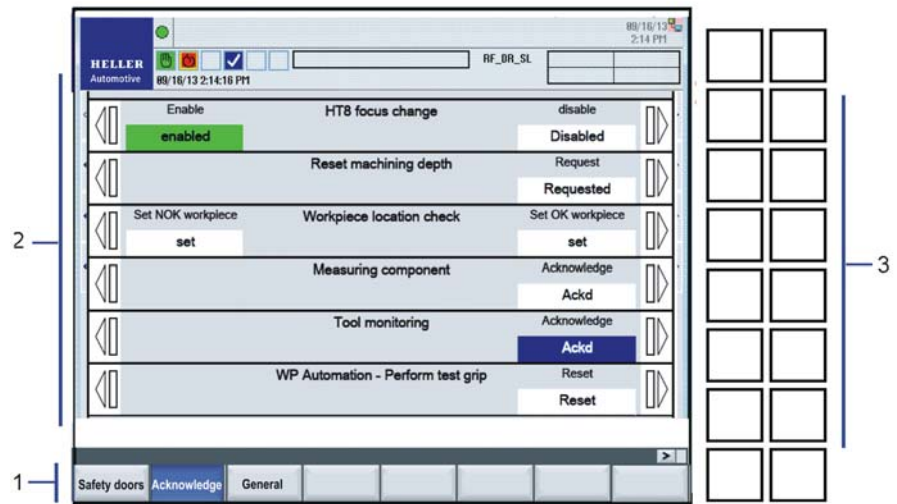
Pressing the vertical keys on the right of the screen (3) allows you to activate a function or initiate a movement in a particular direction.

### **i**

Toggle between the main menu bar and the submenu bar using the *etc.* key

4 Operating and monitoring devices  
4.8 Mobile handheld operating unit (HT8)

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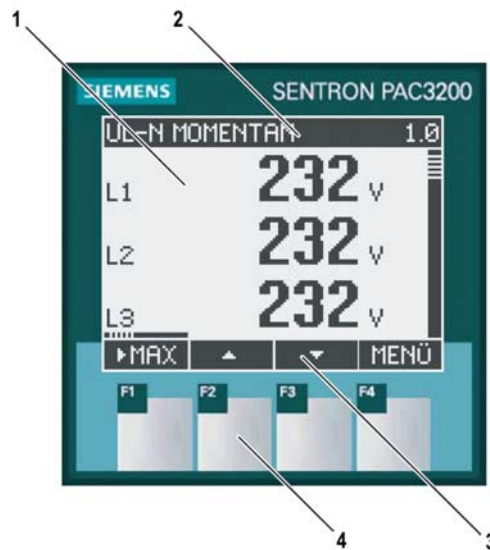
4.8.5 - 3 "Hand functions" HMI screen

- 1 HMI menu bar
- 2 Individual functions HMI screen
- 3 Buttons for triggering the "left"/"right" function

## 4.9 Multi-function measuring device

### SENTRON PAC3200

The following multi-function measuring device for displaying all relevant network parameters in the low-voltage energy distributor is built into the control cabinet door.



4.9 - 1 Operating panel SENTRON PAC3200

- 1 Display measured values, device settings, selection menus
- 2 Menu title
- 3 Current softkey functions
- 4 Softkeys (touch keys F1 ... F4)

It is able perform one-, two-, or three-phase measurements and can be used in two-, three-, or four-wire TN, TT, and IT networks.

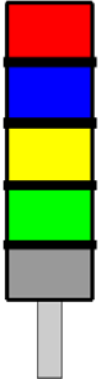
The large, graphic LC display can be read even from a great distance. To ensure optimum readability, even under poor lighting conditions, the background lighting of the SENTRON PAC3200 can be adjusted in increments.

In order to prevent unauthorised access via the device front, there is an integrated password protection.



For detailed information, please see the PDF documents on the CD-ROM under the sub-suppliers information "Siemens".

## 4.10 Multi-coloured status lamp



### Statuslampe

A multi-coloured status lamp (tower light) indicates faults and machine statuses. The status lamp is on the control cabinet so that all existing alarm messages are clearly visible from the main operator station.

#### Red

The red lamp lights up if the machine is at a standstill for various reasons, for instance:

- If the transport equipment is still at a standstill but "Start" is pending.
- If a group fault is reported.
- In an EMERGENCY STOP situation.

Additional information is displayed in the screen. Once the cause of the fault has been remedied, press the *Fault Reset* key.

#### Blue

The blue lamp lights up during a maintenance call that requires operator intervention. Additional information is displayed in the screen.

#### Yellow

The yellow lamp lights up in the event of pre-warnings, for instance:

- When a tool change is required soon.
- If the oil in the lubrication tank is running low.
- If there are no raw parts in the machine infeed.

The machine can only be operated manually in this state (set-up, MDI mode).

#### Green

The green lamp lights up when the machine is running without limitations in linked mode and the program is continually repeated.

## 4.11 Data recording in the event of an error

<b>Error recording</b>	Serious errors caused by a mechanical overload of the machine are permanently recorded on the machine in the form of coded PLC data.
<b>Cylinder</b>	In the case of serious errors, which indicate a machine overload, PLC data are recorded onto at least one storage medium.
<b>Recording format</b>	The PLC data recorded in the case of serious errors, which indicate a machine overload, are coded. Special functions are required to decipher and read these recorded data.
<b>NC mode "Automatic" selection</b>	<p>"Auto" NC operating mode can only be selected if all the storage media required for data recording are present.</p> <p>"Auto" NC operating mode cannot be selected if the storage media required to record PLC data in the event of serious errors that indicate a machine overload are absent.</p> <p>If the storage medium is removed while the machine is running in "Auto" NC operating mode, the machine will stop at the end of the current machining cycle via the "Stop at end of cycle" function. "Auto" NC operating mode is deselected.</p> <p>"Auto" NC operating mode cannot be reactivated until all the storage media required to record PLC data in the event of serious errors that indicate a machine overload are present.</p>





# CHAPTER 5

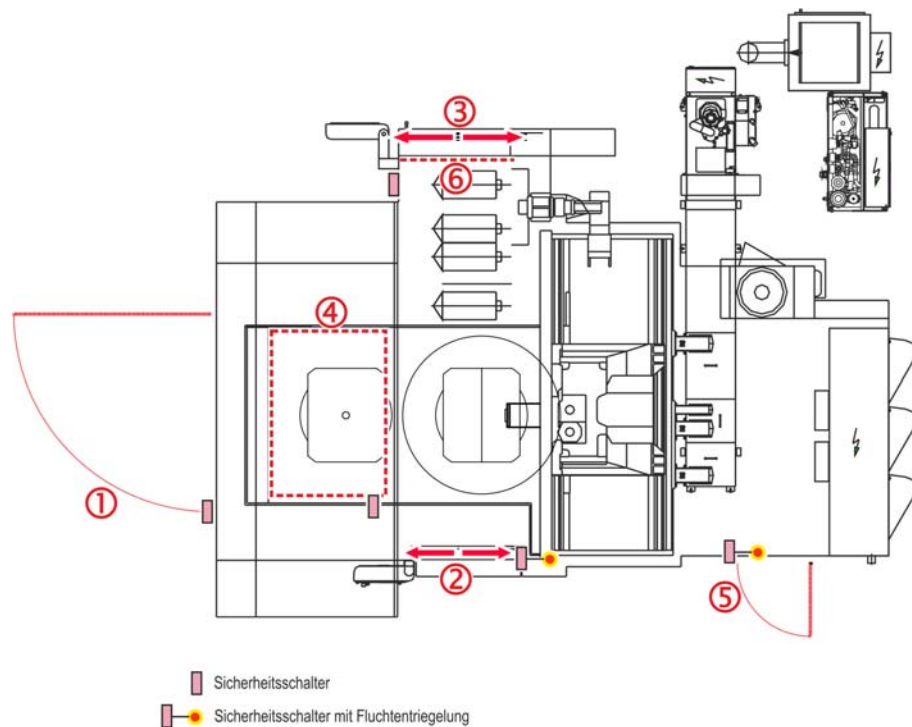
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Operation for production

## 5 Operation for production

### 5.1 Special safety precautions

#### 5.1.1 Safety precautions at safety doors



##### 5.1.1 - 1 Electrically monitored safety doors

- 1 Workpiece setting station safety door (front door)
- 2 Work area safety door
- 3 Tool setting station safety door
- 4 Load hatch
- 5 Maintenance area safety door
- 6 Inner tool setting station safety door

All safety doors are electrically monitored and released via a type "CET" or "CES" safety switch.

### 5.1.1.1 Securing safety doors against closing

#### Securing the safety doors against unintentional closing

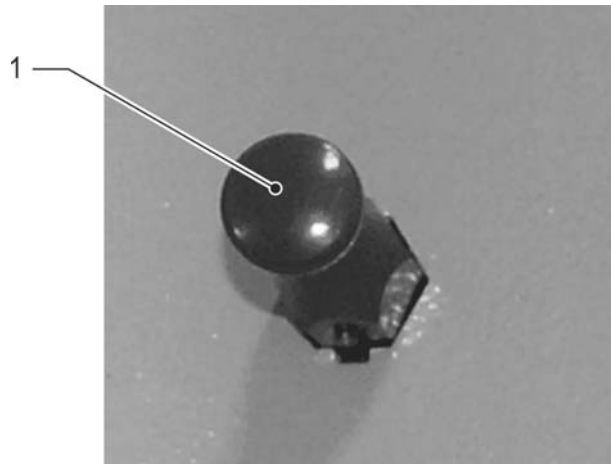


When the machine is started, fatal injury can occur if persons are accidentally trapped in the machine.

Before you enter the machine, secure the used door to prevent closing. You must eliminate the possibility of the door being closed from outside while a person is in the machine.

#### Securing work area safety door to prevent closing

As long as the work area safety door is not locked, the motors cannot be switched on. The escape button on the inside of the safety switch services as an escape release in case of emergency. When this button is pressed, the machine is brought to an EMERGENCY Stop and the work area safety door is unlocked.



5.1.1.1 - 1 Escape release, work area safety door

1 Escape button

- Precondition:
  - Machine switched on at main switch.
- Ensure that the loading hatch in the work area hood is closed.
- Unlock and open the work area safety door.



5.1.1.1 - 2 Work area safety door secured by padlock

- 1 Padlock
- 2 Work area safety door

- Position padlock at angle sheets on guard panels and work area safety door and lock.
- Do not remove padlock before the end of work and before the work area is vacated.

#### **Securing workpiece loading station safety door to prevent closing**

As long as the safety switch of the workpiece setting station safety door is not locked, the motors cannot be switched on.

- Precondition:
  - Machine switched on at main switch.
- Ensure that the loading hatch in the work area hood is closed.
- Open maintenance opening 2 at workpiece setting station.
- The safety switch can be accessed.

5 Operation for production  
5.1 Special safety precautions

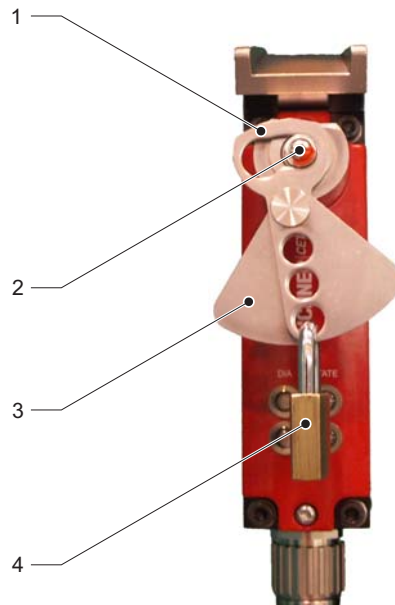
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5.1.1.1 - 3 Maintenance openings and safety doors on the front side

- 1 Workpiece setting station safety door (front door)
- 2 Safety switch (maintenance opening 2 removed)

- Unlock the workpiece setting station safety door (front door) by rotating the casement fasteners.
- Unlock safety switch and open workpiece setting station safety door (front door).
- Press the push button on the safety switch and line up the holes in the two levers.
- Hook padlock into lock insert and lock.
- The tumbler is not activated. Do not remove padlock before the end of work and before the safety area is vacated.



5.1.1.1 - 4 Safety switch with lock insert

- 1 Lock insert
- 2 Pushbutton
- 3 Lever
- 4 Padlock

↪ The safety door can no longer be closed.

- On completion of work:
  - Remove padlock.
  - Move lock insert to the home position (cutting position).
- Close and lock the workpiece setting station safety door (front door).
- Close maintenance opening 2 at workpiece setting station.

#### **Securing tool setting station safety door to prevent closing**

As long as the safety switch of the tool setting station safety door is not locked, the motors cannot be switched on.

- Precondition:
  - Machine switched on at main switch.
- Unlock safety switch and push the tool setting station safety door to the left.

5 Operation for production  
5.1 Special safety precautions

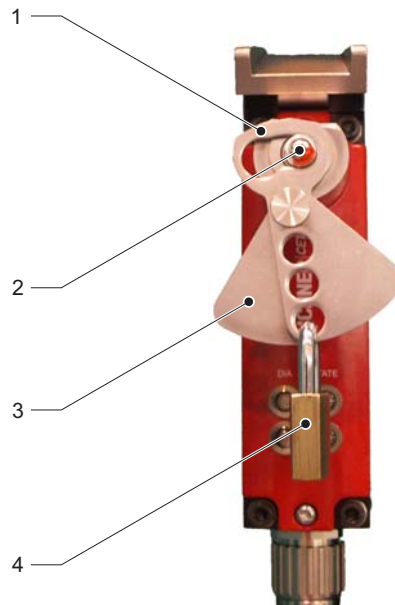
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5.1.1.1 - 5 Tool setting station safety door

- 1 Tool setting station safety door
- 2 Safety switch

- Press the push button on the safety switch and line up the holes in the two levers.
- Hook padlock into lock insert and lock.
- The tumbler is not activated. Do not remove padlock before the end of work and before the safety area is vacated.



5.1.1.1 - 6 Safety switch with lock insert

- 1 Lock insert
- 2 Pushbutton
- 3 Lever
- 4 Padlock

↪ The safety door can no longer be closed.

- On completion of work:
  - Remove padlock.
  - Move lock insert to the home position (cutting position).
- Close and lock the tool loading station safety door.

### 5.1.1.2 Restoring a safe state

The respective safety door must be closed and locked once the safety area has been vacated. The padlock must be removed beforehand.



It must be ensured that nobody is in the safety area concerned.



Depending on the safety area, various control elements are available for locking the safety door.

**Lock work area safety door**



- ☒ Ensure that nobody is in the work area.
- ☒ Close work area safety door.
- ☒ Press the *Lock Doors* on the main operator panel.
- ↪ The work area safety door is locked.  
The key lamp extinguishes.

**Lock tool setting station safety door**

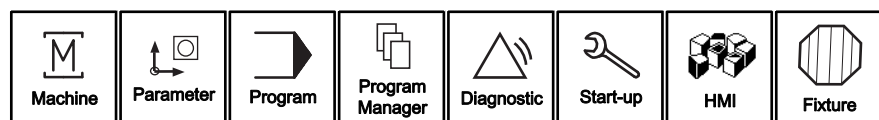


- ☒ Close tool loading station safety door.
- ☒ Press the *SAFETY DOOR REQUEST TOOL MAGAZINE* on the operating panel of the tool setting station.
- ↪ The tool setting station safety door is locked.  
The key lamp extinguishes.

**Lock workpiece setting station safety door, loading hatch etc.**



- ☒ With *Data menu key* call up the basic menu on the main operator panel.



**HMI**



- ☒ Press the "HMI" softkey.
- ↪ The "Setup functions to HMI Standard" menu item appears.

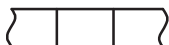
**Man.funct.**



- ☒ Press lower horizontal softkey "Man.funct.".
- ↪ The menu of the "Manual functions" area is opened.

TC	WPC			Add. funct.		Workpiece	Service fct.
Prepare	Handfct.	Diagnostics	Tools	Process	Special scr.	Maintenan.	Document

**Additional fu.**



- ☒ Press upper horizontal softkey "Additional fu."
- ↪ The menu of the "Additional functions" area is opened (3rd menu level).

Safety doors	Acknowledg	General.					
Prepare	Handfct.	Diagnostics	Tools	Process	Special scr.	Maintenan.	Document

**Safety doors**



- ☒ Press upper horizontal softkey "Safety doors".
- ↪ The "Safety doors" HMI screen is opened.

Open	Safety door workpiece settg. station	Close
Opened		Closed
Open	Loader safety door/top loading hatch	Close
Opened		Closed
Unlock	Media supply safety door	Lock
Unlocked		Locked
Unlock	Tool setting station safety door	Lock
Unlocked		Locked

- ↪ The left marked display fields show safety doors that are open and/or not locked.



- ☒ Press the *Setup* key.



- ☒ Press the right softkey "..." of the respective safety door, which is not closed and/or locked.
- ↪ The corresponding safety door is locked. The right status field "Locked" (and/or "Closed") is marked.

Open	Safety door workpiece settg. station	Close
Opened		Closed
Open	Loader safety door/top loading hatch	Close
Opened		Closed
Unlock	Media supply safety door	Lock
Unlocked		Locked

### 5.1.2 Safety during axis positioning

#### B/Z-axis collision warning



**CAUTION**  
B/Z axis collision

With large workpieces (max. workpiece collision path), the rotational movement of the Z-axis may result in stroke restrictions of the Z-axis.

Restricted stroke already with empty pallet or with workpieces whose contours lie within the pallet swing area. The situation is compounded on larger workpieces (within max. workpiece collision path) or versions with expanded Z-stroke.

The stroke restriction is not monitored by the control system and must therefore be observed by the operator.

When the rotary table is rotated in the lower traverse area, the sequence of movements must be strictly maintained:

1. Clear traversing to a suitable Z position (in accordance with the General layout AZ)
2. Carry out B axis rotation.

## 5.2 Considerations for production

### 5.2.1 Setting preconditions

The machine can be operated in both linked and stand-alone mode. In the case of linked operation, the workpiece is transported by the external loading system direct to the work area of the machine.

The following Chapter describes the points that are essential to the standard production process. It is assumed that the machine is equipped with tools and/or a machining program is prepared.



Information about the subject of "workpieces" and "machining programs" can be found in the chapter on "Management of fixtures".



Information about the subject of "tools" can be found in the main chapter 6 on "Tool system".

### 5.2.2 Operating strategy

#### Production mode

##### Linked mode

Machine and loader are in linked mode. In linked mode, the run-in and released machining programs start automatically. This controls the fixture management system in combination with the loader control.

##### Stand-alone mode

Machine and loader are not in linked mode. In stand-alone mode, the run-in and released machining programs start automatically. This controls the fixture management system. The fixture management system ensures a clear assignment of fixture number and/or workpiece to the machining program.

Handling in stand-alone mode has been reduced to just a few operating steps at the workpiece setting station:

- Unload finished part using suitable lifting equipment.
- Load raw part using suitable lifting equipment.
- Confirm loading operation.

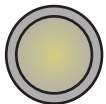
### Fixture management system

The fixture management system ensures a clear assignment of fixture number and/or workpiece to the machining program.

### Operating modes

The following modes are important to operation during production.

AUTOMATIC  
MODE



#### AUTOMATIC MODE

The machine runs in auto mode, during which the safety door to the work area is locked.

OP  
AUTO

#### Interlinked Operation Mode (OP Auto)

Machine operating mode "OP Auto", during which the machining program is continuously repeated, is provided for fully-automatic production mode.

SINGLE  
CYCLE

#### Single Cycle Mode

Machine operating mode "Single Cycle", during which the machining program is run once, is provided for stand-alone mode.



#### Automatic

The NC operating mode "Automatic" is generally intended for production operation.

- "Automatic" is selected automatically when machine operating mode "OP Auto" or "Single Cycle Mode" is activated.
- "Automatic" must be manually selected when "Setup" machine operating mode is activated.

## 5.3 Switch on machine

### 5.3.1 Switching on the basic machine

Precondition:

- The safeguards, such as guards, EMERGENCY STOP devices, silencers and so on must be completely exist and be fully functional.

#### At Control cabinet ...

Preconditions:

- All control cabinet doors closed.
- After making sure nobody is within the hazard zone.
- All safeguards are closed.
- All EMERGENCY STOP devices released.



#### CAUTION

To avoid errors, do not carry out any actions on the control before the control completely run up.



Set the *Main switch* on the control cabinet for the central supply and control to "on".

- The power supply to the overall machine is switched on.

The control system (Channel 1, 2) starts up and responds on the main operator panel after approx. 2 minutes.

- During run-up, the lamp on the machine control panel flash synchronously.
- The message line of the screen displays messages.
- After run-up is completed, the message "Initialisation complete" is displayed.
- The following settings are active in Channel 1:
  - "Setup (ER)" machine mode.
  - "JOG REF" NC mode.
  - "Version" HMI screen.
- Channel 2 is not yet active after run-up.

### ... acknowledge alarms if necessary

#### Alarm display

Alarms or stop reactions may, under certain circumstances, be output after run-up, e.g. if

- a safety door is open.
- the fixture has an undefined clamping status.
- a test stop is required.

The alarms and messages are displayed cyclically in the screen header.



No NC program can be started while one or more NC alarms are present.

#### Remedy

- Correct the causes of the alarm messages, e.g.
  - Close and lock safety doors.
  - Clamp fixture via the individual functions.
  - Execute test stop manually.

The required individual functions (HMI screens) can be called up in the "Hand functions" function area.



For more details on manual clamping of the fixture, see:  
 "Workpiece change" **page 314**



For more details on the manual test stop, see:  
 "Manual brake test and test stop" **page 320**



- ☒ Press the *Reset* key.

- ↪ The corresponding lamp goes out.



A reset in Channel 1 is active only if Channel 2 (magazine control) has Stop status.

#### Alarm log

After pressing the *Data menu key* and selecting the "Diagnostics" menu, you can call-up various alarm logs and messages using the horizontal softkey.

### 5.3.2 Acknowledging alarms

#### Acknowledging alarms, if necessary

After run-up, alarm messages may occur under certain conditions, e.g. if a safety door is open or a power supply is not yet available.

- Alarms are displayed via the message line of the screen display and by the flashing lamp of the *Acknowledge fault* key.
- No NC program can be started while one or more NC alarms are present.

- ☒ Correct the causes of the alarm messages.

- ☒ Press the *Fault Reset* on the main operator panel.
- ↪ The relevant key lamp extinguishes.



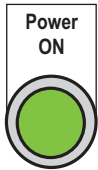
### 5.3.3 Switching on motors, issuing enable signals

*Power On* switches on the supply voltage for the power drivers of the NC axis drives and the hydraulic system.



## 5 Operation for production

### 5.3 Switch on machine



- Press the *Power ON* key.
- Machine is switched on:
  - Initial lubrication takes place.
  - The main valves for hydraulics and pneumatics are opened.
  - All drives are ready to operate.
  - The current status is displayed in the Switch-on conditions HMI screen.



- Press the *Feed/Spindle Start* key.
- The feed and spindle enable is issued.  
The associated key lamp lights up.



Before switching on the spindle, refer to Chapter:  
"Restarting the machine after downtime" **page 247**



- Turn on *Chip transport* switch.
  - Set the key switch to the "ON" position.



#### 5.3.4 Closing and locking the safety doors

Prior to switching on the motors, the safety doors must be closed and locked.

The safety doors must, assuming they are closed, already be locked during run-up of the control.



### DANGER

Danger of injury

Before closing the safety door, check that nobody is in the work area. Close and lock any open safety doors.

#### Close and lock the work area safety door

- Precondition:
  - The "Safety door lock/unlock" key lamp lights up.



- Close work area safety door.
- Press the *Lock Doors* on the main operator panel.
- ↪ The safety door is locked.  
The relevant key lamp extinguishes.

### Closing, locking other safety doors



For more information, see:  
"Restoring a safe state" **page 144**

## 5.3.5 Referencing

### Approach reference point...

on the basic machine      After switching on the machine, referencing of NC axes of basic machine is **not** necessary.

## 5.3.6 Executing the warm-up program

### 5.3.6.1 Basic information

The warmup circuit enables a program to be started automatically every weekday (including Saturday and Sunday). This allows the machine to be run up to operating temperature before machining the first workpiece. Damage to the machine and workpiece can be reduced to a minimum and a high degree of machining accuracy achieved in the initial stages of production.

The warmup program is repeated until the maximum warmup period is over. Programs that run longer than the set maximum running time are however completely processed. The NC program is not re-started.

5.3.6.2 Starting, stopping the warm-up program

Open the "Warm-up program" window

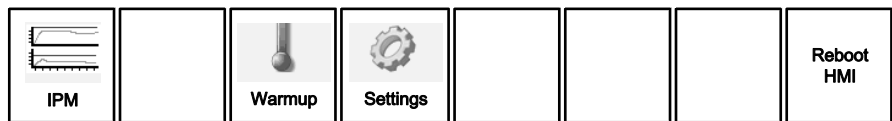
- Preconditions:
  - Drives and media switched on.
  - Safety doors closed and locked.
  - "Automatic" NC operating mode is activated.
  - "Machine" main menu activated.
  - The warmup program is stored in the NC.
  - No program is running.



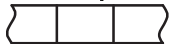
- Call up the machine's basic menu using the *Data menu key*.



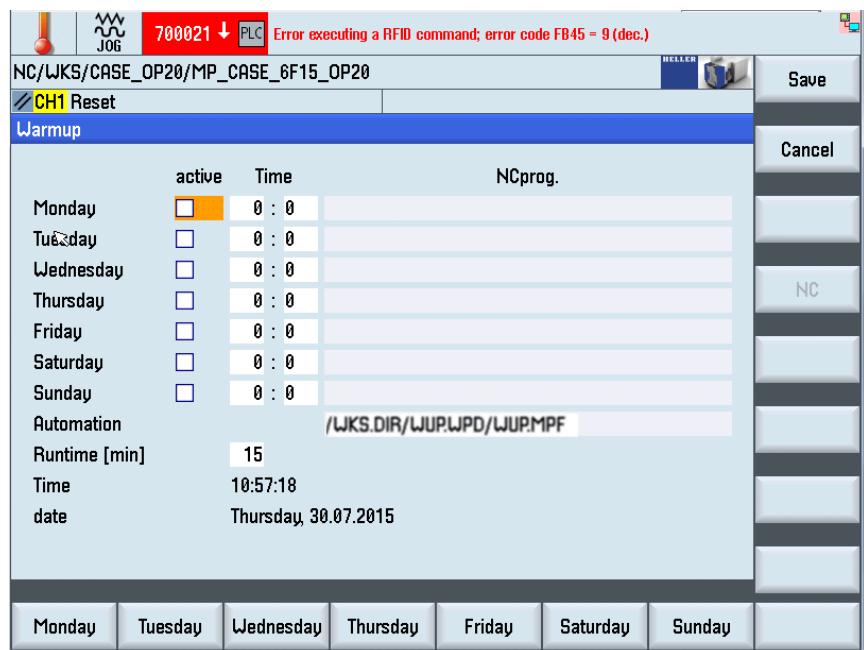
- Press the *etc.* key.
- The basic menu is expanded in a horizontal direction. The "warm-up" softkey is available.



Warmup



- Press the "Warmup" softkey.
- The "Warm-up program" window opens.



The "Warm-up program" serves as the display. If you want to configure warm-up programs, you must switch to edit mode; see following Chapter on "Edit mode".

In the "Automation" line, any NC program must be selected for warm-up. In the example, the NC-program "WUP.MPF" is selected. Entries for the individual weekdays can remain empty.

### Start warmup program

- Preconditions:
  - The machine must be in the home position.
  - Warm-up function must be activated in the "Cycle types" screen ("Prepare" area).
- Press the *Single Cycle Mode* key.
  - ↪ The machine switches to "Single mode".  
The machine automatically switches to "Automatic" NC mode.
- Press the *Master Return* key.
  - ↪ The machine moves to the home position.
- Press the *Start/Step* key.
  - ↪ The warm-up program is started.



#### Message 700756

To indicate that a warm-up is currently running, the message "Warm-up program active - cancel with reset or automatically once the setpoint time has expired at end of program" is displayed.

#### Safety function

When the warm-up program is active, the following functions are disabled:

- NC-start with activated OP AUTO mode.
- NC-start for other programs.

Normal mode is possible again only when the cycle type "Preselect warm-up function" has been deselected.

## 5 Operation for production

## 5.3 Switch on machine

### Stopping the warm-up program manually

The warm-up program stops either automatically or after the specified runtime or via manual intervention.

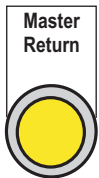


- Press the *Immediate Stop* key.
- ↪ The warmup program is stopped



- Switch-off warm-up function in the "Cycle types" HMI screen ("Prepare" area).

- Press the *Interlinked Operation Mode (OP Auto)* key.
- ↪ The machine is included in the system linkage.



- Also press the *Master Return* key.
- ↪ The machine moves to the home position.



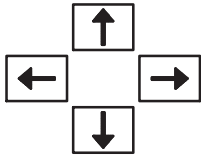
- Press the *Start/Step* key.
- ↪ The machine now runs again with the normal machining program.

#### 5.3.6.3 Edit mode

Edit



- Precondition:
  - The "Warm-up program" window is open.
- Press the "Edit" softkey.
- ↪ Edit mode is opened.  
Further softkeys are displayed.



### Setting time

- Use the *Cursor keys* to select the input field for the hours display of the desired day of the week.
- Use the *Alphanumeric keys* to enter the hour of the desired program start. (e.g.: 05)
- Press the *Tab* key.
  - ↵ The cursor moves to the input field for the minutes display.
- Use the *Alphanumeric keys* to enter the minutes of the desired program start. (e.g.: 25)

### Select warmup program

The following restrictions apply for the warm-up program:

- The warm-up program must not contain an endless loop.
- The warm-up program must not initiate a pallet change.

NC programs from the parts program or any workpiece directories may be selected.

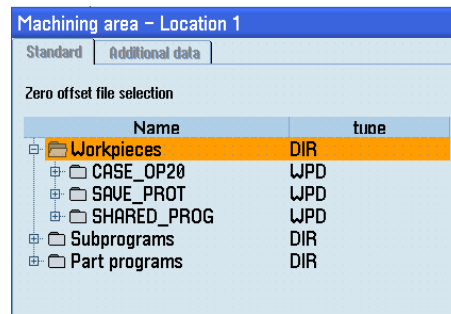
A "warm-up" workpiece, into which the warm-up programs can then be stored, is often created.



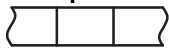
- Press *Tab* to select the "NC program" input field for the desired day of the week.
  - ↵ The "NC" softkey is enabled.
- Press the "NC" softkey.
  - ↵ The file directory opens.
- If necessary open or close directory with the *Enter*.
- Select the desired program using the *Cursor keys*.

## 5 Operation for production

### 5.3 Switch on machine



#### Accept



- Press the "Accept" softkey.
- ↵ The selected NC program is accepted into the input field and the data selection menu is closed.

#### ?

Incorrect file selected?

- Use the *Backspace* key to remove the selected file. Another file can be selected as described above.

### Start warmup program

Use the Checkbox in the "active" column to switch the program for the day of the week on or off.

Example: the entered program should be started on Tuesday in future.

- Edit mode is open.
- Press the "Tuesday" softkey.
- ↵ The cursor moves to the checkbox for Tuesday.

#### Tuesday



- Press the *Highlight* key.
- ↵ The checkbox is ticked.

#### i

Pressing the *Selection* key again will deactivate the warmup program (this is a toggle function).

#### i

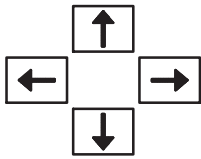
The motors are switched-off at the end of the warmup via the internal function "Stop at end of shift", e.g. after 30 mins.

### Setting maximum runtime

The duration of the warmup sequence is entered in minutes in the "Runtime" field; valid values:

- Minimum warmup time: 3 min
- Maximum warmup time: 9999 min (167 h).

- Edit mode is open.
- Use the *Cursor keys* to select the "Runtime" input field.



- Enter the warmup period (e.g. 15 minutes) using *Alphanumeric keys*.

### Close edit mode

Save



- Press the "Save" softkey.
- The changes made will be accepted and saved. Edit mode is closed.

**i**

If you press the "Cancel" softkey, edit mode will close without saving the changes.

### Important Hints

Reset

Pressing the *Reset* button during warmup interrupts the program.

System time

The system time of the control must be checked on a regular basis and adjusted if necessary.

#### 5.3.6.4 Information on tool spindle warmup

After downtimes

In order to guarantee even distribution of the lubrication oil after down times, you must prepare the spindle by warming-up.

For high speeds

To use the optionally expanded speed range, you must prepare the spindle by warming-up.



5 Operation for production

5.3 Switch on machine

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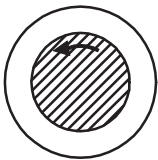


Details on spindle warm-up can be found in the Chapter on:  
"Restarting the machine after downtime" **page 247**

## 5.4 EMERGENCY STOP and stopping for operational purposes

Before you work on the machine	Make sure you know how to protect yourself and your team colleagues. The EMERGENCY STOP device is only one link in a chain of safety-oriented behaviour, preventive measures and emergency measures in case of an accident. Observe the safety regulations in your workplace and the safety information in Chapter 2 of this Operator Manual!
Why? Why not?	<p>The EMERGENCY STOP device is intended for emergency situations but not for operational stopping or switching off.</p> <p>In an emergency, a few broken tools are acceptable to prevent more serious damage. This is not acceptable for an operational stop. For this reason, it is recommended to stop the machine normally before testing the EMERGENCY STOP device.</p>
Every 1000 hours	The EMERGENCY STOP device must be tested every 1000 hours.

### 5.4.1 Activate EMERGENCY STOP



- Press the nearest *EMERGENCY STOP* button.
- The machine stops immediately, all media and spindles are switched off.  
After resetting the EMERGENCY STOP device, the machine will not restart automatically.

### 5.4.2 Stopping the machine normally

There are two methods that can be used at the main operator panel and at each unit control panel to stop automatic machining without risk of tool breakage.

#### 5.4.2.1 Fastest possible stop



- Press the *Immediate Stop* key.
- ↳ Threads are cut completely, milling cutters and drills are allowed to cut free.



Machining can be continued smoothly with the *START* key.

#### 5.4.2.2 Defined stop



- Precondition:
  - Machine in linked mode (OP AUTO).
- Press the *Cancel Next Cycle* key.
- ↳ The system is brought to a defined stop.
  - The cycle that has started will be completed.
  - Workpieces are not removed.
  - All machines and the loader move into home position.

## 5.5 Making preparations

### Opening the "Prepare" HMI screen

The HMI screens for preparing production operation can be called up in the "Prepare" main menu.

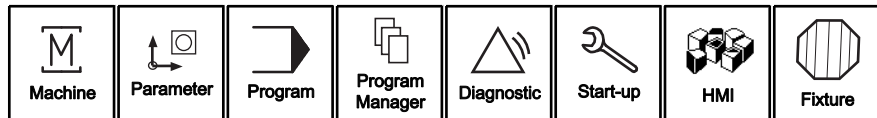
- Preconditions:
  - Control run up.
  - Safety doors closed and locked.
  - "Setup" machine mode is active.



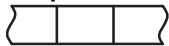
HMI



- With *Data menu key* call up the basic menu on the main operator panel.
- Press the "HMI" softkey.
- ↪ The control switches to the "HMI" main menu.



Preparation



- Press the "Preparation" softkey.
- ↪ The menu of the Prepare HMI area is opened.

Pwr-up cond	Cycle types		Type Setup		Clean cycle		
Prepare	Handfct.	Diagnostics	Tools	Process	Special scr.	Maintenan.	Document

- ↪ The following HMI screens for preparatory measures are available:
  - Power-up conditions
  - Cyc types
  - Setup workpiece types
  - Flush cycl

### 5.5.1 Power-up conditions

For automatic production operation, all media, the chip conveyor etc. must be switched on.

## 5 Operation for production

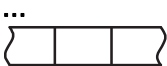
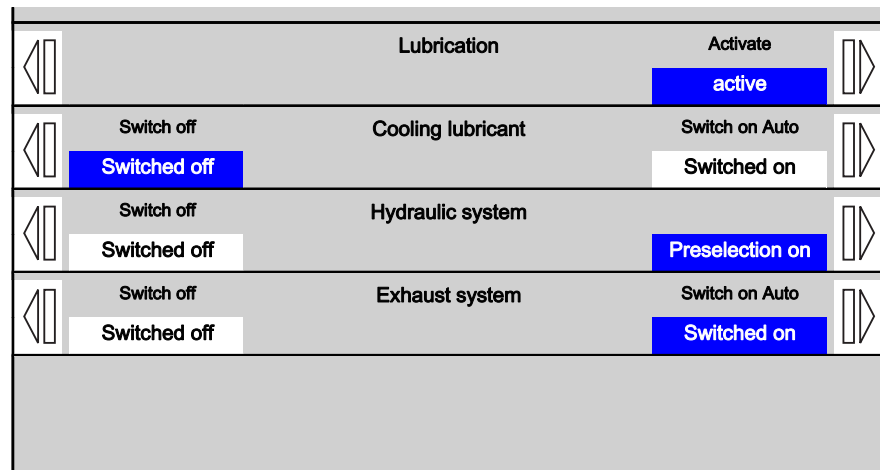
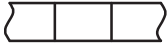
### 5.5 Making preparations

To make sure that the functions are activated when the *Machine ON* key is pressed, you should check the start preconditions and, if necessary, enable them before starting production. The start preconditions are enabled in the "Power-up conditions" HMI screen.

#### Checking and enabling the switch-on conditions

- Preconditions:
  - Control run up.
  - "HMI - Prepare" main menu is open.
- Press upper horizontal softkey "Pow-up condition".
- ↗ The "Power-up conditions" HMI screen is opened.

#### Pow-up condition



- Press right vertical softkey "...".
- ↗ The right-hand display field is shaded green.  
After the drives and media are switched on the above functions will start automatically.

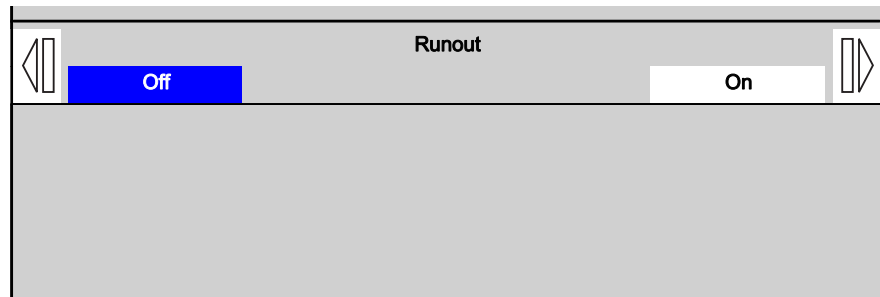
#### 5.5.2 Cycle types

The cycle type function enables special processes to be executed.

### Call up HMI screen "cycle types"

- Preconditions:
  - Control run up.
  - "Setup" machine mode is active.
  - "HMI - Prepare" main menu is open.
- Press upper horizontal softkey "Cycle Types".
- The "Cycle types" HMI screen is opened.

#### Cycle Types



Each cycle type is shown by a screen line, which contains a right (on) and a left (off) status field. The cycle type is switched on or off using the assigned right and left vertical softkeys.

The *Start* key must be pressed to trigger the selected cycle type.

#### 5.5.2.1 Runout machine

The basic sequence for loading and unloading workpieces in automatic production mode can be defined via the "Runout" HMI function.

##### Standard sequence: "Runout" deactivated

- The machine is loaded with a new raw part.
- When the workpiece has been machined, the machine is unloaded.
- The machine is loaded with the next raw part.
- etc.

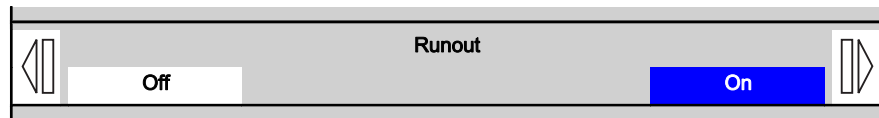
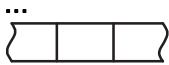
##### Special sequence: "Runout" activated:

- The current workpiece will be finish-machined and then unloaded.
- No new workpiece will be loaded.

### Activating runout

A new workpiece type is to be produced. An old workpiece type is still located in the machine and is to be unloaded.

- Preconditions:
  - Drives and media switched on.
  - Safety doors closed and locked.
  - "Cycle types" HMI screen is opened.
- Press the left-hand softkey.
- ↵ The respective display field "... " is highlighted.



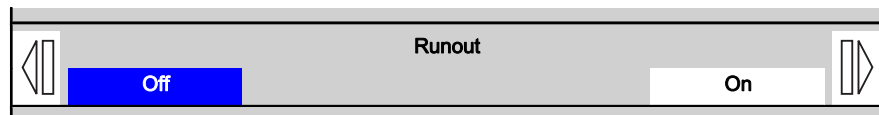
### Starting the unloading operation

- Press the *Interlinked Operation Mode (OP Auto)* key.
- ↵ The machine is switched to linked mode.
- Press the *Start/Step* key.
- ↵ The loader performs the unloading operation.
  - As soon as the workpiece has left the machine, the program is interrupted and the machine stops.
  - No new workpiece will be loaded.



### Deactivating runout again

- Preconditions:
  - "Cycle types" HMI screen is opened.
- Press the left-hand softkey.
- ↵ The respective display field "... " is highlighted.



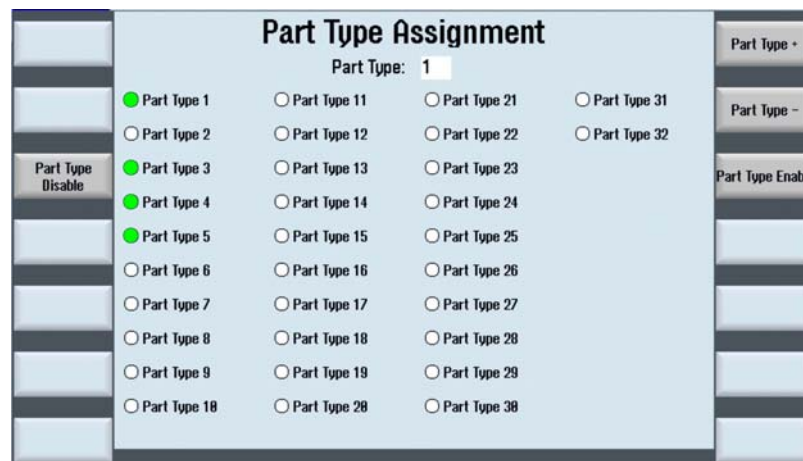
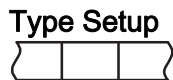
- ↵ The machine is set for regular production mode.

### 5.5.3 Enabling workpiece types

Due to the numerous workpiece types available, the workpiece types that can be machined on the clamping fixture must be preselected before start of production.

#### Calling up the "Type Setup" HMI screen

- Preconditions:
  - Drives and media switched on.
  - Safety doors closed and locked.
  - "HMI - Prepare" main menu is open.
  - Access rights granted (EKS key).
- Press upper horizontal softkey "Type Setup".
- ↪ The "Part Type Assignment" HMI screen is opened.

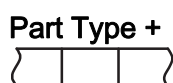


All 32 selectable workpiece types are identified via a LED display. Green control LEDs indicate which workpiece types are currently active and can be machined on the clamping fixture.



The loader is able to load the machine only with workpiece types that have been set to active, other workpiece types are routed past the machine.

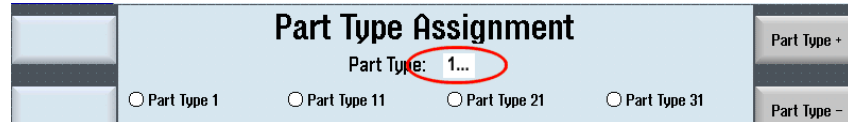
#### Selecting workpiece types



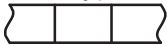
- Press the right softkey "Part Type +".
- ↪ Every time the softkey is pressed, the workpiece type selection is incremented by "one".



The display field in the middle indicates the current selection.



### Part Type -



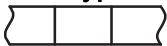
- Press the right softkey "Part Type -"
- ↪ Every time the softkey is pressed, the workpiece type selection is decremented by "one".

## Activating workpiece types

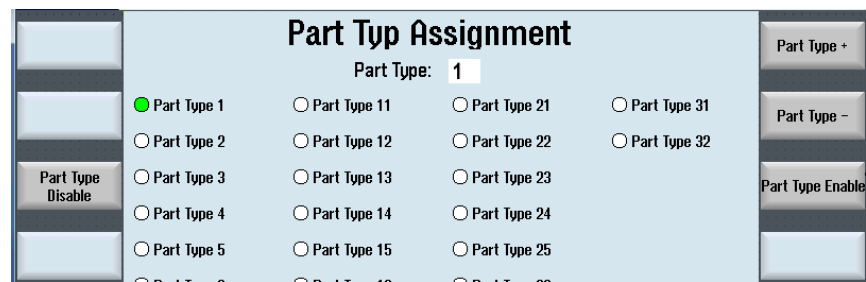
Workpiece types 1, 2 and 3 are to be activated.

- Precondition:
  - Workpiece type 1 has been selected.

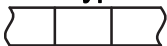
### Part Type Enable



- Press the "Part Type Enable" softkey.
- ↪ Workpiece type 1 is switched to active.  
The respective control LED is highlighted "green".

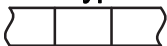


### Part Type +



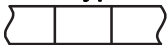
- Press the right softkey "Part Type +".
- ↪ The next workpiece type is selected.

### Part Type Enable



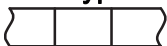
- Press the "Part Type Enable" softkey.
- ↪ Workpiece type 2 is switched to active.  
The respective control LED is highlighted "green".

### Part Type +

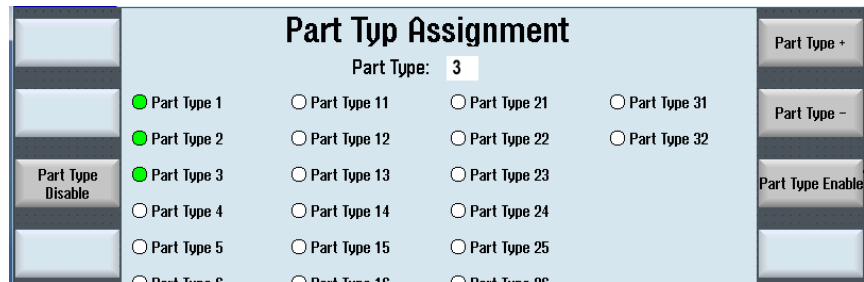


- Press the right softkey "Part Type +" again.
- ↪ The next workpiece type is selected.

### Part Type Enable



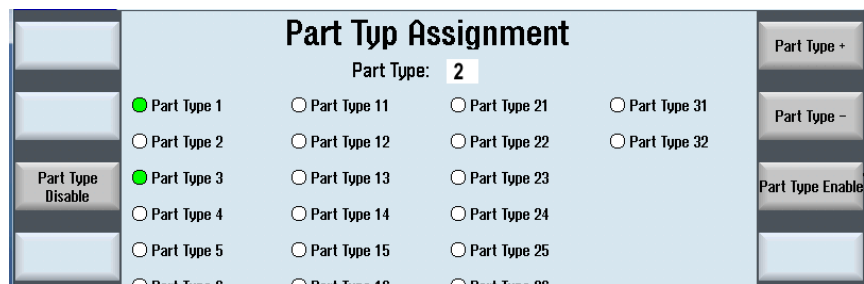
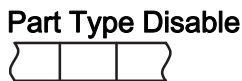
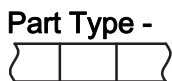
- Press the "Part Type Enable" softkey.
- ↪ Workpiece type 3 is switched to active.  
The respective control LED is highlighted "green".



### Deactivating workpiece types

Workpiece type 2 is to be activated.

- Precondition:
  - Workpiece types 1, 2 and 3 are activated.
- Press the right softkey "Part Type -"
  - ↩ Workpiece type 2 is selected.
- Press the left softkey "Part Type Disable".
  - ↩ Workpiece type 2 is deactivated.
  - The associated control LED goes out.



### 5.5.4 Flushing cycle

#### Counter

A counter is available, which is recording the number of workpiece machinings during the production mode. Every time a finished part is unloaded by the loader, the counter will be decremented by one. When the counter has counted down to zero, the loader gets the signal to stop workpiece loading.

## 5 Operation for production

## 5.5 Making preparations

**Flushing automatically**

Now the flushing cycle will be started. The duration of the flushing process is stored in the machine data. During this cycle, remaining chips were removed from the clamping fixture and from the guideways of the machine.

When the flushing cycle has been stopped, the loader is requested by the machine to load the next raw part.

**Flushing manually**

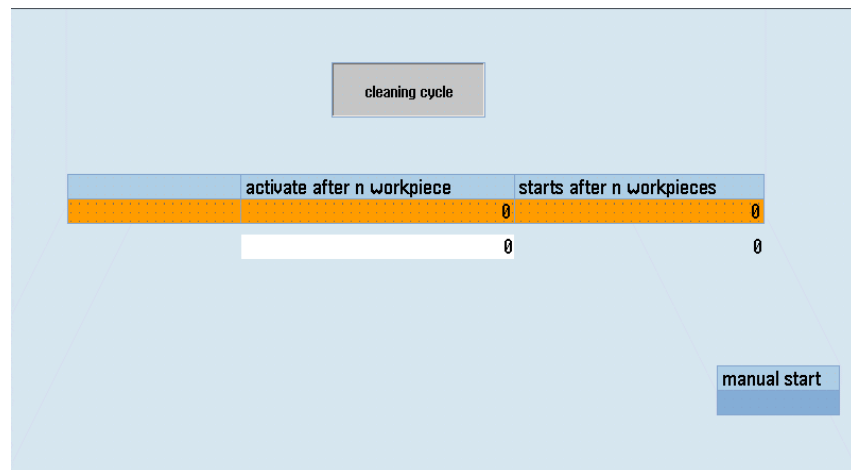
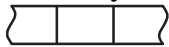
If necessary, the flushing cycle can be started manually:

- Press the softkey that is assigned to the "manual start" button.

**Opening the "Clean Cycle" HMI screen**

The HMI screen allows setting the counter

- Preconditions:
  - Drives and media switched on.
  - "HMI - Prepare" main menu opened.
  - Access rights granted (EKS key).
- Press upper horizontal softkey "Clean Cycle".
- ↪ The "Flushing cycle" HMI screen is opened.

**Clean Cycle****Input field**

In the "activate after n workpieces" input field, the number of machining cycles can be set, after a flushing cycle shall occur.

**Display field**

In the "starts after n workpieces" display field, the current number of machining cycles up to the next flushing cycle is shown.

## 5.6 Fixture management system

### Function

In manual mode, the "fixture management system" controls workpiece machining.

An unmachined part is moved from the loading or setting station to the machining position near to the spindle. The assigned machining program is automatically selected and started. The setter defines the assignment in the "Fixture management system" in a preceding operating step.

The required programs must be loaded into the Programs area of the Sinumerik control system.

### i

In linked mode, the automation system controls the machining of the workpiece (loader interface). During each loading operation, the workpiece data for the unmachined part in the loader are transferred to the machine and used.

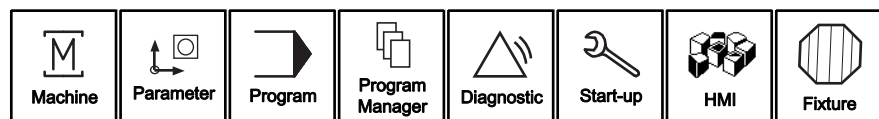
- Wp type
- Machining program

### 5.6.1 Calling up the fixture management system

- Preconditions:
  - Control run up.
  - Safety doors closed and locked.
  - Fixture no. 1 physically in the machine.



- With *Data menu key* call up the basic menu on the main operator panel.

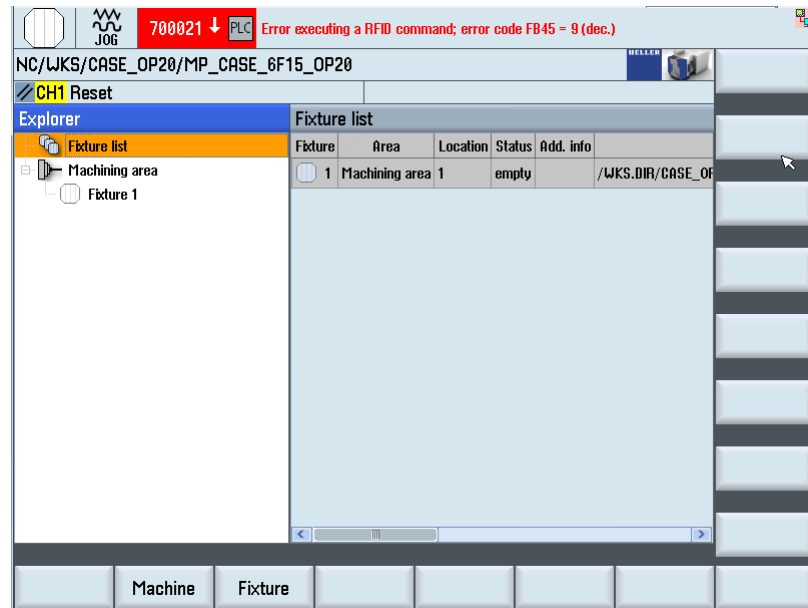


### Fixture

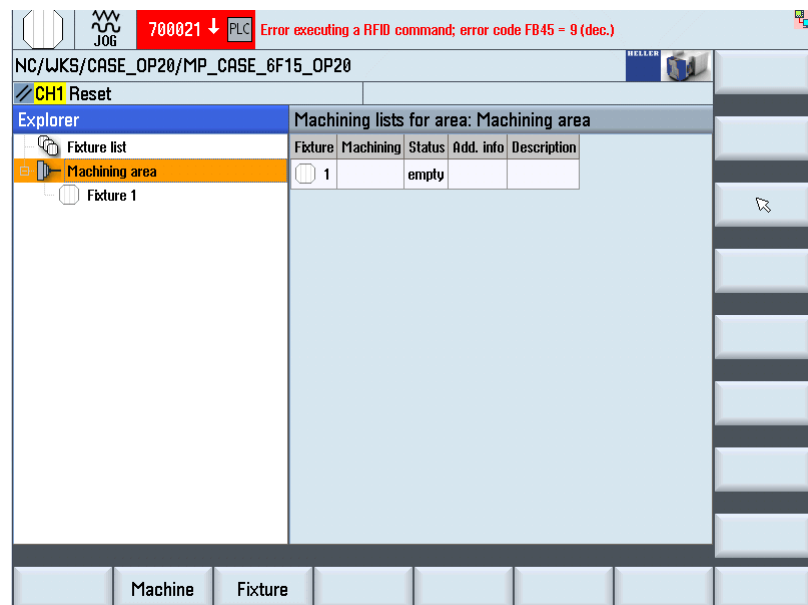


- Press the "Fixture" softkey.
- The basic display of the fixture management system is opened. The cursor is located on the "Fixture list" symbol. The fixture list is shown on the right-hand side.

5 Operation for production  
5.6 Fixture management system



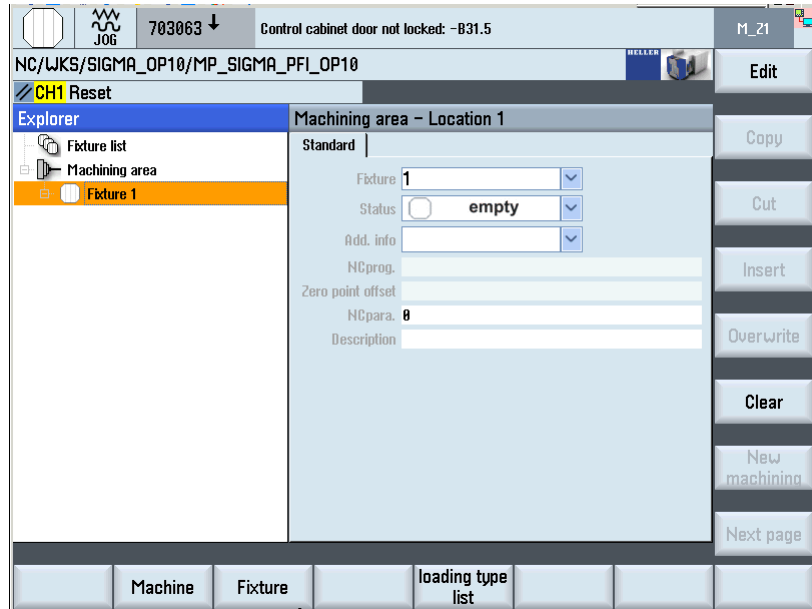
- ☒ In Explorer view, move cursor down one level.
- ↶ The cursor is located on the "Work area" symbol.  
The list of machining operations created for the work area are shown on the right-hand side of the screen.



- ☒ In Explorer view, move cursor down one level.
- ↶ The cursor is located on the "Fixture" symbol.

The data for the fixture in the work area appear on the right side.

- Fixture number: 1
- Fixture status: empty



### 5.6.2 Defining the fixture status



**Mechanical changeover:**  
Before operating the machine with fixture no. 2 (no. 3 etc.), the respective fixture must be physically present in the machine. A fixture change might have to be carried out first.

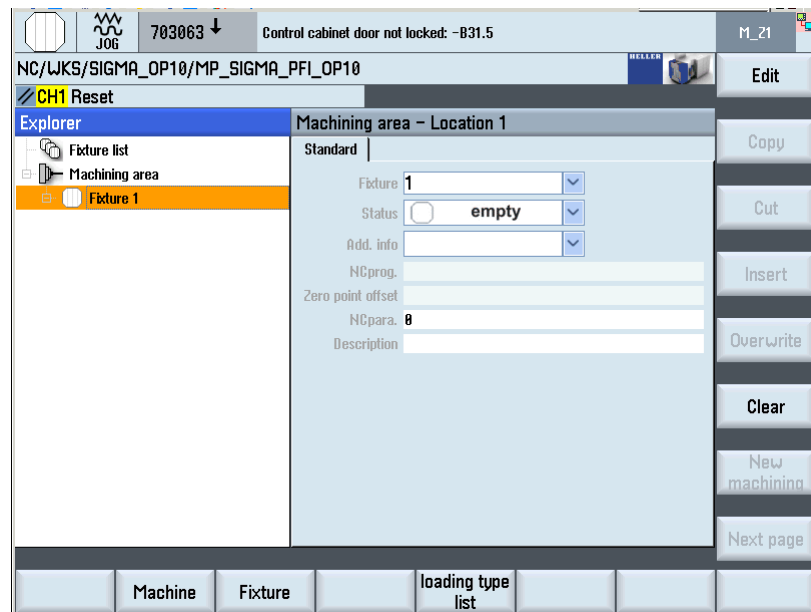


**Change-over by data:**  
During system setup, basic data can be used. Basic data includes the following input fields:

- Fixture number
- Fixture status
- Machining program (file)

### Selecting fixture no. 2

- Preconditions:
  - The basic screen of the fixture management system is displayed.
  - Fixture no. 1 created by data.
- In the Explorer View, select the empty fixture location in the machine using the *Cursor keys* (work area - location 1).
- The data for old fixture no. 1 appear on the right side.



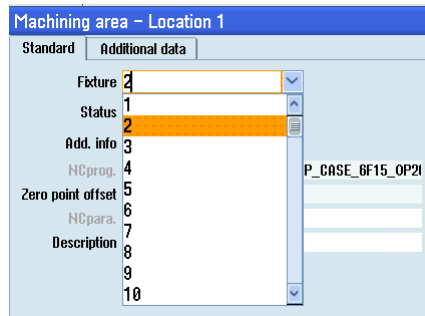
When setting up the new fixture, the basic data must be entered. Basic data includes the following input fields: Pallet number of pallet

- **Fixture** - Fixture number = 2
- **Status** - Fixture status = empty

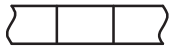
Edit



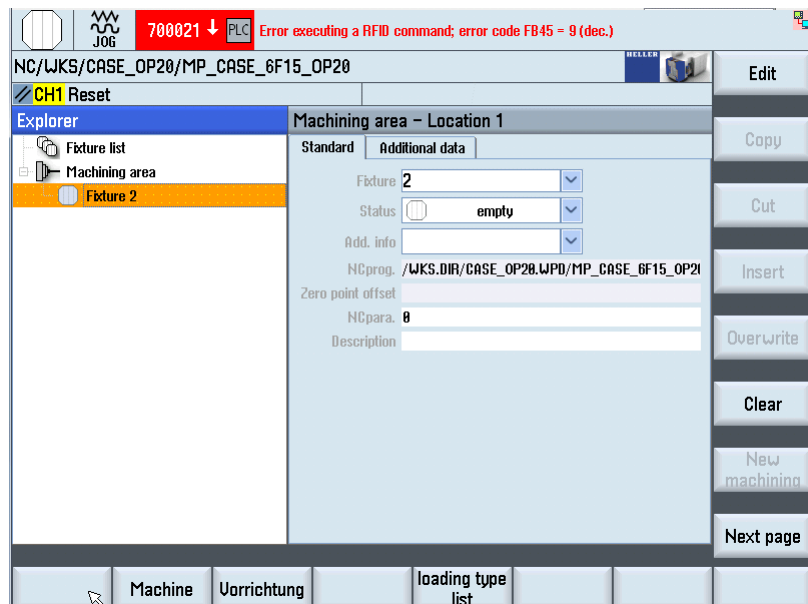
- Press the right softkey "Edit".
- The input fields are ready for data input. The "Fixture" field is ready to accept input (highlighted yellow).
- Open "Fixture" field and select the fixture number 2 using the cursor keys.



Save



- Enter fixture status: empty (white symbol)
  - Press the "Save" softkey.
  - The data are saved.
- Fixture no. 2 is created in the system and active.



### Selecting fixture no. 3 etc

Preconditions:

- The basic screen of the fixture management system is displayed.
- Fixture no. 2 created by data.

Procedure:

See previous procedure for fixture 1 (2) accordingly.



### 5.6.3 Defining workpiece status

#### "Status" input field

The fixture/workpiece status is defined on the "Standard" tab of the "Work area - Location 1" input screen.

The status is always pre-assigned with "raw".

Overview of workpiece statuses:

- **Empty:** Status indicates an empty fixture that can be loaded with a new workpiece.
- **Raw:** Status denotes a new workpiece that has been loaded. The workpiece is released for automatic machining with the "raw" status. If a workpiece is not enabled for automatic machining, you must modify the status manually.
- **Partially machined:** Status denotes a workpiece that is currently being machined. The status can also be assigned to a workpiece outside the machine, for which the machining operation was aborted for some reason.
- **Finished:** Status denotes a finish machined workpiece that is ready for collection.
- **Reject:** Status indicates a NOK part that is also ready for collection.

#### Changing the workpiece status

The workpiece status is to be defined as "raw".

- Precondition:
  - The empty fixture location (work area) is selected in the Explorer View.
  - The "Location 1" input screen is opened for entering data.

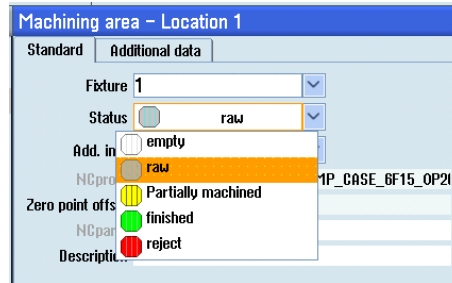
#### Edit



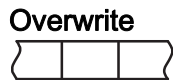
- Press the right softkey "Edit".
  - ↳ The input fields are ready for data input.
- Using the *Cursor keys*, select the "Status" input field.
- Press the *Insert* key.
  - ↳ The selection menu opens.
- Select the "raw" status using the *Cursor keys*.



- Press the *Enter* key.
- ↵ The "raw" entry is accepted into the input field.



- ↵ The selection menu is closed.



- Press "Overwrite" softkey to save the entry.

#### 5.6.4 Specifying additional info

"Additional info" input field More additional info on the fixture and workpiece in the work area can be set using the selection list.

##### Changing workpiece or fixture status

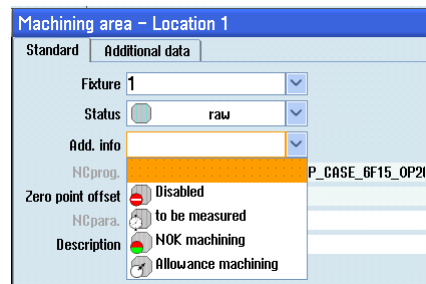
- Precondition:
  - The fixture location (work area) is selected in the Explorer View.
  - The "Location 1" input screen is opened for entering data.



- Using the *Cursor keys*, select the "Status" input field.



- Press the *Insert* key.
- ↵ The selection menu opens.



Possible additional info:

- **disabled:** The fixture is defective and is no longer controlled by the loader. Functions such as clamp/unclamp as well as the workpiece location check are no longer executed.
- **to be measured:** A finished part is to be transported to a measuring station following fault-free machining.
- **NOK Machining:** A partially machined workpiece is to be transported to a measuring station. If the test result is positive, the machining of the workpiece can be finished after reloading.
- **Allowance machining:** The workpiece is to be premachined as a first step.

### 5.6.5 Assigning NC-program to the fixture

#### Preselection of workpiece type

In stand-alone mode, the workpiece type can be selected by selecting the corresponding NC program. There are several NC-programs (workpiece types) to choose from.

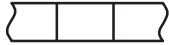
The transfer initiates a changeover by software in the control system (machining program, zero point offset etc.).

The directory and the NC program assigned to the clamping fixture are defined in the "NC Program" input field. The NC program in a program directory can be selected using an Explorer.

#### Select NC program

- Precondition:
  - The empty fixture location (work area) is selected in the Explorer View.
  - The "Location 1" input screen is opened for entering data.

**Edit**

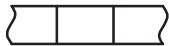


- Press the right softkey "Edit".
- The input fields are ready for data input.

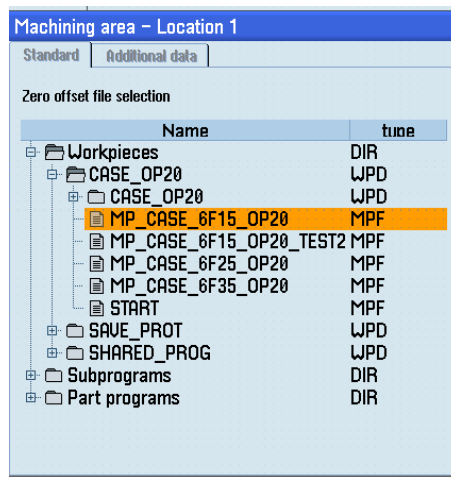


- Use the *Cursor keys* to select the "NC-Prog." input field.
- Vertical softkeys for selecting the file directories are displayed.

**NC**



- Press the right softkey "NC".
- A window for file selection is opened (Explorer tree).



- If necessary open or close directory with the *Enter*.

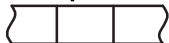


- Use the *Cursor keys* to select a program with ending ".MPF".



Files with a ".URF" extension must not be selected. These files are used for zero offset.

**Accept file**



- Press the "Accept file" softkey.
- The NC program is accepted into the input field.
- The Explorer is closed.



Incorrect file selected?

- Use the *Backspace* key to remove the selected file. Another file can be selected as described above.

**Save**



- Press "Save" softkey to save the entry.

### 5.6.6 Assigning NC programs from the loading type list

#### Function

The loading type list enables you to create ("loading type) production jobs. One or several machining operations can be assigned for each loading type. You can assign an NC program to each machining operation.

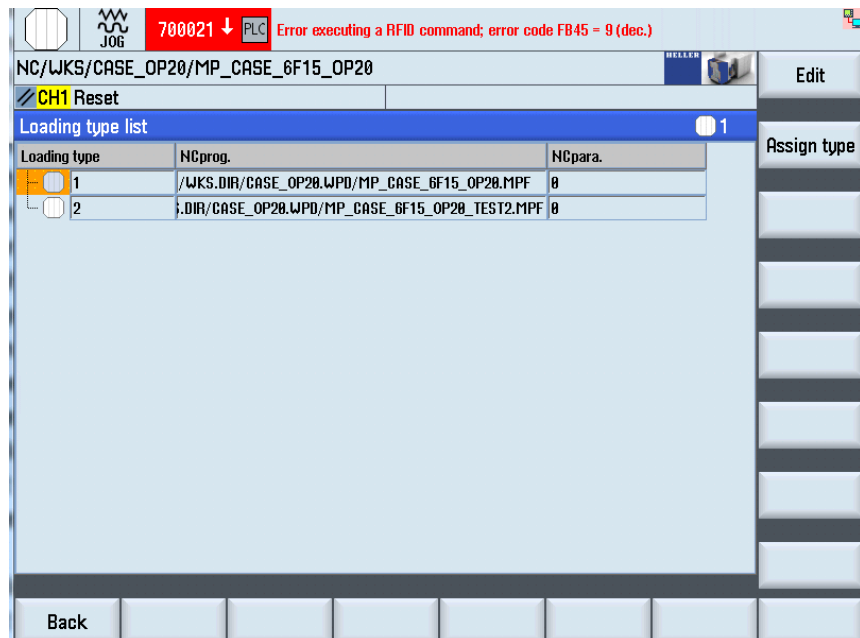
An external loading system control requests a loading type from the loading type list. For this loading type, the data are transferred from the loading type list to the fixture management system.

#### Assigning a loading type to a fixture

- Precondition:
  - Fixture management system opened.
  - The empty fixture location (work area) is selected in the Explorer View.
  - The "loading type list" softkey is displayed.
- Use the *Cursor keys* to select the fixture to which a machining program is to be assigned.
- Press the "Loading type list" softkey.
- The loading type list is opened.



#### Loading type list

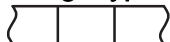




- ☒ Use the *Cursor keys* to select the loading type which is to be assigned, for example:
  - loading type 1 or
  - loading type 2.

↵ The symbol concerned is highlighted in the Explorer.

#### Assign type



- ☒ Press the vertical softkey "Assign type".
- ↵ The loading type is transferred from the loading type list to the fixture management system.
  - The data not stored in the loading type list remain in the pallet management system.
  - The fixture status is set to "raw".
  - The additional info is cleared.
  - The loading type list is closed.

## 5.7 Machining workpieces - stand-alone mode

### 5.7.1 Move machine to home position

#### Home position

The home position is the defined starting point for many NC programs. In the home position, the Z-slide is retracted and in the "Start position". Machining of the workpiece can be started from here.

- Preconditions:
  - Drives and media switched on.
  - Safety doors closed and locked.
- Press the *Single Cycle Mode* key.
  - ↪ The machine is switched to automatic mode.
- Press the *Master Return* key.
  - ↪ The machine moves to the home position.
    - The machine axes move to their retract position.
- ↪ The lamp comes on when the home position is reached.



Approach reference point...  
 After switching on the machine, referencing of NC axes is not necessary.

### 5.7.2 Switching to manual loading

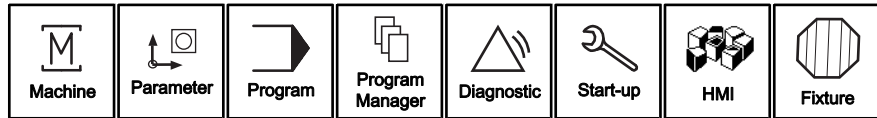
#### Opening the "General" HMI screen

- Preconditions:
  - The machine is stationary.
  - Safety doors closed and locked.
- Press the *Setup* key.
  - ↪ The machine is removed from the system linkage.  
 Setup mode is activated.





- ☒ With *Data menu key* call up the basic menu on the main operator panel.



**HMI**



- ☒ Press the "HMI" softkey.
- ☞ The "Setup functions to HMI Standard" menu item appears.

**Man.funct.**



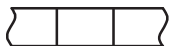
- ☒ Press lower horizontal softkey "Man.funct.".
- ☞ The menu of the "Hand functions" area is opened.

**Additional fu.**

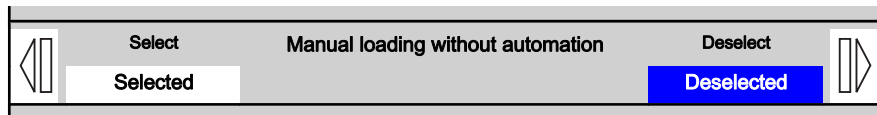


- ☒ Press upper horizontal softkey "Additional fu.".
- ☞ The menu of the "Additional functions" area is opened (3rd menu level).

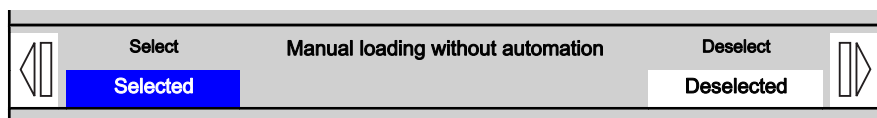
**General**



- ☒ Press upper horizontal softkey "General".
- ☞ The "General" HMI screen is opened.  
 Function "Manual loading without automation" is deselected.  
 The related display field is highlighted.



- ☒ Press the left softkey of "..." line.
- ☞ The "Selected" display field is highlighted.



- ☞ The machine is prepared for stand-alone operation by manual workpiece loading through the workpiece safety door.



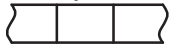
### 5.7.3 Closing the loading hatch if necessary

The loading hatch must be in stand-alone mode and closed. When switching from linked mode to stand-alone mode, the loading hatch is usually opened closed automatically by the loader.

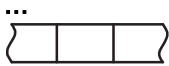
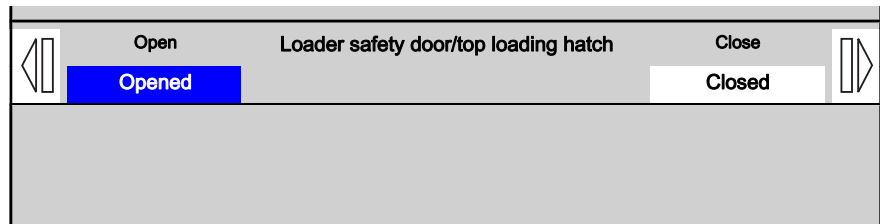
Regardless of the preconditions above, the loading hatch can be opened and closed manually via an HMI function.

- Preconditions:
  - The machine is stationary.
  - Safety doors closed and locked.
  - "General" HMI screen is opened.

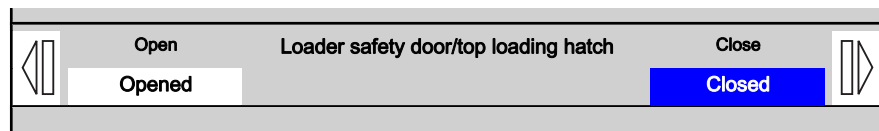
**Safety doors**



- Press upper horizontal softkey "Safety doors".
- ↪ The "Safety doors" HMI screen is opened.



- Press the right-hand softkey "...", which is assigned to the "Loader safety door/top loading hatch" line.
- ↪ The loading hatch is closed.  
The right-hand display field is highlighted.



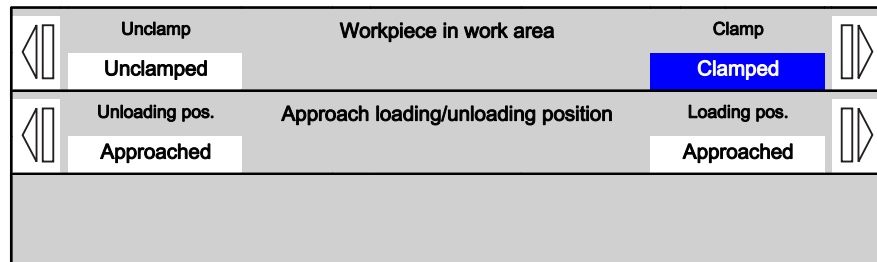
### 5.7.4 Machining an individual workpiece

#### Move machine to loading position

- Preconditions:
  - Drives and media switched on.
  - A-axis swivelled downwards.
  - Clamping fixture empty.
  - Safety doors closed and locked.
  - Loading hatch closed.
  - The raw part is ready.
- Press the *Recall* key to skip to the higher menu level.
  - ↳ The menu of the "Hand functions" area is opened.
- Press upper horizontal softkey "WPC".
  - ↳ The "Workpiece Change" HMI screen is opened.



WPC



- Press the right-hand softkey "...", which is assigned to the "Approach loading/unloading position" line.
  - ↳ Z-axis moves to the loading position.
  - The right-hand display field is highlighted.



#### Raw part loading

The workpiece setting station safety door is mechanically locked via two casement fasteners. Additionally, the safety door is electrically locked by a safety switch. Before the safety door is opened, these locks must be released.

5 Operation for production  
 5.7 Machining workpieces - stand-alone mode



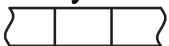
Use suitable lifting gear for handling the unmachined parts and the machined workpieces!

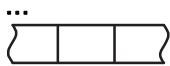
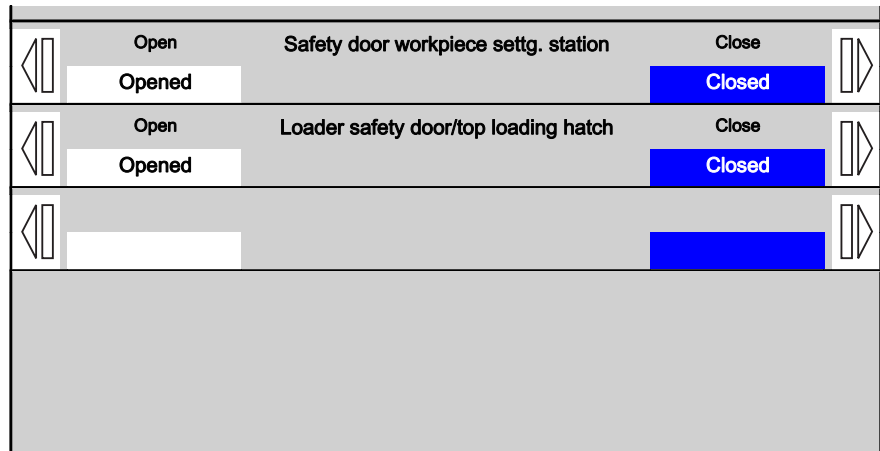
- Preconditions for workpiece setting station:
  - Workpiece loading station safety door closed and locked.
- Preconditions at the main operator station:
  - "Workpiece change" HMI screen opened.
- Press upper horizontal softkey "Additional fu."
  - ↗ The menu of the "Additional functions" area is opened (3rd menu level).
- Press upper horizontal softkey "Safety doors".
  - ↗ The "Safety doors" HMI screen is opened.

Additional fu.

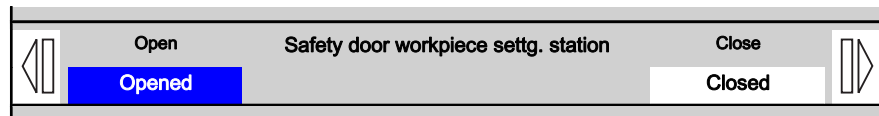


Safety doors





- ☒ Press the left softkey "...", which is assigned to the "Safety door workpiece settg. station" line.
- ↪ The safety door unlocked electrically.



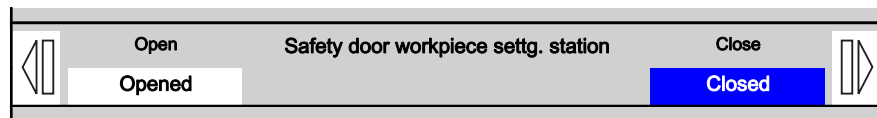
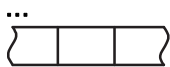
- ☒ Mechanically unlock and open the workpiece setting station safety door by rotating the casement fasteners.
- ↪ The fixture is accessible for setting operations.



Typical illustration

5 Operation for production  
 5.7 Machining workpieces - stand-alone mode

- If necessary, blow off chips from the fixture rest points.
- Pick up new raw part using the hoist.
- Position the hoist over the fixture and lower carefully.
- Insert the workpiece into the fixture in the correct position. Observe the stops and indexing movements.
- Run the hoist completely out of the safety door.
- Close the workpiece setting station safety door and mechanically lock it by rotating the casement lock.
- Press the right-hand softkey "...", which is assigned to the "Safety door workpiece settg. station" line.
- ↪ The safety door is not locked.

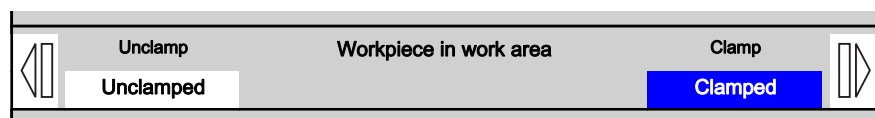
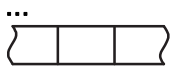


- Press the *Recall* key.
- ↪ The higher-order menu level is displayed.
- Press upper horizontal softkey "WPC".
- ↪ "Workpiece change" HMI screen opened.

WPC



- Press the right-hand softkey "...", which is assigned to the "Workpiece in work area" line.
- ↪ The workpiece is clamped in the fixture.  
The right-hand display field is highlighted.



### Start machining

- Preconditions:
  - Channel 1 and 2 active.
- Press the *Automatic* key.
- ↪ "Auto" NC mode is activated.  
The associated key lamp lights up.





- Press the *Feed/Spindle Start* key.
- ↳ The feed and spindle enable is issued.  
The associated key lamp lights up.



## CAUTION

Workpiece / machine collision

Prior to NC start, check whether the correct machining program for the set workpiece is active in the NC core.



- Press the *Start/Step* key.
- ↳ Machining is started.
  - The Z-axis moves to the machining position.
  - The machining program assigned in the type preselection is started.
  - The "START" lamp remains on throughout the entire machining time.
  - Once the workpiece has been completely machined, the Z-axis moves into the unloading position.
- Take into consideration any messages from the control and, if necessary, carry out the required actions



The status lamp illuminates!

The workpiece is not completely machined and is returned to the loading station.

Possible causes:

- Tool breakage.
  - EMERGENCY STOP situation.
  - Faulty operation (pressing NC stop or reset)
- Check the workpiece (visual inspection) and decide whether you want to release the workpiece for machining or reject it (scrap).

## Unload finished part

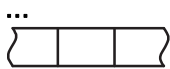
- Preconditions:
  - Machining of the current workpiece is completed.
  - Z-axis in unloading position.
  - A-axis swivelled downwards.
  - "Workpiece change" HMI screen opened.



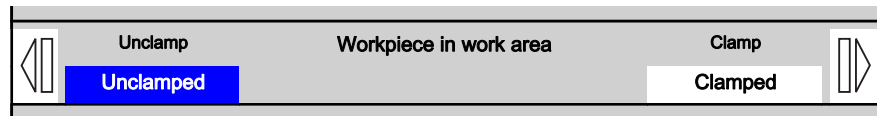
## CAUTION

Danger of serious damage to machine and workpiece! When the clamping device is released, the workpiece can fall out under certain circumstances (defective sensors), if the A-axis is not pivoted downwards.

Ensure that the A-axis is in the 0° position, before you carry out the following individual function.



- Press the left softkey "...", which is assigned to the "Workpiece in work area" line.
- ↪ The workpiece is unclamped from the fixture.  
The left-hand display field is highlighted.

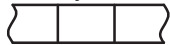


### Additional fu.

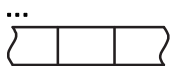


- Press upper horizontal softkey "Additional fu.".
- ↪ The menu of the "Additional functions" area is opened (3rd menu level).

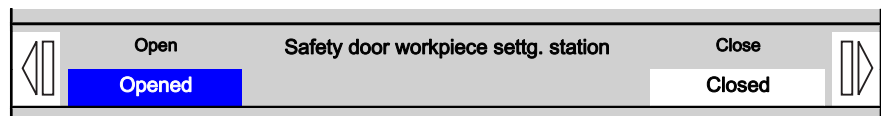
### Safety doors



- Press upper horizontal softkey "Safety doors".
- ↪ The "Safety doors" HMI screen is opened.



- Press the left softkey "...", which is assigned to the "Safety door workpiece settg. station" line.
- ↪ The workpiece loading station safety door is unlocked.

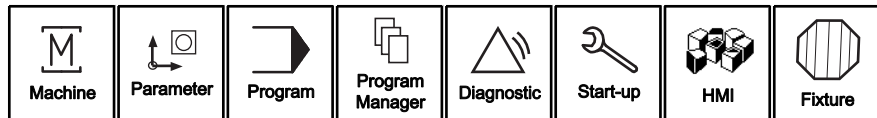


- Mechanically unlock and open the workpiece setting station safety door by rotating the casement fasteners.
- Using the hoist, carefully remove the workpiece carrying the finished part from the fixture.
- Insert next raw part into the fixture.  
etc.
- Insert next raw part into the fixture.  
etc.

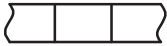
### 5.7.5 Displaying the machining program

#### Calling up the "Automatic" basic screen

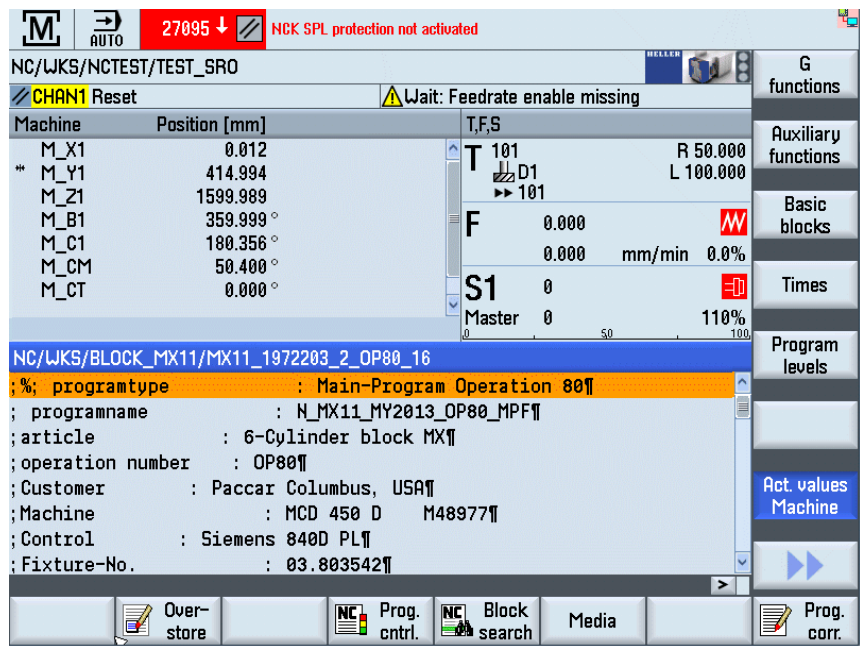
- Precondition:
  - Workpiece machining is active.
- Call up the machine's basic menu using the *Data menu key*.



Machine



- Press the "Machine" softkey.
- ↪ The "Machine" main menu is opened.
- ↪ The "Automatic" basic screen opens.



- ↪ The machining program sequence can be observed.
- ↪ The current NC-blocks are displayed in the lower window.



### 5.7.6 Finish-machining the partially machined workpiece

The machine should start from a defined position rather than complete the entire machining program.

This may be necessary, for example, after a tool break, if part of the machining operation has already been completed.

With simple clamping, you can change only the status of the fixture. With multiple-clamping, you can change either the status of a workpiece on the fixture or the status of the entire fixture.

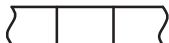
The workpiece in the work area with a "partially machined" status is not automatically machined following an NC-start.

- Preconditions:
  - Drives and media are switched on.
  - Channel 1 and 2 active.
  - Safety doors closed and locked.
  - Z-axis in loading position.
  - Partially machined workpiece is in the fixture

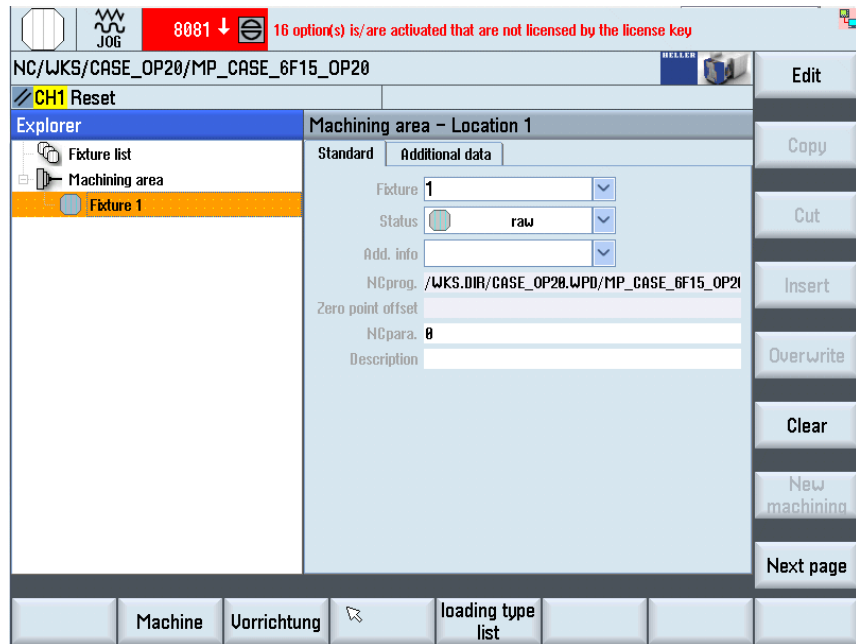
#### Calling up the fixture and workpiece management system



**Fixture**



- With *Data menu key* call up the basic menu on the main operator panel.
- Press the "Fixture" softkey.
- The basic screen of the fixture management system with Explorer View and "Fixture List" tabulated overview appears on the screen.
- In the Explorer View, select the fixture location in the machine using the *Cursor keys*.
- The "Work envelope - Location 1" input screen is now shown on the right-hand side of the screen.



### Setting workpiece status "partially machined"

- The fixture location in the work area is selected in the Explorer View
- The input screen is opened for entering data.



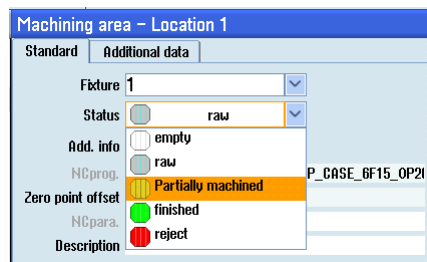
- Using the *Cursor keys*, select the "Status" input field.



- Press the *Insert* key.
- ↵ The selection menu opens.



- Select the "partially machined" status using the *Cursor keys*.



- Press the *Enter* key.
- ↵ The "partially machined" entry is accepted into the input field. The selection menu is closed.

**Overwrite**

- Press "Overwrite" softkey to save the entry.

**i**

The workpiece with a "partially machined" status is not automatically machined.

**Finish-machining workpiece****Situation**

The machine should start from a defined position rather than complete the entire machining program.  
This may be necessary, for example, after a tool break, if part of the machining operation has already been completed.

The workpiece in the work area with a "partially machined" status is not automatically machined following an NC-start.

**Progress marker**

The so-called depth-marker is used to re-enter the program at the various levels:

- Reselecting the last machining step.
- Handling of header specifications (e.g. runout, transport cycle, machining cycle, ...).



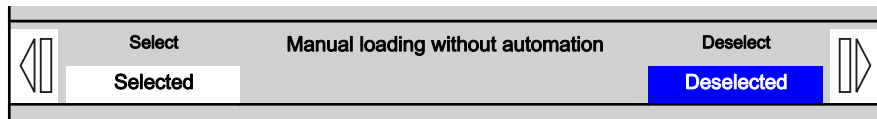
Detailed information on syntax, and on setting and reading the depth marker can be found in the machine programming instructions (PA).

## 5.8 Machining workpieces - automatic mode

<b>Top Loading</b>	The following chapter applies for machines on which workpiece loading and unloading is handled by a portal loader (top loading).
<b>System linking</b>	The machine is linked to other machining modules of a plant and is controlled by the higher-level loader system. The loading/unloading processes can only be carried out if all the units are in the system components are in "Linked" mode.
<b>Preselection of workpiece type</b>	The workpiece data for the raw part in the loader are provided for each loading process and transferred to the machine (loader interface).
<b>Load/unload request</b>	The workpiece transport operation is automatically triggered by the fixture and workpiece management system. Depending on the current status of the fixture on which the workpiece is located, the machine sends a load request or an unload request to the loader controller.
<b>Pallet status "Finished"</b>	<p>If a workpiece is to be unloaded, this can be triggered via the fixture status "Finished".</p> <p>Unloading is automatically started by the NC program at the appropriate time by default (M function M770).</p>

### 5.8.1 Switching to automatic loading

<b>Direct loading</b>	Workpieces are inserted directly into the fixture machine via the loading hatch (raw part) or removed from there (finished part). For the loading and unloading processes, the Z-axis of the machine travels to the loading position and the loading hatch is opened. The coordination for the loading and unloading processes is accomplished by the loader controller via the loader interface.
<b>"Manual loading without automation" function:</b>	Deselecting the "Manual loading without automation" function switches the machine to automatic mode. Check, before starting fully-automatic production mode, whether the function in the "General" HMI screen is set as follows:



**Opening the "General" HMI screen**

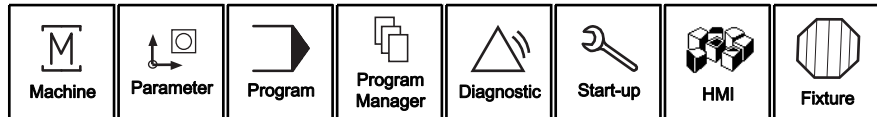
- Preconditions:
  - The machine is stationary.
  - Safety doors closed and locked.



- Press the *Setup* key.
  - ↳ The machine is removed from the system linkage. Setup mode is activated.



- With *Data menu key* call up the basic menu on the main operator panel.

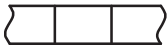


**HMI**



- Press the "HMI" softkey.
  - ↳ The "Setup functions to HMI Standard" menu item appears.

**Man.funct.**



- Press lower horizontal softkey "Man.funct.".
  - ↳ The menu of the "Hand functions" area is opened.

TC	WPC			Add. funct.		Workpiece	Service fct.
Prepare	Handfct.	Diagnostics	Tools	Process	Special scr.	Maintenan.	Document

**Additional fu.**



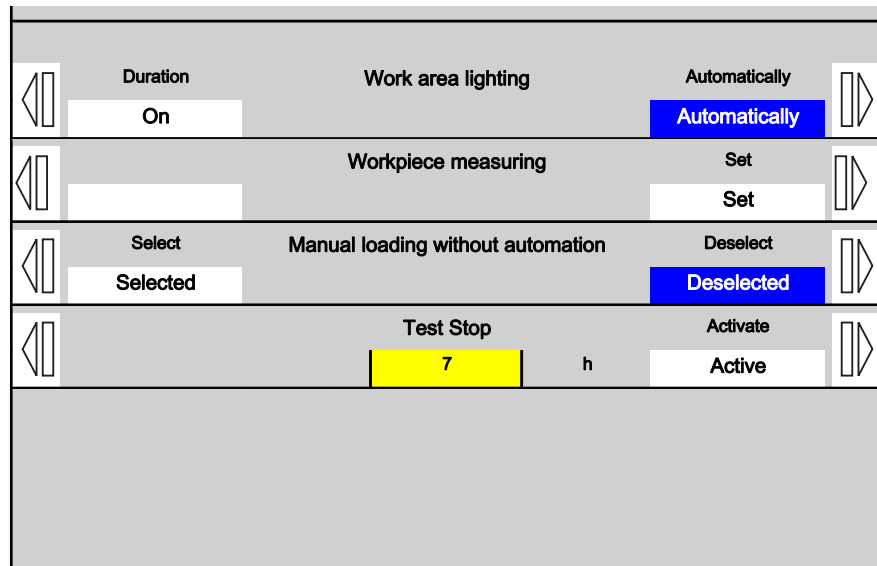
- Press upper horizontal softkey "Additional fu.".
  - ↳ The menu of the "Additional functions" area is opened (3rd menu level).

Safety doors	Acknowledg	General.					
Prepare	Handfct.	Diagnostics	Tools	Process	Special scr.	Maintenan.	Document

**General**

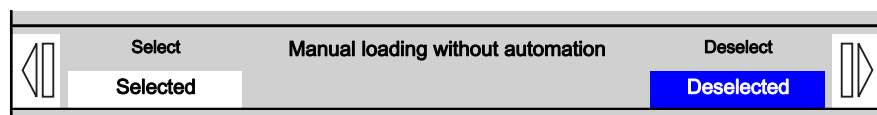


- Press upper horizontal softkey "General".
  - ↳ The "General" HMI screen is opened. The "Manual loading without automation" function is available. Manual loading without automation is selected, the display field is highlighted.



### Switching over to automatic mode

- Preconditions:
  - "General" HMI screen is opened.
- Press the right-hand softkey for the "..." line.
- ↪ The "Deselected" display field is highlighted.



- ↪ Operation for automatic workpiece loading is set.
  - The loading hatch is controlled by the loader.
  - The safety doors are locked.

### 5.8.2 Starting production mode

#### Move machine to home position

The home position is the defined starting point for many NC programs. In the home position, the Z-slide is retracted and in the

## 5 Operation for production

### 5.8 Machining workpieces - automatic mode

---

"Start position". Machining of the workpiece can be started from here.

- Preconditions:
  - Drives and media switched on.
  - Channel 1 and 2 active.
  - Safety doors closed and locked.
- Press the *Single Cycle Mode* key.
  - ↪ The machine is switched to automatic mode.
- Press the *Master Return* key.
  - ↪ The machine moves to the home position.
    - The machine axes move to their retract position.
- ↪ The lamp comes on when the home position is reached.



#### Starting production

- Preconditions:
  - Fixtures of the machine have been changed over to the workpiece type that is to be machined.
  - Axes in home position.
  - Drives and media switched on.
  - Safety doors closed and locked.
  - There is a raw workpiece on the load conveyor.
  - "Manual loading without automation" function is deselected.
- Press the *Interlinked Operation Mode (OP Auto)* key.
  - ↪ The machine is included in the system linkage.
    - The lamp "OP AUTO" illuminates.
    - The "AUTO" NC mode is automatically selected. The "AUTO" lamp comes on.





- Press the *Start/Step* key.
- ↪ The loader control opens and closes the workpiece loading station safety door and controls the workpiece flow within the system in accordance with the transport program.  
 For the machine, this means:
  - If the fixture is empty, it is loaded with a raw part at the next opportunity (load request).
  - If the fixture is occupied by a finished part, the latter is unloaded at the first opportunity (unload request).
- ↪ The system operates cyclically in continuous operation.



See next chapter for controlling the loading and unloading cycle.

### 5.8.3 Transporting SPC and NOK parts

#### Special sequences

Workpieces such as SPC and NOK parts, which have to be handled separately, can be unloaded via the "Workpiece" HMI screen if required. Via the "Workpiece" HMI screen, states for the workpiece currently located in the work area are set and transferred to the loader control. The loader responds with a corresponding transport job:

- Transport a measuring component to the SPC station
- Unload a reject part (NOK) from the normal workpiece flow.

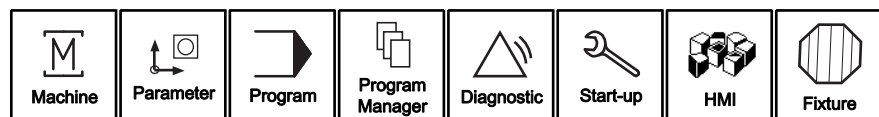
#### Calling up the "Workpiece" HMI screen



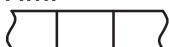
- Press the *Setup* key.
- ↪ The machine is removed from the system linkage.  
 Setup mode is activated.



- With *Data menu key* call up the basic menu on the main operator panel.



#### HMI

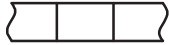


- Press the "HMI" softkey.
- ↪ The "Setup functions to HMI Standard" menu item appears.



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 5.8 Machining workpieces - automatic mode

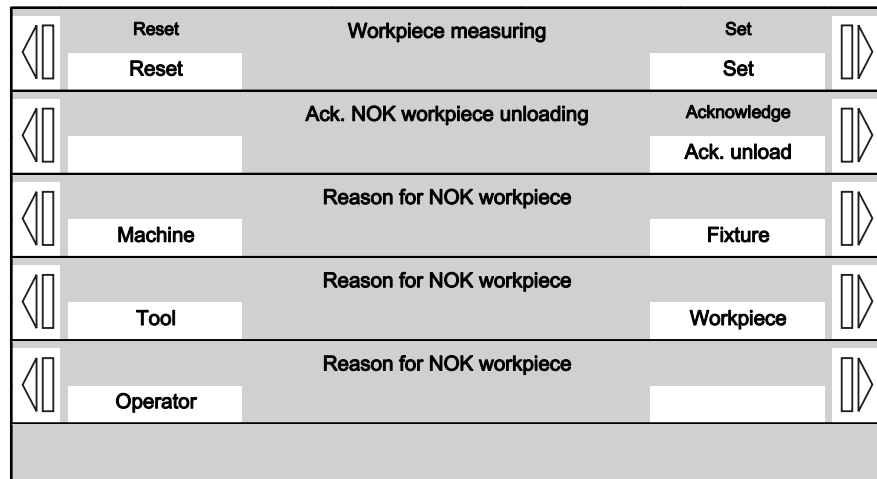
---

**Man.funct.**

- Press lower horizontal softkey "Man.funct.".
- ↪ The menu of the "Manual functions" area is opened.

**Workpiece**

- Press upper horizontal softkey "Workpiece".
- ↪ The "Workpiece" HMI screen is opened.

**Explanation****Workpiece measuring**

- Right softkey: Declare workpiece as measuring component. The workpiece is moved to the SPC station.
- Left softkey: Reset "Measuring component" state.

**Ack. NOK workpiece unloading**

- Right softkey: Declare workpiece as NOK part. The workpiece is unloaded.

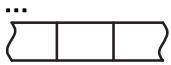
**Reason for NOK workpiece**

Send additional information as to why the workpiece is was declared as a NOK part.

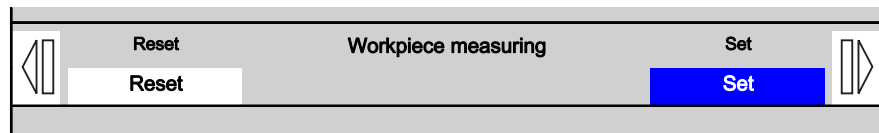
- Machine or fixture was not suitable for the workpiece type.
- Tool break or wrong workpiece type has been loaded
- Operating error has occurred.

### 5.8.3.1 Unloading measuring component

#### Declaring workpiece as measuring component

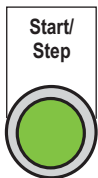


- ☑ Preconditions:
  - "Setup" machine mode is active.
  - "Workpiece" HMI screen is opened.
  - Access rights granted (EKS key).
- ☒ Press the right-hand vertical softkey which is assigned to the "..."  
line.
- ↪ The workpiece is declared as a measuring component.  
The right-hand display field is highlighted.



The entry "to be measured" (Field "Add. info") is set in the fixture management system.

#### Transporting measuring component to the SPC station

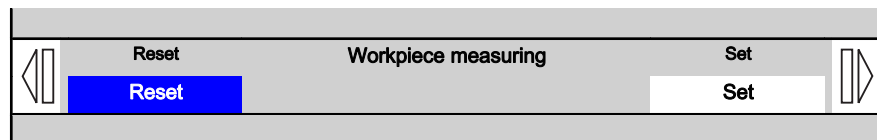
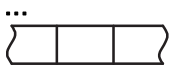


- ☑ Preconditions:
  - Drives and media switched on.
  - Safety doors closed and locked.
  - "Setup" machine mode is active.
- ☒ Press the *Interlinked Operation Mode (OP Auto)* key.
- ↪ The machine is switched to linked mode.
- ☒ Press the *Start/Step* key.
- ↪ The loader transports the workpiece from the work area to the SPC station at the next opportunity.  
Production mode is then continued.

### 5.8.3.2 Resetting measuring component

The "Measuring component" state of the current workpiece in the work area can be reset if required.

- Preconditions:
  - Machining stopped with stop at end of cycle.
  - "MAN - Rignningsdrift" mode activated.
  - "Workpiece" HMI screen is opened.
- Press the left softkey "..." for assigning to the "..." line.
- The workpiece status is cancelled.  
The "Reset" field is highlighted.



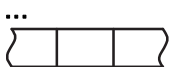
The entry "to be measured" (Field "Add. info") is deleted from the fixture management system.

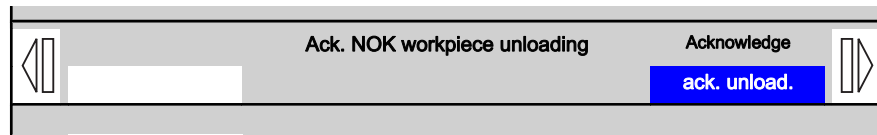
### 5.8.3.3 Unloading NOK part

If an irregularity was discovered or a tool fracture occurred during machining, the operator can systematically unload the workpiece. To do this, the workpiece status must be set manually to "NOK workpiece for unloading". This unqualified part (NOK part) is picked up by the loader and set down at a special location (e.g. SPC location).

#### Declaring workpiece as NOK part

- Preconditions:
  - "Setup" machine mode is active.
  - "Workpiece" HMI screen is opened.
  - Access rights granted (EKS key).
- Press the right-hand vertical softkey which is assigned to the "..." line.
- The workpiece is declared as a NOK part (reject part).  
The right-hand display field "ack. unload. " is highlighted.





### Unloading NOK part

- ☑ Preconditions:
  - Drives and media switched on.
  - Safety doors closed and locked.
  - "Setup" machine mode is active.
- ☒ Press the *Interlinked Operation Mode (OP Auto)* key.
  - ↵ The machine is switched to linked mode.
- ☒ Press the *Start/Step* key.
  - ↵ The workpiece is unloaded from the loader at the next opportunity. Production mode is then continued.



#### 5.8.4 Checking the loader interface

##### Displaying, controlling interface signals

The HMI "Interface" screen can be called in order to gain detailed insight into the automated loading and unloading of the machine via the loader. Individual interface signals are displayed, which can also be set manually if required.

Depending on the actual automation system, the HMI screen makes interface bits available on several pages. The incoming and outgoing signals are displayed in the left and right sides of the screen.

- Incoming: Signals from loader
- Outgoing: Signals from machine

### Opening HMI "Interface" screen

- ☑ Preconditions:
  - Drives and media switched on.
  - Safety doors closed and locked.
  - "OP AUTO" and "Auto" operating modes selected.

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With *Data menu key* call up the basic menu on the main operator panel.

HMI



Press the "HMI" softkey.  
 ↪ The control switches to the "HMI" main menu.

Maintenance

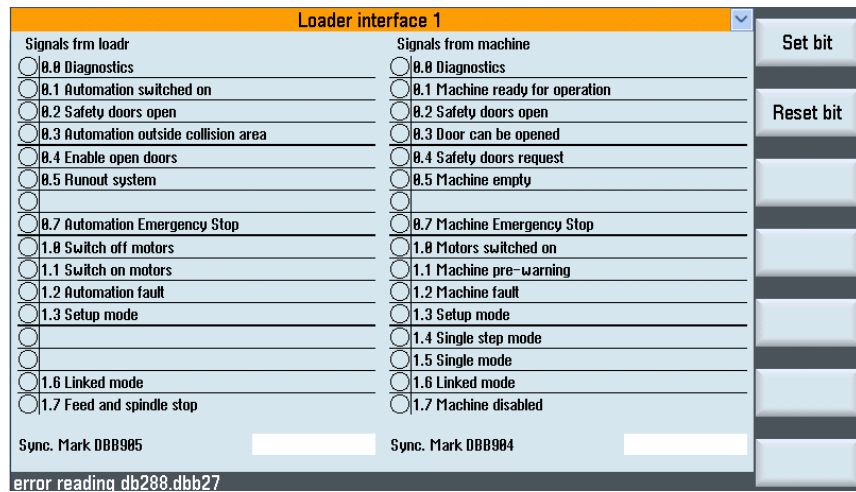


Press lower horizontal softkey "Maintenance".  
 ↪ The "Maintenance" menu is opened.

Interface

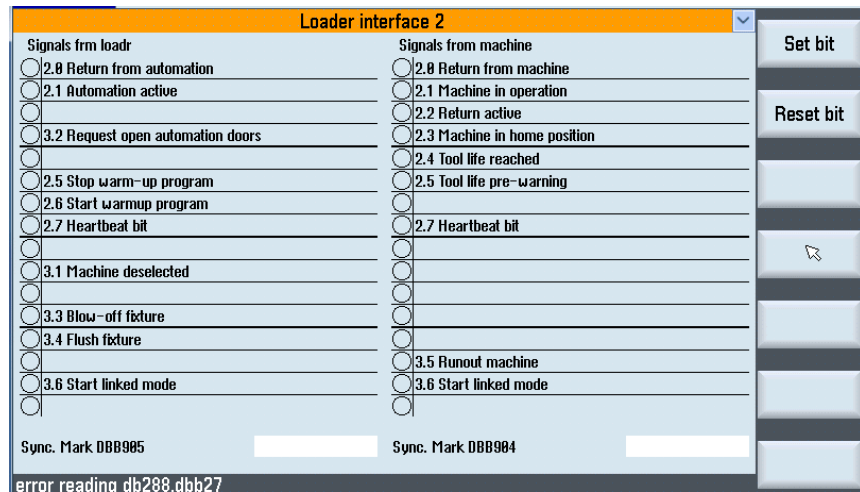


Press upper horizontal softkey "Interface".  
 ↪ The HMI "Interface" screen is opened.

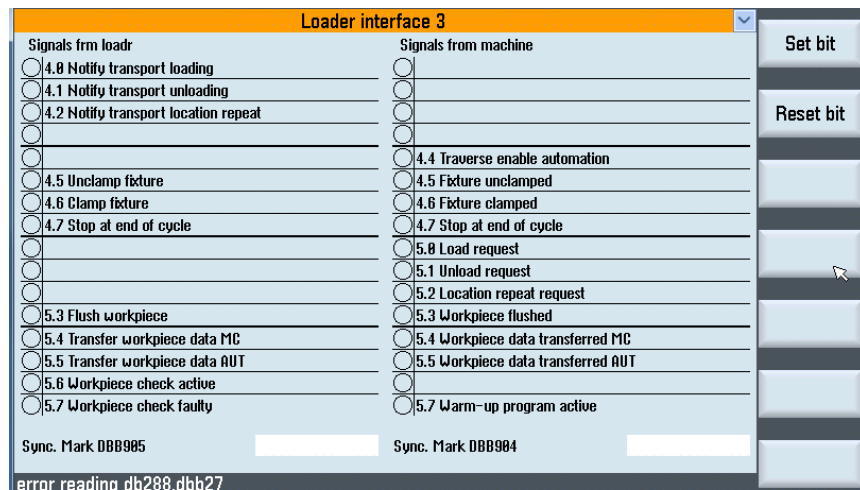


5.8.4 - 1 Loader interface - page 1

The HMI screen comprises several pages to accommodate the numerous interface signals. Selecting the yellow title line opens a pull-down menu via which the other pages can be called up.

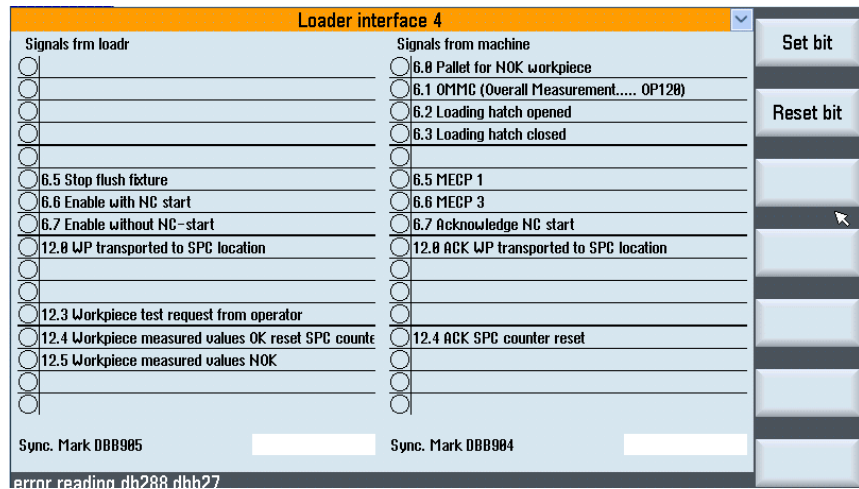


5.8.4 - 2 Loader interface - page 2

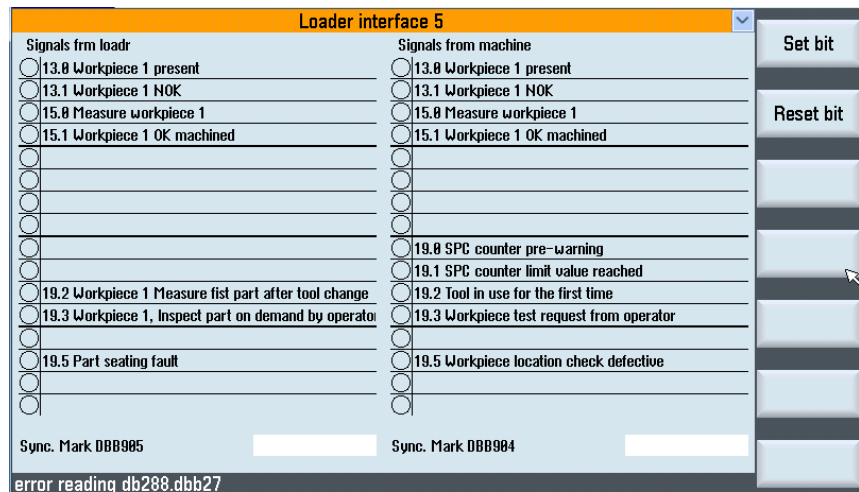


5.8.4 - 3 Loader interface - page 3

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5.8.4 - 4 Loader interface - page 4



5.8.4 - 5 Loader interface - page 5

**Interface display**

Each interface bit is mapped by a line which is preceded by a lamp symbol:

- Green means: Interface bit set.
- Black means: Interface bit not set.

**Interface control**

The interface bits can be controlled as follows:

- Select interface bit via vertical cursor keys. (Horizontal cursor keys for toggling between left and right sides of screen).
- Set or reset the required bit via the corresponding softkey on the right edge of the screen.

When bits are set, an application program can set or reset the interface bit. A password prompt appears the first time the bits are set.



## 5.9 Display operating statuses

The "Process" HMI menu shows the machine status in production mode.

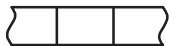
### Opening the HMI menu "Process"



HMI



Process



- With *Data menu key* call up the basic menu on the main operator panel.
- Press the "HMI" softkey.
  - ↪ The control switches to the "HMI" main menu.
- Press lower horizontal softkey "Process".
  - ↪ The "Process" area menu is opened.

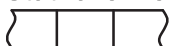
Unit Overv.	Wp count	Cycle time			Qs Data	TestTime	SPC
Prepare	Handfct.	Diagnostics	Tools	Process	Special scr.	Maintenan.	Document

- ↪ The following HMI screens can be selected:
  - Machine overview
  - Workpiece counter
  - Cycle time
  - Qs Data (DMC)
  - Test time
  - SPC

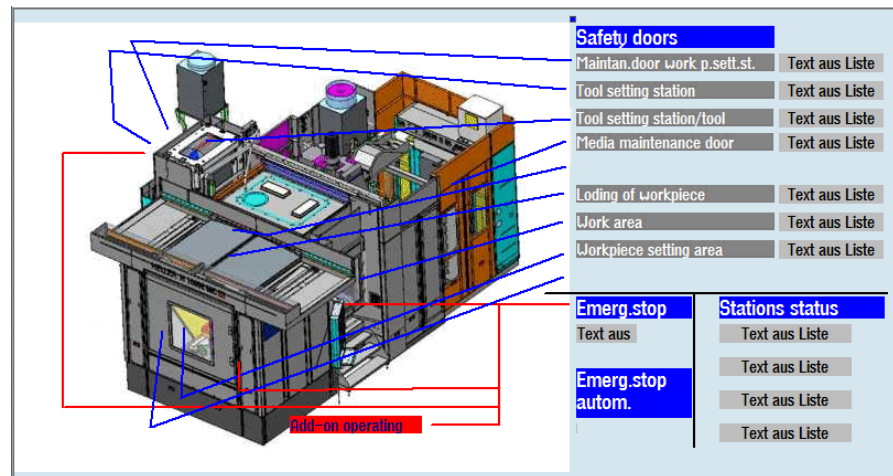
### 5.9.1 Station overview

#### Callup the Station Overview

Stat. overview



- Preconditions:
  - "HMI - overview" main menu opened.
- Press upper horizontal softkey "Stat. overview".
  - ↪ The Station overview is opened.



This screen provides an overview of the machine status. The active statuses are colour-coded.

### Safety doors

Work area, workpiece setting station, tool setting station, maintenance doors, etc.

- closed and/or locked (green)
- open and/or not locked (red)

### Emergency stop

- on the main operator panel
- on the tool loading station control unit
- on the HT8
- on the loader

### Station status

- Fault
  - none (green)
  - present (red)
- STATION
  - selected (green)
  - deselected (red)
- Home position
  - approached (green)
  - not approached (yellow)
- machining
  - completed (green)
  - not completed (yellow)

### 5.9.2 Workpiece counter

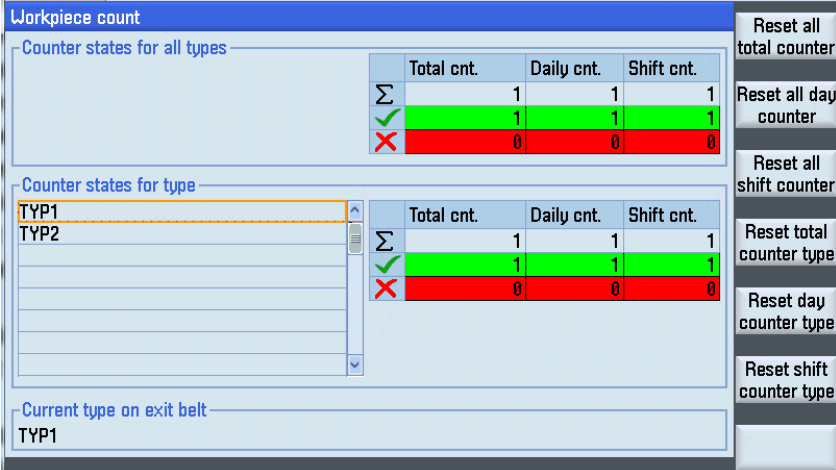
The "Workpiece counter" HMI screen shows the workpiece counter readings of the current workpiece type in the unload area. Three counters simultaneously run in parallel for the workpiece to be produced which are displayed in the following fields:

- Total counter
- Daily counter
- Shift counter

#### Calling up the HMI screen "Workpiece Counter"

- Preconditions:
  - "HMI - Process" main menu open.
- Press upper horizontal softkey "Wp Counter".
- The "Cycle time" HMI screen is opened.

Wp Counter

Counts of different workpiece types are possible if necessary and can be displayed in the fields of the bottom display block.

Each counter records the workpieces in the overall machine, separated into:

- Total number of machined parts.
- Number of correct parts: OK parts.
- Number of parts which are not correct: NOK parts.

#### Total counter

The counters of the fields in the top display block count all machined workpieces, regardless of workpiece type.

#### Type-related counter

The counters of the lower display block show the counter statuses for the workpiece type selected in the workpiece list. If only one workpiece type is produced, the counter readings for the top and bottom display block are identical.

#### Resetting the counters

The three counters to be reset are marked in the fields of the bottom display block by a blue rectangular field before the counter using the horizontal cursor keys.

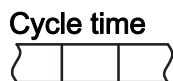
The softkey assigned to the "Plus button", is used to reset the selected counters. When resetting workpiece counters, all figures in a triple display are reset to zero at the same time.

### 5.9.3 Cycle time

The "Cycle time" HMI screen displays the actual and target cycle times for the module. Cycle times are displayed in seconds and to one decimal place.

#### Calling up the "Cycle times" HMI screen

- Preconditions:
  - "HMI - Process" main menu open.
- Press upper horizontal softkey "Cycle time".
- The "Cycle time" HMI screen is opened.



5 Operation for production  
 5.9 Display operating statuses

---

Cycle times								
Unit	Act. cyc.[s]	Tar. cyc.[s]	Unit	Act. cyc.[s]	Tar. cyc.[s]	Unit	Act. cyc.[s]	Tar. cyc.[s]
	0,0	0,0		0,0	0,0		0,0	0,0
				0,0	0,0		0,0	0,0
	0,0	0,0		0,0	0,0		0,0	0,0
	0,0	0,0		0,0	0,0		0,0	0,0
	0,0	0,0		0,0	0,0		0,0	0,0
	0,0	0,0		0,0	0,0		0,0	0,0
	0,0	0,0		0,0	0,0		0,0	0,0
	0,0	0,0		0,0	0,0		0,0	0,0
	0,0	0,0		0,0	0,0		0,0	0,0
	0,0	0,0		0,0	0,0		0,0	0,0
	0,0	0,0		0,0	0,0		0,0	0,0
	0,0	0,0		0,0	0,0		0,0	0,0
	0,0	0,0		0,0	0,0		0,0	0,0
	0,0	0,0		0,0	0,0		0,0	0,0
	0,0	0,0		0,0	0,0		0,0	0,0

#### Actual cycle

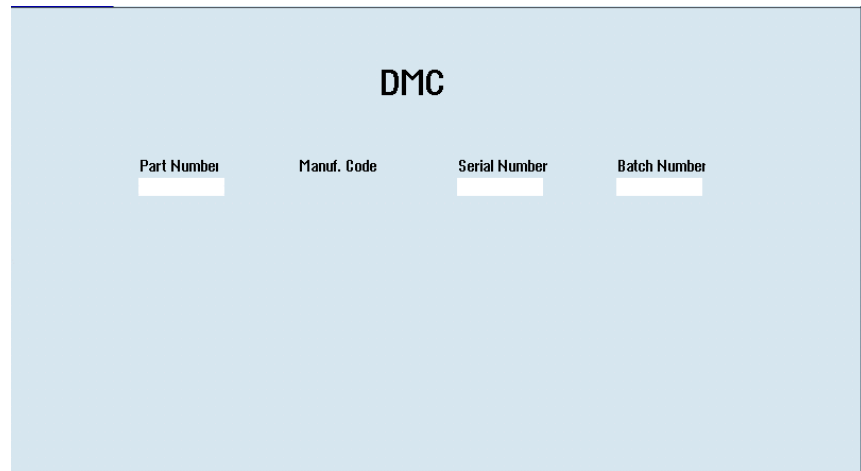
The actual cycle of the module is shown in white as long as the corresponding target cycle time is not exceeded. If the target cycle time is exceeded the actual cycle entry is marked in red.

#### Reference cycle

The target cycle of the module is displayed in the corresponding field of the first line.

#### 5.9.4 Data Matrix Code

The "DMC" HMI screen, which can be selected via the "Qs Data" softkey, allows the Data Matrix Code of the workpiece to be displayed.



The Data Matrix Code was read from the loader when the workpiece was loaded and sent to the machine control (interface).

In the "DMC" HMI screen, the alphanumeric value of the Data Matrix Code is displayed in three number blocks:

- Part Number
- Serial Number
- Batch Number

### 5.9.5 Test time

In the "Test time" screen, the process times of the last 20 workpieces is displayed.

If the operator finds that the process times for workpiece machining are longer, it is possible to check in this screen at which point the actual times deviate from the target times.

5 Operation for production  
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Cycle	Cycle Time	Machining	Exch. Time	Wait Unload	Unclamp	Unload	Wait Load	Load	Clamp
current/	186.4	186.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0
n-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
n-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
n-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
n-04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
n-05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
n-06	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
n-07	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
n-08	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
n-09	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
n-10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
n-11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
n-12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
n-13	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
n-14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
n-15	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
n-16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
n-17	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
n-18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
n-19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
n-20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

5.9.6 SPC Parts

The "SPC" screen enables you to specify, for each workpiece type, the number of workpieces after which a "measuring component" is to be transported to the SPC location of the machine. The component concerned is then unloaded after machining.

Workpiece Type	Current Value	Default Value	Warning Value	Expired Value	MC Stop Value	RESET
10,5L Type 1	0	0	0	0	0	0 0
10,5L Type 2	0	0	0	0	0	0 0
10,5L Type 3	0	0	0	0	0	0 0
10,5L Type 4	0	0	0	0	0	0 0
10,5L Type 5	0	0	0	0	0	0 0
10,5L Type 6	0	0	0	0	0	0 0
10,5L Type 7	0	0	0	0	0	0 0
10,5L Type 8	0	0	0	0	0	0 0
10,5L Type 9	0	0	0	0	0	0 0
10,5L Type 10	0	0	0	0	0	0 0
HDEP 12,8L Type 11	0	0	0	0	0	0 0
HDEP 12,8L Type 12	0	0	0	0	0	0 0
HDEP 12,8L Type 13	0	0	0	0	0	0 0
HDEP 12,8L Type 14	0	0	0	0	0	0 0
HDEP 12,8L Type 15	0	0	0	0	0	0 0
HDEP 12,8L Type 16	0	0	0	0	0	0 0
HDEP 12,8L Type 17	0	0	0	0	0	0 0
HDEP 12,8L Type 18	0	0	0	0	0	0 0
HDEP 12,8L Type 19	0	0	0	0	0	0 0
HDEP 12,8L Type 20	0	0	0	0	0	0 0
10,5L Type 1	0	0	0	0	0	0 0

**Current Value**

After every unloaded finished part, the program counts backwards from the specified standard value. For example, given a standard value of 50, the value 41 is displayed after 9 finished parts are unloaded.

**Warning Value**

When the pre-warning limit, e.g. 20, is reached, the next finished part is transported from the loader to the SPC location. If the SPC location is occupied, the machine continues to produce until the SPC location becomes free or the limit value is reached.

**Expired Value / MC Stop Value**

If the limit value is reached and no component has been transported to the SPC location, the machine will stop.

As soon as the finished part is loaded onto the SPC location, further components can be produced. The component must be measured before the value for the MC stop is reached. After the measurement, the measuring component counter on the SPC location must be set to 0.

If the measurement was not carried out in time, the machine will stop at the end of the cycle.



## 5.10 HMI screens for production support



### HMI



### Special Scr.



With *Data menu key* call up the basic menu on the main operator panel.

Press the "HMI" softkey.

↪ The control switches to the "HMI" main menu.

Press lower horizontal softkey "Special Scr.".

↪ The menu of the "Special screens" area is opened.

Capacity util	Shift						
Prepare	Handfct.	Diagnostics	Tools	Process	Special scr.	Maintenan.	Document

### 5.10.1 Displaying machine utilisation

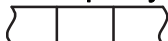
The "Capacity utilisation" HMI screen provides a shift-based overview of machine production over the current production week.

#### Calling up the "Machine utilisation" HMI screen

Preconditions:



- "HMI - Special screens" main menu open.
- Access rights granted (EKS key).

### Ma-capacity



Press upper horizontal softkey "Ma-capacity".

↪ The "Machine utilisation" HMI screen is opened.

Machine utilization												
Shift	01			02			03			Sum		
	Act	Targ	%	Act	Targ	%	Act	Targ	%	Act	Targ	
Monday	18.04.11	0	0	0.0	0	0	0.0	0	0	0.0	0	0
Tuesday	19.04.11	0	0	0.0	0	0	0.0	0	0	0.0	0	0
Wednesday	20.04.11	0	0	0.0	0	0	0.0	0	0	0.0	0	0
Thursday	21.04.11	0	0	0.0	0	0	0.0	0	0	0.0	0	0
Friday	22.04.11	0	0	0.0	0	0	0.0	0	0	0.0	0	0
Saturday	23.04.11	0	0	0.0	0	0	0.0	0	0	0.0	0	0
Sunday	24.04.11	0	0	0.0	0	0	0.0	0	0	0.0	0	0
  Sum CW -- -- --												

Typical display

**Shift-based overview**

The table shows the actual, target, and percentage values of the production volumes by weekday for all 3 shifts.

For every weekday in the first summation column of table the total of actual values is displayed and in the second summation column the total of setpoint values is displayed. The last line shows the total actual values and setpoint values for the entire week. The production week is shown in the bottom right-hand part of the screen.

**Tool clamping check**

All settings of "Capacity utilisation" HMI screen such as number of shifts, start of shift, end of shift, required number of items and so on can be entered in "Shift model" HMI screen. Counting pulses for number of items record had to be delivered by application program.

**Production week**


Use the *Cursor keys* to toggle the display between the current production week and the two previous production weeks.

**Week overview**

Each week overview displays both the absolute production quantities as well as the percentage values. The percentage values for the current shift are displayed dynamically. This means, at the current time the number of reference workpieces to be machined is determined. That amount is set in relation to actual workpiece amount up to now produced in the current shift.

### 5.10.2 Defining the shift model

**Definitions for shift model** Shift-specific settings can be defined for the current production week using the "Shift model" HMI screen. The default settings are required to calculate the machine's capacity utilisation.

- Preconditions:
  - "HMI - Special screens" main menu open.
  - Access rights granted (EKS key).
- Press upper horizontal softkey "Shift mode".
-  The "shift plan" HMI screen is opened.

#### Shift mode



Shift model, 0 Shifts hidden							On/Off
No.	Shift	Strt day	Start	End	Rest	Target/shift	Calendar week: 25
1	1	Mo	06:00	14:00	00:00		Day of the week: Monday, 06/18/12
2	2	Mo	14:00	22:00	00:00		Target cycle time: s
3	3	Mo	22:00	06:00	00:00		Parts per cycle:
4	1	Tu	06:00	14:00	00:00		Target O.E.E.: %
5	2	Tu	14:00	22:00	00:00		
6	3	Tu	22:00	06:00	00:00		
7	1	WJe	06:00	14:00	00:00		
8	2	WJe	14:00	22:00	00:00		
9	3	WJe	22:00	06:00	00:00		
10	1	Th	06:00	14:00	00:00		
11	2	Th	14:00	22:00	00:00		
12	3	Th	22:00	06:00	00:00		
13	1	Fr	06:00	14:00	00:00		
14	2	Fr	14:00	22:00	00:00		
15	3	Fr	22:00	06:00	00:00		

#### Data input

21 shifts can be defined, with a maximum of 3 per day. The "no." and "req. day" columns are static and cannot be edited.

To edit a line of the shift list, select it using the cursor keys. The horizontal cursor keys will take you to the input line of the shift list at the bottom of the screen.

The *Input* key enables you to skip to the next input field. To confirm your entries, press the "Accept" softkey.

The target cycle time, the number of components per cycle and effectiveness are entered into the right-hand side of the screen. Enter the data using the cursor keys and save by pressing the "Accept" softkey.

### 5.10.3 Displaying tool wear

#### Opening "wear" HMI screen

- ☑ Preconditions:
  - Machine in linked operation.
  - "HMI - Special screens" main menu open.
- ☒ Press lower horizontal softkey "Tools".
- ☞ The menu of the "Werkzeuge" area is opened.

Tools



Wear		Layout					
Prepare	Handfct.	Diagnostics	<b>Tools</b>	Process	Special scr.	Maintenan.	Document

- ☒ Press upper horizontal softkey "Wear".
- ☞ The HMI screen for displaying tool wear is opened.

Wear



Platz	Typ	Werkzeugname	ST	D e	ΔRadius	T C	G	U	M
		20.1.5	1	200	0.000				
		20.1.5	1	300	0.000				
		20.1.5	1	400	0.000				
5									
6									
7									
8		20.1.2	1	100	0.000	C	3	4	1
		20.1.2	1	200	0.000		3	4	1
		20.1.2	1	300	0.000		3	4	1
		20.1.2	1	400	0.000		3	4	1
		101	1	100	0.000				
		201	1	100	0.000				
		401	1	100	0.000				
		501	1	100	0.000				
		301	1	100	0.000				

The following parameters are displayed:

5 Operation for production  
 5.10 HMI screens for production support

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Column heading	Explanation
<b>Location</b>	Magazine/place number
<b>Type</b>	Tool type The tool correction data displayed is dependent on tool type (displayed as a symbol).
<b>Tool name</b>	For identification of the tool (e.g. 101).
<b>ST</b>	Sister tool number (for sister tool strategy)
<b>D</b>	Cutting tip number
<b>Δ Length</b>	Wear length
<b>Δ Radius</b>	Half diameter wear
<b>TC</b>	At the time of first use: Input whether tool life (=T) or no. of tool duty cycles (=C). The columns given below are shown.
<b>Life time / Quantity</b>	Current tool life of the tool in minutes / Current number of duty cycles of the tool
<b>Set value</b>	Designation of the reference value for tool life or number of duty cycles.
<b>Prewarn. limit</b>	Pre-warning limit: Designation of the tool life or number of duty cycles, at which a warning is issued.
<b>G</b>	Tool disabled
<b>M</b>	Tool calibrated
<b>V</b>	Pre-warning level reached
<b>IPM1</b>	Tool monitoring via break method.
<b>IPM2</b>	Tool monitoring via overload method.

## 5.11 Acknowledging stops for operational purposes

If malfunctions occur, the machine stops in its current position for safety reasons.

An error message is displayed on the screen.

Once the cause of the malfunction has been remedied, you must confirm this in the "Acknowledge" HMI screen. No machine will not execute any further movements until you have done so.

### Calling up the "Acknowledgment" HMI screen

- Preconditions:
  - Safety doors closed and locked.
  - Drives and media switched on.
  - "HMI" main menu open.
- Press the *Setup* key.
  - ↪ The machine is removed from the system linkage. Setup mode is activated.
- Press lower horizontal softkey "Man.funct.".
  - ↪ The menu of the "Manual functions" area is opened.
- Press upper horizontal softkey "Additional fu.".
  - ↪ The menu of the "Additional functions" area is opened (3rd menu level).
- Press upper horizontal softkey "Acknowledge".
  - ↪ The "Acknowledge" HMI screen is opened.



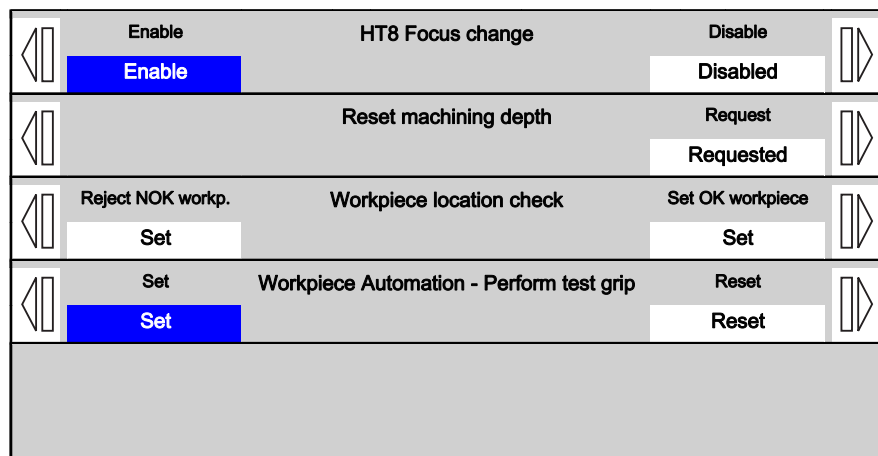
Man.funct.



Additional fu.



Acknowledge



### 5.11.1 Operation at the main operator panel or HT8

If operation is toggled between the stationary operator panel (main operator panel) and the mobile handheld operating unit (HT8), the mobile handheld operating unit can remain inserted on the main operator panel.

To transfer the command from the "mobile" to the "stationary" operator panel and vice versa, only the "Mobile handheld operating unit focus change" HMI function needs to be actuated.

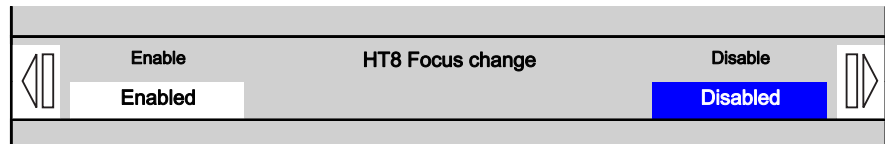
- Preconditions:
  - "Setup" machine mode is active.
  - "Acknowledge" HMI screen is opened.
  - The "HT8 Focus change" function is available.

---

#### Operation at the HT8



- Press the right softkey "...".
- ↔ Operation is transferred from the stationary operator panel to the mobile handheld operating unit.

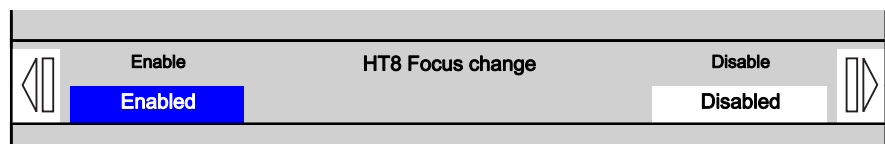



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#### Operation at the main control panel



- Press the left softkey "...".
- ↔ Operation is transferred from the handheld operating unit to the stationary operating unit.



### 5.11.2 Reset machining depth

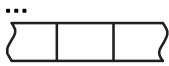
The control has a depth marker for re-entry into the last machining step.



Please refer to programming instructions (PA) in Chapter 1.

The depth marker is cleared when the machining depth is reset.

- Preconditions:
  - "Setup" machine mode is active.
  - "Acknowledge" HMI screen is opened.
- Press the right softkey "... " for assigning to the "Reset machining depth" line.
- Press the *NC Reset* key.



### 5.11.3 Acknowledging workpiece location check

The control has reported a workpiece location error.

The location malfunction message can be cleared by location repeat, e.g. by

- Blowing-off the workpiece support.
- Raise the lifting device and then lower again.

- Preconditions:
  - Safety doors closed and locked.
  - Drives and media switched on.
  - "Setup" machine mode is active.
  - "Acknowledge" HMI screen is opened.

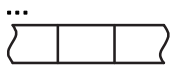
#### Confirming location check as OK

- Preconditions:
  - Location malfunction message no longer occurs.

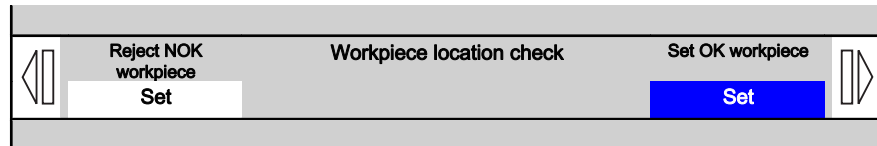


## 5 Operation for production

### 5.11 Acknowledging stops for operational purposes



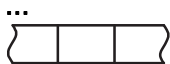
- Press the right softkey "... " for assigning to the "... " line.
- ↩ The right-hand field "set" is highlighted.



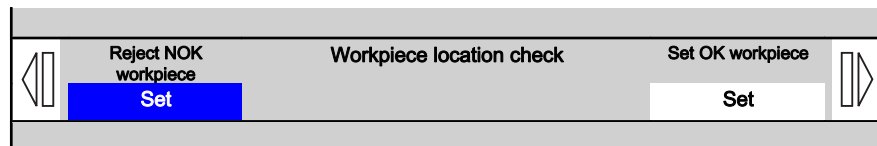
#### Confirming location check as NOK

The location fault cannot be corrected. The error message is still displayed.

The workpiece must be removed for a closer inspection of the locating faces.



- Press the left softkey "... " for assigning to the "... " line.
- ↩ The left-hand field "set" is highlighted.



- ↩ The workpiece is unloaded at the next opportunity.

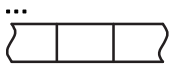
If the location fault is not caused by the workpiece, the clamping fixture must be inspected.

#### 5.11.4 Acknowledge test grip of loader

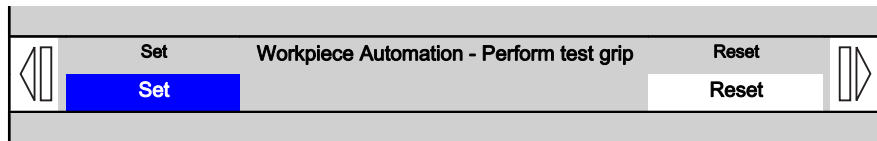
Whenever the workpiece data register of the machine is faulty, the control sends a request to the loader to execute a test grip.

While the Z slide of the machine is at its loading/unloading position, the loader enters the work area with an empty gripper and carries out its "test grip" (workpiece presence check). Subsequently, the loader moves back to its home position.

Finally, the operator must acknowledge the process in the machine control.



- Preconditions:
  - Message from loader control "Test grip performed".
  - Machine in linked operation.
  - "Acknowledge" HMI screen is opened.
- Press the left softkey "..." for assigning to the "..." line.
- The result of the test grip is written to the data register.  
The "Set" field is highlighted.



## 5.12 Machine axis movements in manual mode

### NC axes

The machine has the following NC axes for workpiece machining (main axes):

Machining axes - Channel 1			
Axis no.	Axis designation		Note
	Dialogue line	Key	
1	<b>M_X</b>	<b>X</b>	Gantry column horizontal axis
2	<b>M_Y</b>	<b>Y</b>	Machining unit vertical axis (spindle)
3	<b>M_Z</b>	<b>Z</b>	Z slide with pallet (workpiece)
4	<b>M_B1</b>	<b>B</b>	Rotary table
8	<b>M_C1</b>	<b>C</b>	Spindle

### Operating strategy

Manual mode is not intended for use during production. Its purpose is to enable the machine axes to be moved to a desired position for setting up or maintenance.

### 5.12.1 Moving the individual axes

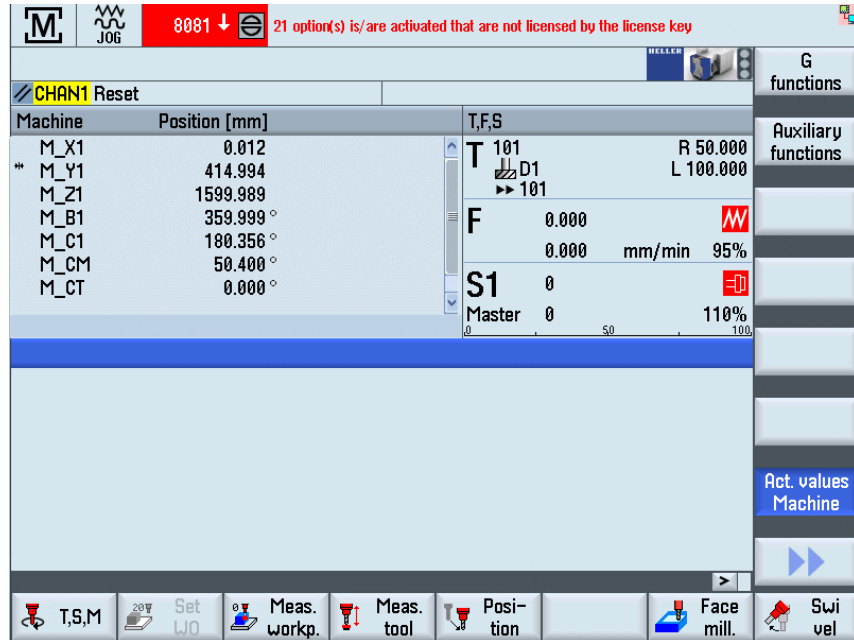
#### Displaying NC-axes

- Preconditions for the main operator panel:
  - Motors are switched on.
  - Safety doors closed and locked.
- Press the *Setup* key.
- "Setup" machine mode is active.
- Use *Machine area key* on the main operator panel to change to "Machine" main menu.
- Turn *Feed override* back to 0%.





- Change to "JOG" NC mode with *JOG*.
- ↪ The NC axes in Channel 1 are shown.



- ↪ The values for position, feed, spindle and tool for the basic machine are displayed.

## Selecting the NC axis

### Select axis via direct keys




- Use *Axis key X/Y/Z* to select the axis to be moved.
  - X: X slide (horizontal)
  - Y-slide (vertical) with machining unit
  - X slide (horizontal) with fixture
- ↪ The lamp of the selected axis lights up.



- Press the *Axis key B* key.
- ↪ The drive of the rotary table (B-axis) is activated.

### Select axis via selection list

NEXT  
AXES

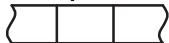
- Press the *Next Axes* key.
-  A dialogue window for axis selection is opened.

Axis selection		
Channel	Axis MCS	Axis number
CH1	M_X1	1
CH1	M_Y1	2
CH1	M_Z1	3
CH1	M_B1	5
CH1	M_C1	6
CH1	MCM	10
CH1	MCT1	11
CH1	MZT1	12



- Select the required axis using the vertical *Cursor keys*.


Accept




- Press the "Accept" softkey.
-  The axis selection is accepted and the dialog window is closed.

### Traversing axis



- Issue the "Feed enable" and the "Spindle enable" using *Feed start*.
-  "Feed Start" lamp lights up.



- Select the correct *Direction keys +/-* according to direction.
-  The axis is moved until either the Direction key is released or the area limit is reached.

Correct axis? Correct direction?

Make sure you are clear about which NC axis you want to move in which direction. For this purpose, observe the markings on the machine.

Hand on feed override:

To check the axis movement in manual mode, proceed as follows:

- Turn back Feed override to 0%.
  - Hand stays on the feed override.
  - Press the Plus Direction Key or the Minus Direction Key with the other hand.
  - Look at the position information to see what movement occurs.
  - Carefully turn up the Feed override from 0%.
  - Turn feed override back to 0%.
  - Release Plus or Minus direction keys.
- Use the *Feed override* to increase the traverse speed to the desired value. Release Direction key when the desired position is reached.

### Further options on axis positioning



- With *Inc Var* (increment variable), the travel increment is set that the preselected axis moves when the *Direction key +* or *-* is pressed.



- With *Inc 1 - Inc 10 000* (increment defined), the travel increment is defined that the preselected axis moves when the *Direction key +* or *-* is pressed.

### MDA (Manual Data Automatic)

In "MDA" (Manual Data Automatic) NC mode, part programs are produced and processed block-by-block. To do so, the co-ordinates of the travel positions and the additional functions (preparatory conditions, auxiliary functions ...) are entered in the "MDA program" window. The control processes the entered blocks after the NC start key is pressed.

### Repos (repositioning)

Following a program interruption in Automatic mode (e.g. to perform a measurement on the workpiece and to correct the tool wear values or after a tool break), the tool can be withdrawn manually from the contour after the NC mode has been changed to "Jog". In this case the control stores the coordinates of the interruption point and displays the movement differences of the axes traversed in "Jog" mode in the actual value window as "Repos" displacement (Repos = repositioning).



Repositioning in setup mode is not possible.

### 5.12.2 Rotating spindle



- Turn *Spindle override* back to the smallest possible value. (50% of speed defined in machine datum.)



- To select the spindle, press the *Axis key C* key.
- ↗ The lamp of the selected axis lights up.



- To select the directional rotation of the spindle, press *Direction keys* *-/+*.
- ↗ The spindle continues to move until the Direction key is released.



- Use the *Spindle override* to increase the spindle speed to the desired value.

### 5.12.3 Moving the axis via the hand wheel (HT8)

#### Pre-settings

- Preconditions
  - Motors switched on.
  - The machine is in Safe operational stop.
  - The work area safety door is locked.



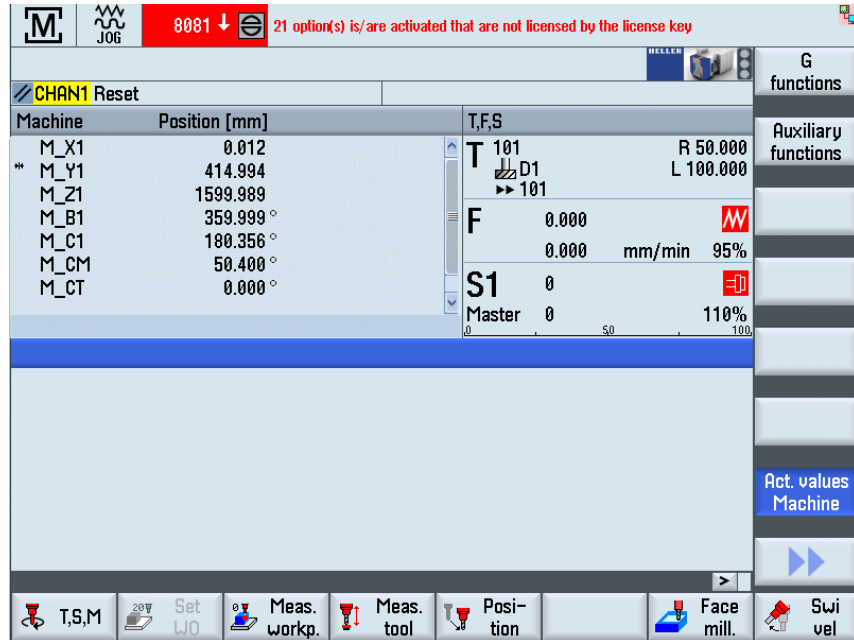
- Press the *Setup* key.
- ↗ "Setup" machine mode active



- Press *Machine area* key.
- ↗ The "Machine" main menu is opened.



- Press the *JOG* key.
- "JOG" NC mode is activated. The "Jog" basic display is opened.



- Press the *Feed/Spindle Start* key.
- The feed and spindle enable is issued. "Feed/spindle start" lamp illuminates.

### Connecting the HT8

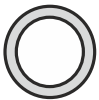
BYPASS  
E-STOP



- Press and hold the *Bypass E-Stop* key at the stationary operating unit.

- Remove the bridge connector from the stationary operating unit.
- Insert the connector of the approval unit into the interface (push-pull).
- Release the *Bypass E-Stop* key.

BYPASS  
E-STOP



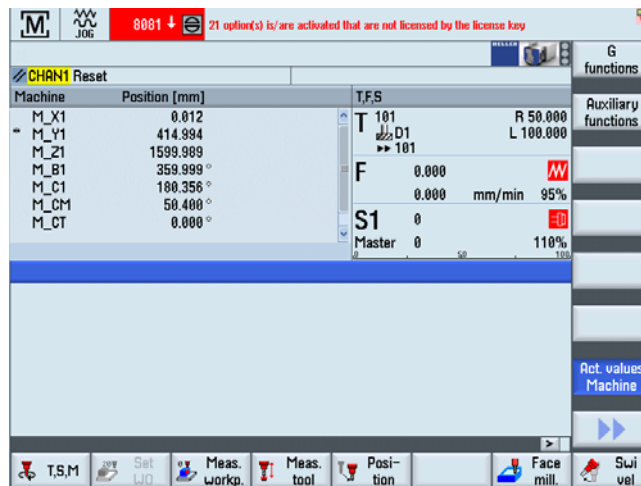


5 Operation for production  
 5.12 Machine axis movements in manual mode

on the HT8

Activating JOG mode

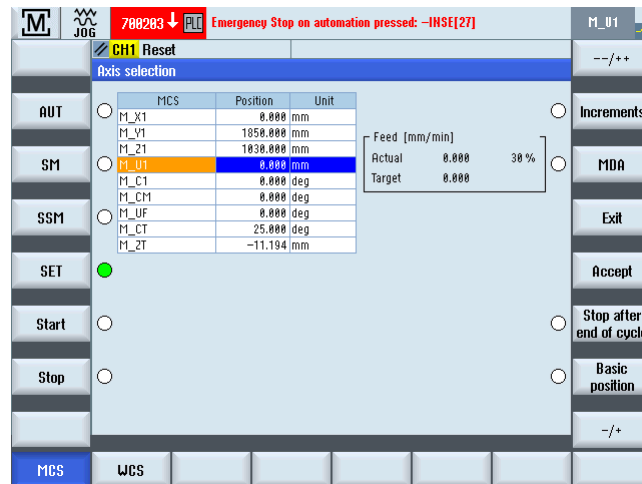
- Preconditions:
- Work area safety door opened.
  - Feed and spindle enable is issued.
  - Mobile handheld operating unit connected and ready for operation.
- Press the *JOG* key.
- "Jog" NC mode is activated.  
 The "Jog" basic screen displays position values.



### Selecting NC-axis, activating the direction keys



- Press the *U (User)* key.
- Important machine control panel functions are activated. In addition to the axis selection, *Feed direction keys +/-* and *Rapid traverse direction keys ++/--* are activated as softkeys. These functions can be executed via the keys assigned on the right.



### Traversing NC-axis

2-hand operation:

To move the selected axis, two control elements must be pressed at the same time.

- on the HT8:
  - *Feed direction key +/-* and one of the approval keys at the rear.
  - *Rapid traverse direction key --/++* and one of the approval keys at the rear.
- at the main operating unit:
  - *Direction key +/-* and *approval key*



- Turn back *Feed override* to **0%**. Then set feed override to a low value (e.g. 10%).

The traverse speed can be modified using Feed Override.

- Press one of the *Approval keys* on the back of the HT8.

**either**



- ☒ Press the approval key and the correct *Direction keys -/+* towards the required axis direction and note the effect of the *-/+*.
- ↻ The axis traverses until either the *Feed direction key -/+* is released or the area boundary is reached.

**Or**



- ☒ At the same time as the approval key, press the correct *Direction keys -/+*.
- ↻ The axis traverses until either the *Rapid traverse direction key --/+ +* is released or the area boundary is reached.



- ☒ Use the *Feed override* to increase the traverse speed to the desired value.
- ☒ Release Direction key when the desired position is reached.
- ☒ Release *Direction key -/+*.
- ↻ The axis stops.
- ☒ Release the *Approval key* on the back of the mobile handheld operating unit.

Start of repetition for further traverse motion.

- ☒ Press the *Approval key*.
- ☒ Press a *Direction key*.
- ↻ Axis will move as long as the *-/+ key* (or the *Approval key*) remain pressed.
- ☒ Release the *-/+ button*.
- ☒ Release *Approval key*.

If further motion is required, repeat the procedure.

on the main operator panel

**Remove HT8**



- Press and hold the *Bypass E-Stop* key at the stationary operating unit.

- Remove the approval unit from the interface (push-pull).

- Connect bridge connector to interface.

- Release the *Bypass E-Stop* key.



For moving axes with open safety door, see chapter 8.

## 5.13 Basic functions with MDA

In "MDA" (Manual Data Automatic) NC mode, part programs are on the one hand produced and processed block-by-block. On the other, already prepared MDA programs are called up and processed. To do so, the co-ordinates of the travel positions and the additional functions (preparatory conditions, auxiliary functions ...) are entered in the "MDA program" window.

The control processes the entered blocks after actuation of the *NC start* key.

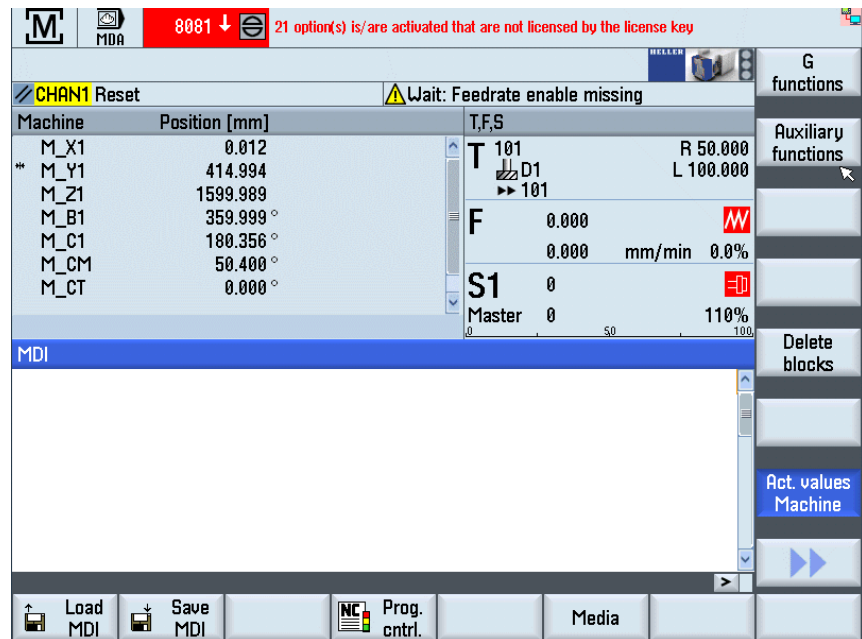
### 5.13.1 Call up MDA program window

- Preconditions:
  - Motors are switched on.
  - Safety doors closed and locked.
- Press the *Setup* key.
- "Setup" machine mode active
- Move to the "Machine" main menu using the *Machine area* key.





- Change to "MDA" NC mode with *MDA*.
  - ↳ "MDA" lamp comes on.
- The "MDA" menu displays position values, feed values, spindle values, tool values and the contents of the MDA buffer memory.



- Turn *Feed override* back to 0%.

The traverse speed can be modified using Feed Override.

### 5.13.2 Approaching an axis position

An example of axis positioning is "rapid motion X axis to mid table position".

With effective zero offset (G54 ...), the axis positions relate to the workpiece zero point.

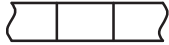
With preparatory condition G53, the effectiveness of the zero offset is cancelled and the path information relates to the fixed-value machine zero point.

- The general "Preconditions for machine functions" are satisfied. See the beginning of this chapter.

5 Operation for production  
 5.13 Basic functions with MDA

- The "MDA" NC operating mode is selected from the "Machine" main menu.
- The "MDA Program window" is open. See "Call up MDA program window" section.

Delete MDA buffer



- If necessary press softkey to "Delete MDA buffer".

NC Block "G0 G53 X0"

Enter NC block "G0 G53 X0" into the "MDA program" window. This is done through the keys on the control function operating panel.

- Enter "Rapid traverse" preparatory condition.
  - Press *Letter key G*.
  - Press *Numeric key 0*.
- Enter Preparatory condition "Cancellation of zero offset":
  - Press *Letter key G*.
  - Confirm *Letter keys 5 3*.
- Enter movement code "Co-ordinate and position".
  - Press *Letter key X*.
  - Press *Numeric key 0*.
- Turn *Feed override* back to **0%**.



The traverse speed can be modified using Feed Override.



- Issue the feed enable using *Feed start*.
  - ↪ "Feed Start" lamp lights up.



- Press the *Start/Step* key.
  - ↪ Axis positioning is triggered. The associated key lamp lights up.



- Pressing the *Feed stop* key halts the current axis positioning operation.
  - ↪ The end of positioning is indicated by the "NC start" lamp going out.

### 5.13.3 Switching on the spindle

The spindle control is explained using the example of a speed value of 50 rpm and a "clockwise" direction of rotation.



#### CAUTION

Danger of tool breakage

Any tools used with this machine must be used at speeds that do not exceed their permissible design speed.

Excessive speeds lead to the destruction of the tool and a risk of accident.

Check for correct balance of the tools. Unbalanced tools destroy the spindle bearing.

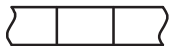


Further information on "Speed limitation" can be found in Section:

Any spindle running unnecessarily is automatically switched off, irrespective of machine or NC operating mode. Unnecessary means that no feed action was active beyond a preset time period. (3 minutes).

- The general "Preconditions for machine functions" are satisfied. See the beginning of this chapter.
- The "MDA" NC operating mode is selected from the "Machine" main menu.
- The "MDA Program window" is open.
- If necessary press softkey "Delete MDA buffer".

Delete MDA buffer



NC Block "S50 M03"

- Enter NC block "S50 M03" into the "MDA program" window. This is done through the keys on the control function operating panel.
- Enter speed information.
  - Confirm *Letter key S*.
  - Confirm *Letter keys 5 0*.
- Enter direction of rotation information.
  - Confirm *Letter key M*.
  - Confirm *Letter keys 0 3*.



```
MDA
S50
M03
=eof=
```



- ☒ Issue the spindle enable using *Feed start*.
- ☞ "Feed Start" lamp lights up.



- ☒ Press the *Start/Step* key.
- ☞ The spindle is activated.
- The associated key lamp lights up.



- ☒ The spindle is stopped when the *Feed stop* key is pressed:
- ☞ "Feed Stop" lamp lights up.
- The rotational direction and speed data is stored and remains effective.
- The spindle is switched back on when the *Feed Start* key is pressed.

The stored, effective rotational direction data is overwritten by entering a "M5" or "SPOS(w)" NC Block.

- M5 spindle stop unaligned.
- SPOS(w) Oriented spindle stop (w = angle in degrees).

#### 5.13.4 Tool change function

##### Call up MDA program



### CAUTION

Danger of tool - workpiece collision.

Ensure no collision occurs during the loading stroke and the indexing movement of the tool changer. In manual mode, move the Z axis into the most convenient change position. (In the event of doubt, return the Z-axis to maximum Z position)



Information on how to avoid collision can be found in Section: "Machine axis movements in manual mode" **page 227**

#### Preconditions

- The general "Preconditions for machine functions" are satisfied.



See the beginning of this chapter:  
"Basic functions with MDA" **page 237**

- The "MDA" NC operating mode is selected from the "Machine" main menu.
- The "MDA Program window" is open.



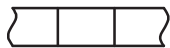
See Section:  
"Call up MDA program window" **page 237**

#### Delete MDA buffer



- If necessary press softkey to "Delete MDA buffer".

#### MDA file function



- Call up file functions with softkey "MDA file function".

↩ The program overview of the "Part programs" is open.



- Select the desired MDA program (MPF) using the *Cursor keys*.

For tool change "MDA\_WZW.MPF" .

#### Read in MDA



- Press the "Read in MDA" softkey to read the selected program into the MDA buffer.



- Press the *SETUP* key.
- ↩ The "setup" machine operating mode is activated.



- Move to the "Machine" main menu using the *Machine area key*.

↩ In the "MDA" basic display, the content of the loaded MDA program appears in the "MDA Program" window.

### Edit MDA program

If necessary, the prepared MDA program must be adapted to current requirements.

```
MDA program
;EXAMPLES
T-"BOHRER"
M6
M46
=eof=
```

T-"\_\_\_"; tool identifier, e.g. T-"DRILL"

M6; fast tool change

M46; slow tool change



The tools must not exceed the specified weights and moments of weight. The tool changer may run with heavy tools only at reduced speed. Adhere to the maximum moment of weight values as specified in "Technical Data"! Take special care when entering the tool change speeds in the tool data section of "Handling data". If you do not make any entries, all tools are changed quickly.



The permissible technical data are described in the General layout (AZ) and the Technical Data (57.). The documents always appear in the chapter headed "Drawings, Plans" in the Machine Operator Manual (BD).



Information on tool data in the "Handling data" group can be found in the "Tool system" chapter in this Operating Manual. See Chapter:

- Enter a max. of 30 characters for "Tool No." (tool identifier).
  - ↳ Tools are stored and called by name.
    - Example: WZ NO. = "DRILL" or TOOL NO. = "123"
- Enter tool change speed:
  - M6 for fast tool change
  - M46 for slow tool change

M6 permits a tool change at the speed specified in the tool data. If you do not make any entry to tool data, the tool will be quickly changed.

If M46 is used, the tool is changed slowly.



- ☒ Press the *NC Start* key.
- ↪ A complete tool change is triggered:
  - Spindle is positioned
  - Cooling lubricant is turned off.
  - WZW door open
  - The X and Y axes move to the tool change position in rapid traverse
  - Tool gripper swivels inwards
  - Tool change stroke from spindle
  - Tool gripper swivels
  - Tool change stroke in spindle
  - Tool gripper swivels outwards
  - WZW door closes
- ↪ "Start" lamp illuminates throughout the tool change operation.
- ↪ The end of the change operation is signalled when the "start" lamp extinguishes.

## 5.14 Machine shut-down / restart

### 5.14.1 Stop at cycle end

To halt a program that is running in an endless loop, the machine can be stopped using the "Stop at end of cycle" function. The current machining cycle will still be completed. The NC axes move to their home position.

The workpiece remains in the machine.

#### Halting the program

- Machine running in production mode.
  - "OP AUTO" machine operating mode.
  - "AUTO" NC operating mode.
- Press the *Cancel Next Cycle* key.
  - ↪ The current machining cycle will be completed.
    - The machine stops without performing a workpiece change.
    - The ready messages are saved so that the machine can continue machining at any time.
    - The machine stops in its home position.
    - The key lamp flashes.



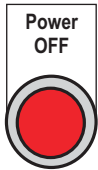
### 5.14.2 Switching off for end of shift, weekend shut-down ...

#### End of program

Wait until program ends.

- Switch-off conditions:
  - "Start" lamp does **not** illuminate.
- Select "JOG" NC operating mode.
- Run cleaning stroke of linear axes.

Run all three linear axes consecutively back and forth once over the entire stroke.
- ↪ The dirt wipers on the runner blocks wipe the guide rails.



- ☒ Press the *Power Off* key.
- ↪ The machine is switched off.
  - Hydraulics are turned off.
  - Lubrication system is turned off.
  - All drives are changed to "not ready" status.
  - Scraping conveyor is stopped.
  - The relevant key lamp extinguishes.



This operating status corresponds to the normal shutdown procedure, (e.g. at shift end and weekend shutdown etc.).

### 5.14.3 Disconnecting machine from mains supply



- ☒ Set the *Main switch* on the control cabinet for the central supply and controller to "off".
- ↪ The power supply to the overall machine is switched off. Once switched off, the main switch can be padlocked to protect it from unauthorised operation.



For mounting position, see:  
"Machine overview" **page 58**  
"Overview of operating devices" **page 83**

### 5.14.4 Prepare machine for downtime

#### Maximum downtime up to max. 1 week

- ☒ Clean the machine.
- ☒ Remove tool from the spindle.
- ☒ Clean spindle taper and cover to prevent contamination.
- ☒ Preserve all guideways, spindles and all blank components in the work area using spray oil.

### Machine downtime from 1 to 6 weeks

In addition to the above work, the following activities must also be carried out:

- Preserve tool holding fixtures using spray oil.
- Flush chips from the complete unit and then rinse through with cooling lubricant.
- Clean cooling lubricant tank.
- Clean filter of cooling lubricant unit.



Further information on cleaning the cooling lubricant unit can be found in the suppliers' documentation provided by Knoll.

### 5.14.5 Restarting the machine after downtime

- Remove spindle cover.
- Clean the machine components that have been preserved with spray oil if necessary.

#### 5.14.5.1 Pre-heat cycle for the tool spindle

The spindle may only be switched on if the temperature of the coolant is between 15°C and 30°C.

Before switching on the spindle in an environment in which the temperature is below this value, it is necessary to pre-heat the coolant. This procedure must be carried out when the coolant circuit pump is switched on.

### After downtime between 8 hours and 1 week

In order to guarantee an even distribution of the lubrication oil, the spindle should run for 1.5 minutes at an average speed.

### After downtime of longer than 1 week

After prolonged downtimes of one week or more, a run-in procedure should be carried out as follows:

1.	4 minutes	1/4 of the maximum speed
2.	2 minutes	Spindle downtime
3.	4 minutes	1/2 of the maximum speed
4.	2 minutes	Spindle downtime
5.	4 minutes	3/4 of the maximum speed
6.	2 minutes	Spindle downtime
7.	4 minutes	Max. speed

During this run-in procedure, the temperature of the spindle bearing must be monitored. If the temperature increase is irregular, do not increase the speed. A complete run-in procedure must be carried out.

#### 5.14.5.2 Checking oil filling of hydraulic pump

After prolonged standstills, check the oil level of the axial piston pump and replenish if necessary.



For a description on how to check the oil filling level in the axial piston pump and top it up, please refer to the Maintenance instructions, chapter 4 "Inspection and Maintenance", functions group "Hydraulics", maintenance item "Oil change in hydraulic reservoir", section "Replenishing oil".



# CHAPTER 6

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Tool systematics

## 6 Tool systematics

### 6.1 Introduction

#### Function scope of the tool management system

The tool management system supports you in all areas of tool handling, e.g. the physical loading and unloading of the tool magazine by data and tool transportation.

The key functions at a glance:

**HMI - Human Machine Interface**

Operator interface of the NC for operating, programming and simulation.



For operator panels, see:  
"Machine overview" **page 58**  
"Overview of operating devices" **page 83**

**Write/read codechip (option)**

Write/read device in the magazine (option) for automatic data transfer when loading or unloading tools.

**Lists for the tool management system**

The SINUMERIK 840D sl control provides for the tool management system various lists that display the tool data by function:

A distinction is drawn between the following areas within the lists:

- Tools that are loaded into the magazine have a magazine place number.
- Tools that are not loaded into the magazine have no magazine place number and appear at the end of the list after the last magazine place number.
- Blocked tools are marked with a red cross.

### Tool list

The tool list includes all tool data required for loading and unloading of tools. Necessary monitoring data also are managed here.

- Length
- radius
- State
- Max. speed
- Change speed
- Tool envelope contour

### Tool wear

The "Tool wear" list includes all tool data that are important during machining. If the tool wear exceeds a certain value, an alarm is output. The following values are displayed:

- Wear length
- Wear radius
- Number of duty cycles
- Tool life

### Magazine

The tool and magazine are positioned using the "Magazine" list.

- The magazine place information can be found here.

## i

If a tool that is no longer required is unloaded from the magazine, the stored tool data can remain in the tool list for use at a later date. These tool data are shown at the end of the tool list.

### OEM tool

The "OEM tool" list includes data that are relevant for diagnostics and troubleshooting.



**Tool storage (TO memory)**

For further information on the tool lists, see:

The operating data of the tools is updated by the control in the tool lists.

If the machine is fitted with an optional codechip device, the operating data are saved to the codechip as the tools are being unloaded from the magazine.

**Temporary storage**

If a tool is located at a stop-off place outside the magazine on a machine, this is referred to as the buffer location. Buffer locations are:

- spindle
- Gripper 1
- Gripper 2
- Provisioning place
- setting station



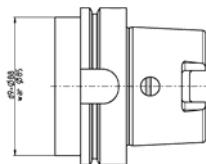
More detailed information on the tool management system can be found in the SIEMENS documentation.

## 6.2 Handling at the tool setting station

### Safe tool handling

<b>Quality of balance</b>	<p>Check for correct balance of the tools. Unbalanced tools destroy the spindle bearing.</p> <p>The required balance quality of the tools is:</p> <ul style="list-style-type: none"> <li>- For speeds up to <math>8000\text{min}^{-1}</math> balance quality G6,3 (DIN ISO 1940).</li> <li>- For speeds <math>&gt; 8000\text{min}^{-1}</math> balance quality G2,5 (DIN ISO 1940).</li> </ul>
<b>Geometry</b>	<p>Make sure the tool geometry is within the permissible limits.</p>
<b>Clearance, empty place</b>	<p>Leave enough clearance between tools.</p> <ul style="list-style-type: none"> <li>- The tools are inserted from the long side of the magazine. The clearance on the rotary track becomes narrower, allowing collisions to occur if tools are not rotation-symmetrical. In this regard, always follow the information on the plate at the tool setting station.</li> <li>- Generally, one magazine place must remain free and must not contain a tool cartridge.</li> </ul>
<b>collision monitoring</b>	<p>The control can guarantee collision monitoring only for tools with known data.</p>
<b>Check fastening of cooling lubrication pipe</b>	<p>On machines with internal cooling lubricant feed, the cooling lubricant pipe must always be inserted into the tool holding fixture.</p> <p>Ensure that the cap nut for securing the cooling lubricant pipe is secured against working loose. If the nut works loose this may result in the tool not being released from the spindle.</p> <p>The cooling lubricant pipe should also be used on tools without internal cooling lubricant feed. This protects the spindle from internal cooling lubricant being inadvertently switched-on.</p>
<b>Note for HSK100</b>	<p>The tools standard was revised in 2003. The dimension d9 was increased from 85 mm to 88 mm.</p>

**i**



The tool holder was modified accordingly. Old and new tool holding fixtures can be combined in the same magazine. Older machines can be upgraded by replacing all tool holders if required.

### General handling data

All user-related tool data for the magazine tools are managed in the tool list.

Handling data such as envelope contour or speed of changing are needed by the tool manager to enable size-related position assignment and to carry out tool transport without collisions.



Risk of collision resulting from incorrect handling data.

Damage to tools and machine to be expected.

Enter handling parameters carefully and in full. In case of doubt, check and re-measure.

### Speed limiting

#### Default rotational speed limits

The rotational speed at which the tools can be used is limited by default. Where the tool data record of a particular tool contains no speed value, a machine-specific maximum spindle speed defined by HELLER automatically applies.

Up to this limiting speed, which is set as standard, we guarantee that any tool fragments resulting from a tool break will not penetrate the guard panels of the machine.

#### Tool-dependent limit speed

Where a higher speed is required for machining, this must be explicitly defined in the tool data record. This maximum rotational speed must be specified by the tool manufacturer. It must not, however, exceed the maximum admissible spindle speed. The definition of this tool-dependent maximum speed is not checked and does not fall within HELLER's sphere of responsibility.

#### Exceeding the limit speed

If a tool's limit speed is exceeded by a programmed speed (manual input, NC program), the machining speed is limited to the limiting speed. A message is displayed on the screen.

#### Gearbox attachment

If a gearbox attachment is used to increase the tool speed compared to the spindle speed, this must be taken into account by the user.

#### Puncture strength of guard panels

HELLER guarantees the puncture strength of the guard panels providing the tool speed does not exceed the specified default limiting speed. This applies to standard versions of the machine as

well as the standard permissible tool dimensions. If this is not the case, the permissible limiting speed will be lower.  
 If these conditions are not adhered to, the user of the machine will be responsible for the puncture strength of the guard panels.

### Tool weight and tool change speed



The tools must not exceed the specified weights and moments of weight. The tool changer may run with heavy tools only at reduced speed.

Adhere to the following limits!

Take special care when entering the tool change speed in the tool data section of the tool list. If no data are entered, all tools will be changed quickly (standard).

#### Restrictions

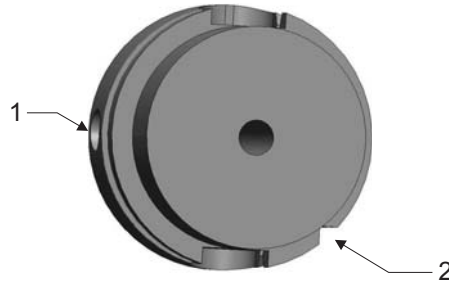
The following restrictions apply:

Size	1000 - 4000	5000 - 8000
Maximum permissible moment due to weight of tool taken up by gripper	10 Nm	20 Nm / optionally 50 Nm
Maximum permissible tool weight	12 kg	25 kg / optionally 35 kg
Rapid tool change up to tool weight of	3 kg	12 kg

#### 6.2.1 Loading tool in correct position

When loading tools make sure that they are inserted in correct position into the tool cartridges at the tool setting station.

### Hollow taper shanks tool holding fixture



6.2.1 - 1 Spindle taper

- 1 Locating hole for code chip
- 2 Notch (bottom right)

To insert a tool in correct position into the tool cartridge, the spindle taper must be positioned as follows:

- The locating hole for the code chip (1) must be pointing towards the tool setting station.
- The notch (2) is in the bottom right position when the tool is viewed from the front.

### 6.2.2 Tool Loading Station

#### Tool loading parallel to machining

For manual loading of the magazine, a tool loading station is provided on the side of the tool magazine facing away from the machine.

An **exterior**, electrically-locking "Tool setting station" safety door offers access to the tool loading position, a position on the tool magazine at which the tools can be individually removed and inserted. This safety door can be unlocked or locked by the operator for tools to be loaded and unloaded.

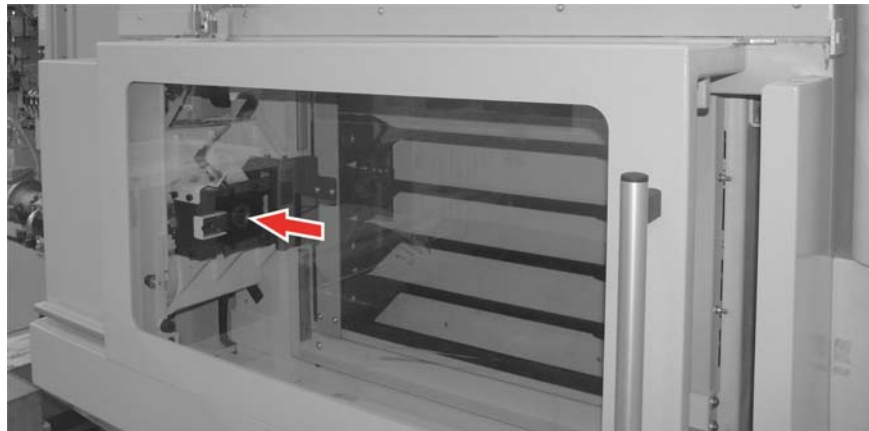
An **interior** safety door separates the loading place from the peripheral chain magazine; this door is opened and closed by the controller.



## 6 Tool systematics

### 6.2 Handling at the tool setting station

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6.2.2 - 1 Tool setting station with empty cartridge (arrow)  
 - Exterior safety door closed  
 - Interior safety door open

#### Traverse attachment "Loading place - Magazine"

Following the loading operation during which a new tool is inserted, the tool identity of the controller notified and the exterior safety door re-closed again, the tool is automatically transported to the magazine. A traverse attachment picks up the tool from the loading place and slides in into the holder at the empty location provided in the magazine.

The precondition for tool loading is that the data for the tool concerned are known to the controller.

The additional safety door between loading place and magazine enables the machine to be set with tools during machining. This also applies for the removal of old tools, which are moved by the controller to the loading place for removal by the operator.

#### Traverse attachment "Magazine - Provisioning Place"

When the machining program requests a new spindle tool, the machine starts up and transports the tool concerned to the side of the tool magazine that faces the machine. A traverse attachment (magazine - provisioning place) is also located here. The tool changer starts up as soon as the tool has been pushed to the provisioning place.

#### Terminal operator panel

A complete monitor cooperating unit (terminal operating unit) is available at the tool setting station. The setting dialogue and the input of the tool data is performed here using the terminal operating unit at the tool setting station.

#### Lists for the tool management system

The SINUMERIK 840D sl control provides for the tool management system various lists that display the tool data by function:

### 6.2.3 Settings - loading tools

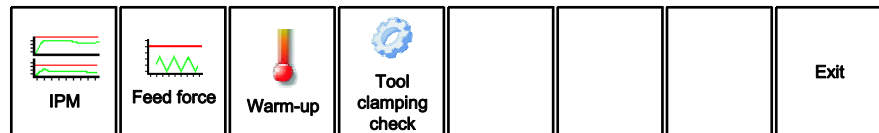
Further function-oriented settings for tool loading are available to persons with the corresponding access rights.



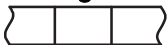
Depending on the selected settings, the tool loading procedure may vary.

#### Calling up the "Settings" window

- The corresponding access right is issued.
- Call up the machine's basic menu using the *Data menu key*.
- Press the *etc.* key.
- ↳ The "Settings" softkey is displayed.



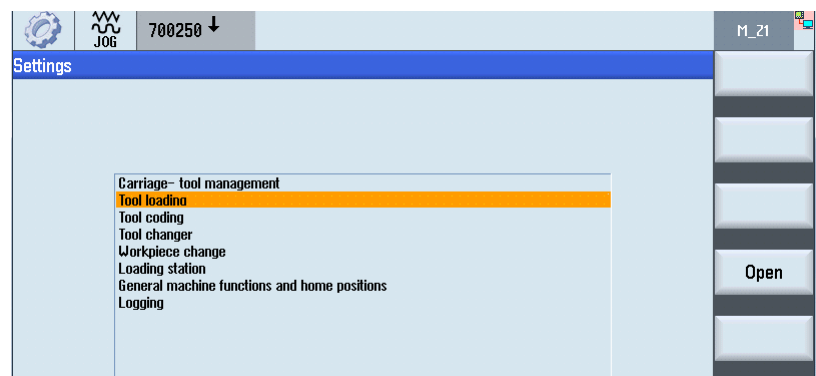
#### Settings



- Press the "Settings" softkey.
- ↳ The "Settings" window will be displayed.



- Highlight the "Tool loading" line using the *Cursor keys*.

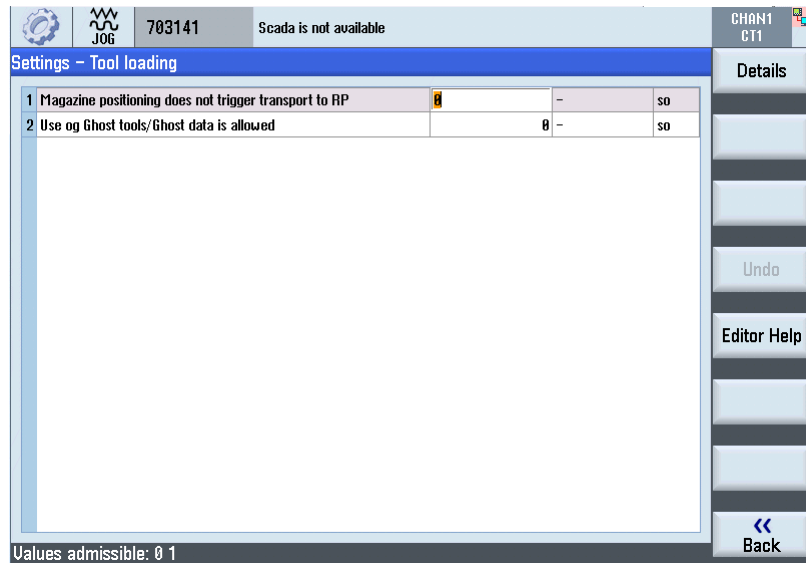


#### open



- Press the "open" softkey.
- ↳ The "Settings - Tool loading" window opens.

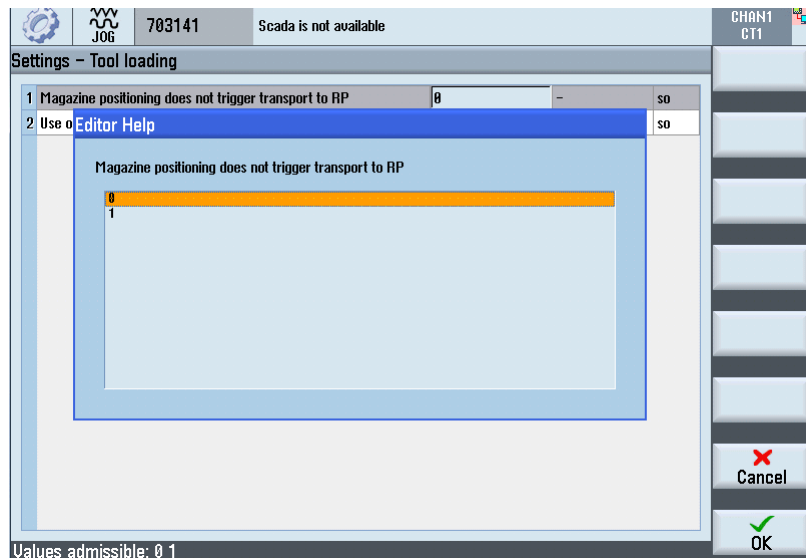
6 Tool systematics  
 6.2 Handling at the tool setting station



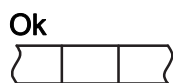
Select the settings you wish to change using the *Cursor keys*.



Press the "Editor Help" softkey.  
 ↵ The "Editor help" window is opened.



Select the desired parameter using the *Cursor keys*.



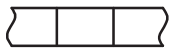
Press "Ok" softkey to accept the entry.

## 6.3 Loading, unloading tools

### 6.3.1 Loading tools with codechip

- Preconditions:
  - Tool setting station safety door locked.
  - Tool with described codechip is at setting station ready to load.

#### Parameter



- Press the "Parameter" softkey.
- ↪ The "Tool" area is opened.

#### Magazine



- Press the "Magazine" softkey.
- ↪ The "Magazine" list is opened.



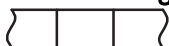
- Select a suitable empty magazine place using the *Cursor keys*.

Magazine													Kette_100			
Loc.	Type	Tool name	ST	D	D	F	H	M	O	U	o	u	W	Tool number		
18	<input checked="" type="checkbox"/>	1643	1	1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	54		Unload all
	<input checked="" type="checkbox"/>	1643	1	2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
	<input checked="" type="checkbox"/>	1643	1	3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
19	<input checked="" type="checkbox"/>	1661	1	1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	58		
	<input checked="" type="checkbox"/>	1661	1	2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
20					<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
21					<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
22					<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
23					<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
24					<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
25					<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
26					<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
27					<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
28					<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
29					<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
30					<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
31					<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
32					<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			
33					<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			



Observe the plate at the tool setting station for half-place assignment of tools. Large tools occupy more than one magazine place.

#### Position magazine



- Press the "Position magazine" softkey.
- ↪ The selected magazine place is positioned at the tool setting station. The safety door tool setting station is unlocked.
- Open tool loading station safety door.



## CAUTION

Danger of injury from sharp edges and centres.  
Wear protective gloves.

- Hold tool in a horizontal position and load firmly into the cartridge. Observe tool position.



For further information, refer to:  
"Loading tool in correct position" **page 255**

- ↩ The read operation commences.



The following error text is displayed: "Unable to load to place - remove tool, close safety door (found place: xx)"

- Insufficient half places available to load tool. (See sign on tool setting station). Remove the tool from the cartridge and close the safety door. An appropriate magazine place is automatically moved to the setting station.

### Reading operation correct...



- Observe *ACKNOWLEDGE TOOL* key.
- ↩ The codechip read process is executed.
  - Key lamp flickers during the read operation. (Wait until the reading process has finished. Otherwise, read process not correct).
  - Key lamp goes out once read operation ends.
  - Tool data are written to the buffer storage place "R" in the tool lists.
  - Read operation completed successfully.

**Reading operation incorrect...**



- Observe *ACKNOWLEDGE TOOL* key.
- The codechip read process is executed.
  - Key lamp flashes.
  - Read operation finished with errors.
  - Errors are displayed on the control panel.



- Remove tool from cartridge again.
- Tool is deleted from the tool list.
- If necessary, press and hold *ACKNOWLEDGE TOOL* key for more than 1.5 seconds.
- Errors with regard to tool loading are deleted.

- Rectify error and re-insert tool.
    - Repeat until the read operation completes successfully.
- 



- Close tool loading station safety door.
- Press the *SAFETY DOOR REQUEST TOOL MAGAZINE* key to lock the safety door.
- The setting operation is completed.
  - "Tool setting station safety door" key lamp extinguishes.
  - As soon as the machining operation permits movement of the magazine chain, the selected magazine place moves to the loading position of the chain-type magazine.
  - The inner tool setting station safety door is opened.
  - The tool holder of the chain is aligned for tool transfer.
  - The tool traverse attachment moves the cartridge with the tool into the transport chain of the magazine.
  - The inner tool setting station safety door is closed.
  - In the tool list, the tool in the buffer storage place "R" is written to the selected magazine place.

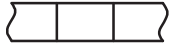
### 6.3.2 Unloading tools with codechip

- Preconditions:
  - Tool setting station safety door locked.

## 6 Tool systematics

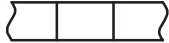
### 6.3 Loading, unloading tools

#### Parameter



- Press the "Parameter" softkey.
- The "Tool" area is opened.

#### Tool list



- Press the "Tool list" softkey.
- The tool list is displayed.



- Use the *Cursor keys* to select the tool you wish to unload.
  - Tools not located in the magazine appear at the start of the list with a magazine place number.

Tool list											Kette_100	Tool measure
Loc.	Type	Tool name	ST	D	Length	Radius	Tip angle	N	O	U	Max.-Speed	
14		1422	1	2	388.338	7.238	0.0					
		1431	1	1	511.571	0.000	0.0		1	1	0	
		1431	1	2	509.987	4.904	0.0					
15		1433	1	1	375.694	0.000	0.0			1	1	3000
		1433	1	2	373.929	4.544	0.0					
16		1435	1	1	254.151	0.000	0.0	0	1	1	0	
		1435	1	2	222.762	14.850	0.0	0				
17		1627	1	1	197.028	0.000	0.0			1	1	0
		1627	1	2	175.439	8.863	0.0					
		1627	1	3	148.760	8.850	0.0					
		1627	1	4	194.508	7.268	0.0					
18		1643	1	1	355.883	0.000	0.0			1	1	0
		1643	1	2	354.398	4.265	0.0					
		1643	1	3	290.893	6.000	0.0					
19		1661	1	1	596.653	0.000	0.0			1	1	0
		1661	1	2	595.073	4.749	0.0					
20												
21												

#### Unload



- Press the "Unload" softkey.
  - The unloading operation is executed.
    - As soon as the machining operation permits movement of the magazine chain, the selected magazine place moves to the unloading position of the chain-type magazine.
    - The inner tool setting station safety door is opened.
    - The tool holder of the chain is aligned for tool transfer.
    - The traverse attachment moves the cartridge with the tool from the transport chain of the magazine to the tool setting station.
    - The inner tool setting station safety door is closed.
    - In the tool list, the tool is written from the magazine place to the buffer storage place "R".
    - The safety door tool setting station is unlocked.
- Open tool loading station safety door.



## CAUTION

Danger of injury from sharp edges and centres.  
Wear protective gloves.



- Observe *ACKNOWLEDGE TOOL* key.
  - ↗ The data is written to the codechip.
    - Key lamp flickers during the write/read operation.
    - Key lamp flashes when the write/read operation finishes but the tool is still to be loaded.
- Take hold of the tool and at the same time push the pedal in front of the tool setting station with your foot.
  - ↗ The tool is released from the cartridge.
  - ↗ "Acknowledge tool" key lamp extinguishes.
  - ↗ The tool is deleted from the buffer storage place "R" in the tool list.



---

When the pedal is pushed, the tool is not released from the cartridge.

- Slide the tool setting station safety door to the left as far as it will go. Push the pedal again.
- 

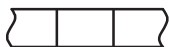


- Close tool loading station safety door.
- Press the *SAFETY DOOR REQUEST TOOL MAGAZINE* key to lock the safety door.
  - ↗ "Tool setting station safety door" key lamp extinguishes.

### 6.3.3 Loading tools without codechip

- Preconditions:
  - Tool is created in the tool list.
  - Tool setting station safety door locked.
  - Tool is at setting station ready to load.

Parameter

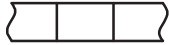


- Press the "Parameter" softkey.
  - ↗ The "Tool" area is opened.



6 Tool systematics  
 6.3 Loading, unloading tools

Tool list



- Press the "Tool list" softkey.
- The tool list is displayed.



- Use the *Cursor keys* to select the tool you wish to load.
  - Tools not located in the magazine appear at the end of the list without a magazine place number.

Tool list											NC memory
Loc.	Type	Tool name	ST	D	Length	Radius	Tip angle	N	O	U	Max.-Speed
97											
98											
99											
100											
		39	1	1	211.531	8.996	0.0	0	1	1	0
		1019	1	1	224.948	15.988	0.0	0	1	1	0
		101	1	1	88.600	0.000	0.0	0	1	1	5000
		102	1	1	260.000	0.000	0.0	0	1	1	5000
		104	1	1	260.000	0.000	0.0	0	1	1	2000
		105	1	1	0.000	0.000	0.0	0	1	1	2000
		1411	1	1	170.516	5.025	0.0	0	1	1	0
		1341	1	1	309.013	12.438	0.0	0	1	1	0
		1015	1	1	150.001	40.150		0	1	1	0
		1154	1	1	162.308	0.000	0.0		1	1	0
		1154	1	2	130.229	9.000	0.0				
		1155	1	1	162.345	0.000	0.0		1	1	0
		1155	1	2	129.730	7.500	0.0				

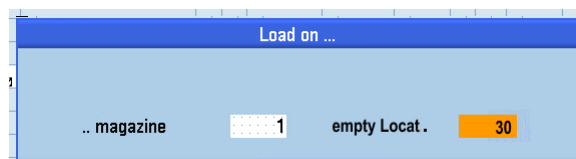


Observe the plate at the tool setting station for half-place assignment of tools. Large tools occupy more than one magazine place.

Load



- Press the "Load" softkey.
- "Load to..." window opens.



- The next possible, empty magazine place is suggested.
- If necessary, enter a different magazine place using the *Alphanumeric keys*.



Ok



- Press the "Ok" softkey.
- The selected magazine place is positioned at the tool setting station. The safety door tool setting station is unlocked.

- Open tool loading station safety door.



### CAUTION

Danger of injury from sharp edges and centres.  
Wear protective gloves.

- Hold tool in a horizontal position and load firmly into the cartridge. Observe tool position.



For further information, refer to:  
"Loading tool in correct position" **page 255**

- ↪ The tool is written to the buffer storage place "R" in the tool list and disappears at the end of the list.

- Close tool loading station safety door.



- Press the *SAFETY DOOR REQUEST TOOL MAGAZINE* key to lock the safety door.

- ↪ The setting operation is completed.
  - "Tool setting station safety door" key lamp extinguishes.
  - As soon as the machining operation permits movement of the magazine chain, the selected magazine place moves to the loading position of the chain-type magazine.
  - The inner tool setting station safety door is opened.
  - The tool holder of the chain is aligned for tool transfer.
  - The tool traverse attachment moves the cartridge with the tool into the transport chain of the magazine.
  - The inner tool setting station safety door is closed.
  - In the tool list, the tool in the buffer storage place "R" is written to the selected magazine place.

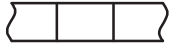
#### 6.3.4 Unloading tools without codechip

- Preconditions:
  - Tool setting station safety door locked.

## 6 Tool systematics

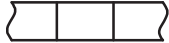
### 6.3 Loading, unloading tools

#### Parameter



- Press the "Parameter" softkey.
- The "Tool" area is opened.

#### Tool list



- Press the "Tool list" softkey.
- The tool list is displayed.



- Use the *Cursor keys* to select the tool you wish to unload.
  - Tools not located in the magazine appear at the start of the list with a magazine place number.

Tool list											Kette_100	Tool measure
Loc.	Type	Tool name	ST	D	Length	Radius	Tip angle	N	O	U	Max.-Speed	
14		1422	1	2	388.338	7.238	0.0					
		1431	1	1	511.571	0.000	0.0		1	1	0	
15		1433	1	1	375.694	0.000	0.0			1	1	3000
		1433	1	2	373.929	4.544	0.0					
16		1435	1	1	254.151	0.000	0.0	0	1	1	0	
		1435	1	2	222.762	14.850	0.0			0		
17		1627	1	1	197.028	0.000	0.0			1	1	0
		1627	1	2	175.439	8.863	0.0					
		1627	1	3	148.760	8.850	0.0					
		1627	1	4	194.508	7.268	0.0					
18		1643	1	1	355.883	0.000	0.0			1	1	0
		1643	1	2	354.398	4.265	0.0					
		1643	1	3	290.893	6.000	0.0					
19		1661	1	1	596.653	0.000	0.0			1	1	0
		1661	1	2	595.073	4.749	0.0					
20												
21												

#### Unload



- Press the "Unload" softkey.
  - The unloading operation is executed.
    - As soon as the machining operation permits movement of the magazine chain, the selected magazine place moves to the unloading position of the chain-type magazine.
    - The inner tool setting station safety door is opened.
    - The tool holder of the chain is aligned for tool transfer.
    - The traverse attachment moves the cartridge with the tool from the transport chain of the magazine to the tool setting station.
    - The inner tool setting station safety door is closed.
    - In the tool list, the tool is written from the magazine place to the buffer storage place "R".
    - The safety door tool setting station is unlocked.
- Open tool loading station safety door.



## CAUTION

Danger of injury from sharp edges and centres.  
Wear protective gloves.

- ☒ Take hold of the tool and at the same time push the pedal in front of the tool setting station with your foot.
- ↪ The tool is released from the cartridge.



---

When the pedal is pushed, the tool is not released from the cartridge.

- ☒ Slide the tool setting station safety door to the left as far as it will go. Push the pedal again.



- ☒ Close tool loading station safety door.
- ☒ Press the *SAFETY DOOR REQUEST TOOL MAGAZINE* key to lock the safety door.
- ↪ "Tool setting station safety door" key lamp extinguishes.  
The tool is unloaded from the magazine by data and now appears at the end of the tool list without a magazine place number.

## 6.4 Loading and unloading tool in special situations

### 6.4.1 Unloading tool and loading a different tool

Once you have unloaded a tool, you can immediately load another tool type to the cartridge at the tool setting station.

Preconditions:

- Tool setting station safety door is open and unlocked.
- After you have unloaded a tool, the empty cartridge is at the tool setting station. (The cartridge is pulled from the transport chain).
- The tool list is displayed.



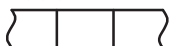
- Use the *Cursor keys* to select the tool in the magazine you wish to load.

Tool list											NC memory	Tool measure
Loc.	Type	Tool name	ST	D	Length	Radius	Tip angle	N	O	U	Max.-Speed	
97												
98												
99												
100												
	39		1	1	211.531	8.996	0.0	0	1	1	0	
	1019		1	1	224.948	15.988	0.0	0	1	1	0	
	101		1	1	88.600	0.000	0.0	0	1	1	5000	
	102		1	1	260.000	0.000	0.0	0	1	1	5000	
	104		1	1	260.000	0.000	0.0	0	1	1	2000	
	105		1	1	0.000	0.000	0.0	0	1	1	2000	
	1411		1	1	170.516	5.025	0.0	0	1	1	0	
	1341		1	1	309.013	12.438	0.0	0	1	1	0	
	1015		1	1	150.001	40.150		0	1	1	0	
	1154		1	1	162.308	0.000	0.0		1	1	0	
	1154		1	2	130.229	9.000	0.0					
	1155		1	1	162.345	0.000	0.0		1	1	0	
	1155		1	2	129.730	7.500	0.0					



Tools not located in the magazine appear at the start of the list with a magazine place number.

**Load**



- Press the "Load" softkey.  
 The magazine place already located at the setting station is displayed.



## CAUTION

Danger of injury from sharp edges and centres.  
Wear protective gloves.

- Insert tool into the correct position.



Complete tool loading as described in chapter "Tool loading without code carrier".

### 6.4.2 Performing visual inspection of tool without code chip

To determine the status of a tool, you can make a visual check at the tool setting station by removing and examining the tool.

Depending on the outcome of the examination, you can reload the same tool or replace it by an identical, new tool.

#### Parameter



#### Tool list



- Preconditions:
  - Tool setting station safety door locked.
- Press the "Parameter" softkey.
  - ↩ The "Tool" area is opened.
- Press the "Tool list" softkey.
  - ↩ The tool list is displayed.
- Use the *Cursor keys* to select the tool in the magazine you wish to examine.
  - Tools not located in the magazine appear at the start of the list with a magazine place number.

## 6 Tool systematics

### 6.4 Loading and unloading tool in special situations

Tool list											Kette_100	Tool measure
Loc.	Type	Tool name	ST	D	Length	Radius	Tip angle	N	O	U	Max.-Speed	
14	✓	1422	1	2	388.338	7.238	0.0					
	✓	1431	1	1	511.571	0.000	0.0			1	1	0
	✓	1431	1	2	509.987	4.904	0.0					
15	✓	1433	1	1	375.694	0.000	0.0			1	1	3000
	✓	1433	1	2	373.929	4.544	0.0					
16	✓	1435	1	1	254.151	0.000	0.0	0	1	1	0	
	✓	1435	1	2	222.762	14.850	0.0	0				
17	✓	1627	1	1	197.028	0.000	0.0			1	1	0
	✓	1627	1	2	175.439	8.863	0.0					
	✓	1627	1	3	148.760	8.850	0.0					
	✓	1627	1	4	194.508	7.268	0.0					
18	✓	1643	1	1	355.883	0.000	0.0			1	1	0
	✓	1643	1	2	354.398	4.265	0.0					
	✓	1643	1	3	290.893	6.000	0.0					
19	✓	1661	1	1	596.653	0.000	0.0			1	1	0
	✓	1661	1	2	595.073	4.749	0.0					
20												
21												

#### Unload



- Press the "Unload" softkey.
- The unloading operation is executed.
  - As soon as the machining operation permits movement of the magazine chain, the selected magazine place moves to the unloading position of the chain-type magazine.
  - The traverse attachment moves the cartridge with the tool from the transport chain of the magazine to the tool setting station.
  - The inner tool setting station safety door is closed.
  - In the tool list, the tool is written from the magazine place to the buffer storage place "R".
  - The safety door tool setting station is unlocked.
- Open tool loading station safety door.



### CAUTION

Danger of injury from sharp edges and centres.  
Wear protective gloves.

- Remove the tool.
- Check the tool.

---

**Continue to use used tool. No tool change required...**

- Hold the same tool in a horizontal position and load firmly into the cartridge.
  - ↻ The data for the tool are not changed in the tool list.  
"Acknowledge tool" key lamp flashes.
  - Close tool loading station safety door.
  - Press the *SAFETY DOOR REQUEST TOOL MAGAZINE* key to lock the safety door.
  - ↻ The visual inspection is completed.
    - "Acknowledge tool" key lamp extinguishes.
    - "Tool setting station safety door" key lamp extinguishes.
    - As soon as the machining step allows the magazine to move, the tool is carried via the traverse attachment to the original magazine place.
    - In the tool list, the tool is written from buffer location "R" to the magazine place.
- 


**Insert new tool. Tool change required...**

- Hold the same, new tool in a horizontal position and load firmly into the cartridge.
- ↻ The data for the tool are not changed in the tool list.  
"Acknowledge tool" key lamp flashes.
- Close tool loading station safety door.
- Press the *ACKNOWLEDGE TOOL* key.
- ↻ In the "Tool wear" list the following parameter values are changed:
  - the values for tool life and/or number of items are set to the setpoint values.
  - the wear values are set to "0".
  - "SBBK" reference value is set to "0". (optional)
- ↻ The tool will be disabled if necessary.
- ↻ "Acknowledge tool" key lamp extinguishes.







- ☒ Press the *SAFETY DOOR REQUEST TOOL MAGAZINE* key to lock the safety door.
  - ↩ The visual inspection is completed.
    - "Acknowledge tool" key lamp extinguishes.
    - "Tool setting station safety door" key lamp extinguishes.
    - As soon as the machining step allows the magazine to move, the tool is carried via the traverse attachment to the original magazine place.
    - In the tool list, the tool is written from buffer location "R" to the magazine place.
- 

### 6.4.3 Loading tool with code chip without write/read operation

In special cases, if the codechip is absent or faulty for example, tools can to be loaded without the write/read process.

#### 6.4.3.1 Deactivating the reading/updating code carrier function

If the code carrier is not to be read or updated during tool loading, you have to activate corresponding functions.

To do so, there are general functions available in the "Settings" menu. In addition, it is possible to deactivate the reading process for individual tools in the tool list.

#### "Tool coding" settings

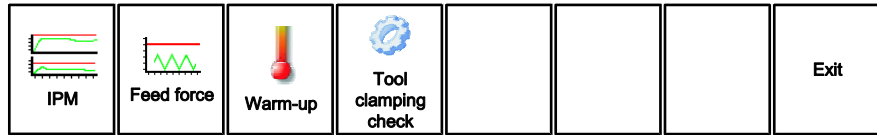
The setting made in the "Tool coding" menu generally apply to all tools within the machine. These settings remain in force even after a machine restart and must be reset.



- ☒ Press *Data menu key*.



- Press the *etc.* key.
- ↳ The "Settings" softkey is displayed.



Settings



- Press the "Settings" softkey.
- ↳ The "Settings" window will be displayed.



- Select the "tool coding" line using the *Cursor keys*.

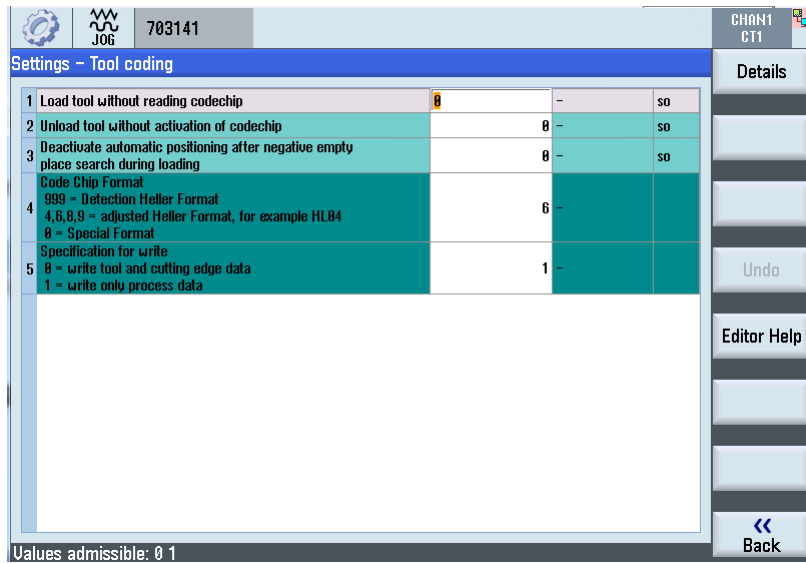


open



- Press the "open" softkey.
- ↳ The "Settings - tool coding" window is opened.

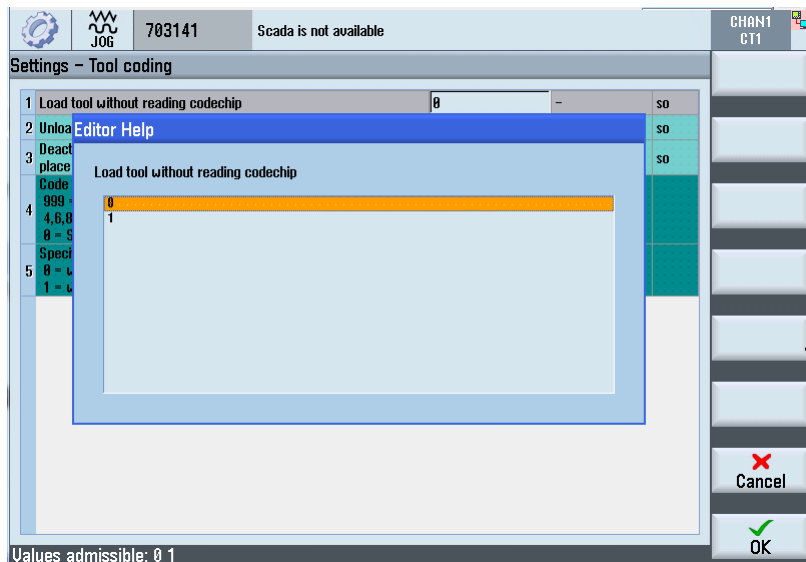
6 Tool systematics  
 6.4 Loading and unloading tool in special situations



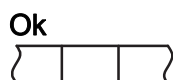
Select the required function using the *Cursor keys*.



Press the "Editor Help" softkey.  
 The "Editor help" window is opened.



Use the *Cursor keys* to select parameter "1" in order to activate the function or select parameter "0" to deactivate the function.



Press "Ok" softkey to accept the entry.

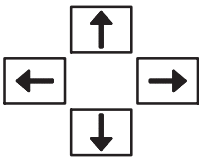
### Setting parameter "CT"

If a certain tool is to be excluded from the read process during loading, parameter "CT" must be activated in the OEM data tool list. The reading process is executed for all other tools.

#### Parameter



#### OEM tools



- ☒ Press the "Parameter" softkey.
- ☞ The "Tool" area is opened.
  
- ☒ Press the "OEM tools" softkey.
- ☞ The "OEM tools" list is opened.
  
- ☒ Use the *Cursor keys* to select the "CT" parameter of the tool which is to be excluded from reading the code carrier during loading.
  
- ☒ Set parameter "CT".
- ☞ No read process is executed during the loading of these tools.

Tool data OEM										WZ-Zwischenspeic...		
Loc.	Type	Tool name	ST	D	C	O	I	SBBK Ref	CTCA	Sort	Filter	Search
		GR1										
		GR2										
		BP										
		R										
1		1009	1	1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.000	<input checked="" type="checkbox"/>			
2		1033	1	1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.000	<input checked="" type="checkbox"/>			
3		1042	1	1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.000	<input checked="" type="checkbox"/>			
4		1149	1	1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.000	<input checked="" type="checkbox"/>			
		1149	1	2								
		1149	1	3								
		1149	1	4								
5		1230	1	1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.000	<input type="checkbox"/>			
		1230	1	2								
		1230	1	3								
		1230	1	4								
6		1235	1	1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	0.000	<input type="checkbox"/>			
		1235	1	2								

### 6.4.4 Loading ghost tools

#### Application

Depending on the expansion stage of the machine, it may be useful to simplify the loading operation by loading "ghost tools". This especially accelerates the loading process significantly.

"Loading of ghost tools" simplifies the loading operation when the following preconditions have been fulfilled:

- The machine is equipped with the standard operating unit at the tool setting station.
- The tools are **not** equipped with code carriers.
- Several tools are to be loaded one after the other.



To use the "Loading of ghost tools" function, you need to activate it. See also:

"Settings - loading tools" **page 257**



Risk of collision from incorrect handling during tool loading.

Loading of ghost tools may only be performed by trained personnel. Damage to tools and machine to be expected.

#### Preconditions

- The tools are at the setting station ready to load.
- The "magazine" list is open.



Further information on "magazine" list, see Chapter "Magazine list" **page 291**

### Loading ghost tools by data

#### Preconditions:

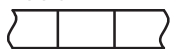
- Tools are created in the tool list.
- The tool list is opened.



#### Use the *Cursor keys* to select the tool you wish to load by data.

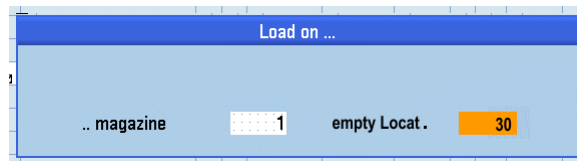
- Tools not located in the magazine have no magazine place number in the tool list.

#### Load



#### Press the "Load" softkey.

↗ "Load to..." window opens.



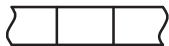
↗ A magazine place is suggested.

## i

The control considers the envelope contour of the tool and proposes a suitable magazine place based on the data entered. The proposed magazine place can be overwritten, but the envelope contour must, however, be taken into account.

- Make a note of the magazine place to which the tool was loaded by data.
- Press the "Ok" softkey.
- ↗ The tool is loaded by data.
  - The tool is written to the relevant magazine place in the tool list and disappears at the end of the list.
  - "0" remains in the "magazine" list in column "W" of the magazine place. Thus, it becomes apparent that no tool is located on this magazine place.
- Repeat the procedure until all ghost tools have been loaded by data.

Ok



### Use of ghost tools

- Preconditions:
  - Tool setting station safety door is closed and locked.
  - The tools are at the setting station ready to load.
  - The "magazine" list is open.



Further information on "magazine" list, see Chapter "Magazine list" **page 291**



- Press the *TOOL MAGAZINE DOWN* key on the standard operating unit of the tool setting station until a magazine place that is only loaded by data is at the setting station.
  - To do this, refer to your notes.

## 6 Tool systematics

### 6.4 Loading and unloading tool in special situations



Risk of collision resulting from incorrect magazine place assignment.

Only load tools to free magazine places. A magazine place may also be occupied when there is no tool on the magazine place.

- The place is a return location for the spindle tool.
- The place is occupied by the envelope contour of the adjacent tool.

Check the the "magazine" list for this.



Observe section



- Press the *SAFETY DOOR REQUEST TOOL MAGAZINE* key.

↪ Safety door is unlocked.

- Open safety door.

- Insert the tool corresponding to the data.

↪ The following error text is displayed: "Ghost tool inserted or removed, check required"

"1" is entered in the "magazine" list in column "W" of the magazine place. That makes it obvious that only one tool is located on this magazine place.

**i**

If you wish to insert a tool on a place that is already occupied, the error message "Magazine place already occupied" is displayed.



For further information on tool loading refer to Chapter "Loading tool without code chip".

- Close and lock the safety door.

- Repeat the procedure until all ghost tools have been inserted.

### Check tool magazine

After inserting ghost tools, it must be ensured that the corresponding data is available for each tool in the magazine or a tool has been inserted for all the tool data. The "Check ghost tools" function is provided for this purpose.

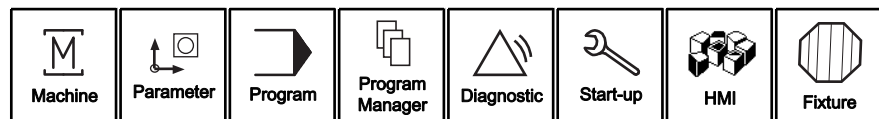
At the next tool provisioning all magazine data are compared to the "Tool present" bit. In case of a deviation, a corresponding error message is output.



- Press the *Setup* key.
- ↪ The machine is removed from the system linkage.  
Setup mode is activated.



- With *Data menu key* call up the basic menu on the main operator panel.



#### Manual Mode



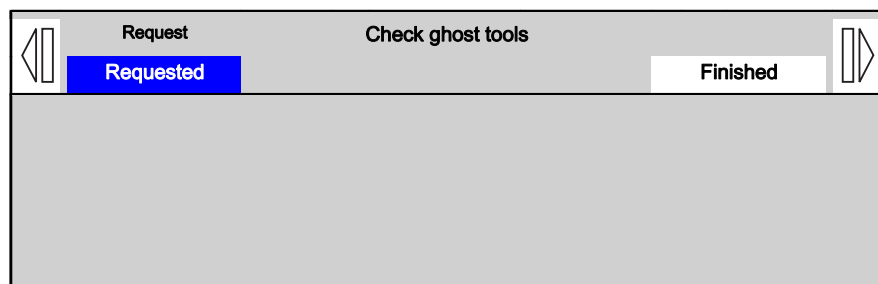
- Press lower horizontal softkey "Manual Mode".
- ↪ The menu of the "Hand functions" area is opened.

The available HMI screens for the individual functions are displayed in the upper horizontal softkey bar.

#### Tool changer



- Press upper horizontal softkey "Tool changer".
- ↪ The first page of the "Tool changer" HMI screen is opened.
- Scroll to page 3 in the "Tool change" menu and trigger the "Check ghost tools - request" function.



- ↪ At the next tool provisioning the tool data of the magazine are compared to the "Tool present" bit.
- ↪ If inconsistencies are detected in the magazine, the following error message is output:



6 Tool systematics  
6.4 Loading and unloading tool in special situations

---

"Tool data absent or tool not inserted (place: xx). Magazine movement disabled."

- Rectify errors in the magazine if needed and again execute the "Check ghost tools" function.



For further information on executing individual functions, refer to "Initiating individual functions" **page 302**

## 6.5 Tool data management

### 6.5.1 Fundamental principles

#### Lists for managing the tools

The lists in the tool area show all tools and, if configured, also all magazine places, which have been created and/or configured in the NC.

All lists show the same tools in the same order. On toggling between the lists, the cursor remains on the same tool in the same image section.

The lists differ in the displayed parameters and the softkey assignment. Toggling between the lists is a systematic movement from one area to the next.

#### Tool list

All parameters and functions for creating and setting tools are displayed.

#### Tool wear

Located here are all parameters and functions that are required during operation, e.g. wearing and monitoring functions.

#### OEM tool data

This list is available to the OEM for free design.

#### Magazine

Located here are the magazine-related and/or magazine place-related parameters and functions for the tools/magazine places.

#### Handling the lists

#### Context-sensitive Help

Irrespective of which tool you select in the list, the corresponding data for this line will be displayed.

This means, for example, that a column for the point angle is available for a drill or a second radius can be entered for a milling cutter.

The meaning of the individual columns will be displayed when you select the field concerned.

### Geometric data

If a further tool is to be included in or deleted from the lists, you must do this in the tool list. A tool created in the tool list will automatically appear in all further lists. The tool list contains all geometry data.

Tool wear data can be found in the "Tool wear" list.



For a description of the individual lists, see next Chapter.

Further geometric data can be displayed in the lists using the scrollbar at the bottom of the screen.

Unit of geometric data is mm, resolution 0.001 mm (= 1 µm)

### Edit geometric data

Most data can be edited in the lists themselves. To do this, use the *Cursor keys* to select the required value and enter the new value with the *Alphanumeric keys*.

The new value will be accepted as soon as you exit the selected fields with the *Cursor keys*.

## 6.5.2 Tool list

All relevant geometry and handling data of tools are managed in the tool list.

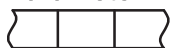
Handling data such as envelope contour or speed of changing are needed by the system module to enable size-related position assignment and to carry out tool transport without collisions.

### Calling-up tool list



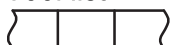
- Press *Data menu key* to call-up the machine's basic menu.

#### Parameter

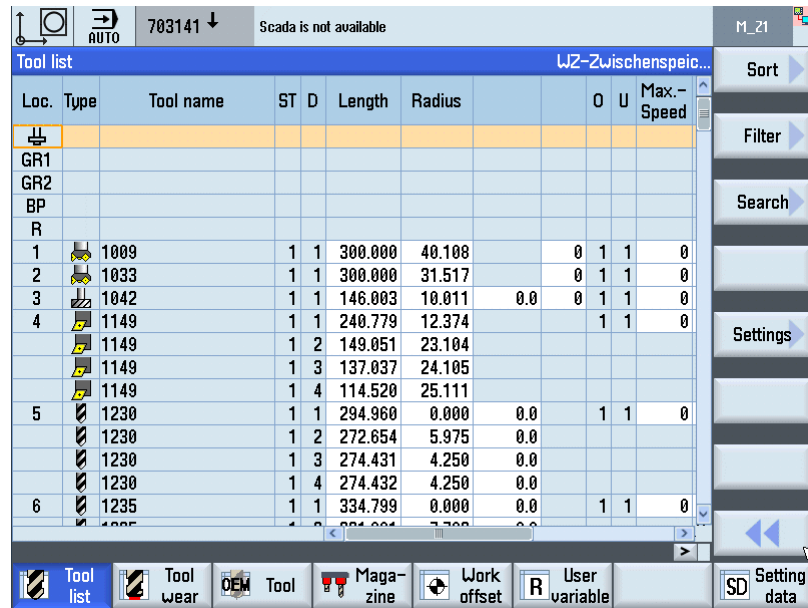


- Press the "Parameter" softkey.
- ↵ The "Tool" area is opened.

#### Tool list



- Press the "Tool list" softkey.
- ↵ The "Tool list" window is opened.



Actual display may differ.

### Parameters

Column heading	Explanation
Loc.	Magazine place number
Type	Tool type (shown as symbol).
Tool name	Tool name, for identification of the tool.
ST	Sister tool number (for sister tool strategy)
D	Edge number, D = 1, 2, etc.
Length	Tool length, geometric data, length
Radius	Half tool diameter
	Tip angle and/or pitch with some tool types.
O	Half-places upwards (1, 2, 3 or 4)
U	Half-places downwards (1, 2, 3 or 4)
Max.-Speed	Max. speed
HL	Envelope contour, tool diameter
HD	Envelope contour, tool diameter
HH	Envelope contour, tool height
WG	Change speed
SBBK	Fast drill break monitoring
A	Active tool.
P	Tool has fixed-place coding.
Pi	Pick-up tool
PI	Facing slide tool

### Softkey "Magazine selection"

The softkey "Magazine selection" is used to navigate between the NC memory, tool buffer and the chain.

#### 6.5.2.1 Creating new tool in the tool list

- The "tool list" window is open.



For further information on handling the tool list, see

#### Select magazine



- Press the right softkey "Select magazine" until "NC memory" is displayed in the tool list header.
- ↵ This prevents automatic tool transport to the tool setting station being triggered.

#### New tool



- Press the right softkey "New tool".
- ↵ The right menu bar changes its assignment.

#### Favorites



- Press the right softkey "Favorites".
- ↵ The "New tool - favorites" window opens.

- Select the required tool type from the right menu bar.
  - "Cutters 100-199"
  - "Drill 200-299"
  - "Spec. tool 700-900".

#### Ok



- Press the "Ok" softkey.
- ↵ The selected tool type will be transferred to the tool list. The tool will be displayed as a symbol in the "Type" column in all lists.
- The the tool name if necessary.
- Enter the required geometric data. (See parameters described below.)

### Defining place coding

Column P in the tool list can be used to specify either variable or fixed place coding for each tool.

Column P	Explanation
Checked = active	Tool with fixed place coding
Unchecked = inactive	Tool is variable



It is generally required to mark the column "P" for "Tool at fixed location".

Exception: the machine is fitted with the "variable place coding" option. In this case, combinations can be selected in column "P".

Place coding can be set to active or inactive in the tool list and also, in the loaded state, in the magazine list.

### Specify changing speed

The tools must not exceed the specified weights and moments of weight. The tool changer may run with heavy tools only at reduced change speed.

Abbreviation	Explanation
WG	0: normal
	1: slow



See also General layout and Technical data. The documents always appear in the chapter headed "Drawings, Plans" in the Machine Operator Manual (BD).

### Maximum speed

Value	Explanation
= 0	The machine limit speed applies
> 0 < spindle limit speed	The set date applies
> spindle limit speed	The machine limit speed applies



See Chapter

### Specify envelope contour

Tools may occupy more than one magazine place. In order to define the place assignment for a tool within the magazine, you have to determine the half-place assignment for the tool by means of the tool's envelope contour.

Envelope contour and parameters for the half-place assignment must be entered into the tool list.

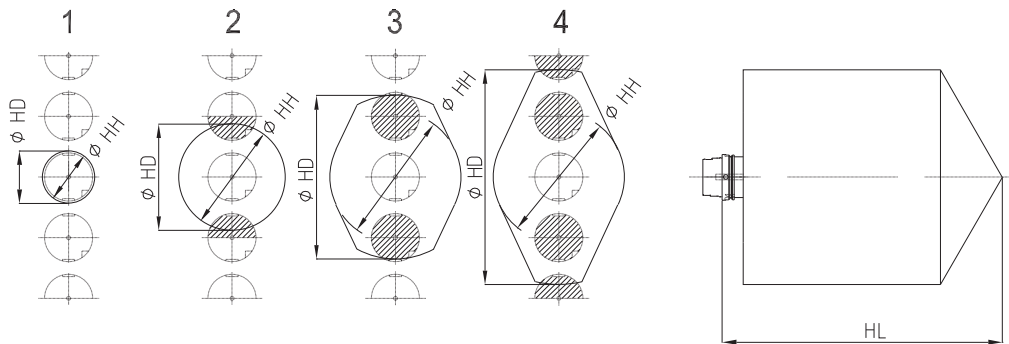


Risk of collision resulting from incorrect handling data.

Damage to tools and machine to be expected.

Enter handling parameters carefully and in full. In case of doubt, check and re-measure.

Observe the plate at the tool setting station.



6.5.2.1 - 1 4 possible situations for the half-place assignment

**Envelope contour**

Abbreviation	Designation	Remarks
HD	Tool diameter	HD corresponds to the diameter of the rotating tool. The smallest tool occupies one half-place to the top and one half-place to the bottom.
HL	Tool length	
HH	Tool height	required only for non-rotation symmetrical tools

**Half-place assignment**

Abbreviation	Designation	Remarks
O	Half-place to the top	Enter figure "1" for the smallest tool and "4" for the largest tool.
U	Half-place to the bottom	



With the "Code carrier" option, half-place assignment is automatically calculated by means of the envelope contour.

Handling data must be changed while the tools are in the magazine. The envelope contour is entered in mm, resolution 0.001mm (= 1µm).



For further information, refer to section:

### 6.5.3 Tool wear list

Cutting tip-related monitoring data are managed in the "Tool wear list".

Tools and cutting edges that are used for long periods wear and become unusable. This wear is measured in trial runs and entered into the tool wear list. The control then uses these data to calculate tool lengths and/or radius correction. This achieves consistent precision during workpiece machining.

#### Calling up the "Tool wear" list

- Preconditions:
  - The "Parameter" main menu is opened.
- Press the "Tool wear" softkey.
- The "Tool wear list" is opened.

Tool wear





## 6 Tool systematics

### 6.5 Tool data management

Loc.	Type	Tool name	ST	D	ΔLength	ΔRadius	T	C	M
GR1									
GR2									
BP									
R									
1	1009		1	1	0.000	0.000	C	150	1 150
2	1033		1	1	0.000	0.000	C	100	1 100
3	1042		1	1	0.000	0.000	C	300	1 300
4	1149		1	1	0.000	0.000	C	200	1 200
	1149		1	2	0.000	0.000		200	1 200
	1149		1	3	0.000	0.000		200	1 200
	1149		1	4	0.000	0.000		200	1 200
5	1230		1	1	0.000	0.000	C	150	1 150
	1230		1	2	0.000	0.000		150	1 150
	1230		1	3	0.000	0.000		150	1 150
	1230		1	4	0.000	0.000		150	1 150
6	1235		1	1	0.000	0.000	C	250	1 250

Actual display may differ.

#### Parameters

Column heading	Explanation
Loc.	Magazine place number
Type	Tool type (shown as symbol).
Tool name	Tool name, for identification of the tool.
ST	Sister tool number (for sister tool strategy)
D	Edge number, D = 1, 2, etc.
Δ Length	Wear length
Δ Radius	Half diameter wear
TC	At the time of first use: Input whether tool life (=T) or no. of tool duty cycles (=C). The columns given below are shown.
Life time / Quantity	Current tool life of the tool in minutes / Current number of duty cycles of the tool
Set value	Designation of the reference value for tool life or number of duty cycles.
Prewarn. limit	Pre-warning limit: Designation of the tool life or number of duty cycles, at which a warning is issued.
M	Tool calibrated.
W	Pre-warning limit reached.
IPM1	Tool monitoring via break method.
IPM2	Tool monitoring via overload method.

## i

The tool wear data can also be called-up directly in the "HMI" main menu ("Tools - Wear" menu).

### Softkey "Reactivate"

You can use the "Reactivate" softkey to reset individual edge wear values to the setpoint. Select the required tip using the *Cursor keys* and press the "Reactivate" softkey.

If the tool is disabled due to the wear values for this tip, it will now be released.

**i**

In the case of machines with a tool magazine, the softkey is of less importance, since the corresponding wear values are reset automatically (to the reference value for tool life/number of duty cycles), when new tools are loaded.

#### 6.5.4 OEM data tool list

The user-related tool data for the tools are managed in the "OEM tools" list.

The special codes for tool handling via the control are entered into this list.

#### Retrieving OEM data tool list

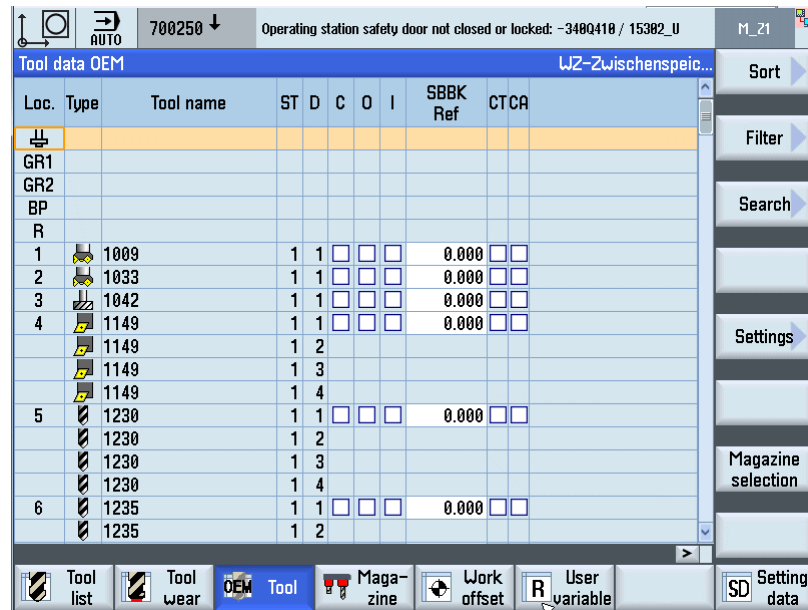
- Preconditions:
  - The "Parameter" main menu is opened.
- Press the "OEM tools" softkey.
- The "OEM tools" list is opened.

OEM tools



## 6 Tool systematics

### 6.5 Tool data management



Actual display may differ.

#### Parameters

Column heading	Explanation
Loc.	Magazine place number
Type	Tool type (shown as symbol).
Tool name	Tool name, for identification of the tool.
ST	Sister tool number (for sister tool strategy)
D	Edge number, D = 1, 2, etc.
C	Tool is being changed.
O	Tool is selected for unloading.
I	Tool is selected for loading.
SBBK Ref	Reference value for fast tool break monitoring active.
CT	Tool with codechip.
CA	Tool with codechip: Update all data.

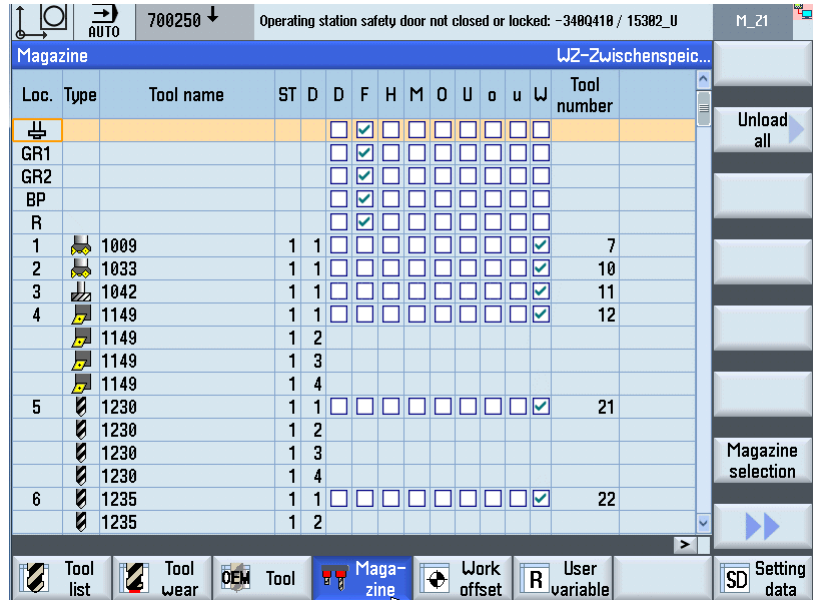
#### 6.5.5 Magazine list

##### Calling up the "Magazine" list

- Preconditions:
  - The "Parameter" main menu is opened.



- Press the "Magazine" softkey.
- The "Magazine" list is opened.



Actual display may differ.



To avoid errors, the last magazine place must always be disabled. This means that parameters "G" (disabled) and "F" (magazine place not occupied) must be selected.

Parameters

Column heading	Explanation
Loc.	Magazine/place number The magazine number is stated first and then the place number in the magazine. Only the place number is shown for a chain-type magazine.
Type	Tool type (shown as symbol).
Tool name	Tool name, for identification of the tool.
ST	Sister tool number (for sister tool strategy)
D	Edge number, D = 1, 2, etc.
G	Tool pocket is disabled.
F	Magazine place not occupied.
Z	Magazine place is reserved for buffer.
B	Place is reserved for tool to be loaded.
O, o	Top half place is occupied by a top neighbouring tool
U, u	Bottom half place is occupied by bottom neighbouring tool
W	
Tool number	

### Half-place assignment of tools

Large tools occupy more than one magazine place. The "Magazine" list reflects for example parameters for the envelope contour and the half-place assignment entered in the tool list.

The assignment of magazine places in the "Magazine" list is shown below and described based on examples:



See section



Also observe the plate at the machine setting station.

### Tool is located in the magazine

As an example, the display is explained by means of the tools on place 5 and place 11:

Loc.	Type	Tool name	ST	D	G	F	Z	B	O	U	o	u	W	Tool number				
4						X			X	X								
5		Milling cutter xx	1	1										1	1	3	3	X
6						X			X	X								
10						X				X								
11		Drill	1	1										1	1	2	2	X
12						X			X									

#### Milling cutter on place 5

The milling cutter takes up 3 places.

- Place 5 is an occupied place where the tool is actually located.
- Second and third occupied place:
  - The tool projects over places 4 and 5. These places are displayed as follows:
  - Columns "O" and "U" are ticked, because the milling cutter protrudes over two half-places.
  - The column "F" is ticked because no tool is located on these places in terms of data.

#### Drill on place 11

The drill takes up 2 places.

- Place 11 is an occupied place where the tool is actually located.
- The tool projects one half-place each over places 10 and 12:
  - The drill projects over the lower half of place 10, therefore column "U" is ticked.
  - The drill projects over the upper half of place 12, therefore column "O" is ticked.
  - The column "F" is ticked in places 10 and 12 because no tool is located on these places in terms of data.

**The tool is located inside the spindle or at the provisioning place**

When the tool is placed inside the spindle or moved to the provisioning place, the place in the magazine must be kept free. Half-places must be taken into consideration:

Loc.	Type	Tool name	ST	D	G	F	Z	B	O	U	o	u	W	Tool number					
4						X					X	X							
5		Milling cutter xx	1	1		X	X							1		1	3	3	X
6						X					X	X							

The tool on place 5 has been placed into the spindle. The place is kept empty for intermediate storage.

- Column "Z" is ticked.
- The column "F" is ticked because no tool is located on the place.

To indicate that the relevant half-places need to be kept free, columns "o" and "u" are ticked.



Observe the context-sensitive help in columns "O", "U", "o" and "u" in order to avoid mistakes.

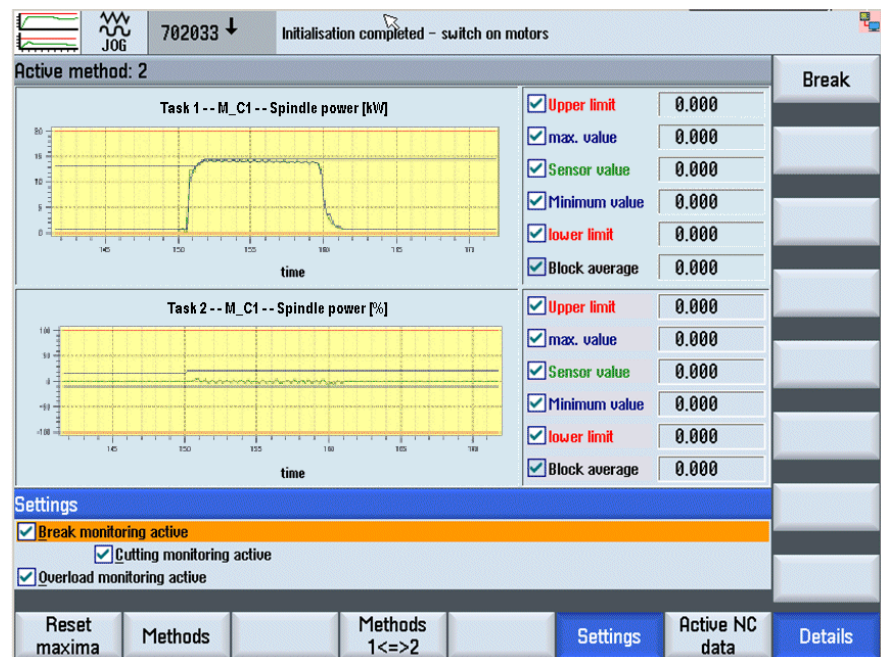
## 6.6 Integrated tool monitoring

Integrated Process Monitoring (IPM) is a dynamic addition to the existing standard procedure in connection with tool management.

IPM allows you to detect tool overloads early, thereby avoiding tool fracture and all the consequential damage to machine and tool.

To achieve this aim, the IPM area, with which freely parameterisable monitoring methods can be generated, has been developed.

By pressing the "IPM" softkey from the extended basic menu, tool monitoring is called up.



For more information, see separate Operator Information **BI.000225-EN/ES**.

## 6.7 Fast drill break monitoring

### 6.7.1 General:

#### Activate SBBK

If a tool is to be measured using "Fast tool break monitoring", the parameter for the "fast tool break monitoring" must be entered into the tool list after the tool has been loaded into the magazine. This activates "Fast tool break monitoring" for this tool.

#### Principle of operation

Before the first tool is loaded, a reference measurement is taken at the provisioning place. The determined value is entered into the "OEM tools" list against the "SBBK" parameter.

Each time the tool is loaded, a measurement is taken and then compared to the reference value.



See list  
"Tool list" **page 283**

#### Break detection

The "Fast tool break monitoring" option allows tools to be checked for breakage during a tool change. Only complete broken tools are detected, not breaks in individual cutting tips. Length changes of 2 mm and more (tolerance), which may result in a tool break, are detected.

#### Measuring principle

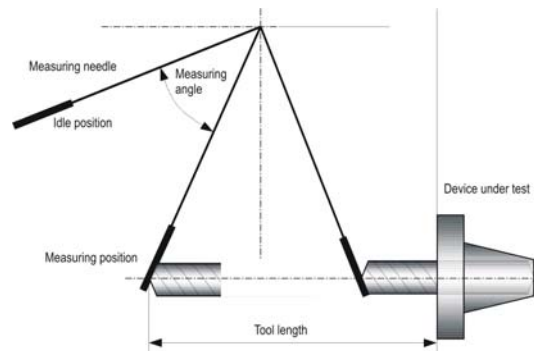
Measuring is carried out "mechanically" by scanning the tool with a measuring needle. During the measuring process, the tool is located in the provisioning place.

The measuring needle moves at maximum speed out from the idle position towards the measuring angle (see diagram). The measuring angle to be approached is derived from the determined reference value of the tool, to which a tolerance value is applied. Before the tool is scanned, the speed is reduced.



## 6 Tool systematics

### 6.7 Fast drill break monitoring



To prevent a waiting period occurring during measuring, the traverse movement can be triggered at the next machining position as early as the tool change.

**Tools up to 5 mm diameter**

Boring tools with the following geometric data can be tested:

- Tool length: 70 mm to 600 mm
- diameter: 1 mm to 5 mm
- Point angle: up to 118°

With these geometric data, a length change of 2 mm or more is reliably detected and any break event is ascertained.

## Application

### Supplement to IPM

The "Fast tool break monitoring" option supplements the online monitoring facility "Integrated Process Monitoring (IPM)". This enables the checking of tools, which due to their low performance/torque and/or feed power can no longer be reliably recorded by the "IPM".

### Optimised for time-critical NC machining

Fast tool break monitoring is intended particularly for time-critical NC machining, which involves predominantly those tools listed below.

### Suitable for the monitoring of: ...

The following tool types can be monitored particularly effectively with the "Fast tool break monitoring" option.

- Drilling tools diameter up to 5 mm, e.g.
  - HSS drills
  - Coated drills
  - Solid carbide drills
  - Step drills
- Tap up to M6

Tool fracture monitoring on tools with a diameter greater than 5 mm may only be included in the monitoring option following consultation with HELLER.

**In combination with an alternative strategy**

Fast tool break monitoring can of course be combined with the alternative strategy (option), which reacts appropriately to a tool break without parts machining coming to a halt.

# CHAPTER 7

---

Operation in setup mode

## 7 Operation in setup mode

### 7.1 Set-up mode

#### 7.1.1 Fundamental principles

##### Target group

The Chapter entitled "Operation in case of malfunction and maintenance" is intended first and foremost for error correction and is aimed at the machine operators and also at the service and maintenance personnel. Knowledge of operation during production is a precondition. It is also an advantage to have an exact knowledge of the machine concept and sequences and to have experience of problem solving.

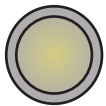
The machine must be operated only by trained personnel.

The safety rules in Chapter 2 of this Operator Manual must be strictly observed!



When the machine is switched on, fatal injuries may occur if persons are accidentally trapped in the machine. Before closing and locking the safety or maintenance doors, make sure nobody is in the danger zone.

AUTOMATIC  
MODE



#### **AUTOMATIC MODE**

For setup and troubleshooting activities, the safety doors are normally closed and locked:

This mode is activated by pressing the key *AUTOMATIC MODE* on the machine function operator panel. The associated key lamp lights up.

##### HMI screens

#### **Main menu "Hand functions"**

The chapter focuses on the operation of the machine components in the "Hand functions". main menu Machine operating mode "Setup" is the precondition for manual operation with individual functions.

The following machine areas can be manually controlled and their statuses queried:

- **TC:** Tool change
- **WPC:** Workpiece change (Clamp, unclamp fixture, workpiece change position).
- **Add. functions:**
  - **Safety doors:** workpiece sitting station, loading hatch, media supply, tool setting station.
  - **Acknowledg.:** HT8 focus change, reset machining depth, location check, workpiece automation - perform test grip.
  - **General:** Work area illumination, measure workpiece, manual loading, manual test stop (brake test)
- **Service fct.:**
  - **IBN-I:** Release motor brake, switch off collision monitoring.
  - **IBN-II:** Start/stop spindle, rapid traverse reduction, backup data modules
  - **KM times1:** Coolant times 1

### Main menu "Diagnostics"

The projected HMI screens are described briefly in this chapter.

- **History:** Alarm History
- **PB/PN Diag.:** Profibus/Profinet diagnosis
- **Alarms**
- **Messages**
- **Diag. TCP/IP**
- **WSSP:** Workpiece clamping system

Depending on the components used, the control system can contain several alarm systems, which are all handled via the alarm server. Just like, for example, SINUMERIK uses the standard alarm system via DB2 or the ProAgent Diagnostics as its own alarm system, an HMI-specific system is also provided for alarms and messages.

#### 7.1.2 Calling up individual functions

- The machine is stationary: "NC-start" lamp does not illuminate

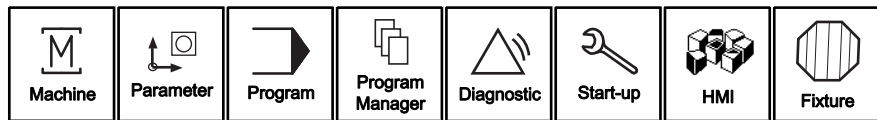
- ☑ Preconditions:
  - Drives and media switched on.
  - Safety doors closed and locked.
  - Machine in linked mode (OP AUTO).
  - Access rights granted (EKS key).



- ☑ Press the *Setup* key.
- ↪ The machine is removed from the system linkage. Setup mode is activated.



- ☑ With *Data menu key* call up the basic menu on the main operator panel.



HMI



- ☑ Press the "HMI" softkey.
- ↪ The "Setup functions to HMI Standard" menu item appears.

Man.funct.



- ☑ Press lower horizontal softkey "Man.funct.".
- ↪ The menu of the "Manual functions" area is opened.

The available HMI screens for the individual functions are displayed in the upper horizontal softkey bar.

Call up the required HMI screen by pressing the relevant softkey.

The corresponding HMI screen is displayed.

### 7.1.3 Initiating individual functions

Structure

The HMI screens for the individual functions on the main operator station are setup in tabulated format. The centre column first shows six functions. Further individual functions are accommodated on a second screen page, which you can call up using the *Page up* key.

The corresponding statuses are displayed in the left and right-hand columns. The selected status is achieved.

Select the required movement using the assigned softkeys on the left and right.

Forwards	Tool change system	reverse
	99	in home position
open	Tool change door	close
opened		closed
To spindle	Tool gripper rotated 90°	to home position
on spindle		in home position
unclamp	Tool in spindle	clamp
unclamped	26000	clamped
Gripper 1 to spindle	Tool gripper lift rotated +180°	Gripper 2 to spindle
Gripper 1 at spindle		Gripper 2 at spindle
To change pos.	Axes	
Change position		
Page: 1/3 Symbols/address		

TC	WPC			Add. funct.		Workpiece	Service fct.
Prepare	Hand fct.	Diagnostics	Tools	Process	Special scre	Maintenan.	Document

### 7.1.4 Collision monitoring

**With collision monitoring**

For safety reasons, collision monitoring is enabled by default. It monitors the fulfillment of certain preconditions for a movement.

**Without collision monitoring**

In certain exceptional circumstances, when pallet or tool changers no longer react to individual functions, it may be necessary to turn collision monitoring off. This allows movements to be continued or a default position to be approached when the system is in an undefined condition.

**Access rights**

Disabling collision monitoring is only permitted to trained personnel, to whom access rights for the access level has been granted via the EKS key.



## CAUTION

Collision danger "Pallet/tool - NC axis".

With individual functions, machine movements are not coordinated automatically by the NC program. A potential risk of collision exists when collision monitoring is switched off.

Therefore,

- always move NC axes into the tool change position before initiating an individual function.
- when changing pallets with clamped workpiece, observe the resultant interference diameters.
- Observe the information and/or error messages on the screen.

## Movements without collision monitoring



### Vertical softkey



APPROVAL  
KEY



- Grant access with the corresponding *Electronic Key* (green, black).
  - ↗ e.g. access level 4 (6) is enabled.
  - The user has a high level of access rights.
  - A reduced protection level is applied to data and functions.
- Select the function you want to run without collision monitoring.
- Press "Vertical softkey".
- Observe the message text displayed on the screen. This describes the reason for a potential collision.
- In addition to the function vertical softkey, press the *Approval key*.
  - ↗ The individual functions have a blue background, collision monitoring is not active.
- ↗ The message "Approval - potential collision" is displayed.
- ↗ The function is run until you release the *Approval key*.

**i**

Collision monitoring will be reactivated as soon as you release the *Approval key*.

**i**

Movements without collision monitoring are saved in the error and message log.



7 Operation in setup mode

7.1 Set-up mode

---

### Revoking access rights



- Remove *Electronic Key* and store in a safe place.

## 7.2 Individual functions of tool changer

- ☑ Preconditions:
  - Drives and media switched on.
  - Safety doors closed and locked.
  - "Setup" machine mode is activated.
  - "HMI - Manual mode" main menu is open.

### HMI screen "WZW", page 1

#### Tool changer



- ☑ Press upper horizontal softkey "Tool changer".
- ↵ The 1st page of the "Tool changer" HMI screen is opened.

◀	Forward	Tool change system 99	Back In home position	▶
◀	Open Opened	Tool change door	Close Closed	▶
◀	To spindle From spindle	Tool gripper rotated 90°	to home position In home position	▶
◀	Unclamp Unclamped	Tool in spindle 26000	clamp clamped	▶
◀	Gripper 1 to spindle Gripper 1 at spindle	Tool gripper lift rotated +180°	Gripper 2 to spindle Gripper 2 at spindle	▶
◀	To change pos. Change position	Axes		
Page: 1/3   Symbols/address				

#### Explanation

#### Tool change system

The function will finish an interrupted tool change. During this, all axes CT1 and ZT1, collet and changer door movements are executed to move the tool changer to its home position.

- *forwards*: If you execute the "forwards" function, the tool requested by the NC program will be transported into the spindle. Once, the home position is reached, the corresponding display field is marked.
- *backwards*: If you execute the "backwards" function, the tool located in the spindle before the aborted tool change will be returned to the spindle. Once, the home position is reached, the corresponding display field is marked.

Precondition:

- Tool setting station safety door closed and locked.

#### Tool change door

The function closes and opens the safety door between the tool magazine and the work area.

#### Tool gripper rotated 90°

The movement direction of the tool gripper can be reliably defined as follows:

- *towards spindle*: The gripper in the work area, or the bottom gripper moves towards the spindle.
- *to home position*: The gripper in the work area and/or the bottom gripper moves towards the home position.

#### Tool in spindle

The function releases or clamps the tool in the tool spindle.

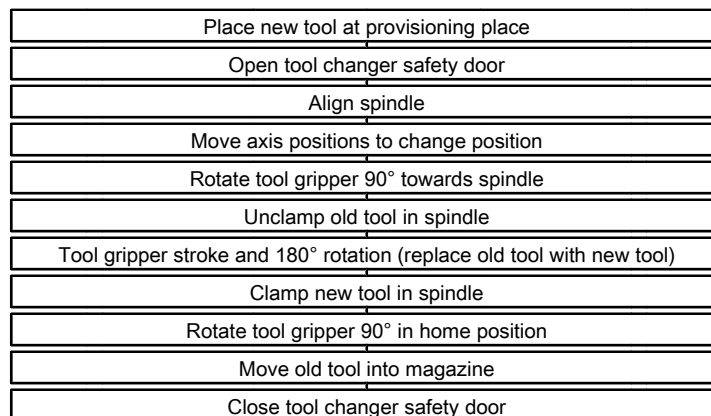
#### Tool gripper lift rotated +180°

The function is used to remove the tool in the spindle and the tool in the cartridge by the tool gripper at the same time. The tools are then swapped by means of a 180° rotation of the tool gripper and pushed into the spindle or cartridge accordingly.

#### Axes

The "Axis - to change position" function traverses the X and Y-axes into the tool change position.

#### Function diagram



**HMI screen "WZW", page 2**



- ☑ Preconditions:
  - "WZW" HMI screen, page 1 opened.
- ☒ Press the *Page up* key.
- ↩ The 2nd page of the "Tool changer" HMI screen is opened.

spindle		Align	▶▶
		Aligned	
◀◀	to prov. place	Tool cartridge	To magazine
	at prov. place		In magazine
◀◀	Open	Safety door workpiece setup station/tool magazine	Close
	Opened		Closed
◀◀	to setup station	Tool carriage on the tool setup station	To magazine
	on the setup station		In magazine
◀◀	align	Tool holder	Swivel back
	Aligned		Not aligned
◀◀	to setup station	Chain synchronisation	Towards TC
	At setting station		At TC
		Page: 2/3	☐ Symbols/address

**Explanation**

**Spindle**

The "Align spindle" function rotates the spindle to its tool change position.

**Tool cartridge**

The function pushes the cartridge containing the tool from the tool change position of the chain-type magazine to the provisioning place and vice versa. The tool gripper picks up the tool from the provisioning place.

**Safety door workpiece setup station/tool magazine**

The function closes and opens the safety door between the tool magazine and the setting station.

Preconditions for collision monitoring on:

- Exterior safety door closed and locked.

Preconditions for collision monitoring off:

- Exterior safety door closed.

As long as the tool loading station safety door is open, no tool change functions can be carried out.

### Tool carriage on the tool setup station

The function moves the tool cartridge with the tool from the chain-type magazine loading position to the setting station and vice versa.

Preconditions for collision monitoring on:

- Magazine not in motion.
- Magazine is at a valid location.
- No tool or cartridge at the destination location.
- Tool holder is aligned.
- Exterior safety door closed and locked.
- Interior safety door open.

Preconditions for collision monitoring off:

- Exterior safety door closed.
- Interior safety door open.

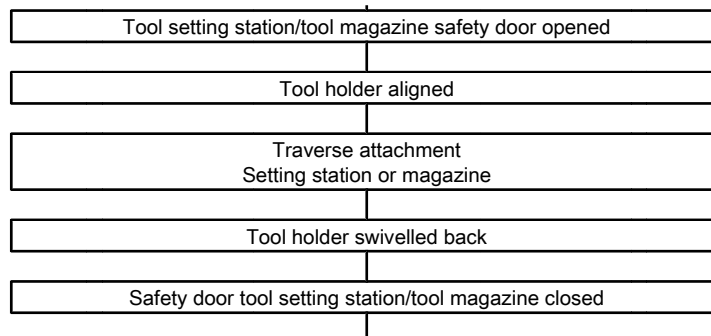
### Tool holder

The function moves the tool holder, particularly of heavy tools, from the chain-type magazine loading position into a suitable transfer position.

Precondition:

- Magazine not in motion.
- Magazine is at a valid location.

### Function diagram

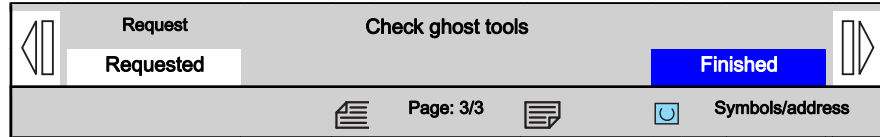


### HMI screen "WZW", page 3

- Preconditions:
  - "WZW" HMI screen, page 2 opened.



- ☒ Press the *Page up* key.
- ↶ The 3rd page of the "Tool changer" HMI screen is opened.



**Explanation**

**Check ghost tools**

The function must be executed after loading ghost tools. Using this function, it will be checked at the next tool provisioning for each magazine place whether there is a tool and tool data. If there is only a tool on the magazine place and no tool data, or only tool data are available without a tool being present, a corresponding error message is output. Magazine movement is disabled.



Further information on the topic of "Ghost tools" can be found in chapter "Loading ghost tools" **page 276**

**7.2.1 Error correction on tool changer**



Error correction on the tool changer may only be implemented by special trained personnel with authorization for access level 1.

The incorrect use of data in the area of access level 1 may cause damage to machines, tools and workpieces.

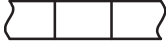
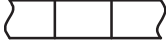



Ensure the reset of access level after error correction.

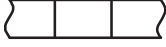
**7.2.1.1 Error message "67112 tool management invalid: Unknown T-number"**

**Cause**

Variable contents may be changed after switching on/ off control due to an error originated at Siemens.

## Troubleshooting

- Parameter**  

- Password set for access level 1.
  - Press the "Parameter" softkey.
  - The "Tool" area is opened.
- User variables**  

- Press the "User variables" softkey.
- Channel GUD**  

- Press the "Channel GUD" softkey.
- GUD selection**  

- Press the "GUD selection" softkey.
- M GUD**  

- Press the "M GUD" softkey.
  - A list of GUD variables is displayed.
  - Change the following variables to value "-1":
    - SYG\_IM[12]
    - SYG\_IM[13]
  - Please check whether tool changer is in home position. If this is the case, the error has been corrected.
  - Reset password.
- Tool changer is not in home position...**
- Please check whether tool management data corresponds with the current status of following places:
    - Provisioning place
    - Gripper 1
    - Gripper 2
    - spindle

If necessary, move the tools to the appropriate places according to tool management.
  - Tool management's tool list is opened.
  - Password for access level 1 is set.
- Relocate**  

- Press Softkey "Transfer" to move tools to the appropriate places according to tool management.

Observe the following:

Using the function "Transfer" the intermediate storage (provisioning place, gripper 1 and 2) can **not** be specified as target location. If a tool is to be loaded into the spindle, this can be done with the "Relocate" function. The tool, belonging to the provisioning place, temporarily remains in the gripper. Determine this tool's return location in the magazine and transfer it accordingly. Correct tool data accordingly.



See Chapter

- Reset password.

### 7.2.1.2 Error message "701202 invalid cartridge management"

#### Cause

If the error message "701202 invalid cartridge management - Check data" is displayed, plausibility check of cartridge management has detected an error.

Another error in cartridge management occurs when executing an unexpected movement of the magazine or the tool during tool provisioning.

#### Troubleshooting

To correct an error clear provisioning place and spindle. Because cartridge management forms the basis of provisioning movements, no tool provisioning, e.g. "T0" can be executed if the tool management is invalid.

In this case, required movements need to be performed manually using the individual functions.



For further information on handling individual functions, see "Initiating individual functions" **page 302**

- Spindle and provisioning place are empty.
- With *Data menu key* call up the basic menu on the main operator panel.





## 7 Operation in setup mode

### 7.2 Individual functions of tool changer

#### Diagnostics



- Press the "Diagnostics" softkey.

#### NC/PLC variables



- Press the "NC/PLC variables" softkey.
- ↵ The list of variables is displayed.

- Please check the following variable values and correct them if necessary:

Variable	Variable value	Function
DB702.DBW0	Last magazine place number. (Depending on magazine size)	Location without cartridge 1
DB702.DBW2	9998	Location without cartridge 2
DB702.DBW4	65535	Return cartridge 1
DB702.DBW6	65535	Return cartridge 2

#### 7.2.1.3 Determine return location of a tool

- Tool management's tool list is opened.
- Password for access level 1 is set.

#### Magazine

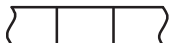


- Press the "Magazine" softkey.



- Select a tool using the *Cursor keys*.

#### Relocate



- Press the "Transfer" softkey.
- ↵ The tool's return location in the magazine is displayed.

#### Cancel



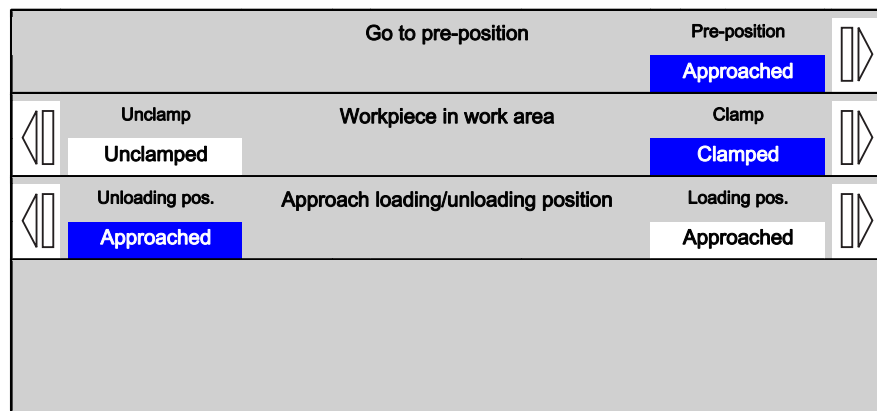
- Press Softkey "Cancel" to end function.
- Reset password.

## 7.3 Workpiece change

A workpiece change can be carried out in single steps via the following individual functions and the loader.

The screen becomes available after pressing the "WPC" softkey.

### HMI screen



### Individual functions

#### Workpiece in work area

The workpiece can be clamped or unclamped in the fixture via the HMI function. Pressing (and holding) the right softkey clamps the fixture in jog mode. Successive clamping steps, for example, are executed:

- Blow-off locp
- Extend backlash reducer
- Clamp swivel clamp
- Clamp clamping cylinder.
- Activate location check.

The blue "Clamped" field signals the end of the clamping sequence.

Pressing (and holding) the left softkey unclamps the fixture in jog mode:

- Unclamp all clamping cylinders, supports.
- Activate unclamp check.

The blue "Unclamped" field signals the end of the unclamping sequence.



The clamping or unclamping sequence stops when the softkey is released. When the softkey is pressed again, the clamping or unclamping sequence is continued.



See also drawings and diagrams for the clamping fixture:

#### **Approach loading/unloading position**

The "Approach unload/load position" HMI function can be used to position the Z-slide for transferring the workpiece between machine and loader. The rotary table must be moved to the 180° position beforehand. The clamping fixture must be released.

- *Unloading pos.:* position Z-slide for unloading the finished part. The unload gripper can then remove the finished part from the fixture.
- *Loading pos.:* position Z-slide for loading the raw part. The load gripper can then deposit the finished part in the clamping fixture.

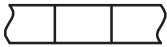
## 7.4 Additional functions

### Calling up Additional Functions

Preconditions:

- Safety doors closed and locked.
- Drives and media switched on.
- "HMI" main menu open.

**Man.funct.**



Press lower horizontal softkey "Man.funct.".

↗ The menu of the "Manual functions" area is opened.

**Additional fu.**



Press upper horizontal softkey "Additional fu.".

↗ The menu of the "Additional functions" area is opened (3rd menu level).

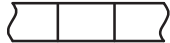
Safety doors	Acknowledg	General					
Prepare	Handfct.	Diagnostics	Tools	Process	Special scr.	Maintenan.	Document

↗ There are HMI screens available for the following machine components:

- Safety doors
- Acknowledge
- General:

## 7.4.1 Individual functions for safety doors

## Safety doors



- Precondition:
  - "Manual mode - Additional functions" menu opened (3rd menu level).
- Press upper horizontal softkey "Safety doors".
- The "Safety doors" HMI screen is opened.

Open	Safety door workpiece settg. station	Close
Opened		Closed
Open	Loader safety door/top loading hatch	Close
Opened		Closed
Unlock	Media supply safety door	Lock
Unlocked		Locked
Unlock	Tool setting station safety door	Lock
Unlocked		Locked

SETUP

- Press the *Setup* key.

## Open safety door

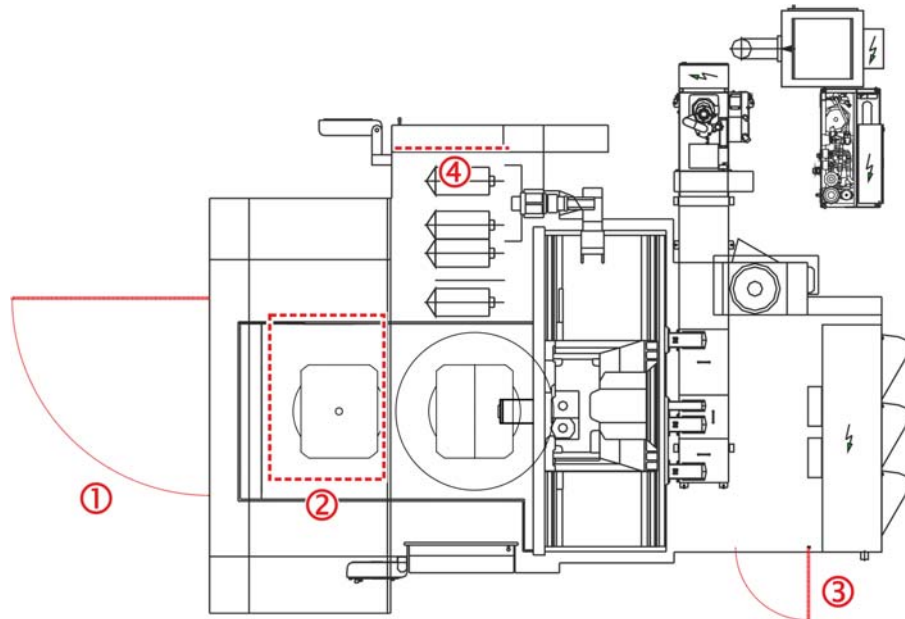


- Press the left softkey "..." of the respective safety door, which is closed and/or locked.
- The corresponding safety door is unlocked.  
The left status field "Unlocked" (and/or "Opened") is marked.

## Open safety door



- Press the right softkey "..." of the respective safety door, which is not closed and/or locked.
- The corresponding safety door is locked.  
The right status field "Locked" (and/or "Closed") is marked.



7.4.1 - 1 Safety door unlocking via individual functions

- 1 Workpiece setting station safety door (front door)
- 2 Load hatch
- 3 Maintenance area safety door
- 4 Inner tool setting station safety door

## 7.4.2 General additional functions

### Calling up the "General" HMI screen

- Precondition:
  - "Manual mode - Additional functions" menu opened (3rd menu level).
- Press upper horizontal softkey "General".
- ↪ The "General" HMI screen is opened.

General



◀	Duration	Work area lighting	Automatically	▶
	On		Automatically	
◀		Workpiece measuring	Set	▶
			Set	
◀	Select	Manual loading without automation	Deselect	▶
	selected		Deselected	
◀		Test Stop	Activate	▶
		7 h	active	

### Work area lighting

The HMI function enables the work area lighting to be switched on or off.

### Workpiece measuring

The HMI function enables the current workpiece in the work area to be declared a measuring component. During the subsequent unloading operation by the automation, the workpiece is transported to a separate storage location in the discharge (SPC location).

### Manual loading without automation

The HMI function can be used to switch the machine from automatic production mode, where the machine is operated linked to the robot, to "stand-alone" mode.

- *Select*: Activate stand-alone operation for manual workpiece loading through the workpiece setting station safety door.
- *Deselect*: Operation for automatic workpiece loading via the loading device (default setting). The workpiece setting station safety door is controlled from the loading device.

### Test Stop (Bremsentest)

The brake test must be run every 8 hours. If the brake test has not been run, you cannot open the safety doors and the "Brake test required" message will be displayed. The machining program must be terminated before a manual brake test.

A test stop is normally triggered if a safety door is unlocked < 8 hours after the last test stop.



For further information, see:  
"Manual brake test and test stop" page 320

### 7.4.2.1 Manual brake test and test stop

#### Fundamental principles

Vertical axes and certain rotary axes are gravity-loaded (axis weight). When they are at a standstill and the power supply is switched off, they are held in position only by the motor brake. Mechanical wear or oiling can cause the rated holding torque of the motor brake to be underrun. This can lead to unintentionally lowering or even crashing of the vertical axis.

#### Affected axes

The following axes on the machine are affected:

- Y-axis (machining unit) <sup>1</sup>

1) Axis in the work area: it is possible to stand under this axis, which presents a hazard.

#### Brake test (test stop)

For safety reasons, the machine runs a brake test (test stop) at the affected axes, depending on the situation concerned.

The brake is checked by admitting a torque onto the engaged brake (1.3 times its own weight). This torque must be held for a defined period without the axis making impermissible movements. If the brake is unable to hold the torque or unable to hold it for long enough, this is detected and evaluated accordingly.

The safety door may only be unlocked and opened without additional measures being taken if the brake test finishes successfully.

If the brake test is unsuccessful, the safety doors cannot be unlocked. Access to the work area remains disabled.



**Times for the brake test Automatic brake test**

- At the end of machining and after an interval of 7.5 hours.
- Linked mode: Before the workpiece change, the axes are moved to a position at which no hazard is presented. The brake test is run and the workpiece change operation is completed.
- Stand-alone mode: The brake test runs automatically after a request to unlock the safety door.
- After the control has been run-up.
- After feed/spindle start has been switched on.

**Manual brake test**

- After an interval of 8 hours.

**Executing a manual test stop**

After an 8 hour interval, a test stop request is output by the control. The brake test must be initiated manually.

 Preconditions:

- Safety doors closed and locked.
- Drives and media switched on.

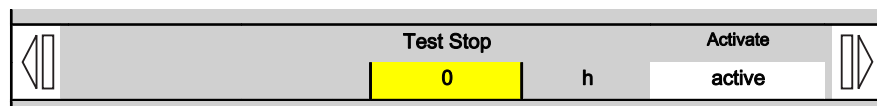
 Press the *Setup* key.

- ↳ The "setup" machine operating mode is activated.

 Calling up the "..." HMI screen

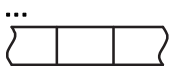
- Press the *data menu* key.
- Press the "HMI" softkey.
- Press the "Handfct." softkey in the lower horizontal softkey bar.
- Press upper softkey "General".

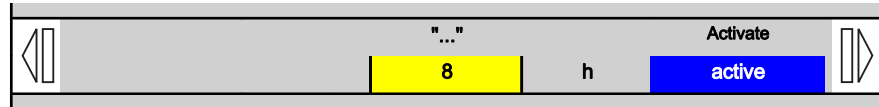
- ↳ The ""General"" HMI screen is opened. The "Test stop" function is available:

 Press the right-hand softkey, which is assigned to the **Test stop** line.

- ↳ The brake test is executed. After the brake test is terminated, a status message is output (successful / not successful).

SETUP





If the brake test was **not successful**, the operation of the machine must stop.

### Measures to be taken if brake test is unsuccessful

**Safety door unlock inhibited**

If a brake test ends unsuccessfully, the safety door is prevented from unlocking and opening in order to prevent accidents. The potential risk to man and machine increases due to the possibility of the machining unit of Y axis "dropping down".



Risk of collision from falling vertical axes.

Because the drives on Y vertical axis is not self-locking, the slide unit may move downwards under its own weight and cause a collision if the holding brake on the motors fails when idle and the hydraulically actuated, external holding brake fails in the depressurised state.



- ☒ Press the *Lock/unlock safety door* key.
- ☒ If the brake test is unsuccessful, the safety door is not unlocked.
  - Message regarding faulty motor brake or external holding brake on a vertical axis is displayed in the control.
  - Unlocking of the safety doors is not possible without special measures.
- ☒ Avoid operating situations in which the brake test on vertical axes is inhibited:
  - Switching off mains voltage when motors are enabled.
  - Switching off the motors when the safety door has already been unlocked or opened.
  - Switching off the motors when a brake test is running.

**Additional measures**

The operator may take the following measures should a brake test finish unsuccessfully:

- Contact a member of the maintenance team.
- Traverse Y and/or YM vertical axes into a safe position.
  - Move Y axis downwards as far as possible.
- Open the safety door in operating mode 2 or 3.
- Shim the vertical axis if necessary.

**Axis in safe position**

The vertical axis is in a safe position if the risk of injury and collision from a falling vertical axis is minimised: This means, if the vertical axis is in the lowermost position!

The safe position of a vertical axis is dependent upon the relevant situation. The operator's decision for a safe position is influenced by several factors, which differ from case to case:

- Workpiece in the machine or not.
- Tool in spindle or not.
- Position of other axes and components.

It may be necessary to first unload the workpiece via the front safety door. All safety doors must then be closed and locked.

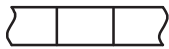
## 7.5 Service functions

### Call up service functions

Preconditions:

- Safety doors closed and locked.
- Drives and media switched on.
- "HMI" main menu open.

**Man.funct.**



Press lower horizontal softkey "Man.funct.".

↗ The menu of the "Manual functions" area is opened.

**Service functions**



Press upper horizontal softkey "Service functions".




↗ The menu of the "Service functions" area is opened (3rd menu level).

↗ HMI screens are available for the following machine components:

- IBN-I (Commissioning function 1)
- IBN-II (Commissioning function 2)
- Coolant functions
- Coolant times

### 7.5.1 "IBN-I" HMI screen

Actuating the "IBN I" softkey opens the following HMI screen:

◀	Teach-in	WBK act.val	Accept	▶
		xx.xx		
◀	Measure	WBK sp value	OK	▶
		yy.yy		
◀	To ref position	WBK	To home pos.	▶
	In ref position		In home position	
◀	Setpoint pos. ( - )	WBK	Setpoint pos. ( + )	▶
		0.00		
◀	Tolerance ( - )	WBK	Tolerance ( + )	▶
		0.10		
◀	Activate	Alt. strategy, manned operation	Deactivate	▶
	active		Inactive	
 Page: 1/2   Symbols/address				

The HMI screen is important for commissioning and fault elimination of the following functions.

- Fast drill break monitoring
- Motor bakes

### 7.5.1.1 Fast drill break monitoring

The tactile probe can also be moved with the aid of individual functions for commissioning and test purposes. A tool must be moved to the provisioning place for this purpose.

The following functions are possible:

- Teach-in WBK actual value: The tool at the provisioning place is scanned and the measured value determined is displayed in the list of OEM tool data ("TW" column).
- Measure WBK setpoint value: The tool at the provisioning place is scanned at the angle displayed in the "TW" column.

#### WBK act.val

Manually teach a tool that is located on the provisioning place.

- *Teach*: Function for determining the angle value (actual value) of the tactile probe that occurs when probing the tool. The actual value is displayed in degrees in the yellow field.

- *Apply*: Function for applying the angle value in the control (tool data record). This value is used for the following measurements as a reference value (teach value)<sup>1</sup>.

1) "TW" column in the OEM tool list.

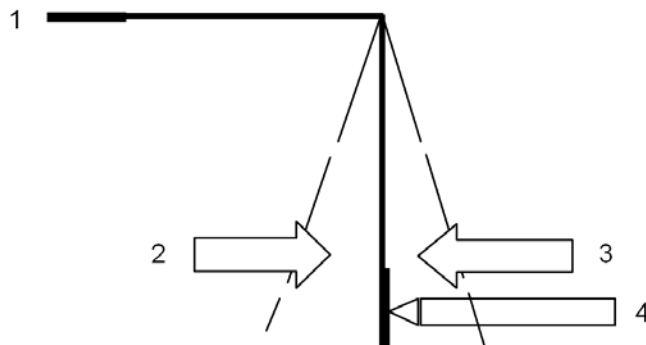
### WBK sp value

Pressing the left softkey executes a measurement on the tool that is located at the provisioning place. If the difference of the measured value, compared to the reference value, is greater than the tolerance value, an error message is output.

### WBK

Function for moving the tactile probe to the preferred angle values.

- *to setpoint position*: Move tactile probe to a specified setpoint position. This setpoint position is entered via the individual function below.
- *to home position*: Move tactile probe to the home position (0 degrees).



- 1 Home position
- 2 Tolerance negative
- 3 Tolerance positive
- 4 Setpoint position (example)

### WBK

Function for entering the setpoint position for the tactile probe. The input value appears in the yellow field.

- *Setpoint pos. (-)*: Alter position in small increments:
  - Reduce value: Brief keystroke on the left softkey.
  - Increase value: Brief keystroke on the right softkey.
- *Setpoint pos. (+)*: Alter position in large increments:
  - Reduce value: Long keystroke on the left softkey.
  - Increase value: Long keystroke on the right softkey.

### WBK

Function for entering the tolerance value for the tactile probe. The tolerance value appears in the yellow field (typically 0.5 degrees).

- *Tolerance (-)*: Reduce value with the left softkey.
- *Tolerance (+)*: Increase value with the right softkey.

## 7.5.1.2 Collision monitoring in special operating mode "SETUP"

### "Approval key" key

"Collision monitoring off"

In normal operating mode "AUTOMATIC" (chap. 5, 6 und 7), collision monitoring is switched on and off with the *Approval key*.

- Key *Approval key* pressed: Collision monitoring is deactivated.
- Key *Approval key* released: Collision monitoring is activated.

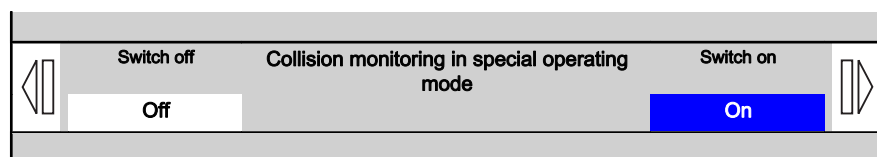


For more information on enabling or disabling the Collision monitoring function see:

"Approval for traversing movement"

In special operating mode "SETUP", the *Approval key* is used, to even release traversing movements of individual axes. However, in this case, the collision monitoring is switched on for safety reasons (standard setting).

The status is displayed in the HMI function "Collision monitoring in special operating mode" as follows:



With an open safety door, the above setting can be used to move axes without collision.

### "SETUP" special mode

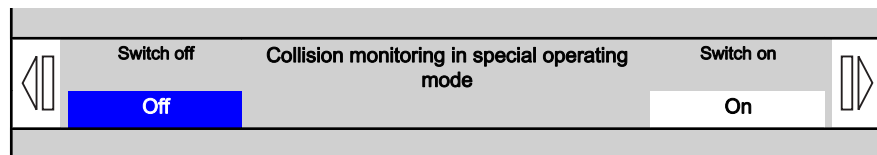
#### Collision monitoring deactivated



CAUTION: Risk of collision "Pallet/tool - NC axis".

In certain exceptional situations, when pallet or tool changers no longer react to individual functions, it may be necessary to turn collision monitoring off in special operating mode "SETUP".

- Press left-hand softkey, which is assigned to the function (the l.h. display field is highlighted).



This allows movements to be continued or a default position to be approached when the system is in an undefined condition.

### 7.5.1.3 Releasing motor brake

#### Fundamental principles

The "Brake active axis" HMI function of the "IBM I" HMI screen is used to release the motor brake of an NC axis in case of malfunction. The motor brake holds the NC axis in this situation for safety reasons.

Release of the motor brake should take into account whether it is a horizontal or a vertical axis.

Basic sequence:

- Select the NC axis on the motor brake has been triggered.
- Disable Collision Monitoring.
- Release the motor brake.
- Enable collision monitoring.



## Release motor brake

### Preselect NC axis

- Preconditions:
- Safety doors closed and locked.
  - Drives and media switched on.
  - Operating mode "ER" active.
  - "AUTO" NC operating mode active.
  - Access rights to switch-off collision monitoring is granted (EKS key).



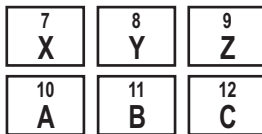
Refer to:  
"Collision monitoring" **page 303**



- Press *Machine area key*.  
↪ The "Machine" main menu is opened.



- Press the *JOG* key.  
↪ "JOG" NC mode is activated.



- Select axis.
- *X key* for the horizontal axis of the machining unit.
  - *Y key* for the vertical axis of the machining unit.
  - *Z key* for the Z slide.
  - *A key* for the A axis.
  - *B key* for the rotary table.
- ↪ The associated LED is lit.

### Release motor brake



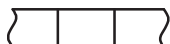
- Press *Data menu key*.  
↪ The machine's basic menu is opened.

**HMI**



- Press the "HMI" softkey.  
↪ The "HMI" operating area is opened.

**Man.funct.**



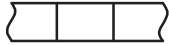
- Press lower horizontal softkey "Man.funct.".  
↪ The menu of the "Manual functions" area is opened.

**Service functions**



- Press the "Service functions" softkey.  
↪ The menu of the "Service functions" area is opened (3rd menu level).

IBN-I



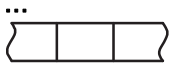
- Press the "IBN-I" softkey.
- ↪ The "IBN-I" HMI screen is opened.



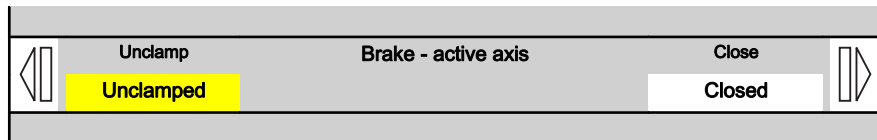
**DANGER**

When the motor brake is released, an axis may suddenly start moving (drop) under its own weight. It is possible for persons in the danger area to sustain fatal injuries as a result.

Make sure that no one is in or near the traversing range of the vertical units.



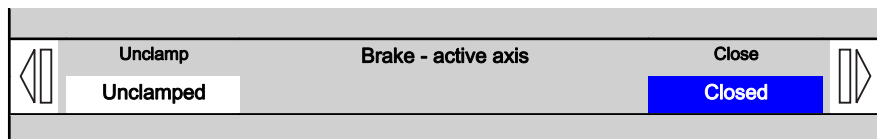
- Press left-hand softkey assigned to the line "Brake active axis" and hold it down.
- ↪ The function is selected.



- In addition to the "Brake active axis" function, press the *Approval* key on the main operator panel.
- ↪ The individual functions have a blue background, collision monitoring is not active.  
The motor brake of the selected axis releases.  
With selected vertical axis, motor brake will be released for the duration of 100 ms approximately.

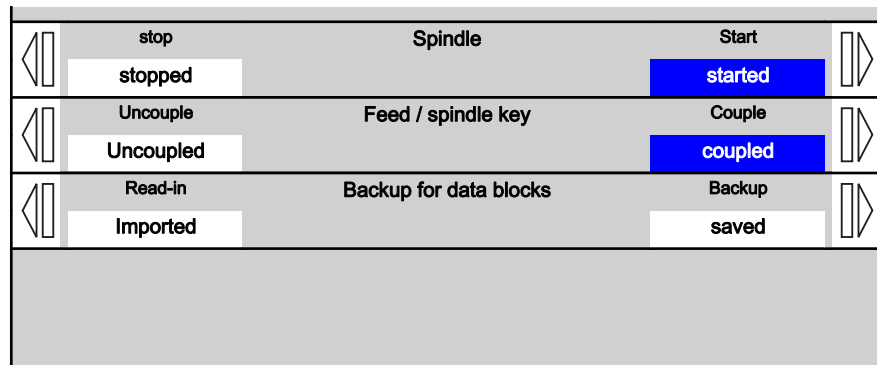


- Release the *Approval* key.
- ↪ Collision monitoring is reactivated again.  
The motor brake is activated.



### 7.5.2 "IBN-II" HMI screen

Actuating the "IBN II" softkey opens the following HMI screen:



#### Spindle control



The *Feed - spindle start* key issues the enable for the feed and the spindle. The key's action on the spindle can be disabled in the "Service functions" HMI screen via the "Feed/spindle" key HMI function.



The *Feed - spindle stop* key issues the enable for the feed and the spindle. The key's action on the spindle can be disabled in the "Service functions" HMI screen via the "Feed/spindle" key HMI function.



See also:  
 "Feed and spindle control" **page 108**

#### Spindle

When the action of the *Feed/spindle start* key on the spindle is disabled, the HMI function "Spindle" can be used to issue or clear the spindle release.

#### Feed / spindle key

The action of the *Feed/spindle start* key on the spindle can be disabled and enabled using this HMI function. Enabled is the basic status.

#### Backup for data blocks

#### Backup

This HMI function can be used to read out PLC data modules and backed up in a file.

#### **Read-in**

After a repair, the machine status can be reproduced quickly with this function, when the register data are imported into the control.

### **7.5.3 Cooling lubricant cleaning unit**

#### **Coolant unit**

Pressing the "KM unit" softkey provides two HMI screens for manually controlling the cooling lubricant cleaning unit with chip conveyor.

- "KM functions" - switches individual units on and off.
- "KM times" - displays and changes the runtimes of individual units.

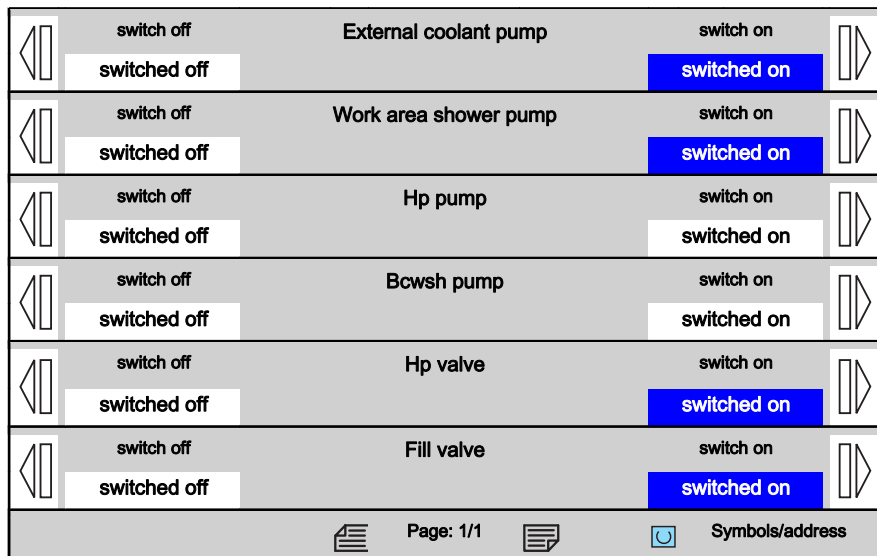
The individual function scope depends on the fitted options and the access authorisation issued.



For more information on the cooling lubricant cleaning unit, see subsupplier's information.

#### **7.5.3.1 Coolant functions**

Pressing the "KM functions" softkey provides the HMI screens for switching on and off the individual units such as pumps, solenoids, motors etc. of the cooling lubricant unit.



Example: KM functions

### 7.5.3.2 Coolant times

Persons with the relevant access rights can use further, function-related settings of the cooling lubricant cleaning unit.



If incorrect settings are entered, damage to the cooling lubricant cleaning unit or overflows may occur.

Settings may be changed only by trained specialists.

Pressing the "Coolant times" softkey opens the HMI screen for displaying and changing the coolant times.

**Page 1 (example)**

Page 1 of "KM times" HMI screen provides the following fields for inputting time intervals:

- Circulation pause
- Run-on time after Auto Stop
- Delay for fill level Tank 1 above max
- Delay for fill level Tank 1 min. prewarning
- Delay for fill level Tank 1 below min.
- Delay for fill level Tank 2 below min.
- Run-on time high pressure pump
- Switch-on delay for chip conveyor (interval)
- Pulse duration for chip conveyor (interval)
- Runtime monitoring for chip conveyor Prio 1
- Runtime monitoring for chip conveyor Prio 2
- Run-on time for chip conveyor lifting pump
- Lifting pump runtime monitoring
- Delay for fill level chip conveyor above maximum

**Page 2 (example)**

Page 2 of "KM times" HMI screen provides the following fields for inputting time intervals:

- Runtime for circulation via high pressure pump
- Runtime for backwash high pressure pump
- Runtime backwash
- Pause for fleece drive (interval)
- Pulse duration for fleece drive (interval)
- Switch-on delay (fleece drive float switch, fleece drive on)
- Run-on time fleece drive (float switch, fleece drive on)

**Page 3 (example)**

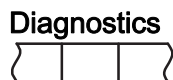
Page 3 of "KM times" HMI screen provides the following fields for inputting time intervals:

- Run-on time for fleece drive float switch on
- Runtime monitoring float switch fleece drive on
- Switch-on delay for fleece drive (fill level above max.)
- Run-on time for fleece drive (fill level filter above max.)
- Runtime monitoring for fleece drive (fill level filter above max.)
- Run-on time winding unit

## 7.6 "Diagnostics" function area

### Call up the "Diagnostics" HMI operating area

- Preconditions on the module operating unit:
  - "HMI" main menu open.
  - Access rights granted (EKS key).
- Press lower horizontal softkey "Diagnostics".
- ↵ The menu of the "Diagnostics" HMI area is opened.



History		PB/PN Diag		Alarm	Messages	Diag.TCP/IP	WSSP
Prepare	Handfct.	Diagnostics	Tools	Process	Special scre	Maintenanc.	Document

### 7.6.1 Alarm history

In the "History" HMI screen, all fault messages accumulated at that time are listed with information on their time of occurrence and their processing status.

Alarm log				Display new
Raised	Cleared	Number	Text	
07/31/15 11:14:57.186 AM	07/31/15 11:14:57.192 AM	150206	Can't find alarm text index file "sltIpronv_chs.qm"!	
07/31/15 11:14:44.287 AM	07/31/15 11:14:44.294 AM	150206	Can't find alarm text index file "sltIpronv_ita.qm"!	
07/31/15 11:13:45.263 AM	07/31/15 11:13:45.268 AM	150206	Can't find alarm text index file "alsi_idxALSI_fra.qm"!	Sort
07/31/15 11:13:45.260 AM	07/31/15 11:13:45.267 AM	150206	Can't find alarm text index file "sltIpronv_fra.qm"!	
07/31/15 11:13:41.627 AM	07/31/15 11:13:41.632 AM	150206	Can't find alarm text index file "sltIpronv_chs.qm"!	
07/31/15 11:12:58.571 AM	07/31/15 11:12:58.579 AM	150206	Can't find alarm text index file "sltIpronv_ita.qm"!	
07/31/15 11:11:13.870 AM	07/31/15 11:11:13.875 AM	150206	Can't find alarm text index file "alsi_idxALSI_fra.qm"!	Settings
07/31/15 11:11:13.868 AM	07/31/15 11:11:13.875 AM	150206	Can't find alarm text index file "sltIpronv_fra.qm"!	
07/31/15	07/31/15		Can't find alarm text index file	Save log

### Fault status

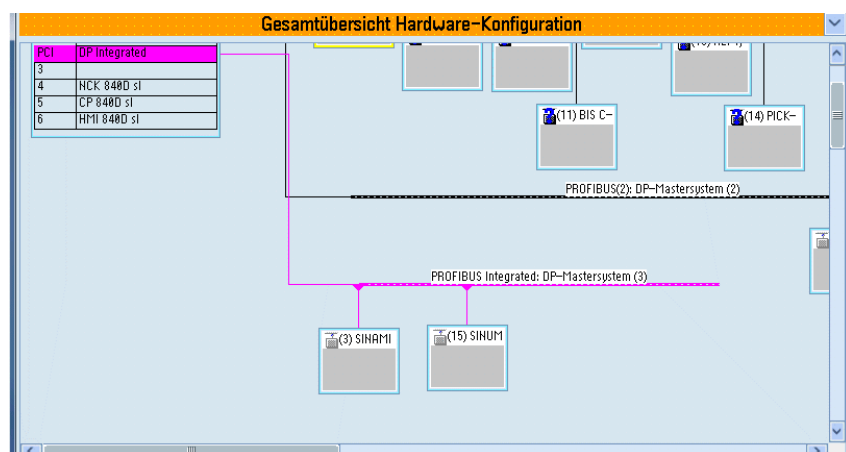
The status of the fault is displayed in the "Fault status" field. The following statuses are possible:

- C = message received
- Q = message acknowledged
- G = message sent

### 7.6.2 Profibus diagnostics

You can use the "PB/PN Diag" HMI-screen for diagnosing hardware configured via STEP7:

- PROFIBUS: DP\_Master system: Slaves
- Ethernet: PROFINET IO-System: Devices



The diagnostics is evaluated in the following figures:

- General overview of the hardware configuration
- PROFIBUS: DP-Mastersystem
- Ethernet: PROFINET IO-System



7 Operation in setup mode  
 7.6 "Diagnostics" function area

Status	PROFIBUS address	Module is OK
	3	Module is OK
	4	Module is OK
	5	Module is OK
	6	Module is OK
	7	Module is OK
	13	Module is OK
	20	Module is OK

The status of all assemblies is visualised via a symbol. The following statuses are diagnosed:

- Assembly is OK.
- Assembly has failed.
- Assembly is faulty.
- Assembly is suppressed.
- Assembly is not present. Assembly missing in the STEP7 hardware configuration on the PLC.
- Assembly is deactivated. This version is available from PLC 319.
- Assembly is not considered. The status of the equipment on the integrated drive bus (PROFIBUS Integrated) is not diagnosed (PCI port).

The display can be filtered via the softkeys arranged on the right.

### 7.6.3 Alarms, messages

#### Displaying alarm messages

If faulty states are detected during operation of the machine, an alarm will be generated and the machining interrupted if necessary. The error text, which is displayed simultaneously with the alarm number, provides more detailed information on the cause of the fault.



Check the system situation carefully using the description of the alarm that has occurred. Remedy the cause of the alarm and acknowledge in the manner indicated.

If this procedure is not followed, there is a risk of damage to the machine, workpiece and saved settings as well as a risk to your health.

HMI screen

**Alarm**

You have the option of displaying all pending alarms and confirming them. The alarm overview contains the following information:

- Date and time
- The deletion criteria indicates which key or softkey can be used to acknowledge the alarm
- Alarm number
- Alarm text

Alarms			
Date ▲	Delete	Number	Text
07/31/15 10:39:21.482 AM		8081	16 option(s) is/are activated that are not licensed by the license key
07/31/15 9:39:46.608 AM	PLC	703031	Mains contactor not switched on: - OUTSE[15]/E21.7
07/31/15 9:39:43.306 AM	PLC	702107	Tool cleaning filling level below minimum: -B06.4
07/31/15 9:39:42.615 AM	PLC	700203	Emergency Stop on automation pressed: - INSE[27]
07/31/15 9:39:42.572 AM		27095	NCK SPL protection not activated
07/31/15 9:39:41.296 AM	PLC	703024	Exh system fault container monitoring: -B216.0
07/31/15 9:39:41.296 AM	PLC	703023	Exh system fault relief valve: -B216.1
07/31/15 9:39:41.296 AM	PLC	703015	Wrong type of temperature compensation (\$A_DBB[800], \$A_DBB[801])
07/31/15			Extraction system fault temperature monitoring

Acknowledging alarm:

- Position the cursor on an alarm.
- Press the key indicated as acknowledge symbol.

**alarm messages**

In the "Alarm messages" HMI screen, all alarm messages accumulated at that time are listed with information on their time of occurrence and their processing status.

7 Operation in setup mode  
 7.6 "Diagnostics" function area

Alarm log				Display new
Raised	Cleared	Number	Text	
07/31/15 11:14:57.186 AM	07/31/15 11:14:57.192 AM	150206	Can't find alarm text index file "sltprnv_chs.qm"!	
07/31/15 11:14:44.287 AM	07/31/15 11:14:44.294 AM	150206	Can't find alarm text index file "sltprnv_ita.qm"!	
07/31/15 11:13:45.263 AM	07/31/15 11:13:45.268 AM	150206	Can't find alarm text index file "alsi_idxALSI_fra.qm"!	Sort
07/31/15 11:13:45.260 AM	07/31/15 11:13:45.267 AM	150206	Can't find alarm text index file "sltprnv_fra.qm"!	
07/31/15 11:13:41.627 AM	07/31/15 11:13:41.632 AM	150206	Can't find alarm text index file "sltprnv_chs.qm"!	
07/31/15 11:12:58.571 AM	07/31/15 11:12:58.579 AM	150206	Can't find alarm text index file "sltprnv_ita.qm"!	
07/31/15 11:11:13.870 AM	07/31/15 11:11:13.875 AM	150206	Can't find alarm text index file "alsi_idxALSI_fra.qm"!	Settings
07/31/15 11:11:13.868 AM	07/31/15 11:11:13.875 AM	150206	Can't find alarm text index file "sltprnv_fra.qm"!	
07/31/15	07/31/15		Can't find alarm text index file	Save log

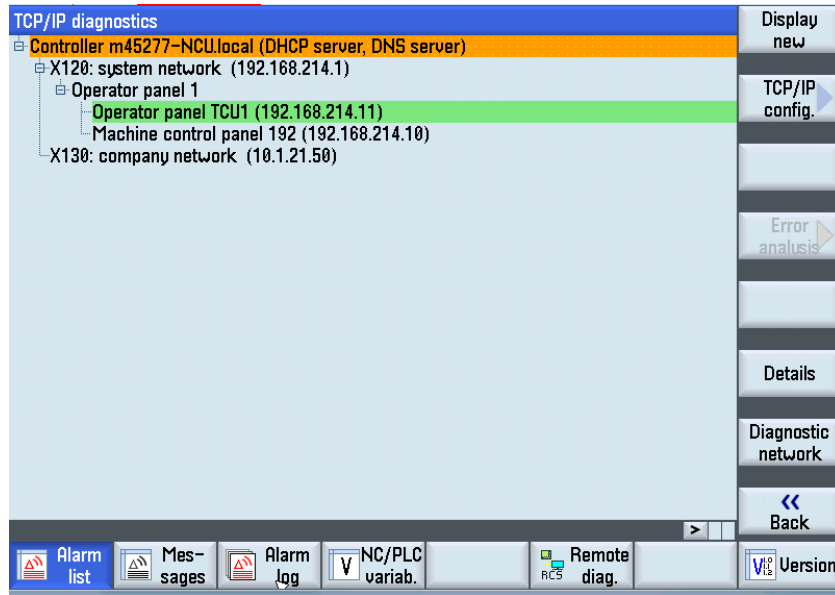
### Fault status

The status of the fault is displayed in the "Fault status" field. The following statuses are possible:

- C = message received
- Q = message acknowledged
- G = message sent

### 7.6.4 TCP/IP Diagnostics

You can run a standard diagnostic of the network via the "TCP/IP" HMI screen. The data for the network are determined and displayed. The list of planned operating panels is read and the corresponding data (IP address and connection status) are determined and displayed.



A detailed diagnostics is possible using the softkey arranged to the right.

### 7.6.5 Status of clamping fixture hydraulic lines

The "WSSP" HMI screen (workpiece clamping) is used for the status display of hydraulic lines H1 to H8 at the workpiece clamping fixture.


Each line is identified by two LEDs.

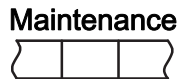
- Activate request: Line under pressure
- Relieve request: Line depressurised

Workpiece clamping				
Activate request Hx	Relieve request HX	Activate output HX	Relieve output Hx	Activate input
<input type="radio"/> PLCSIN(33) - H1	<input type="radio"/> PLCSIN(34) - H1	<input type="radio"/> Outse(31) - H1	<input type="radio"/> Outse(32) - H1	<input type="radio"/> E155.0 - H1
<input type="radio"/> PLCSIN(35) - H2	<input type="radio"/> PLCSIN(36) - H2	<input type="radio"/> Outse(33) - H2	<input type="radio"/> Outse(34) - H2	<input type="radio"/> E155.1 - H2
<input type="radio"/> PLCSIN(37) - H3	<input type="radio"/> PLCSIN(38) - H3	<input type="radio"/> Outse(35) - H3	<input type="radio"/> Outse(36) - H3	<input type="radio"/> E155.2 - H3
<input type="radio"/> PLCSIN(39) - H4	<input type="radio"/> PLCSIN(40) - H4	<input type="radio"/> Outse(37) - H4	<input type="radio"/> Outse(38) - H4	<input type="radio"/> E155.3 - H4
<input type="radio"/> PLCSIN(41) - H5	<input type="radio"/> PLCSIN(42) - H5	<input type="radio"/> Outse(39) - H5	<input type="radio"/> Outse(40) - H5	<input type="radio"/> E155.4 - H5
<input type="radio"/> PLCSIN(43) - H6	<input type="radio"/> PLCSIN(44) - H6	<input type="radio"/> Outse(41) - H6	<input type="radio"/> Outse(42) - H6	<input type="radio"/> E155.5 - H6
<input type="radio"/> PLCSIN(45) - H7	<input type="radio"/> PLCSIN(46) - H7	<input type="radio"/> Outse(43) - H7	<input type="radio"/> Outse(44) - H7	<input type="radio"/> E155.6 - H7
<input type="radio"/> PLCSIN(47) - H8	<input type="radio"/> PLCSIN(48) - H8	<input type="radio"/> Outse(45) - H8	<input type="radio"/> Outse(46) - H8	<input type="radio"/> E155.7 - H8

## 7.7 "Maintenance" function area

### Call up the "Maintenance" HMI function area

- Preconditions on the module operating unit:
  - "HMI" main menu open.
  - Access rights granted (EKS key).
- Press "Maintenance" softkey.
-  The menu of the "Maintenance" HMI area is opened.



			"Maintenance"		Interface	Lamp Test	
Prepare	Handfct.	Diagnostics	Tools	Process	Special scre	Maintenanc.	Document

### 7.7.1 PLC status

The "PLC/NC" HMI-screen is available for observing and controlling the PLC and NC variables.

CH1 NC/PLC-Variablen				Operand +
Variable	Format	Value	Unit	Operand -
DB59.DBp1004	D		piece	Insert variable Display comments Change Delete all
DB59.DBD1006	H	00000620		
DB59.DBD1020	D	0		
DB59.DBD1034	D	0		
DB59.DBD1048	D	0		
DB59.DBD1062	D	0		
/GUD3/UAR1	D	0		
IB1-	D	-120		
IB1	D	136		

The values of the variables can be edited in the respective input field or the values from an existing recipe can be transferred and written to the PLC or NC control. It is also possible to save values for variables in a recipe.

The screen structure can be controlled via screens. A total of 200 lines are available per screen. Use the *Cursor keys* to scroll and the *TAB key* to toggle between the columns.

Changing screen configurations and writing values can be protected for a particular softkey via the access level.

### 7.7.2 Loader interface

#### HMI screen

The "Interface" HMI screen serves to monitor and control the "Machine/Automation system" interface.

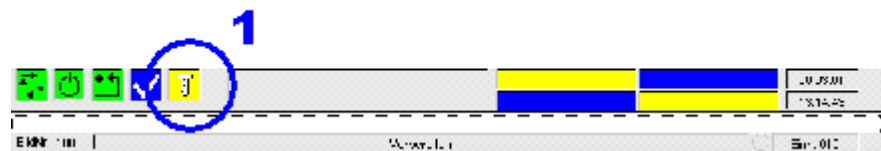


For further information, refer to:  
"Checking the loader interface" **page 204**

### 7.7.3 Lamp test

The "Lamp test" softkey of "Lamp test" HMI screen is available for a lamp test. Pressing the "Lamp test" softkey allows all illuminated pushbutton lamps to come on while the key is pressed plus a subsequent illumination period of 3 seconds.

No separate HMI screen is shown.  
A lamp symbol (1) appears in the screen header information for checking purposes.



1 Symbol lamp test

## 7.8 "Document" function area

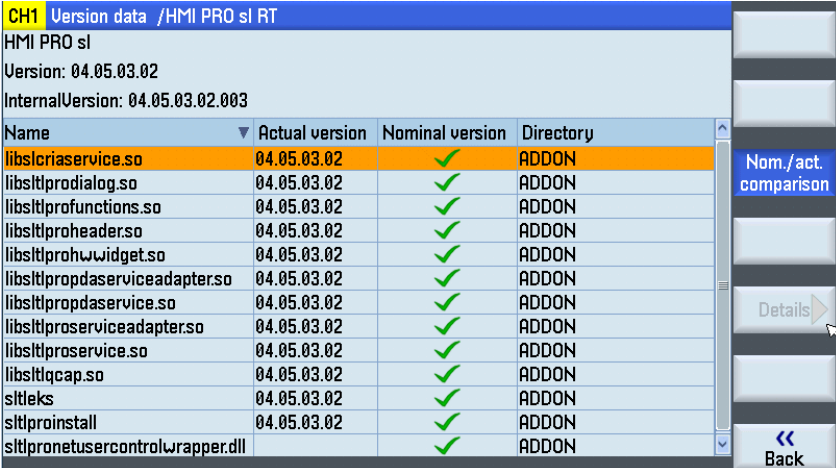
### 7.8.1 Software version

#### Version

The "Version" HMI screen displays the software versions of the software, which is installed on the machine.

#### HMI-Advanced package

The version number is permanently stored as text in the screen. It indicates the current status of the HMI screens. If the user initiates an update, the version number in Screen 8200 (S7 call up / version) must be traced.



Name	Actual version	Nominal version	Directory
libslcriaservice.so	04.05.03.02	✓	ADDON
libsltprodialog.so	04.05.03.02	✓	ADDON
libsltprofunctions.so	04.05.03.02	✓	ADDON
libsltproheaders.so	04.05.03.02	✓	ADDON
libsltprohw.widget.so	04.05.03.02	✓	ADDON
libsltpropdaserviceadapter.so	04.05.03.02	✓	ADDON
libsltpropdaservice.so	04.05.03.02	✓	ADDON
libsltproserviceadapter.so	04.05.03.02	✓	ADDON
libsltproservice.so	04.05.03.02	✓	ADDON
libsltlqcap.so	04.05.03.02	✓	ADDON
sitleks	04.05.03.02	✓	ADDON
sltproinstall	04.05.03.02	✓	ADDON
sltpronetusercontrolwrapper.dll		✓	ADDON

### 7.8.2 Safety Integrated checksum

#### General

The "SI Checksum" HMI screen shows axis-specific parameters for maximum 31 safety axes.

SI configuration			AX1.M_X1
Overview of Safety options:			
Number of Safety axes		8	
Number of external SPL inputs/outputs		SI Comfort (64 inputs 64 outputs)	
Overview of Safety checksums:			
NCK	Checksum NCK		Date NCK
	NCK SPL	000008F0H	---
	MD 13318[0]	546916A1H	
	MD 13318[1]	E6F5AA52H	
	MD 13318[2]	DCCA6FE5H	
	MD 13318[3]	00000000H	

Axis +  
Axis -  
Axis selection

Safety axes are detected separately from other axes, and only these are displayed. The axis-specific data are from Safety Integrated.



# CHAPTER 8

---

Movement with open safety  
door

## 8 Movement with open safety door

### 8.1 Movement with open safety door - Safety

#### Movement with open safety door

In special operating modes "SETUP MODE" and "SETUP MODE WORKPIECE CLAMPING", axis movements and hydraulic functions are possible with the safety door open. The movements are run at reduced speed if the approval key is pressed in addition to the movement-triggering control element.

The special operating modes may only be used by qualified service personnel. The axis movements and chip removal operations expose this group of persons to particular risk if the safety precautions are not followed.

#### Potential risks

The following risks should be expected:

- Rotating spindle and tools can cause hands, hair and clothing etc. to become trapped.
- Risk of being crushed or cut by moving axes.
- Risk of flying parts in the event of a tool break or failure of the workpiece clamping device.
- Eye injuries caused by flying chips and coolant.
- Foot injuries caused by falling workpieces.
- Gashes caused by sharp-edged workpieces and chips.
- Skin and respiratory tract conditions caused by coolant.



Before commencing work in special operating modes "SETUP MODE" and "SETUP MODE WORKPIECE CLAMPING", observe the safety precautions in Chapter 2.

#### Wear protective clothing

Personnel are required to wear the following protective equipment:

- Unbreakable safety glasses from polycarbonate with side protectors.
- Close-fitting clothing.
- Safety shoes with steel toe caps.
- Safety helmet.
- Hair protection where necessary.
- Skin protection where necessary (as per skin protection plan).

**i**

**Important:** Gloves must not be worn due to ease of being trapped. Chips must be removed with a broom or chip hook.

**Secure against lock-in**

The work area safety door must be secured to prevent unauthorised closing prior to work commencing. This is achieved by placing a padlock in the appropriate holder on the door and locking. The key must then be removed and carried on your person. This means that the safety door can not be closed.

**Risk prevention**

The tool used for machining must be as new.

The workpiece must be deposited securely and/or clamped in the fixture and be free from chips.

Before any activity involving entering the work area can be carried out using the mobile handheld operating unit, the danger area of the machine must be explained in advance. This means:

- Which axes are able to move when you actuate the axes keys on the operating unit.
- What are the traversing ranges of these axes.

Make sure you are clear about which NC axis you want to move in which direction. For this purpose, observe the markings on the machine.

Ensure that there is always a safe escape route from the hazard area.

**Access authorisation**

The electronic key (EKS) for selecting special operating modes "SETUP MODE" and "SETUP MODE WORKPIECE CLAMPING" may only be made available to approved specialist personnel.

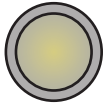
When work in special operating modes "SETUP MODE" and "SETUP MODE WORKPIECE CLAMPING" is complete, the program must be switched to normal operating mode "AUTOMATIC MODE".

- The EKS key must be removed.

## 8.2 Functions and conditions

### 8.2.1 Special operating mode "SETUP MODE"

SETUP  
MODE



#### SETUP

"SETUP MODE" mode is activated by pressing the middle key *SETUP MODE* on the machine function operator panel.

Provided that the green "Electronic Key" has been inserted into the EKS holder.

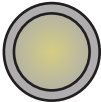
Machine movements are now possible under the following conditions.

Function	Condition
<b>Permissible NC operating modes</b>	- Jog (Inch mode, inch spindle) - INC 1... (incremental movement, maximum increment = 100)
<b>Axis movements</b> Initiate and maintain the movement: Axis speeds:	Control via module operating unit. <i>-/+ direction key</i> or <i>Handwheel</i> together with <i>Approva</i> key.  - maximum 2 m/min with linear axes - and/or circumferential speed with rotary axes.
<b>Spindle movement</b> Spindle speed:	Control via module operating unit. 30 rpm (corresponds to 100 % override)
<b>Stop category for approval key</b>	Releasing the <i>Approva</i> /key causes a switchover to the Safe operational stop (SBH), during which the energy supply is retained at standstill.
<b>Non-permissible functions</b>	- Tool change - Workpiece change - Coolant functions - Chip conveyor.

When work in special operating mode "SETUP MODE" is complete, the program must be switched to normal operating mode "AUTOMATIC MODE". The key must be removed. It must only be accessible to authorised specialists.

### 8.2.2 Special operating mode "SETUP MODE WORKPIECE CLAMPING"

SETUP  
MODE



#### SETUP

"SETUP MODE WORKPIECE CLAMPING" mode is activated by pressing the right key *SETUP MODE WORKPIECE CLAMPING* on the operator panel for machine functions.

Provided that the black "Electronic Key" has been inserted into the EKS holder.

The NC-axes are in safe operational stop, machine movements are now possible under the following conditions:

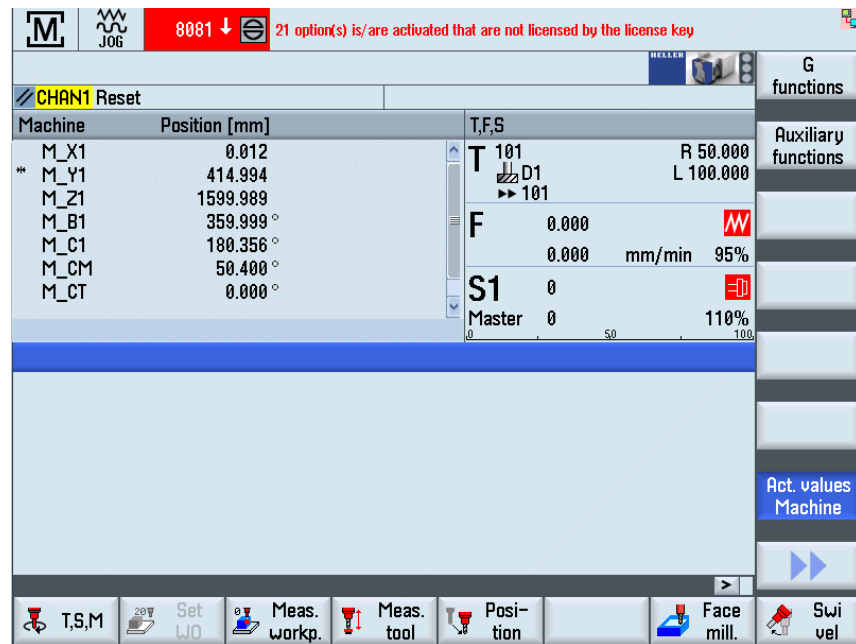
Function	Condition
Actuate clamping fixture	<ul style="list-style-type: none"> <li>- hydraulic functions selected</li> <li>- pneumatic functions are selected</li> <li>- Safety doors are opened</li> </ul>

When work in special operating mode "SETUP MODE WORKPIECE CLAMPING" is complete, the program must be switched to normal operating mode "AUTOMATIC MODE". The key must be removed. It must only be accessible to authorised specialists.

## 8.3 Jogging in Special mode "SETUP MODE"

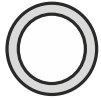
### Pre-settings

- Preconditions
  - Motors switched on.
  - The machine is in Safe operational stop.
  - The work area safety door is locked.
  - Normal mode "AUTOMATIC MODE" is activated.
- Press the *Setup* key.
  - ↪ The "SETUP" machine mode is activated.
- Press *Machine area* key.
  - ↪ The "Machine" main menu is opened.
- Press the *JOG* key.
  - ↪ "JOG" NC mode is activated. The "Jog" basic display is opened.



- Press the *Feed/Spindle Start* key.
  - ↪ The feed and spindle enable is issued. "Feed/spindle start" lamp illuminates.

### Connecting the HT8



- ☒ Press and hold the *Bypass E-Stop* key at the stationary operating unit.

- ☒ Remove the bridge connector from the stationary operating unit.
- ☒ Insert the connector of the approval unit into the interface (push-pull).



- ☒ Release the *Bypass E-Stop* key.
  - ↗ The same operating screen (blacked out) as on the stationary operating unit will appear in the screen of the mobile handheld operating unit.
- ↗ The mobile handheld operating unit accepts the command after the first key depression (and/or touchscreen actuation).
- ↗ The stationary operating unit is disabled.
  - The message "Toggle disable set in current PLC" will appear.
  - The operating screen is shown with reduced dimensions.

### Open safety door



- ☒ Press the *Lock/unlock safety door* key.
- ↗ The work area safety door is unlocked.  
The lamp stays on as soon as the safety door is fully unlocked.



The work area safety door is not unlocked immediately when a brake test is required on the Y and A axes. That means an automatic brake test is run before the safety door is unlocked, if more than 8 hours have passed since the last brake test.

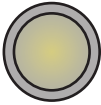


For detailed information on the brake test, see: "Brake test, vertical axes"

"Manual brake test and test stop" **page 320**

- ☒ Open work area safety door.

### Activate special operating mode "SETUP MODE"



- Insert green *Electronic Key* for special operating mode "SETUP MODE" into the key holder.
- ↪ Access rights for special operating mode "SETUP MODE" are granted.  
The middle key lamp flashes.
- Actuate middle key *Preselection Open Safety Door - Setup*.
- ↪ Special operating mode "SETUP MODE" is activated.  
The associated key lamp now lights up permanently.

Functions listed in Chapter 8.2.1 are executable.

### on the HT8

### Activating JOG mode

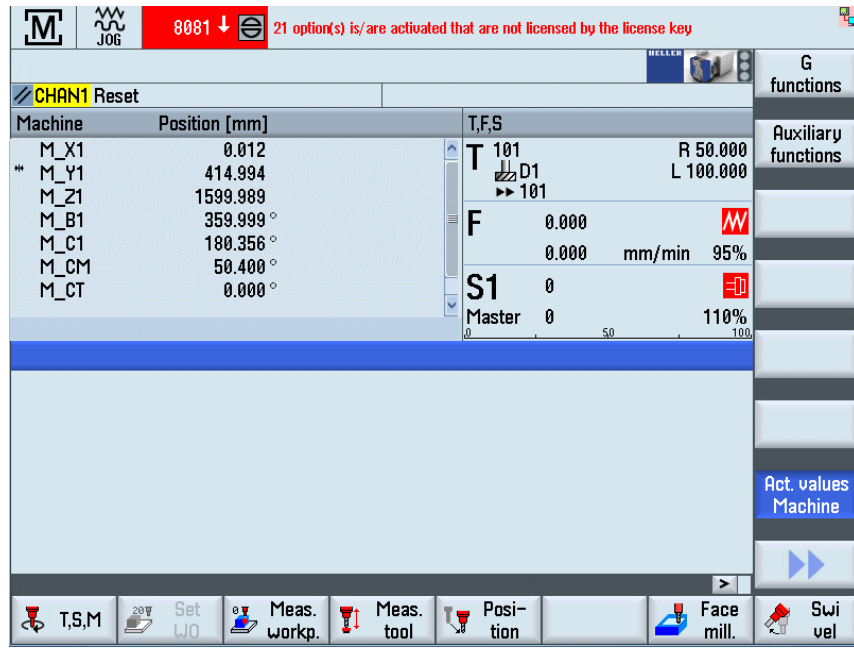
- Preconditions:
  - Work area safety door opened.
  - Feed and spindle enable is issued.
  - Mobile handheld operating unit connected and ready for operation.



8 Movement with open safety door  
 8.3 Jogging in Special mode "SETUP MODE"



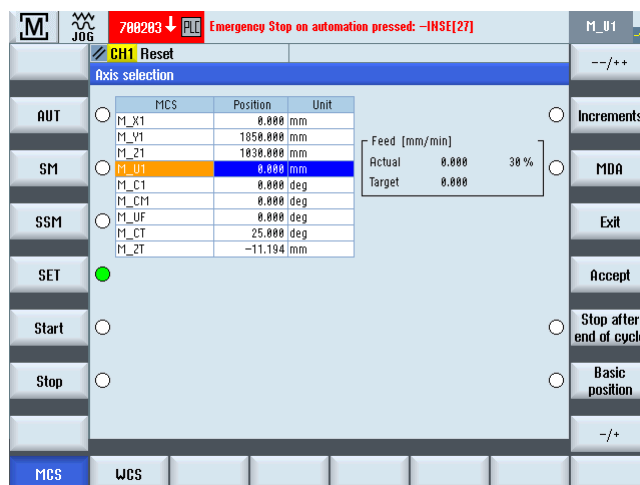
- ☒ Press the *JOG* key.
- ↪ "Jog" NC mode is activated.  
 The "Jog" basic screen displays position values.



Selecting NC-axis, activating the direction keys



- ☒ Press the *U (User)* key.
- ↪ Important machine control panel functions are activated.  
 In addition to the axis selection, *Feed direction keys +/-* and *Rapid traverse direction keys ++/--* are activated as softkeys. These functions can be executed via the keys assigned on the right.



### Traversing NC-axis

2-hand operation:

To move the selected axis, two control elements must be pressed at the same time.

- on the HT8:
  - *Feed direction key*  $-/+$  and one of the approval keys at the rear.
  - *Rapid traverse direction key*  $--/++$  and one of the approval keys at the rear.
- at the main operating unit:
  - *Direction key*  $+/-$  and *approval key*



- Turn back *Feed override* to **0%**. Then set feed override to a low value (e.g. 10%).

The traverse speed can be modified using Feed Override.

- Press one of the *Approval keys* on the back of the HT8.

### either



- Press the approval key and the correct *Direction keys*  $-/+$  towards the required axis direction and note the effect of the  $-/+$ .
- ↪ The axis traverses until either the *Feed direction key*  $-/+$  is released or the area boundary is reached.

### Or



- At the same time as the approval key, press the correct *Direction keys*  $-/+$ .
- ↪ The axis traverses until either the *Rapid traverse direction key*  $--/+$  is released or the area boundary is reached.



- Use the *Feed override* to increase the traverse speed to the desired value.
- Release Direction key when the desired position is reached.

## 8 Movement with open safety door

### 8.3 Jogging in Special mode "SETUP MODE"

- ☒ Release *Direction key* *-/+* .
- ↪ The axis stops.
- ☒ Release the *Approval key* on the back of the mobile handheld operating unit.

Start of repetition for further traverse motion.

- ☒ Press the *Approval key*.
- ☒ Press a *Direction key*.
- ↪ Axis will move as long as the *-/+ key* (or the *Approval key*) remain pressed.
- ☒ Release the *-/+ button*.
- ☒ Release *Approval key*.

If further motion is required, repeat the procedure.

#### on the main operator panel

#### Deactivating special operating mode "SETUP MODE"

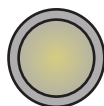
On completion of work in this special operating mode "SETUP MODE", proceed as follows:

- ☒ Close work area safety door.
- ☒ Press the *Lock/unlock safety door* key.
- ↪ The work area safety door is locked.  
The relevant key lamp extinguishes.  
The key lamp for the special operating mode also extinguishes.



- ↪ The control unit switches to "AUTOMATIC MODE" normal mode.  
The associated key lamp lights up.

AUTOMATIC  
MODE



- ☒ Remove *Electronic Key* from the key holder and secure to prevent unauthorised access.

The EKS key must only be accessible to authorised specialists.

### Remove HT8

BYPASS  
E-STOP



- Press and hold the *Bypass E-Stop* key at the stationary operating unit.

- Remove the approval unit from the interface (push-pull).
- Connect bridge connector to interface.

BYPASS  
E-STOP



- Release the *Bypass E-Stop* key.

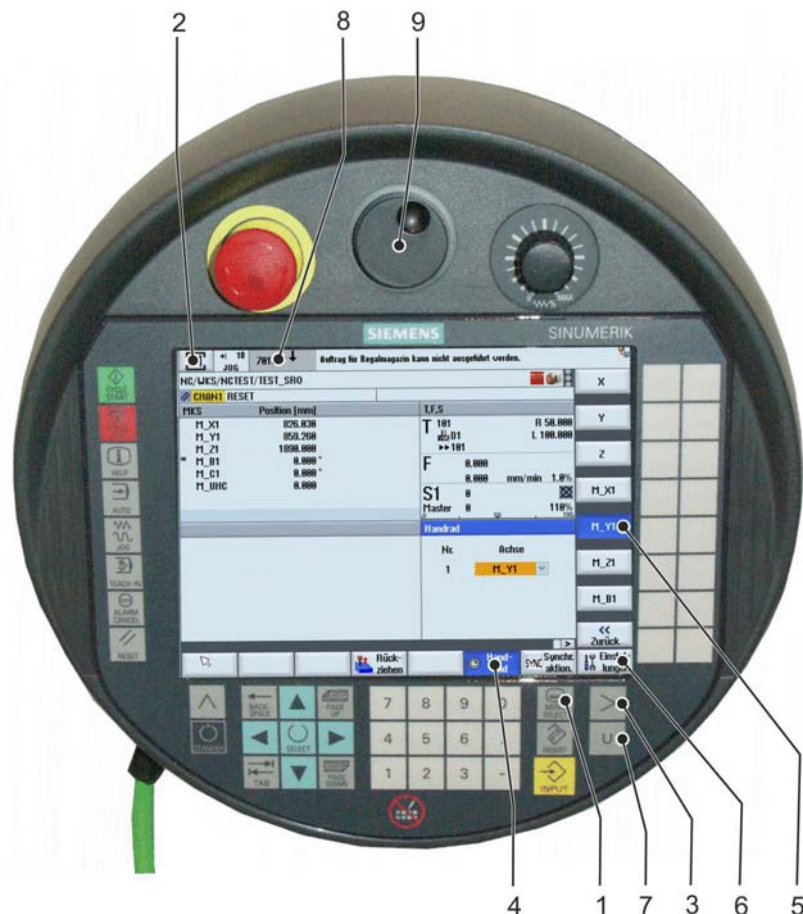
- 8 Movement with open safety door  
 8.4 Hand wheel on the mobile handheld operating unit (HT8)

## 8.4 Hand wheel on the mobile handheld operating unit (HT8)

The hand wheel on the HT8 can be used to traverse the individual NC-axes of the machine in a plus and minus direction.



Traversing without due care and attention can cause damage to the tool/workpiece. The increments per revolution at the hand wheel of the HT8 are 50 increments/revolution, at the main operator panel, 100 increments per revolution. A different traverse path length is derived from this difference.



8.4 - 1 HT8 handheld operating unit with hand wheel function

☒ Procedure:

1. Use the *Menu select key* (1) to call up the basic menu of the handheld operating unit.
2. Use the lower *Machine* softkey to switch to the "Machine" main menu.
3. Press the *etc.* (3) key.
  - Hand wheel softkey (4) appears.
4. Select required axis (5).
5. Call-up softkey settings (6), set variable increment.
6. Use the User key key (7) to select the increment.
  - The message 703032 (8) appears in the menu screen, HT8 is active.
7. Traverse the selected axis using the hand wheel (9).

## 8.5 Manual spindle rotation

The spindle can be rotated manually at a correspondingly lower speed of rotation. The sequence must be strictly observed for the following operating steps.

Preconditions:

- Machine has stopped at end of cycle.
- Move spindle towards work area safety door.
- Motors switched on.
- Work area safety door closed and locked.



- Press the *Feed/Spindle Stop* key if the spindle has not yet stopped.  
 ↪ The associated LED comes on as soon as "Spindle stop" has been accepted by the control.



The effect of the *Feed/spindle start* key must be coupled to the spindle via the "Feed/spindle key" HMI function (see "Service functions - IBN II).



- Press the *Lock/unlock safety door* key.  
 ↪ The safety door is unlocked.

- Open work area safety door.



### DANGER

Risk of injury - tool has sharp edges!  
 Wear protective gloves.

- Slowly rotate the spindle so that the Safety Integrated monitoring device cannot trip.

### On completing the manual spindle rotation

- Close work area safety door.



- Press the *Lock/unlock safety door* key.
- ↪ The safety door is locked.



- Press the *Feed/Spindle Start* key.
- ↪ The associated LED comes on as soon as Feed/spindle start has been accepted by the control.



# CHAPTER 9

---

Remote diagnosis, data  
backup

## 9 Remote diagnosis, data backup

### 9.1 Introduction to "ePS Network Services"

#### 9.1.1 Introduction

The "ePS Network Services" software module will help you make a professional malfunction diagnostics.

Remote control signals and all communication between machine operator and HELLER Service run over a secure Internet connection under the control of the ePS Network Server.

To be able to use the "ePS Network Service", you must start the software from the main operator panel of the machine and authorise yourself.



For more information on the "ePS Network Services" software module, please see the Operator Manual of the "BS.000113-XX-00" control.

#### 9.1.2 Starting "ePS Network Service"

Preconditions:

- The machine is on and the control has run up.
- The machine is setup for Internet access.
- Access data, including password, are known.



Press the *Data menu key*.

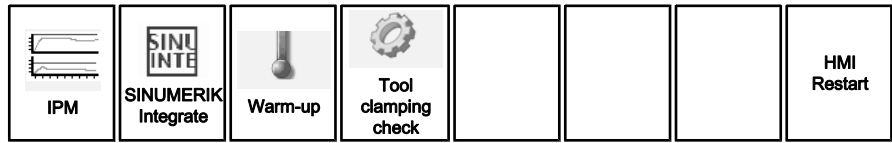
↵ The machine's basic menu is opened.



Press the *etc.* key.

↵ The expanded menu of the horizontal softkey bar is opened (2rd level).

9 Remote diagnosis, data backup  
 9.1 Introduction to "ePS Network Services"



**SINUMERIK Integrate**  Press the "SINUMERIK Integrate" softkey.  
 ↗ The diagnostic software is started.



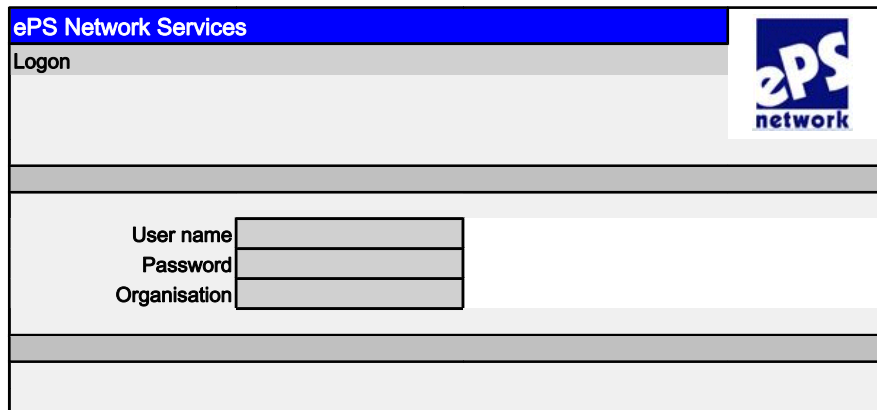
↗ The softkey bar layout changes as follows:



**Online Services**  Press the "Online Services" softkey.



↗ The "Logon" window is displayed:



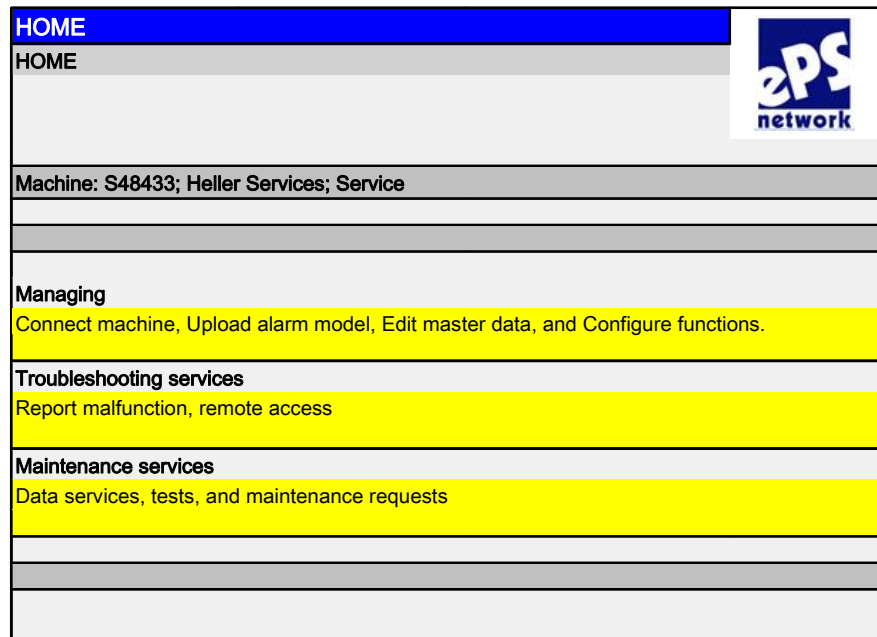
The "Logon" window requires no input.

Press the "Ok" softkey.

**Ok**



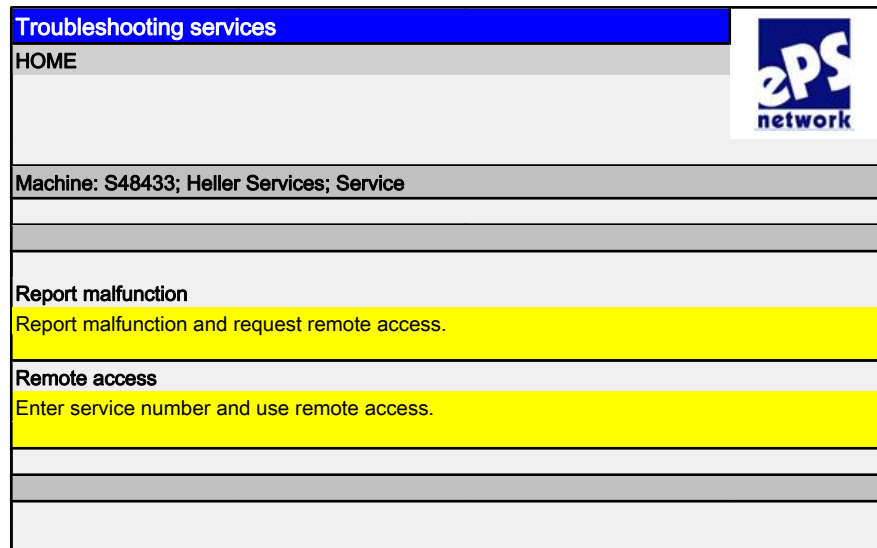
↗ The "Home" window is displayed:



Select



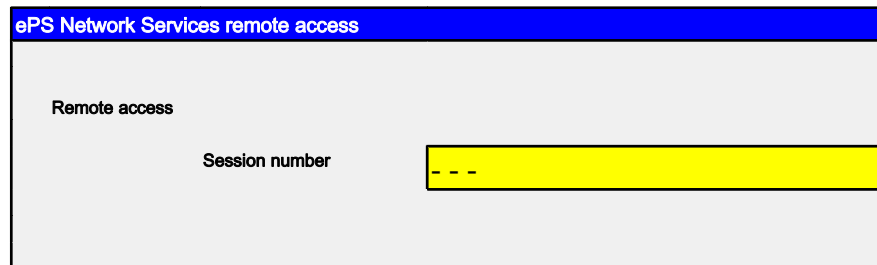
- Press the "Select" softkey on the right, which belongs to the "Troubleshooting services" function, to select the "Troubleshooting services" function.
- ↩ The "Troubleshooting services" window is displayed:



Select



- Press the "Select" softkey on the right, which belongs to the "Remote access" function, to select the "Remote access" function.
- ↩ The "ePS Network Services remote access" window appears:



- Enter into the input field the session number that Heller Service gave you by phone.

No cursor appears. The session number can be entered directly.

Ok



- Press the "Ok" softkey to confirm the input.

↵ The machine is now connected online with the Heller Service.

- Please follow the instructions by the Heller Service personnel.

### 9.1.3 Exiting "ePS Network Service"

When the service has finished, the Heller Service will terminate the online connection.

The main operator panel of the machine returns to the "Home" window.

Exit



- Press the "Exit" softkey.
- ↵ A blue screen is displayed.



- Press the following keys simultaneously: *Recall and Data menu key*.

↵ Wait until the "Service sessions" window is displayed.



- Use the *Cursor keys* to select the "Show HMI on Mxxxxx-NCU" line.

Ok



- Press the "Ok" softkey.

↵ The "ePS Network Service" is exited.

↵ The machine's user interface is displayed.

## 9.2 Backing up NC, PLC and drive data

The data for the NC, PLC and the drives are stored in the NCU and/or on the CF-card. These data must be backed up at regular intervals. The NC and PLC data are stored in the NCU's S-RAM, while the drive data are on the CF-card and copied to the drives during each start-up.

### Run NC- data backup



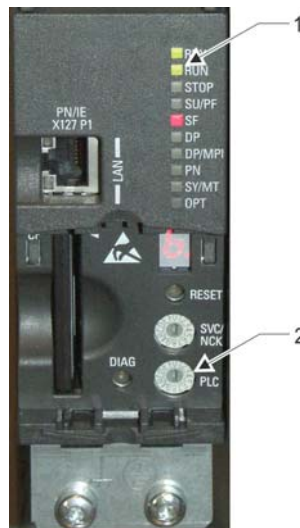
#### **DANGER**

Electric shock from touching live parts. Risk of injury from live components in the control cabinet.

Only qualified electricians are allowed to work on the energised control cabinet

#### Stop PLC:

- Open the control cabinet.
- At the NCU, turn the switch (2) to position 2.

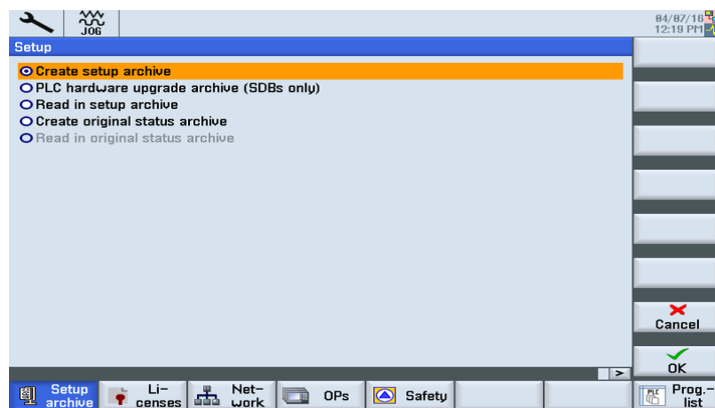


- 1 Status LEDs
- 2 PLC rotary switch

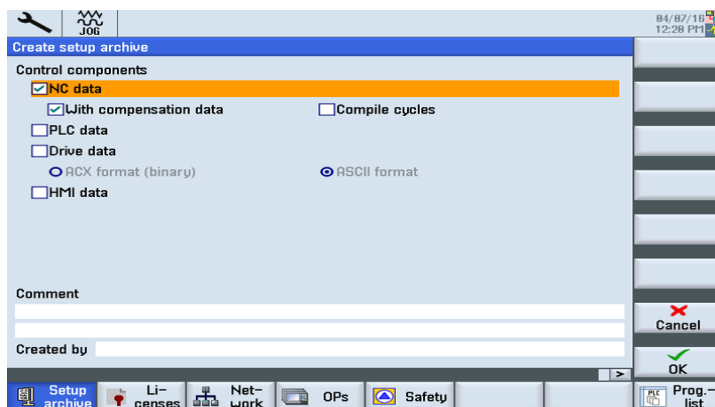
## 9 Remote diagnosis, data backup

### 9.2 Backing up NC, PLC and drive data

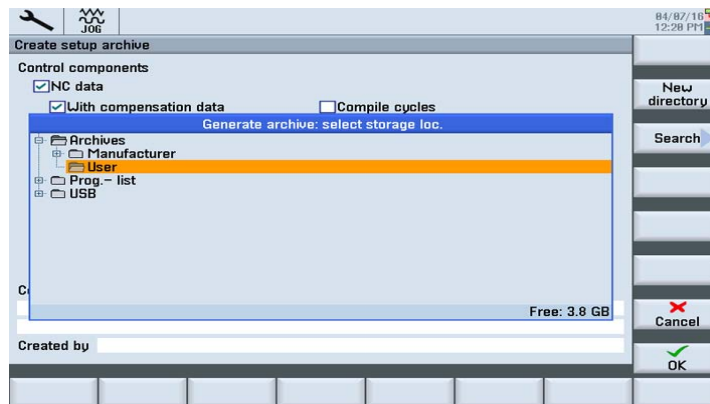
- ☒ further actions at the main operator panel:
  - Switch to the basic menu.
  - Call up "Commissioning" menu.
  - Press the "System data" softkey.
  - Press the ">> (Switch page)" softkey.
  - Press the "Commissioning archive" horizontal softkey.
- ☞ The menu of the "Commissioning archive" area is opened.
- ☒ Select the "Create commissioning archive" option and confirm via the "OK vertical softkey.



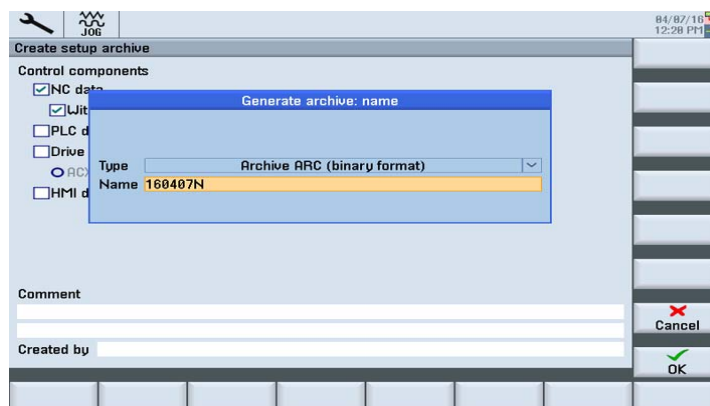
- ☒ Select "With compensation data" and "Compile cycles" options. If applicable, enter a comment and confirm via the "OK" vertical softkey.



- ☒ Select storage location.



- ☒ Assign name. Suggested name: yymmddN and confirm via the "OK" vertical softkey.
- ↵ The data backup is created.



### Run PLC and drive data backup

- ☒ Back up PLC and drive data following the NC procedure:
  - At PLC data backup, select only the PLC option. Suggested name: yymmddP.
  - At Drive data backup, select only the Drives option and then ACX. Suggested name yymmddD.
- ☒ When importing a series commissioning procedure into an empty NCU, observe the following sequence: first import the NC data and then the PLC data.



# CHAPTER 10

---

Drawings, plans

## 10 Drawings, plans

### 10.1 Technical data on the application field of the machine MC 8000 + MC 10000

The following technical data reflect the standard version. Please refer to the General layout (AZ) for order-related modifications of individual data.

			MC 8000	MC 10000
<b>Work area</b>				
	Longitudinal stroke (X-axis)	mm	1 250	1 600
	Vertical stroke (Y-axis)	mm	1 200	1 400
	Transverse stroke (Z-axis)	mm	1 100	1 300
<b>Feed forces</b>				
	X and Y axes at duty cycle S3 - 40%	N	15 000	15 000
	Z axes at duty cycle S3 - 40%	N	20 000	20 000
<b>Speeds</b>				
	Rapid traverse in X, Y and Z-axis.	mm/min	50 000	40 000
	Acceleration	m/s <sup>2</sup>	4.0	4.0
<b>Machining unit</b>				
	Spindle taper	SK HSK BT	50 A100 50	50 A100 50
<b>Power Cutting (PC)</b>				
	Maximum drive power at duty cycle S6 - 40%	kW	43	43
	Maximum drive torque at duty cycle S6 - 40%	Nm	822	822
	Speed range	1/min	5 - 8 000	5 - 8 000
<b>Enforced Power Cutting (EPC)</b>				
	Maximum drive power at duty cycle S6 - 40%	kW	60	60
	Maximum drive torque at duty cycle S6 - 40%	Nm	1 146	1 146
	Speed range	1/min	5 - 8 000	5 - 8 000
<b>High Power Cutting (HPC)</b>				
	Maximum drive power at duty cycle S6 - 40%	kW	60	60
	Maximum drive torque at duty cycle S6 - 40%	Nm	2 292	2 292
	Speed range	1/min	5 - 6 000	5 - 6 000

## 10 Drawings, plans

## 10.1 Technical data on the application field of the machine MC 8000 + MC 10000

			MC 8000	MC 10000
<b>Speed Cutting (SC)</b>				
	Maximum drive power at duty cycle S6 - 40%			
	Siemens	kW	52	52
	Fanuc	kW	37	37
	Maximum drive torque at duty cycle S6 - 40%			
Siemens	Nm	166	166	
Fanuc	Nm	161	161	
Speed range		1/min	5 - 12 500	5 - 12 500
<b>Power Speed Cutting (PSC)</b>				
	Maximum drive power at duty cycle S6 - 40%		kW	52
	Maximum drive torque at duty cycle S6 - 40%		Nm	500
	Speed range		1/min	5 - 12 500
<b>Tool magazine</b>				
	Maximum tool mass		kg	35
<b>Chain-type magazine</b>				
	Magazine places		Pieces	50/100/150
	Maximum tool length		mm	800
	Maximum tool diameter		mm	280
<b>Rack-type magazine</b>				
	Magazine places		Pieces	265/425
	Maximum tool length		mm	600
	Maximum tool diameter		mm	280
<b>Rotary table</b>				
	Indexing		degrees	360 000 x 0,001
	maximum speed		1/min	10
<b>Pallet design</b>				
	Pallet size		mm x mm	800 x 800 / 1 000 x 1 000
<b>Workpiece</b>				
	Maximum workpiece collision path		mm	1 250
	Maximum workpiece height		mm	1 400
	Maximum pallet loading capacity		kg	3 000
Special cases, see "Loading regulation" in Chapter 5 of the Operator Manual (BD).				

			MC 8000	MC 10000
<b>Installation data</b>				
	Footprint (length x width), depends on cooling lubricant system	m	7,5 x 5,4	8,0 x 5,8
	Machine height	m	4,9	4,7
	Machine mass approx.	kg	29 500	29 500
	Overall operating power of the machine approx.	kVA	37	37
	Overall operating power of the cooling lubricant unit approx.	kVA	13	13
	Compressed air	bar	4,5 - 6	4,5 - 6
	Temperature range	°C	+10 ... +45	+10 ... +45

Subject to technical revisions.

Status: August 2012

## 10.2 Drawing overview

The table below shows which drawings and plans are valid for your machine and in which manual which documents can be found. The documents always appear in the Section headed "Drawings, Plans".

	Drawing no.	Page	IA	BD
General layout	AZ.			X
Foundation layout	FZ.			X
Transportation Information	TI.			X
Tool assignment plan	57.			X
Hydraulic Diagram <sup>x)</sup>	HP.		X	
Lubrication Diagram <sup>x)</sup>	SP.		X	
Pneumatic Diagram <sup>x)</sup>	PP.		X	
Coolant diagram <sup>x)</sup>	KP.		X	
Coolant diagram <sup>x)</sup>	KP.			
shown on:	KP.	50	X	
Lubrication Instructions	SA		X	
Lubrication Chart	BA0124		X	
Wiring Diagram	See electronics documentation			
IA	Maintenance Instructions			
BD	Machine Operator Manual			
x)	with parts list			



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   Repos S. 230

### B

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