Technical Documentation

CNC Machining Systems

June 2007

Operating Instructions
Classic Line

vhf camfacture AG ■ Lettenstraße 10 ■ 72119 Ammerbuch ■ Phone: +49 (0)70 32 970 97-0 ■ www.vhf.eu ■ info@vhf.eu

Contents

1 About this document

1.1 Used symbols

Instructions

➤ General instruction

M Specific manual action

S Specific action in the manufacturing software

➨ Result

Additional symbols

Cross reference

■ List

Information to make work more efficient.

Important instructions without any danger for people or objects.

Additional information

1.2 Structure of safety notes

⚠ SIGNAL WORD

Type and source of hazard

Further explanations and consequences when ignoring hazards.

➤ Instructions to avoid hazards.

The following signal words may occur in this document:

⚠ DANGER

DANGER indicates a hazardous situation which will result in death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which can result in death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which can result in minor or moderate injury.

NOTICE

NOTICE indicates a situation which can lead to physical damage of the product or in the surrounding area(s).

2 Safety instructions & regulations

2.1 General safety instructions

⚠ DANGER

Incorrect operation of the machine

➤ Read this document carefully **before** installing and operating the machine.

➤ If it is unclear how to operate the machine in any way, do not use the machine and contact customer service.

➤ Do not use the machine under the influence of alcohol, pharmaceutical drugs or psychoactive drugs.

➤ Make sure that every user has access to this document.

➤ Instruct every user on safe and proper machine handling.

➤ Do not place any objects onto the machine.

Danger to life due to an electric shock

➤ If you come into contact with electrically charged parts, you can suffer from an electric shock. Water increases the risk significantly.

➤ Only have qualified electricians work on any electric equipment.

➤ Run power cables so that they cannot be damaged by sharp edges.

➤ In the following cases, disconnect the machine from the electrical source immediately and prevent it from being restarted:

■ When machine connections, compressed air hoses or electric cables are damaged
■ When water is leaking
■ **Before** you check or run electric cables

➤ Never perform any troubleshooting while the machine is operating.

➤ Only have authorized service technicians repair the machine.

➤ Replace damaged cables with original manufacturer's spare parts.

➤ Install all electric connections as specified by vhf (chapter 2.3).

➤ Do not touch the machine and especially the cables with wet or damp hands.

➤ Remove any liquids near the machine immediately.

➤ Apply voltage to the system only after the installation of all devices and electric cables is complete.

⚠ WARNING

Respiratory diseases when processing material with harmful dust formation

If you inhale materials with harmful dust formation during their processing, your respiratory tracts may be damaged.

- ➤ Mill these materials only with an activated air extraction system.
- ➤ For dry machining: Only use suitable materials for dry machining.
- ➤ Use an air extraction with a suitable filter system.

Damage caused to your health by the cooling liquid

It can cause damage to your health if you use a wrong cooling liquid or if you are not informed about the handling of the cooling liquid.

- ➤ Only use the cooling liquid which is prescribed by vhf for the respective material.
- ➤ Carefully read the safety data sheet of the cooling liquid **before** you use the cooling liquid.
- ➤ Store the safety data sheet together with the cooling liquid.

Crushing hazard and risk of cutting injuries through moving machine parts

Through the moving axes and the rotating spindle you can suffer bruises and cuts.

- ➤ Use the machine only with a housing around the complete workspace or with a correctly positioned dust extraction (ca. 1mm above the workpiece surface) around the rotating tool.
- ➤ Do not circumvent or deactivate safety devices of the machine.
- ➤ Check the machine regularly for damage, especially the safety devices.
- ➤ Have damaged safety devices repaired by an authorized service center unless stated otherwise in this document.
- ➤ Use only original manufacturer's equipment and original spare parts in the machine.
- ➤ Keep children and animals away from the machine.

Risk of cutting injuries and bruises as well as hazards through ejected debris

- ➤ Operate the machine only with a housing around the complete workspace or with a correctly orientated dust extraction (ca. 1 mm above the workpiece surface) around the rotating tool.
- ➤ For machines without housing: Start the program only from the work station. Approach the machine only after the program is finished.
- ➤ Only use carbide tools.

- ➤ For processes without housing and without air extraction: Everyone within reach of the machine must wear protective eye wear.

- ➤ For processes without housing and without air extraction: Do not reach in the processing area while the axes are moving and while the job is running.

Hearing damage due to loud noise

- ➤ In case of loud machining noise check the working conditions: Ensure that the workpiece is fixed properly, and verify the condition of the tool and the material you are using.

- ➤ If loud noise cannot be avoided, wear ear protection during processing.

Risk of injuries through loose pneumatic components under air pressure

Loose pneumatic components can move extremely fast and unpredictably and may cause injury.

- ➤ **Before** you run the pneumatic hoses, close the compressed air supply valve.
- ➤ **Before** you check the pneumatic hoses and pneumatic connections, set the air pressure to a minimum value.

- ➤ In case of defective machine connections and pneumatic hoses, disconnect the machine from the external compressed air supply and the electrical source to prevent it from being restarted.
- ➤ Contact customer service if connections are damaged or defective.

⚠ CAUTION

Trip, fall and slipping hazards

➤ Keep the working environment and installation site clean.

➤ Run cables in such a way that persons cannot trip over them.

Risk of cutting injuries and burns

If you touch tools or sharp edges on workpieces or the machine, you may suffer from cuts. If you touch the hot spindle body or hot tools, you may suffer from burns.

➤ Wear gloves when you perform manual work at the machine or with workpieces / tools.

Reduced ability to act with insufficient lighting

In case of an insufficient lighting your judgement and / or your precision may be reduced.

➤ Make sure that the lighting in your working environment is sufficient..

Risk of injury in case of malfunctions caused by insufficient maintenance

If you do not maintain the machine as often as is required, malfunctions may occur which can lead to injuries.

➤ Take note of the intervals and conditions mentioned in the maintenance table in this document and carry out the respective maintenance steps accordingly.

Health risks through constant malpositioning if your working environment is not sufficiently ergonomic

Over the long run, an improper or one-sided positioning can be a risk to your health.

➤ Set up an ergonomic work environment.

➤ Ensure the seat height and monitor position is ideal and the lighting is sufficient.

➤ Use proper lifting and carrying devices for the positioning of the workpieces.

NOTICE

Damage to the spindle bearings due to missing warm-up time

After a long off-time of the spindle the grease in the spindle bearings can be placed unevenly. If you mill directly afterwards the spindle bearings can wear down faster than expected.

➤ Run the spindle several minutes without load at low rotational speeds, if the machine has not been used for several days.

2.2 Operating regulations

If you violate the following regulations, you may lose your entitlement for benefits. In addition, we cannot be held liable for any damage resulting from such violations..

2.2.1 Intended use

The portal milling machines are CNC machines designed for milling or cutting materials, depending on their configuration. The machines are designed for commercial use.

➤ Only process materials that have been approved for your machine by vhf.
➤ Only use extra equipment approved by vhf.
➤ Do not run the machine unattended.
➤ Before every program start, ensure that there are no other persons directly near the workspace of the machine.

2.2.2 Reasonably foreseeable misuse

➤ Do not use the machine in a private environment.
➤ Never use the machine with open safety devices. Do not use the machine with defective, manipulated or bypassed safety devices.
➤ The machine may only be used and maintained by trained personnel.
➤ Do not use the machine in explosion-endangered areas.
➤ Do not use the machine in a playful manner.
➤ Make sure that unauthorized persons do not have access to the machine.
➤ Only perform repair and maintenance works, that are described in the respective operating instruction.

2.2.3 Special persons

➤ When the following groups / individuals are in the same room as the machine, always supervise them and establish further safety measures if necessary:

- Cleaning personnel, **even if instructed**
- Persons that are not familiar with the system
- Users of other machines
- Employees from the surrounding area(s)
- Strangers, for example visitors
- Pregnant women

- Persons below the age of 18
- General public

2.3 Preparations before delivery

The portal milling machines from vhf are constructed modularly. Consequently, the requirements for the installation site are specific to every individual machine.

vhf clarifies critical points regarding installation and transport of the machine (such as access to the installation site or the available space at the installation site) before delivery.

You will receive an individual layout plan for your machine before delivery. The layout plan enables you to ensure that all requirements for use are met (required electric connections, compressed air connections...).

2.4 Installation site

➤ Choose the installation site based on the following criteria:

- Firm and even surface, must carry the weight of the machine.
- Room temperature ideally between 18 °C and 25 °C; minimum room temperature: 10 °C; maximum room temperature: 32 °C
- Relative air moisture: max. 80 %, non-condensing
- Power supply according to the layout plan
- Compressed air supply according to the layout plan (if necessary for the system)
- Sufficient space around the sides of the machine

➤ If you have further questions regarding the installation site, contact vhf to guarantee a smooth machine installation.

2.5 Transport

vhf will deliver and install the machine. If you do not use this service, you will receive additional instructions for transport and installation of the machine.

- Ambient air temperature: between 10 °C and 32 °C
- Relative air moisture: max. 80 %, non-condensing

➤ Only trained transport personnel may transport the machine to the installation site.

➤ Always transport the machine in an upright position.

➤ In case of overseas transport, take proper measures against corrosion.

2.6 Safety instructions for individual machine modules

2.6.1 System rack

⚠ DANGER

Damage of the insulation of electrically charged parts due to movements

➤ Preferably cover all cables, hoses, plugs and connections that are not needed for using and operating the machine.

➤ Run cables and hoses between the system rack and the machine in an unaccessible area if possible.

➤ Do not run cable and hoses to the machine in the direct movement area or in a traffic zone. Avoid slipknots in the movement area.

Electric shock while cleaning the system

➤ **Before** cleaning the system, disconnect it from the electrical source.

➤ Shut down all components in the system rack and disconnect the power plug.

⚠ WARNING

Tilting of the system rack

➤ Position the system rack only on a firm and even surface.

2.6.2 Automatic Z adjustment unit

⚠ WARNING

Trapping your hand while measuring the workpiece height

➤ Only trained personnel may measure the workpiece height.

Danger of cuts by tool breakage when using the automatic Z adjustment wrong

If you use the automatic Z adjustment for measuring the oscillating tangential head, the oscillating tool can break and be ejected from the machine.

➤ Never use the automatic Z adjustment for measuring the oscillating tangential knife.

2.6.3 Line laser

⚠ WARNING

Eye irritation when using reflecting surfaces

➤ Do not use the line laser with workpieces with a reflecting surface.

2.6.4 Cutting unit

⚠ WARNING

Danger of cutting yourself on the installed knifes

➤ Avoid the installed knifes in the multi unit when you apply the workpiece on the machine.

➤ **Before** you change the knives or the workpieces, apply protecting caps onto the blades in the multi unit.

⚠ CAUTION

Postural defects caused by inappropriately changing the tool plate

➤ To have an ergonomically good access to the tool, move the portal to the end position at the front.

2.6.5 Special vacuum table

⚠ WARNING

Risk of ejection of the workpiece during operation by loss of the needed vacuum

If the vacuum of the special vacuum table is too low or if the workpiece is milled out without sufficient bars, the spindle rotation can eject the workpieces during processing.

➤ Chek before operation that all vacuum units are on and that all of them are working.

➤ Stop operation if a vacuum unit fails.

➤ To ensure a vacuum as efficient as possible, cover the areas of the vacuum table which are not used.

➤ To prevent the milling parts from becoming loose, attach a sufficient amount of connectors to them. Make sure that the connectors have a sufficient height over the complete table if there are height differences.

➤ If existing, machine small parts only on the designated area.

2.6.6 Tool changer

⚠ WARNING

Crushing hazard when putting your hands in the tool changer

➤ Stay at the control station during the automatic tool change.

⚠ CAUTION

Risk of trapping and abrasion hazard during workpiece changes

➤ Regard the tool changer especially during applying and picking up workpieces.

2.6.7 Portal shoulder

⚠ CAUTION

Pinching of body parts when moving the portal manually

➤ To identify possible pinching points, see the labels attached to the machine.

➤ Only move the portal manually if it is absolutely necessary.

2.6.8 Cooling and spraying unit

⚠ CAUTION

Tilting or leaking of cooling liquid

➤ Store the cooling liquid container safely under the machine and secure it against tilting.

Danger caused by the cooling liquid

➤ Read the specifications in the safety data sheet of the cooling liquid.

Slipping hazard caused by atomized cooling liquid

➤ Wipe up residues of the cooling liquid in the movement area around the machine after operation.

Danger of injury caused by misuse of the nozzle

➤ Never point the nozzle of the cooling and spraying unit at persons.

2.6.9 Control unit

NOTICE

Damage by cleaning with wet work equipment

➤ Clean housings for electric components with dry tools only.

Chapter 1

General Information

1.1 Concept

1.1.1 About this Manual

This manual will enable you to use the engraving and milling systems CAM 100 Classic to CAM 450 Classic and the controller CNC 580 as well as accessory equipment safely and reliably. In this manual we want to advise especially about the possible sources of danger that stem from the systems and to emphasise the correct use of the systems. Accordingly, we request you to read this handbook attentively and to heed the advice given.

1.1.2 Basic Systems

The vhf basic systems CAM 100 Classic to CAM 450 Classic consist of a triple-axis mechanism, accessory equipment and the controller CNC 580 for connecting the system to your computer. The systems are available in many different sizes for nearly all kinds of application. All systems use the controller CNC 580 that facilitates rapid work with constant velocity along the path.

1.2 Production Software

A productive CAM system includes a high quality production software that will effortlessly import your projects from different design programs from the world

of CAD and DTP. Regarding the software, special attention was given to universal import filters and easy handling. As the software has been developed by our company you will always find a competent partner to answer your questions.

Starting with the labelling software ACS for industrial serial labelling over the universal program Cenon for engraving and sign-making, for model-making and for industry, up to the special software Cenon PCB for environmentally friendly production of printed circuit-board prototypes, vhf offers the whole range of advanced software solutions in the CAD/CAM area. Special engraver's fonts complete our program.

For the operating the production software, please view the corresponding manuals.

1.2.1 Cenon

Cenon takes care of finest engravings and complex milling tasks with ease. Therefore it is an ideal tool for the production of single parts and limited series in sign-making, in advertising, in model-making and in industry. With Cenon you can concentrate on the essential aspects of your work while intelligent algorithms take care of transporting the graphics to your CAM system.

The double-sided tool radius correction (cutter compensation) facilitates precise inlay work and the milling of outline contours in fonts, logos and other graphics. Even several combined work routines like milling of pockets and drilling are dealt with casually. You can import drawings, logos and fonts from nearly all graphics programs and re-edit them if needed. Cenon controls engraving machines, cutting-plotters and CNC milling machines as well as laser labelling systems, water-torch systems and normal pen plotters.

Through Cenon's secure handling of the PostScript technology you have all the type-faces of your system and software at your disposal. Special type-faces for engraving are not needed because a dimensionally accurate tool-oriented conversion is being applied. If you discover that the imported graphics chart has to be modified - no problem. Cenon includes all necessary editing functions needed to edit files or to create new ones. Cenon does not set borders concerning the size of your workpieces, even if a workpiece does not fit entirely onto the system. You can split the task into several jobs in order to create large signs or joined logos.

1.2.2 Cenon PCB

Cenon PCB is a program for a very comfortable and fast production of printed circuit-board prototypes and limited series. By using the standardised formats

PostScript and Extended Gerber Cenon PCB opens a new dimension of quality and openness: environmentally friendly prototypes directly from the computer, without exposing, without etching! The flexible working method of Cenon PCB also facilitates the production of front-plates, the processing of housings and the creation of signs.

The outline algorithm for prototype production makes you independent of waiting times and high costs of custom manufacture by your circuit-board producer. Through Cenon PCB you have a direct connection to your printed circuit-board CAD system. As usual you create your printed circuit board layout and drilling data. These, then, you do not send to your printed circuit board manufacturer any more. Instead, with the aid of Cenon PCB and its intelligent algorithms, you will process your project.

Around tracks, soldering points and ground areas, Cenon PCB will calculate isolation channels that will separate the electric potentials later on. Of course, drillings are calculated and contours can be milled too. The usual production steps of exposing, developing and etching as well as the disposal of environmentally harmful chemical waste products fall away.

All you have to do is to fix the material onto your CAM system and after a short time you will obtain a circuit-board with engraved isolation channels and precisely drilled holes ready to be assembled and soldered. With this procedure your developments will be in a marketable shape more rapidly and more cheaply.

1.2.3 Labelling Software ACS

This program is an easy to handle database software for all requirements in the world of labelling. The advantages of this program cover all areas of producing large numbers of labels.

You can either import the data for your labels from an ECAD program or from a chart calculation program like Excel or Access. Of course you can also enter the data directly in ACS, as this program does include a database function. In ACS you can assign an appropriate label to the data.

ACS labels are used for single cable cores, hoses, switching devices and clamp labels of different producers. All functions of the program are user-guided and provided with online help.

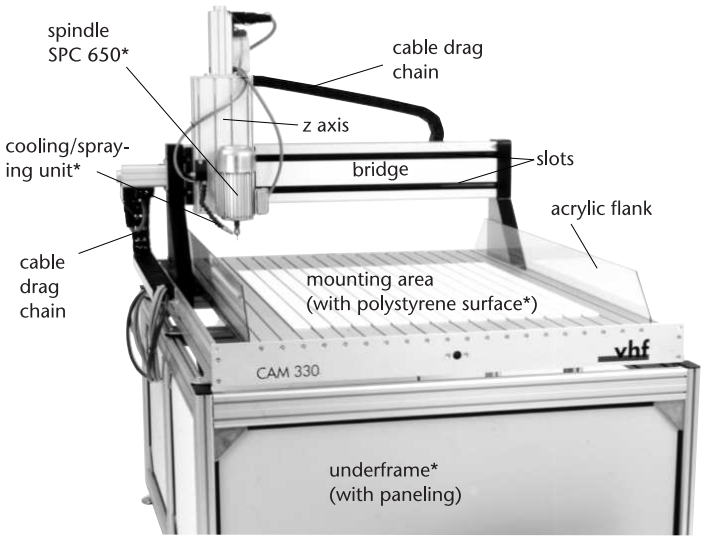
Chapter 2

CAM Basic Systems

2.1 Concept

The vhf basic systems CAM 100 Classic to CAM 450 Classic consist of a triple-axis mechanism, accessory equipment and the controller CNC 580 which represents the link between the machine and your computer. The systems are available in different sizes for nearly all kinds of application. From small compact systems that find their place on every laboratory table up to large systems for the production of advertising panels, all systems possess strong driving units and a high positioning precision. That is why they are equally suited for milling jobs as well as for finest engravings.

On the following illustration which shows a CAM 330 Classic, we will show you the most important components that you should know for setting up your system. As our systems generally only differ in size, this picture should help you to localise the corresponding components on your system, even if it is not a CAM 330 Classic.



*[Illustration: Components of a CAM 330 Classic (the components marked * are not included in the delivery of a basic system)]*

2.2 Transport/Set-Up

The machine is principally not intended for self-installation. All installation and maintenance duties must be carried out by qualified experts. Therefore, in this chapter you will only find advice about selecting the proper place for the machine and about transport.

During a longer transport the bridge of the z-axis has to be secured against unintentional shifting by fastening it with angular transport brackets. For this you should move the bridge all the way to the front side of the machine and the z-axis all the way down. Now secure the bridge and the z-axis by screwing an angular corner bracket into the T-slot on either side and fixing it to the working surface. Before a renewed operation of the machine it is strictly necessary to remove them.

The following components are included in the delivery of a basic system.

- basic mechanism CAM 100 Classic - CAM 450 Classic with 3 stepper-motor cables, two of them inside of cable drag chains
- controller CNC 580
- serial cable for connection to the computer
- separate emergency-stop switch
- mains cables

2.2.1 Placement

This machine must not be set up in moist rooms. The surface of the floor must be sturdy and even. The room temperature should be between 18° and 25° C as this is the best range for the gliding quality of the employed lubricants. It is possible to use the machine in a widened temperature range of 10° to 32° C, but in this case the acceleration ramps must be adjusted down. The relative air humidity may be max. 80%, non-condensing.

For connecting the machine, an A. C. power supply with 230 V/50 Hz, fused with 16 A, is needed. Depending on the actual power consumption of your complete system (e. g. by the use of several vacuum units) there could be a higher power demand which could make it necessary to supply further power lines, also secured with 16 A. If possible, the computer should be fused separately. Please also take care not to connect the machine to the same power net with other, insufficiently shielded, devices as these could electrically interfere with the high end controller and cause a failure of the system.

If the machine is not placed on a special vhf underframe, it is necessary to ensure that the table has sufficient strength and torsion-sturdiness. You will find the weights and sizes of the machines in chapter 2.7.

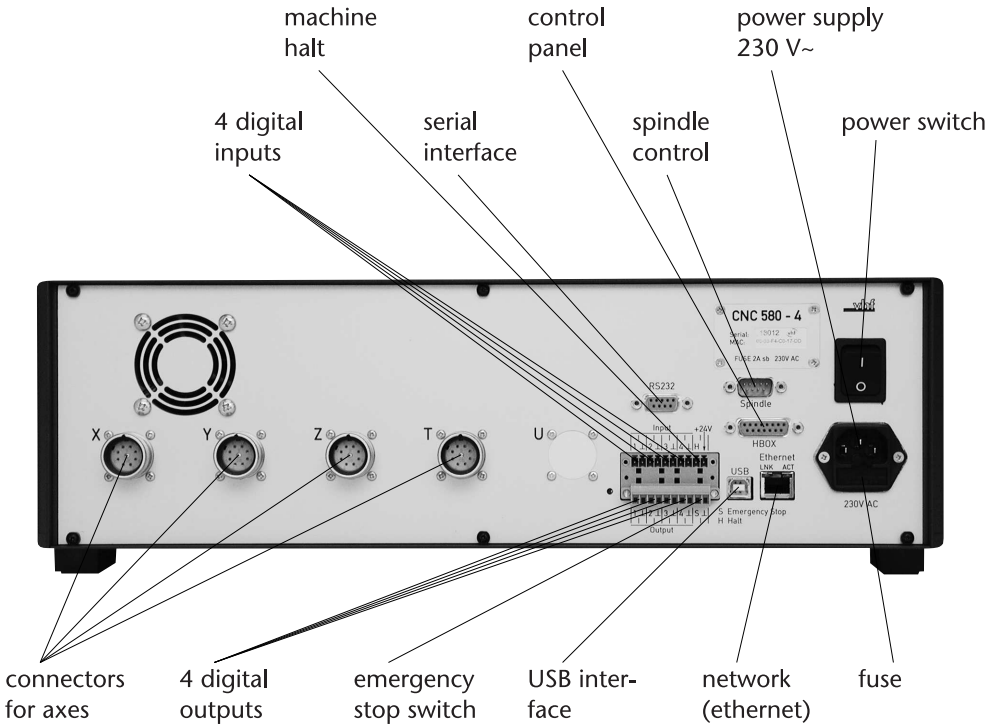
2.2.2 Connections

The controller CNC 580 has the following connectors on the reverse side. If you have to re-connect the system (e. g. after a transport), please commence as follows:

- First connect the cables for the stepper motors to the corresponding sockets at the back of the CNC 580 controller. Each cable is labelled x, y and z, and

is connected to the correct axis at first delivery. Optionally, your controller may be equipped with a fourth or fifth axis connection, e. g. when your system is also equipped with a tangential cutting head and/or with a rotary axis.

- The sockets have a notch to ensure that the plugs are connected in the correct position. After the plugs have been inserted in their total length please secure them by tightening the screw ring.



[Illustration: Reverse side of the controller CNC 580]

- Please use the supplied serial cable to connect the RS 232 interface to the corresponding interface of your computer. Usually this will be Com 2. Tighten the screws on both sides with a small screwdriver.

- Connect the emergency stop button to the 2-pin „Emergency Stop“ connector. Usually the plug is already screwed correctly.

[Illustration: Emergency-stop button]

- The control panel (available as accessory equipment) can be connected to the 15-pin Sub-D socket („HBOX“). It is used e.g. for accessing the work-piece origin, or setting the rotational speed of the spindle.

[Illustration: control panel (optional)]

- If you do not use a standard spindle, the spindle will be controlled by the CNC 580. In this case you have to connect the frequency converter to the appropriate 9-pin socket („Spindle“). For this, please see chapters 3.2 and 3.3.

- You can connect different types of measuring devices to the „Input“ terminal strip. This can be for instance a sensing device for a workpiece levelling unit, an automatic z adjustment unit or a calibration switch for the automatic tool change (each optional). For more details, please also see chapter 3.3.6.

- The output terminal strip can be used for switching up to four accessory devices (e. g. cooling/spraying unit, secured housings, fixing devices). It delivers an output voltage of 24 V. In order to switch also bigger devices like vacuum suction units or dust extraction units, there is also an appropriate switching unit available.

- The mains supply must be connected to 230 V/50 Hz using the mains cable included. Make sure that the mains switch is off until the entire system is completely set up.

Caution!

- Make sure that all angular transport brackets have been removed after a transport of the machine.

- Level an uneven ground by adjusting the screw feet accordingly.

- Before starting the controlling software, make sure that the emergency stop switch is released (by a slight clockwise turn of the button).

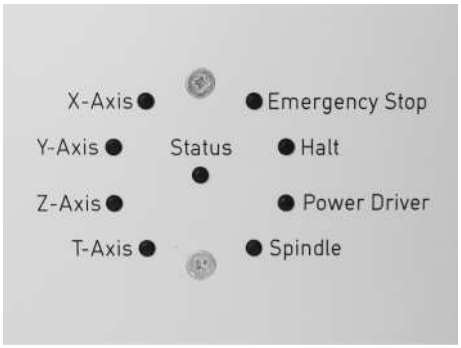
2.3 Handling

After you have ensured that all cables have been connected as described, you can turn on the controller using the switch on its reverse side.

Caution!

Turn on all accessory devices (frequency converter etc.) together with the CNC 580 controller, favourably before starting the production software. A switchable multiple socket would be very useful.

2.3.1 Significance of the LEDs



[Illustration: LEDs on the front side of the controller CNC 580]

Status This LED pulses blue when the controller is ready for operation. However, this LED still remains dark for a few seconds after turning on the controller, until it has booted completely.

Emergency Stop This LED lights up red as soon as the emergency stop button has been pushed or when the electronics have activated an emergency stop out of security reasons.

Halt A machine halt is triggered when either the optional control panel has been used to activate the according function or when the output procedure of the controlling software has been interrupted. A third possibility for a machine halt consists of an optional switch that reacts to opening the lid of the housing or to interfering with a light curtain which will also lead to a halt of the machine. In case of a machine halt, the z-axis will move up and the spindle (except for the standard spindle) will switch off. When you click on „continue“ (or the lid of the covering cap is closed), the system will continue to work where it has been interrupted.

Power Driver This LED lights yellow if the temperature of the power drivers comes into a critical range. Stop the machining in such a case. The LED lights red if one of the power drivers had to be switched off. If it had been yellow before, the reason is probably overheating, if the LED starts to light red immediately, there is a different reason for the error (e. g. a shortcut).

Spindle A yellow LED shows that the spindle is working, a red LED indicates a spindle error. Usually you will get more information on a possible reason over the spindle controller.

X/Y/Z/T-Axis When an axis is moving, the appropriate LED lights green, when the axis is on its zero position, the LED lights red. However, usually it flashes red only for a short moment while the axis is exactly at its zero position when a reference drive is being performed.

The emergency-stop button is used to immediately stop the system in case of danger. If you are using an automatically controlled spindle (SPC 650 - SPC 5000, SF 170 - SF 1600 P), also the spindle will be brought to a halt. After you have pushed the button, a warning sound will be heard. Place the emergency stop button in such a position that it is always easily within reach during the working process.

After you have activated the emergency stop button, you must carry out the following steps in the given order to re-start the output process:

1. Leave the emergency stop button in the pressed state
2. Save your actual start position and your current project in the production software
3. Stop the production software according to the proper procedure
4. Switch off the CNC 580 controller and wait for approximately 10 seconds
5. Release the emergency stop button by turning it clockwise
6. Turn the CNC 580 controller on and start the production software. After returning to its zero-position the machine will be ready for work again.

2.4 Security

2.4.1 Intended Use of the Machine

The machines of the types CAM 100 Classic to CAM 450 Classic have been designed for easy to medium milling works and for of all kinds of engraving works. For milling works it has to be considered that the machine cannot withstand all powers that can possibly occur. There are no limitations on processing most synthetic plastics like PVC, acrylic and polystyrene on these machines. For processing metals it is necessary to regard that only non-ferrous metals may be processed without restrictions. For working on steel, you should take several precautions

(cooling, fixation, machine safety, ...) for which you should contact us. Processing materials that are hazardous to the health is not an intended use of these machines.

Please keep always in mind not to use too high values for the cutting depth and the rate of feed. This could lead to ripping loose the workpiece and jamming the tool. This can cause irreversible damage to the machine and/or the spindle. A loosened workpiece may fly around uncontrollably, possibly causing injury. As these parameters (values) depend on the spindle in use, please see also chapter 3.

The CAM systems must, depending on their field of application, be equipped either with a housing/covering cap or a dust extraction unit as spindle protection. Existing safety devices must not be removed under any circumstances.

We can only guarantee for a safe and faultless operation of the system if the following vhf components have been installed properly and are used according to the operating instructions. You will find the operating and security advice in the referred chapters:

Components	*Chapter*
standard spindle	3.1
rotary current spindle SPC 650 - SPC 5000	3.2
high frequency spindle SF 170 - SF 1600 P	3.2
T-slot fixing set	4.1
grid vacuum table	4.2
special vacuum table	4.3
polystyrene surface	4.4
cooling and spraying unit	5.1.1
dust extraction unit	5.2

2.4.2 Security and Protective Regulations

- The working personnel must be trained in the proper handling of the machine and in the following security and protective regulations.
- The machine may be operated by only one person at a time.
- The working place must be kept clean and orderly. Disorder in the working environment can be a cause of accident.
- Keep children away from the machine.

- Check the machine for possible damage. Before starting to work with the machine, ensure that all safety devices and their components are in place and in good working order. Damaged safety devices or parts thereof must, if not stated otherwise in the user manual, be repaired or replaced by authorised service personnel.
- While working with the machine, the working personnel and all persons within reach of the machine must wear protective safety glasses and a hairnet in case of long hair. Operating the machine with a necktie or a long necklace is prohibited.
- Do not let the machine run unobserved.
- During dust producing works it is necessary to wear dust protecting face masks.
- Loud noise can arise from certain modes of work. In this case do wear ear protection. Loud noise is often a sign for wrong operating circumstances. Ensure that the workpiece is fixed properly and that the values for rotational speed, cutting depth and rate of feed are correct.
- Do not forget to remove the wrenches from the spindle after changing the tool.
- The workplace has to be illuminated sufficiently.
- Good ventilation is necessary when working with cooling liquids. You may only use cooling and lubricating liquids that are generally recognised as safe, so that no danger of fire, combustion, explosion or nausea, poisoning, suffocation or causticisation can occur.
- The safety devices of the machine are designed for practical use. During the conception of the machine special attention was given to the working practice of the user. Safety features that would inhibit the usability were not implemented. Thus it is prohibited to circumvent or set out of use present safety devices.
- During the use of the machine there is the danger of squeezing fingers or limbs when grasping at the guiding rails. Yellow warning signs mark the most dangerous places.
- Place the emergency stop button in a position where it is always easily reachable. Memorise the position of the button before starting the machine. Please note that it is not possible to set the machine to work without an installed emergency stop button.

- Before starting the automatic output process, make sure once more that all settings and parameters are correctly set. If in doubt, a „dry run“ (without diving into the workpiece) may make sense.
- Be very careful if you use tools that are sharpened on both ends (e. g. gravers) in a changing station. The unguarded tip of the tool, pointing out of the changing station, poses a danger of injury.
- Be certain that the tools in the changing station are set in entirely straight and that they are in exactly the same positions that have been programmed in the production software.
- Make sure to read the preceeding passage „Intended Use of the Machine“ in the user manual.

Spindles

For the operation, installation and maintenance of the spindles follow the regulations for the prevention of accidents. Improper handling or operations differing from the intended use of the machine greatly diminish the security of usage. If tools with greater diameters (e. g. cutting discs or grinding wheels) are in use, make sure that the permitted circumferential velocity is not exceeded and that an appropriate rotational speed of the spindle is chosen.

- Before a tool change, please make sure that the spindle is at rest.
- Always take care that the tool and the workpiece are tightly fastened. Due to high centrifugal forces improperly fixed parts can be thrust outwards.
- Fasten the tool as deeply as possible into the collet chuck (gripping jaw) so that it can not start to „tumble“ and fly outwards at high rotational speeds.
- Use no unbalanced tools at high rotational speeds. This applies to single tooth cutters and gravers with a shaft diameter larger than 3 mm. Such an imbalance makes itself heard by a loud running noise and puts a great strain on the ball bearing of the spindle. Gravers that are „halved“ on both sides could remedy the problem. Please consult your tool supplier for details about this.
- If possible, use no tools with blade diameters that exceed the shaft diameter. If it cannot be avoided (e. g. with router-bits) you should work with a lower abrasive rate.

- Caution! Do not grasp into the range of the tool.
- Please be aware of the information about the choice of tool and the adjustment of tool parameters given in chapter 3.5.
- After switching off the frequency converter (for high frequency spindles and rotary current spindles) there can be electronic potentials that are dangerous to touch for up to 3 minutes due to capacities in the output device. Do not touch any contacts within this time span.
- According to the mode of work and the selected tools, protection against splashing liquids must be considered.
- Do not process materials containing asbestos or other hazardous or harmful materials.
- Fasten the spindle with the fixing block belonging to the delivery only. Punctual fastening of the spindle will lead to the destruction of the bearing. Improper fixing of the spindle may be the cause for the spindle to turn loose.
- In order to mark the spindle its housing may not be drilled, engraved or tampered otherwise, as the protective isolation could be bridged in that way. Instead, use stickers to label the spindle.
- Always lead the connection cables through the cable drag chains.
- A damaged cable may not stay in use. An original spare cable must be used to replace it.

Fastening Devices

- In each case, ensure and check that the workpiece is properly fixed before starting the work.
- In general, you should start with a relatively small cutting depth and increase it in small steps. A higher abrasive rate in milling works leads to stronger forces acting on the workpiece. If these forces exceed the fixing power of the fastening device the workpiece may come loose.
- If you are using a grid vacuum table, take special care that you do not drill or mill through the workpiece. The vacuum would break down immediately causing the workpiece to fly around uncontrollably. This could be the cause of serious injury.

- Be careful with liquid cooling on vacuum tables. No liquid may get into the vacuum table as this could lead to a short circuit in the vacuum aggregate. If you are cooling with alcohol or other inflammable liquids there is an additional danger of explosion inside the vacuum aggregat. Adjust the spraying device to produce a very fine drizzle that directly reaches the blade of the tool. Areas of the vacuum table not covered by the workpiece should be blocked using patches of other material so that no cooling liquid can be sucked in. Also note that no liquid should enter the vacuum table through the resulting milling channels in the workpiece.
- Empty the dust bag of the vacuum aggregate regularly and if it is equipped with a fine dust filter, replace it at regular intervals.
- If you are fixing the workpiece using special adhesive film, take care that not too much cooling liquid creeps under the workpiece. The workpiece could possibly come off and fly around uncontrollably.
- In case that a dust extraction unit is installed, please ensure that no collisions between the workpiece or the fixing devices and the dust extraction unit may occur.

Please also note further advice given in the chapters dealing about the components you have in use.

2.5 Tips & Tricks

In this chapter you will find tips that should make working with your system easier for you, as well as answers to frequent questions.

After an emergency-stop the machine cannot be made to get back to work.

- Please follow exactly the order of steps given in chapter 2.3.

Although the CNC 580 is switched on and connected to the power supply, the power LED does not light even after one minute.

- Possibly the fuse is defect. You will find it on the back side of the housing, just above the power switch. As a replacement only use new fuses of the same type!

2.6 Maintenance

The spindle drives should be greased every 500 to 1000 working hours. This procedure must be carried out by vhf service personnel because, among other things, the z-axis has to be removed and the tool change station, if present, has to be readjusted, etc.

Clean the machine regularly to prevent dirt and shavings to accumulate in the guiding rails and other sensitive components of the system. Do not use compressed air for this, as this could blow the shavings into the guiding rails. Therefore, use a vacuum cleaner to remove the dirt. Certain materials that may not be vacuumed must be cleaned away using a hand brush, etc.

2.7 Technical Data

- the following features are partly optional

2.7.1 Controller CNC 580

- simultaneous interpolation of up to five axes (40 V, max. 3 A)
- continouos velocity along the path, in 3-D and real-time with dynamic precalculation of path
- greater smoothness of running, more powerful and more accurate due to micro-steps (1/64 step), automatic change-over to full step mode for greater rates of feed
- high processing speed, exponetial acceleration ramps
- easy adaptation of different software packages via Extended HPGL or DIN 66025 (optional) command set
- 4 digital outputs (24 V, together max. 3 A) for controlling process flows (e. g. clamping devices for workpiece feed) or extra devices
- 4 digital inputs (24 V) for security appliances (light barriers, safety shut-off mats, etc.) or measuring devices
- RS 232 spindle interface
- connection for control panel

- connection to PC via RS 232, USB or Ethernet; the Ethernet connection may also be used for easy equipment condition monitoring or remote control/maintenance
- halt function with continue or program termination
- status display via LEDs
- robust and isolated metal housing

2.7.2 Mechanics – CAM 100 Classic to CAM 450 Classic

- construction using high-strength aluminium profiles ensures extreme stiffness and low weight
- T slot table for easily fastening workpieces and fixing devices
- precise steel linear guides driven by hybrid motors
- ball screw spindles free from backlash with flanged bearings (x/y/z: 16 x 5 mm, other leads are available)
- dimensioning of x/z axis: 175 mm
- Teflon-coated rubber seal protects the spindles from chips
- repetition accuracy +/- 1/100 mm
- 3 end/reference switches, accuracy < 1/100 mm
- cable drag chains for all cables
- easy-to-maintain construction

type	x/y positioning range	mounting area	z axis lift	z passage height
CAM 100	290 x 335 mm	500 x 600 mm	70 mm	105 mm
CAM 200	540 x 500 mm	750 x 850 mm	70 mm	170 mm
CAM 220	540 x 500 mm	750 x 850 mm	160 mm	170 mm
CAM 250	540 x 750 mm	750 x 1,100 mm	175 mm	170 mm
CAM 300	790 x 850 mm	1,000 x 1,350 mm	175 mm	170 mm
CAM 330	790 x 1,000 mm	1,000 x 1,500 mm	175 mm	170 mm
CAM 450	1,040 x 1,250 mm	1,250 x 1.750 mm	175 mm	170 mm

Chapter 3

Spindles

3.1 Standard-Spindle

3.1.1 Concept

This standard spindle is a simple milling motor with a power of 900 watts and a rotational speed range from 8.000 to 26.000 rpm. It is equipped with an electronic control to keep constant the rotational speed and represents a good value alternative. The main areas of use are drilling and milling in wood, synthetic plastics and aluminium.

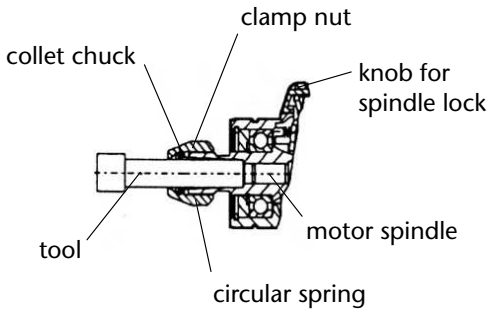
[Illustration: Standard spindle]

3.1.2 Handling

3.1.2.1 Changing of Tools

The spindle is equipped with a precision collet chuck for mounting the tools. A spindle catch facilitates the tightening and the loosening of the clamp nut. For mounting the tools, the spindle has to be locked by pressing the catch button. The clamp nut is tightened with the enclosed fork spanner SW 22.

For removing the tools, the spindle has to be locked too. One revolution with the fork spanner will relieve the tension of the clamp nut, while a few further turns will drive the tool loose, so that it can easily be retrieved from the collet chuck.



[Illustration: Schematic depiction of the collet chuck]

3.1.2.2 Changing the Collet Chuck

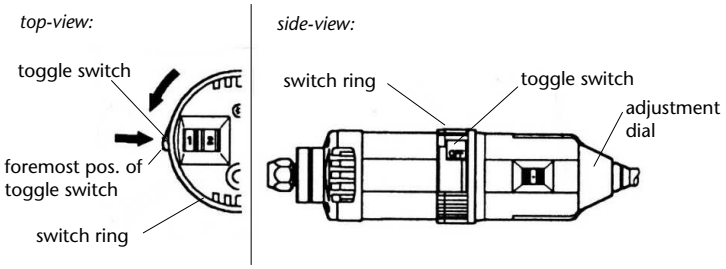
A circular spring is holding the collet inside the clamp nut. The collet can be removed from the clamp nut by pulling it strongly out. Let the new collet chuck snap into the clamp nut with strong pressure.

- Never tighten the clamp nut if no tool is present. The collet chuck could be compressed excessively and thereby suffer damage.
- Before inserting or removing tools, always disconnect the mains cable or remove the mains cable module from the spindle casing by using the cable locking device button.

- Make certain only to use sharp and well maintained tools. Thereby you protect the spindle and increase the lifetime of the machine. Carbide tipped tools require very careful handling as the blades can splinter easily. Because of an increased danger of injury, damaged milling, grinding, or polishing tools may not be used any further.
- Only use tools that are approved for high speed application (from 30.000 rpm on.)

3.1.2.3 Switching On and Off

By turning the switch ring in the direction of the arrow, the spindle motor will be activated. The toggle switch will automatically catch in the foremost position of the ring. Pushing on the tilted front edge of the toggle switch disengages it and the switch ring will snap back into its inactive position. The motor will then come to a standstill.



[Illustration: Schematic depiction of the control elements]

3.1.2.4 Control of the Rotational Speed

The motor starts up slowly until reaching the pre-set speed. Please keep this in mind and do not start the output of the milling procedure until the spindle has reached its working velocity.

In case of excessive, harmful feed effort, the integrated motor control will reduce the rotational speed of the spindle. In this case the spindle has to be relieved of the pressure (by stopping the working process) so that the full rotational speed can be reached again. It is then appropriate to reduce the rate of feed before restarting the process.

The control electronics facilitates rotational speeds from 8.000 to 26.000 rpm. Under strain the tacho generator automatically provides power reserves in order to sustain the pre-set rotational speed. Independent of the working material or the tool, an optimised cutting speed can thus be set by using the appropriate adjustment dial. This speed is determined by several factors, such as hardness of the material, quality of the tool, rate of feed etc.

3.1.3 Safety

Please observe the safety regulations in chapter 2.4.

3.1.4 Tips and Tricks

- Tool life will be increased by not choosing the fastest possible rate of feed. This also prevents burn spots in wood, the „smearing“ in plastics and it also protects the spindle against excessive strain.
- Please give consideration to the sharpness of the tools, as blunt tools will produce uneven surfaces and lead to unnecessary, excessive strain on the spindle.

3.1.5 Maintenance

This spindle is pre-lubricated and mostly maintenance-free. The machine lifetime will be enhanced by regularly blowing the dust out of the casing with compressed air. Always keep the ventilation slots free, as constant ventilation is necessary.

Occasionally the graphite brushes have to be exchanged the service personnel.

3.1.6 Technical Data

- Power consumption: 900 W
- Range of rotational speeds: 8.000 - 26.000 rpm
- Electronic control with tacho generator for constant rotational speed
- collet chucks: 3 - 8 mm

3.2 Rotary Current Spindles SPC 650 - SPC 5000

3.2.1 Concept

These rotary current asynchronous motors are due to their high torque very well suitable for powerful millimg works with bigger tool diameters in plastics and metal. Maximum rotational speeds of up to 30,000 RPM (SPC 1000) even allow high rates of feed.

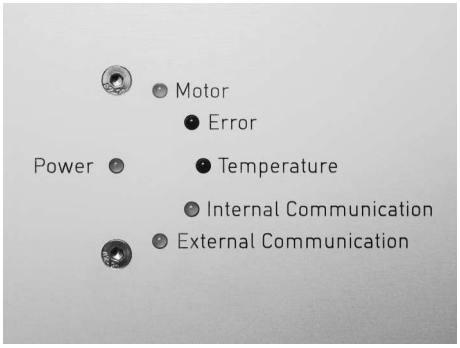
The intelligent controller creates maximum spindle torque over the whole speed range. By using vhf production software you can start and stop the spindle automatically and control the rotational speed.

[Illustration: Three phase rotary current spindle SPC 650 mounted on z-axis]

3.2.2 Handling

3.2.2.1 Spindle Control SPC 980

Switch on all devices (CNC 580, frequency converter, etc.) together, before starting the production software. A switchable multiple socket would be very useful.



[Illustration: LED displays on SPC 980]

LED displays on the frequency converter:

Power: LED lights when the frequency converter has booted completely. However, if it should not light after a few seconds, please check the mains cable and the device's fuse.

Motor: This dual-color LED lights green when the spindle is running and yellow while the motor is off.

Error: As soon as an error turns up, this LED will light up. If it continues to light when you have restarted the device after about one minute of waiting time and all connection cables have been checked without detecting any defects, you should contact the vhf service. In case of a software error this LED will blink.

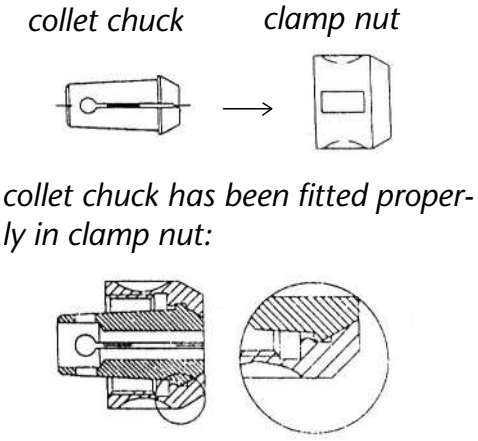
Temperature: The temperature inside the frequency converter is too high. In this case, stop the output process and wait for the frequency converter to cool down. Possibly, you are working with a load that is too high for the spindle. Maybe you should choose a smaller rate of feed or a smaller cutting depth in future.

Internal Communication: This LED lights while the internal components of the frequency converter are communicating with each other. As the CNC controller usually checks the status five times per second, this LED will always blink. In case of an error, it will light permanently (the Error LED will light too, then). Please contact the vhf service.

External Communication: This LED lights when data is being transferred from the CNC controller to SPC 980. As the CNC controller usually checks the status five times per second, this LED will always blink. In case of an error, it will light permanently (the Error LED will light too, then). In this case, there is a communication problem between the frequency converter SPC 980 and the CNC controller CNC 580. Please check whether all devices are switched on and if all cable connections are plugged in properly. It may also help to turn off both devices and turn them on again.

3.2.2.2 Inserting a Tool

- First loosen the clamp nut, which is fastened on the spindle shaft.



[Illustration: Inserting the collet chuck]

- Only when the collet chuck has been fitted properly in the clamp nut, the tool may be inserted into the collet chuck. The included sickle spanner is now used to tighten the clamp nut while the open-jawed spanner SW 15 (SW 22) can be used to counter the spindle shaft.

3.2.3 Safety

Please observe the safety regulations in chapter 2.4.

3.2.4 Tips and Tricks

- Tool life will be increased by not choosing the fastest possible rate of feed. This also prevents burn spots in wood, the „smearing“ in plastics and it also protects the spindle against excessive strain.
- Please give consideration to the sharpness of the tools, as blunt tools will produce uneven surfaces and lead to unnecessary, excessive strain on the spindle.
- Please also note our tips for the choice of tools and parameters in chapter 3.5.

3.2.5 Technical Data

3.2.5.1 Spindle

type	nominal power	speed range	chucking capacity
SPC 650	650 W	800 - 20,000 RPM	3 - 6.35 mm
SPC 1000	1,000 W	up to 30,000 RPM	3 - 8 mm
SPC 3000	3,000 W	up to 24,000 RPM	up to 12 mm
SPC 5000	5,000 W	up to 24,000 RPM	up to 16 mm

3.2.5.2 Control Electronics

- LED display for status information
- fully automated control through CNC 580

3.3 HF Spindles SF 170 - SF 1600

3.3.1 Concept

Special features of these high frequency spindles are an absolutely precise bearing of the shaft and high rotational speeds of up to 60.000 rpm. Finest engravings can

be performed with high precision at fast rates of feed. The high frequency spindles are available in different power categories from 170 watt to 1.600 watt, so that the advantages of a high frequency spindle come to bear in engraving as in the milling of stronger material.

SF 170

SF 1600 P

[Illustration: High frequency spindles from 170 watt to 1.600 watt]

The tool change is done either manually or pneumatically. On the spindle SF 170 the manual tool change is performed with a practical quick action chuck, while special fastening tools are used on the models SF 300 and SF 600. On the P models (SF 170 P - SF 1600 P) the tool change is done automatically, using tool magazines with 9 or 19 tools.

All spindles are delivered with an appropriate frequency converter which facilitates the control of all spindle functions by the production software.

3.3.2 Notice of Caution

The high frequency spindles SF 170 to SF 1600 are high precision devices that may never be subject to any form of raw force like strikes and impacts, excessive

pressure on the shaft, forcible fastening in the spindle support (spindle fastening block) or eccentric thrust through too much tolerance in the spindle support.

The maximum surrounding temperature of the spindle may not exceed 50° C. Therefore the spindle may never be used with any spindle support other than the one delivered, as only this one can assure sufficient heat elimination.

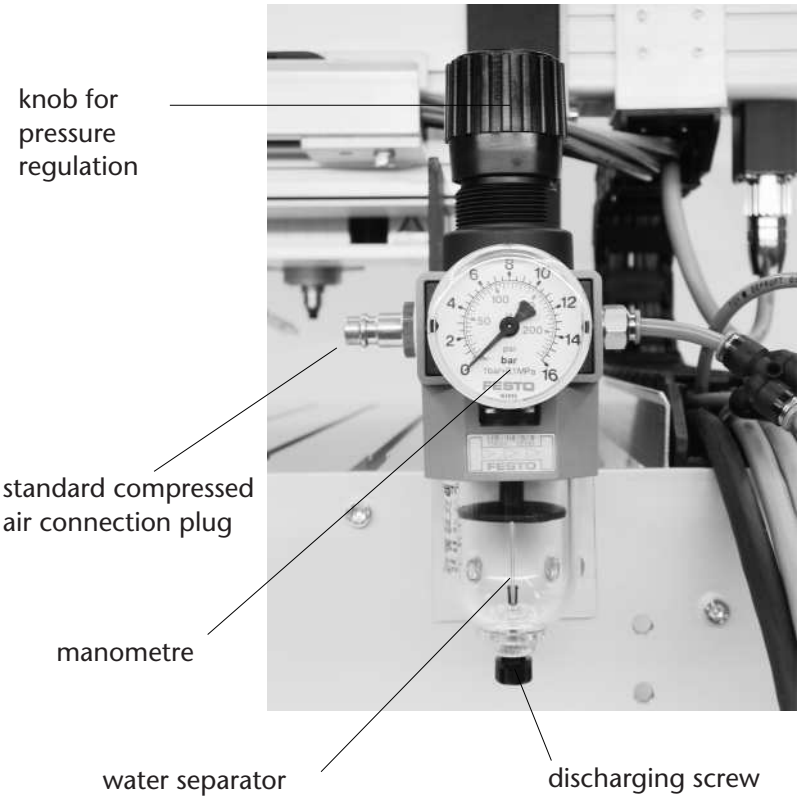
If you work with liquid cooling (either with a cooling/spraying unit or manually), you must take care that no liquid can enter the spindle bearing. This may lead to a spindle damage.

3.3.3 Compressed Air

3.3.3.1 Connection and Adjustment

All SF spindles, except the SF 170, need compressed air. Spindles with an automatic tool change need compressed air for operating the pneumatic collet chuck. All spindles from SF 300 on also need barring air to prevent particles from getting into the spindle.

The pneumatic connection is on the back or the side of the machine. Depending on the type of spindle and machine it may vary slightly from the version shown here.



[Illustration: Pneumatic connection and regulator]

Connect the pressure regulator of the machine to your compressor using a standard compressed air connection plug. The supply of compressed air has to be dry, oil-free and must deliver at least 8 bar of pressure continually. Compressed air which is not dry may lead to a damage of the spindle bearing and to electrical defects. Be careful when using a small household compressor. If you are simultaneously operating the cooling and spraying device with it, the pressure might fall to below 6 bar! Please note also the operating instructions of your compressor.

Use the turning knob of the regulator to adjust the pressure at 6 bar. For this the knob has to be pulled up a little bit - only then can it be adjusted. By turning the knob toward "+" you can increase the pressure, turning toward "-" will decrease the pressure. Afterwards, please press the knob back down to prevent unintentional misadjustment. The water separator with a 5-μm micro filter is to prevent air contaminated with moisture or dirt particles from damaging the sensitive bearings of the spindle. In spite of this device, the compressed air supply must be

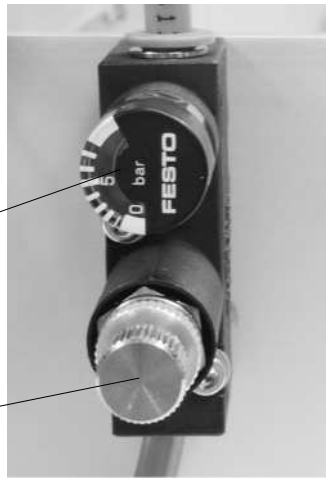
dry and oil-free because the water separator is able to remove only small residual amounts.

Mechanical damage to the pressurised separator beaker may lead to its rupture and can cause severe injuries to personnel in the vicinity. Thus, please handle all compressed air devices with increased care.

The water separator has to be emptied regularly. For the maintenance of the water separator please read chapter 3.3.10.

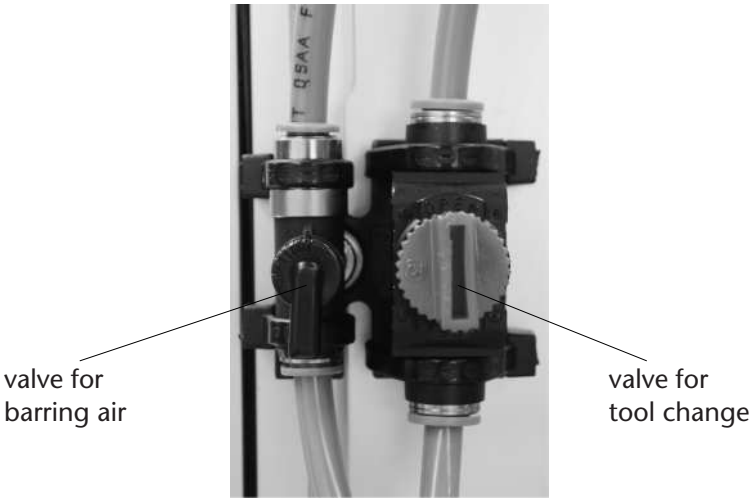
3.3.3.2 Barring Air

Barring air is used to prevent (cooling) liquid or chips from entering the spindle bearing, which would lead to premature bearing damage. The air outlet is at the front side between the housing and the rotary disc. Adjust the small reducing regulator to a barring air pressure between 0,5 and 1,0 bar. More pressure does not lead to an improvement, it only consumes more air.



[Illustration: Regulation of the barring air]

In order to protect the spindle even during standstill, you ought to switch the barring air on as soon as you activate the machine. Depending on the equipment, there are one or two pneumatic valves just above the spindle on the z-axis.



[Illustration: Valves on the z-axis]

3.3.4 Spindle Control

3.3.4.1 General Information About the Frequency Converter

The spindle may only be connected to the supplied frequency converter and is determined for right-handed, clockwise rotation only. The frequency converter can be controlled either remotely through the production software or locally, directly on the device. For the possibility of remote control, please see also the documentation of your production software. When turning the spindle on or off, the run-up and the breaking time should not fall below one second per 10.000 rpm.

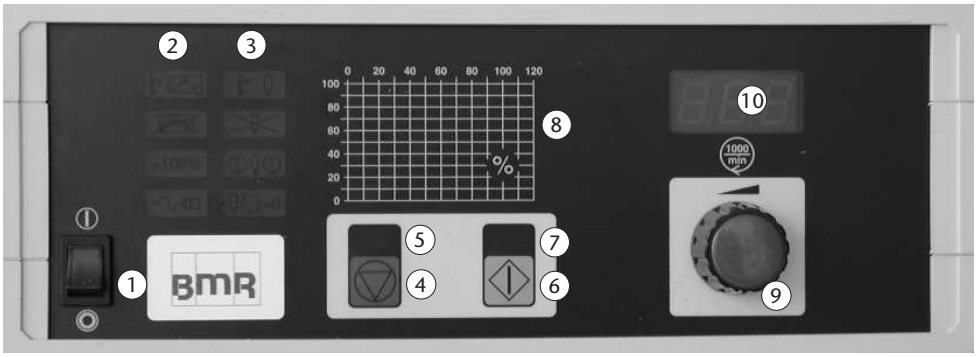
The operating elements of the frequency converter are active until the device has been switched to remote control mode by the production software. So, please make sure that you never start the spindle unintentionally.

First start the controller CNC 580 and the frequency converter before starting the software. The frequency converter will then automatically be set to remote control mode. As soon as the converter has been switched to the remote control mode its operating elements are out of function, i. e. the spindle can now be controlled through the software only. Naturally, the function of the emergency stop button is still available then and will also stop the spindle in case of emergency.

As the frequency converters SFU 101 to SFU 401 for the different types of spindles only differ in their capacity (and thereby in their weight and size) there will be no further differentiation in the following description of the operating elements and warning displays.

3.3.4.2 Local Operation

In the following we will describe the displays on the frequency converter and the possibilities of operating.



1: power switch
2: LEDs for frequency converter
3: LEDs for spindle
4: button for "spindle on"
5: LED for "spindle on"
6: button for "spindle off"
7: LED for "spindle off"
8: load display (spindle load in %)
9: rotation speed display
10: digital rotation speed display

[Illustration: Front view of the frequency converter SFU 201]

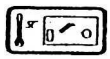
After setting off the start button (4) the spindle will run up to the rotational speed set by the turning knob (9). The run-up speed is approximately 10.000 rpm per second. The actual rotational speed is visible on the digital display (10).

During work the spindle load display (8) should always be in the green range. When the spindle is not under load and there is no defect, the spindle load display should show approximately 0 %.

If you press the red stop button (6) the spindle speed will be reduced down to standstill electronically. The stopping time is approximately equal to the run-up time. If the start button (4) is pressed during the stopping process the spindle will speed up again to the set rotational speed.

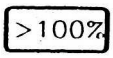
Decelerating the spindle with the stop button is only possible if the frequency converter is not in the remote control mode.

3.3.4.3 Displays Frequency Converter

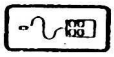


This display will light up if the *temperature* in the frequency converter becomes *too high.* The converter will switch to *Stop* with a delay of about 3 seconds and the display *frequency converter not ready* will light up.

In case of an error this display shows that the *frequency converter* is *not ready*. The spindle can be restarted only after this display has gone out.

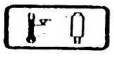


An *overload switch-off* happens if the spindle runs under overload for more than about 10 seconds. After this time, the frequency converter will turn off the spindle and the display *frequency converter not ready* will light up as well.

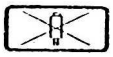


This display lights up if the converter is *remote controlled* by the controller CNC 580. Controlling the spindle function manually on the device is not possible in this mode.

3.3.4.4 Displays Spindle



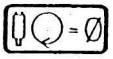
If the *spindle temperature* is *too high,* this display lights up. After a delay of about 3 seconds, the converter will switch to *stop* and the display *spindle not ready* will light up.



In case of an error, this display shows that the *spindle* is *not ready*. The spindle can be restarted only after this display has ceased to light.

As soon as the preset *rotational speed* has been *reached,* one of the halves of this display will light up. The left half with the symbol *set-value* (s) will light when the internal converter frequency equals the preset value. This analysis happens if the spindle is not equipped with a rotational speed measurement.

The right half with the symbol *is-value* (i) lights up when the rotational speed has actually been measured on the spindle shaft.



This display lights up when the spindle shaft is no longer rotating.

3.3.5 Manual Tool Change

3.3.5.1 SF 170

This spindle is equipped with a practical quick action chuck so that the manual tool change is done in seconds without any additional fastening tools. For this, press the turning knob down onto the spindle with gentle pressure until it locks into place. When the knob is engaged the spindle is simultaneously blocked.

[Illustration: Quick action chuck on the SF 170]

A clockwise turn of the knob will fasten the tool, while a counter-clockwise turn will loosen it. For this, relatively little strength is necessary, too much force could damage the thread of the collet chuck.

Only tools with an appropriate diameter can be mounted in the collet chuck. Always mount the tools as deep into the chuck as possible.

Before switching on the spindle, the turning knob must always be pulled out again in order to release the mechanical block on the spindle. Never turn on the spindle while the motor is blocked, as the resulting overheating would lead to serious damage of the spindle! In this case a spindle fault will be shown on the display of the frequency converter and a warning sound will be heard.

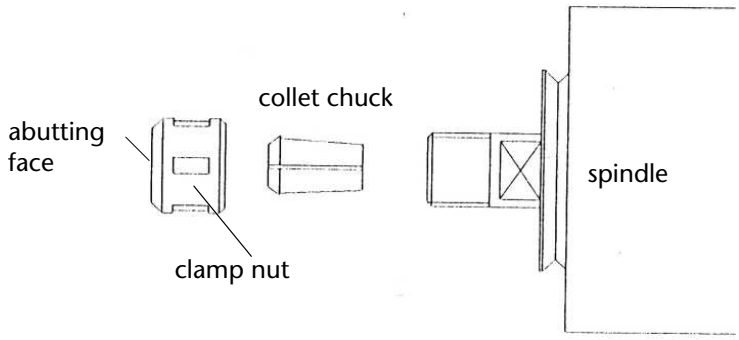
Change of Collet Chuck:

For exchanging the collet chuck, just turn the turning knob until the collet chuck comes out.

3.3.5.2 SF 300 - SF 600

For these types of spindle, the included spanners must be used for changing tools.

First the collet chuck has to be inserted. For this, the collet chuck has to be pushed into the clamp nut until it clicks into the appropriate groove.



[Illustration: Inserting the collet chuck]

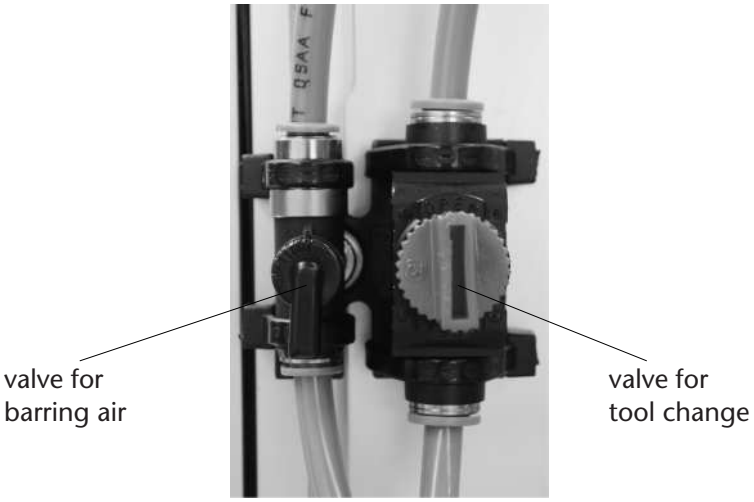
- The collet chuck is correctly placed when its face surface is equal to that of the clamp nut. Only this ensures that the collet chuck will also be pulled out when the clamp nut is loosened.
- Insert the tools as deeply as possible into the collet chuck to prevent them from "tumbling" during work.
- The tools must be tightened securely with the included spanners.
- In order to prevent a widening of the clamp nut at high rotational speeds and a possible loosening of the collet chuck it is advised to re-tighten the clamp nut at standstill after a short working time.

Keep the collet chuck and the inside cone of the shaft very clean in order to always guarantee optimally concentric running.

3.3.6 Automatic Tool Change

3.3.6.1 Pneumatic Collet Chuck

All spindles from SF 170 to SF 1600 as P modelsare equipped with a pneumatic collet chuck. If your machine is not equipped with a tool changing station, the tool change is done by hand using the red pneumatic valve installed on the z-axis. The compressed air pressure for the pneumatic cylinder must be between 5,5 and 6 bar.



[Illustration: Pneumatic valves on the z-axis – here in "open" position]

Spanning Tools

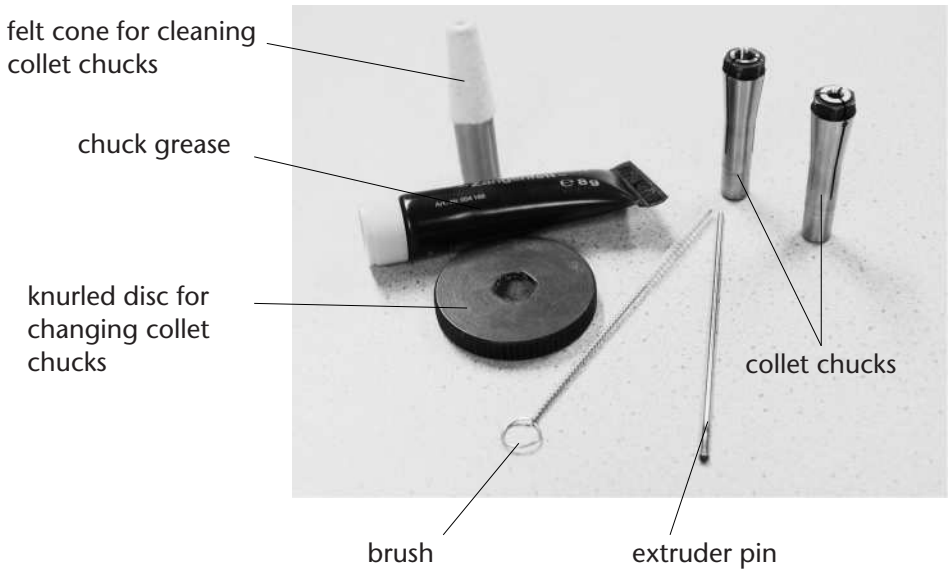
When removing a tool, please hold it to prevent it from falling down and getting damaged. Now open the pneumatic valve (red valve vertical in *open* position - see illustration.) The collet chuck will open and you can remove the old tool. Now you can insert the new tool until the stopp ring touches the collet chuck. Hold the tool there and close the valve.

Caution!

Never open the pneumatic valve while the spindle is turning. This would block the spindle and damage it severely.

3.3.6.2 Change of Collet Chucks

First close the pneumatic valve and then screw the collet chuck counter-clockwise out of the shaft with the knurled disc included in the spindle service set. If necessary, clean the inside cone of the spindle shaft with the appropriate felt cone. Possibly, the chuck also has to be cleaned with the brush included in the set. Be careful to allow no dirt to enter during the change of the collet chuck.



[Illustration: Service set for pneumatic spindles]

Apply a thin film of the included chuck grease onto the cone of the new collet chuck before inserting it into the spindle shaft. Use the knurled disc to screw in the collet chuck tightly. Insert a tool with the fitting shank diameter and actuate the pneumatic valve 2 - 3 times. Now check the collet chuck again and screw it in tighter if necessary.

Note:

If a tool happens to break off during work and the shank stays stuck in the collet chuck, remove the chuck as described above and use the extruder pin from the service-set. Insert the extruder pin from the back side into the chuck thus pressing out the broken shank. Afterwards you can set in the collet chuck in the manner described above.

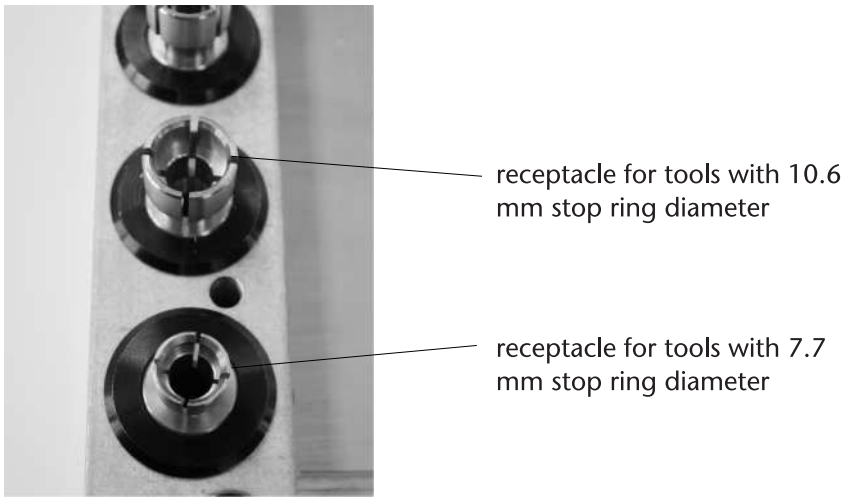
3.3.6.3 Tool Change Station

Your machine with pneumatic spindle can be equipped with a tool change station with length measurement, for 9 or 19 tools. The positions of the respective tool receptacles have to be defined in the device file of the production software. CAM

systems by vhf that are equipped with the production software Cenon already come along with a device file that is fits precisely to your system. Please view the documentation of your production software regarding the subject tool change.

Stop Rings:

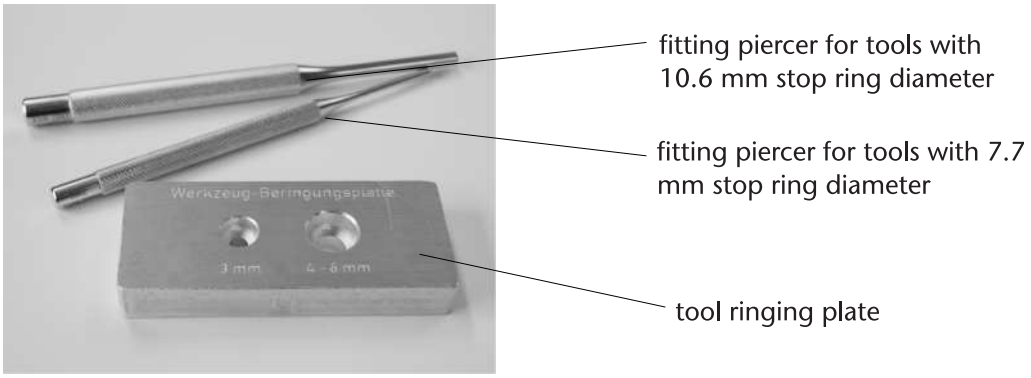
According to their shank diameter, your tools are equipped with stop rings of different width or still have to be furnished with them. Tools with a shank diameter of 3 mm have a stop ring with a diameter of 7.7 mm, all tools with a larger tool diameter have rings with a diameter of 10.6 mm. According to how often you need which tool you can equip your tool change station with different receptacles (also see the section about reduction liners). Of course, all inserted tools have to comply to the defined position saved in the production software.



[Illustration: Receptacles for tools with different stopper ring diameters]

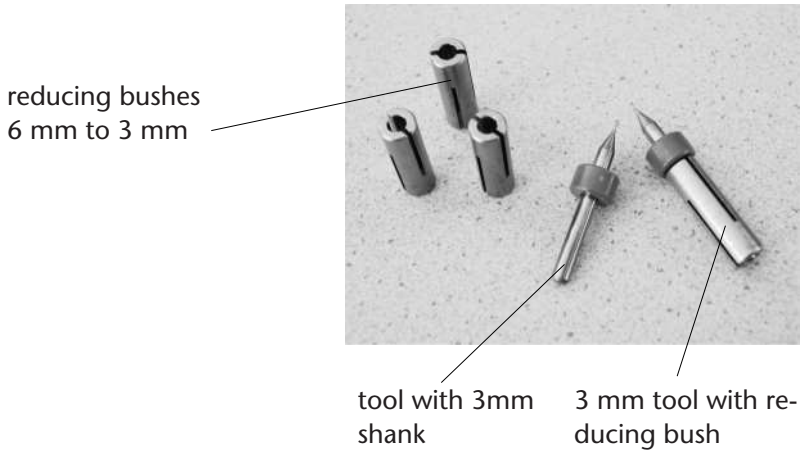
As mentioned before, all tools intended for automatic tool change have to be furnished with a stop ring. Tools without a stop ring may be used under no circumstances. From vhf you can acquire a special tool ringing set that enables you to fit your tools with stop rings.

The tool ringing plate is fastened onto a vice. The stop ring is inserted into the appropriate hole in the tool ringing plate. The tool can now be driven into the ring to the wanted depth with the aid of a little hammer and a fitting piercer.



[Illustration: Tool ringing set by vhf]

Reducing Bushes:



[Illustration: Tools with reducing bushes]

In practical operation it can often occur that you have to process a workpiece with different tools that also have different shank diameters. To make it possible to use the automatic tool change in this case too without changing the collet chuck, there are the so-called reducing bushes that increase the shank diameters of small tools. If, for example, you want to pick up a tool with a shank of 3 mm with a collet chuck for 6 mm tools, you need a reducing bush from 6 mm to 3 mm. This will

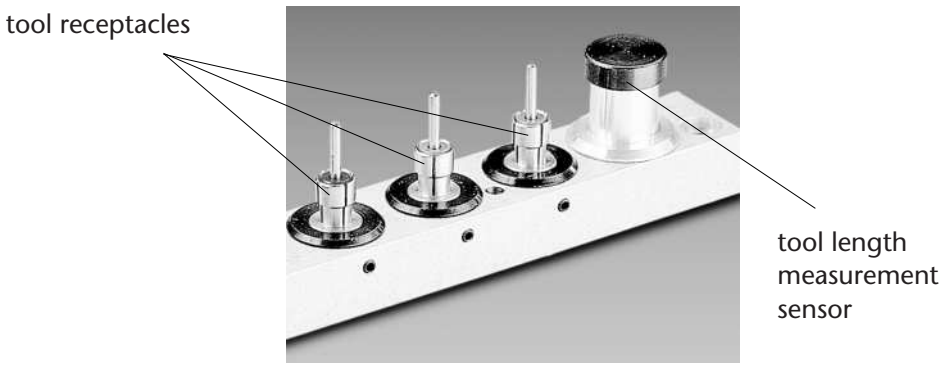
be simply pushed onto the shank of the 3 mm tool. A blot of screw locking paint can be helpful to fix the reducing bush safely on the tool. This minimizes the risk that the reducing bush will be lifted accidentally from the tool after the tool has been changed.

Pressure Adjustment:

Please make sure each time before starting to work that the air pressure for the pneumatic cylinder lies between 5,5 and 6 bar as the collet chuck would otherwise fail to open for the tool change, which can lead to severe damage of spindle and tool.

As soon as the compressed air for the pneumatic cylinder is switched on, the collet chuck opens. During operation of the spindle, the collet chuck must in no case be opened. If a tool changing station is present, the control electronics will prevent this problem by releasing compressed air for the pneumatic cylinder only when the spindle is actually at a standstill.

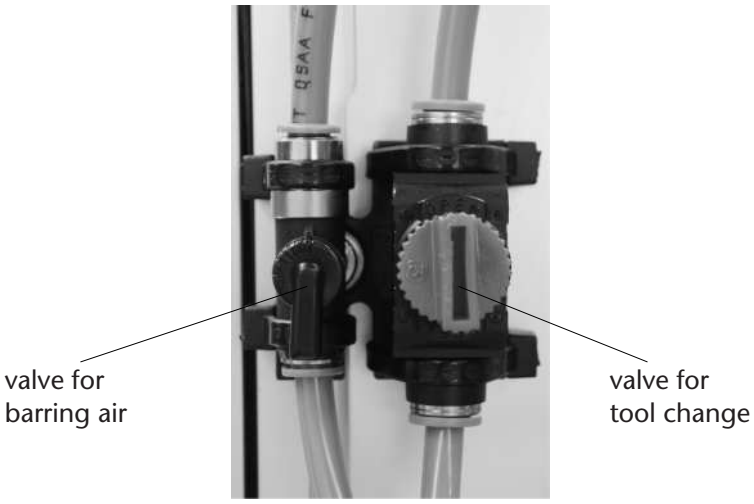
The automatic tool changing process happens as follows: a tool in the collet chuck is placed back into its (free) tool receptacle, pressure is given onto the pneumatic cylinder and the collet chuck opens. Then, without a tool, the spindle moves to the position of the new tool where the air pressure is switched off and the collet chuck closes again. After the new tool has been picked up the spindle moves to the height measurement sensor and slowly lowers the tool until it touches the sensor. By this process, the length of the tool is determined, which is important for setting the milling depth later.



[Illustration: Tool changing station with height measurement sensor]

Caution!

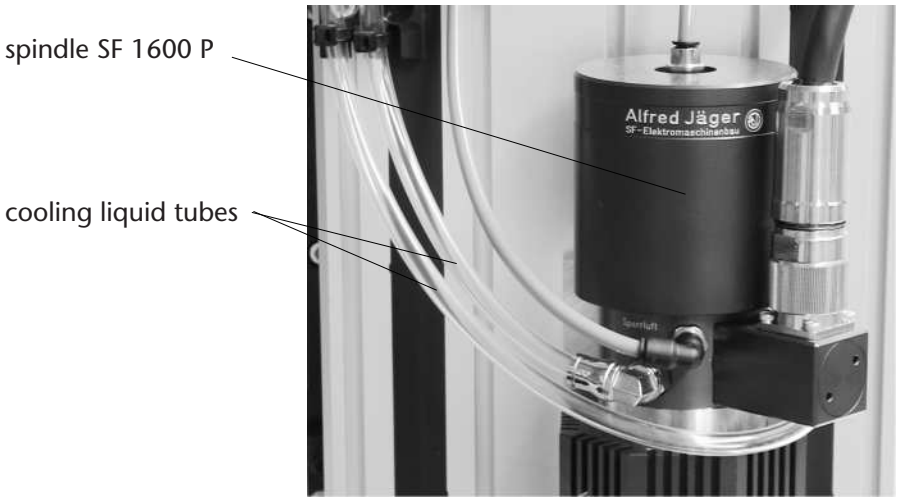
On the z-axis there is a red pneumatic valve, which can be used to switch off the compressed air even when the controlling relay is switched on, i. e. the collet chuck is open. If you are working with an automatic tool change it *must* be ensured that the switch is in the *open*-position. Otherwise the old tool cannot be placed away, it will stay in the spindle and there will be a collision once the spindle moves to the position of the new tool.



[Illustration: Pneumatic valves on the z-axis must be in the "open"-position when working with the automatic tool change]

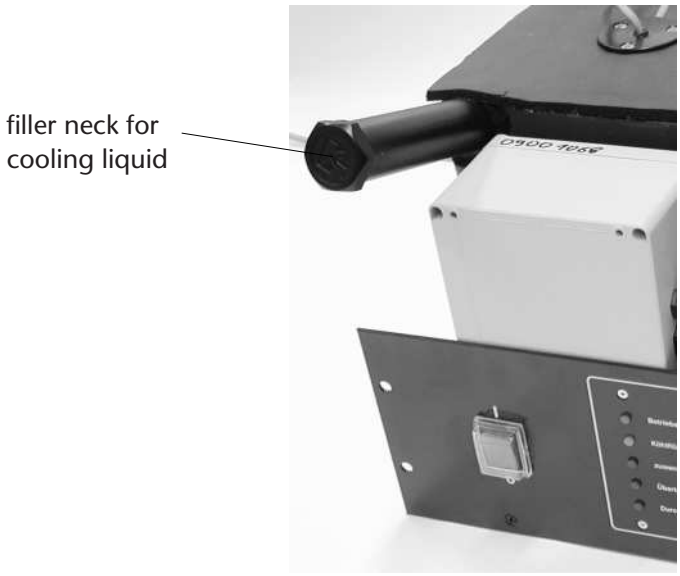
3.3.7 Cooling

The spindle types SF 1200 P and SF 1600 P are equipped with a cooling device to remove developing heat and to keep the spindle at a constant temperature during work. The temperature of the cooling liquid should not be below 20°C and not above 40°C. To ensure the safety of the spindle, the cooling device should be switched on along with the machine.



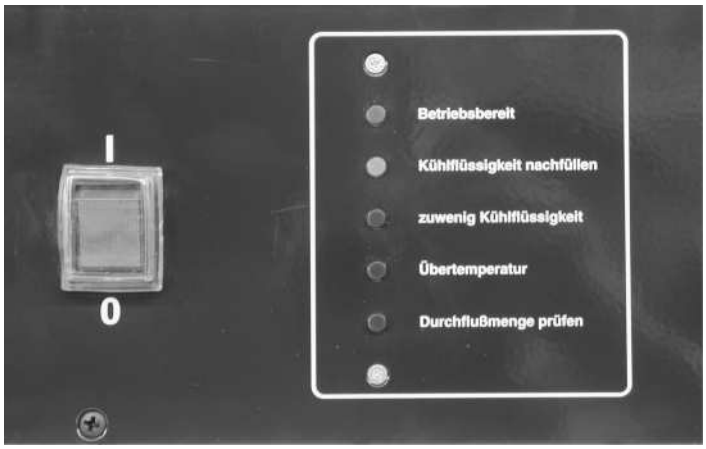
[Illustration: Flexible tubes for cooling liquids on SF 1600 P]

Before the first use, the tank of the cooling device has to filled. Open the screwed plug of the filler neck and fill the tank completely with distilled water. The tank volume is 4,7 litre. In order to improve the cooling result, you can add the delivered special cooling liquid K 100 to the distilled water with a mixing ratio of 1:5.



[Illustration: Filling in of cooling liquid]

Before the first usage please check whether all flexible tubes have been connected correctly and tightly. Turn on the cooling device and let the pump run for about a minute. Depending on the length of the flexible tubes, it is possible that the yellow LED *"Kühlflüssigkeit nachfüllen"* (refill cooling liquid) will light up after a short time. In this case, refill with distilled water until the green LED *"Betriebsbereit"* (ready for use) lights up.



[Illustration: Control elements of the cooling device]

Betriebsbereit (ready for use): All systems work without fault; the pump is running and the fill level is about 4,7 litre.

Kühlflüssigkeit nachfüllen (refill cooling liquid): This LED lights up if the level of cooling liquid drops by more than 1 litre during operation.

zu wenig Kühlflüssigkeit (too little cooling liquid): The amount of cooling liquid is less than 2 litres. In this case the pump will run no longer. *Stop the machine immediately* and refill the cooling liquid.

Übertemperatur (temperature too high): This LED lights up when the temperature of the cooling liquid rises to more than 42° C. The pump and the cooling device continue running, but the *spindle has to be stopped*. The LED stops shining when the temperature falls below 38°C.

Durchflußmenge prüfen (check amount of flow-through): As soon as the flow rate falls to a value below 0,8 l/min this LED will light up. In this case, check whether there is a leakage in one of the hoses and continue the work process only when this display has stopped shining.

General Advice:

- Keep an eye on the displays during work, so that you are able to take the appropriate measures as soon as a red LED lights up in case of a disturbance.
- Do not blow out the flexible tubes of the cooling system with compressed air.
- The cooling agent used in the compressor of this cooling device is the CFC-free R 134A.

3.3.8 Safety

Please heed the safety regulations in chapter 2.4 as well as the information about the tool parameters in chapter 3.5.

3.3.9 Tips & Tricks

- Please give consideration to the sharpness of the tools, as blunt tools will produce uneven surfaces and lead to unnecessary, excessive strain of the spindle.
- If the controller shows a spindle error and a warning sound is audible, the cause may be that the quick action chuck of the SF 170 has not been unlocked.

3.3.10 Maintenance

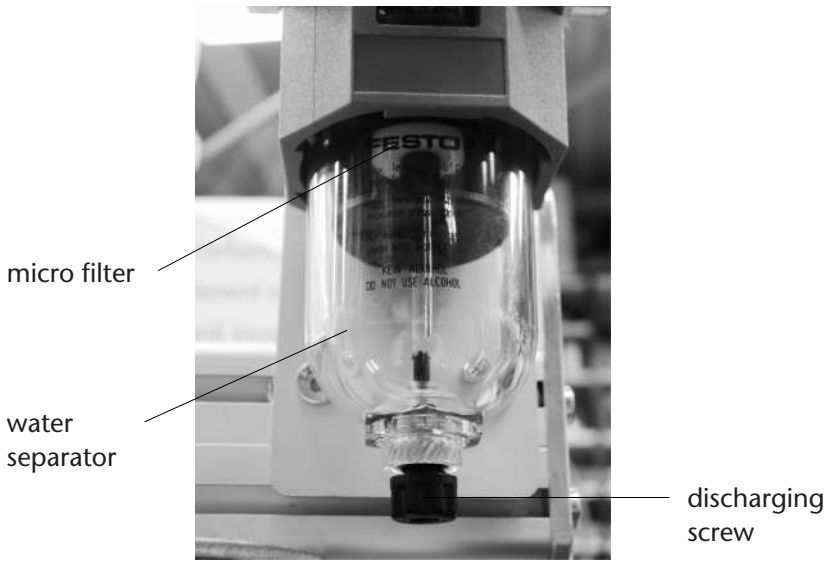
Spindle:

The ball bearings of the spindle are furnished with lifelong greasing and are therefore maintenance-free. But, the spindle should not be stored for more than three months without being used (see section *Storage*)

Compressed Air Installations:

Control regularly whether liquid has accumulated in the water separator and, if so, empty it by opening the discharging screw. The condensate will be blown out under pressure.

In case of strong dirt accumulation the micro-filter element has to be cleaned or exchanged. A strongly foiled filter element may cause a loss of working pressure. *Disconnect* the air pressure by unplugging the main compressed air supply hose. Only then can you open the bayonet fixing (quarter-turn fastener) by turning the beaker 45° clockwise and pulling it down. After you have screwed out the supporting spring from under the filter element you can pull out the filter element. New filter elements are available as spare parts from vhf.



[Illustration: Water separator]

Cooling of the Spindle:

If you have a spindle with liquid cooling, please check the level of cooling liquid regularly and fill up any missing amount with the appropriate cooling liquid. Also see chapter 3.3.7.

Tool Changing Station:

The tool receptacles have to be tightened from time to time. If you should notice that the tools do not fit in the receptacles firmly and develop too much play, you should carefully compress the brass cheeks of the receptacles with pliers until the receptacles will hold the tools tightly and free of play.

3.3.10.1 Cleaning

According to the grade of staining the collet chuck has to be cleaned at appropriate intervals. No grease or oil may enter the bore of the chuck. Also the tool shafts have to be free from oil, grease and dust to ensure optimal tension force.

Do not use compressed air to clean the spindle, as dust could be blown into the sensitive bearing area otherwise! The inside cone of the spindle shaft has to be free of chips or any other dirt.

3.3.10.2 Storage

If you own a reserve spindle this should not lie in storage unused for more than three months, as otherwise alterations in the greases can have negative effects on the lifetime of the spindle. Because of this, you should exchange the spindle in use against the spindle in reserve every three months. In this way you will, in the case of a spindle damage, have a spindle that reaches its working age.

Before the storage of a spindle that has to be connected to a cooling device (SF 1200 P and SF 1600 P), the cooling channel in the spindle should be rinsed with distilled water and blown through with compressed air to remove any residues of cooling liquid.

3.3.11 Technical Data

3.3.11.1 Spindle

Spindle Type	Performance	converter	Tool Change	Barring Air	Shank Range	Features
SF 170	170 Watt	SFU 101	quick action	no	1 - 3,175 mm	mech. height
SF 170 P	170 Watt	SFU 101	pneumatic	yes	1 - 3,175 mm	mech. height
SF 300	300 Watt	SFU 201	manual	yes	1 - 6 mm	
SF 300 P	300 Watt	SFU 201	pneumatic	yes	1 - 6 mm	
SF 600	600 Watt	SFU 401	manual	yes	1 - 6 mm	
SF 600 P	600 Watt	SFU 401	pneumatic	yes	1 - 6 mm	
SF 1200 P	1.200 Watt	SFU 401	pneumatic	yes	1 - 6 mm	cooling de
SF 1600 P	1.600 Watt	SFU 401	pneumatic	yes	2 - 8 mm	cooling de

3.3.11.2 SF-Frequency Converters

High Frequency Converter SFU 101D

- permanent performance: 250 VA
- output voltage: 3 x 0 - 36 V
- phase current: max. 8 A
- frequency range: 83 - 1.000 Hz (5.000 - 60.000 rpm)
- plastic casing (290 x 107 x 295 mm; 5,5 kg)
- short circuit proof through electronic current limiting
- displays for rotational speed, spindle load and spindle control
- control elements on the front side
- software guided spindle control and supervision through digital interface

High Frequency Converter SFU 201D

- permanent performance: 400 VA
- output voltage: 3 x 0 - 60 V
- phase current: max. 8 A

- frequency range: 83 - 1.333 Hz (5.000 - 80.000 rpm)
- plastic casing (290 x 107 x 295 mm; 5,5 kg)
- short circuit proof through electronic current limiting
- displays for rotational speed, spindle load and spindle control
- control elements on the front side
- software guided spindle control and supervision through digital interface

High Frequency Converter SFU 401D

- permanent performance: 1.800 VA
- output voltage: 3 x 0 - 200 V
- phase current: max. 8 A
- frequency range: 83 - 1.333 Hz (5.000 - 80.000 rpm)
- plastic casing (117 x 380 x 260 mm; 8 kg)
- short circuit proof through electronic current limiting
- displays for rotational speed, spindle load and spindle control
- control elements on the front side
- software guided spindle control and supervision through digital interface

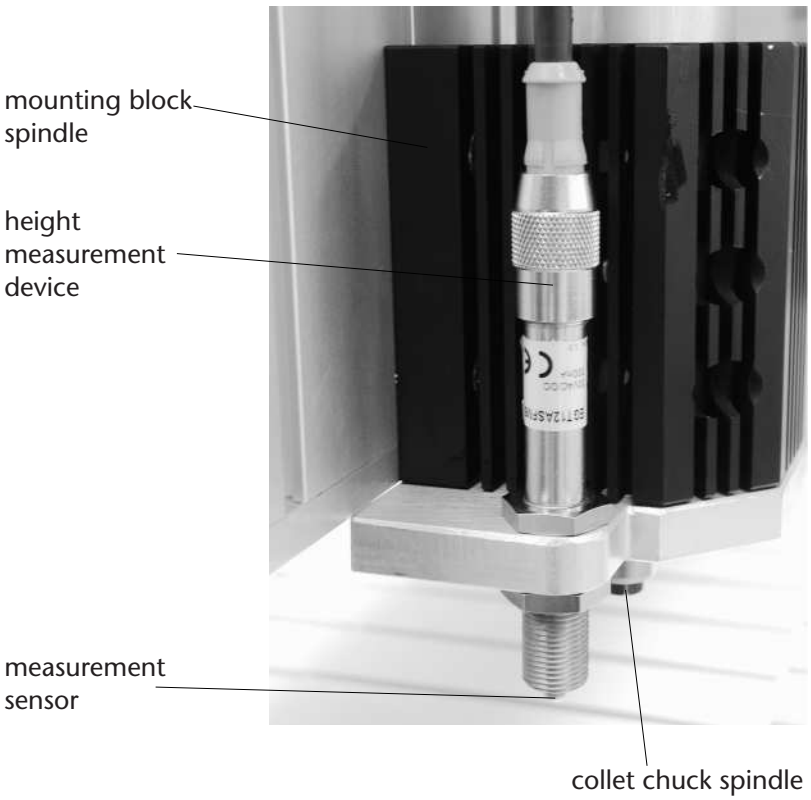
3.3.11.3 Compressor Driven Cooling Device for SF 1200 P and SF 1600 P

- connections for cooling liquid: in- and outlet, 1/4 inch
- cooling performance: 600 Watt (at 20° C surrounding temperature)
- power consumption: 5 A, 1150 Watt; mains connection: 230 V, 50/60 Hz
- cooling agent: R 134A, CFC-free
- cooling liquid: distilled water
- contents of tank: approx. 5 litre

- pump performance: approx. 8 l/min
- pump pressure: 3,5 bar
- materials: aluminium and other non-corroding materials
- weight: approx. 28 kg (without cooling liquid)

3.4 Workpiece Levelling Unit

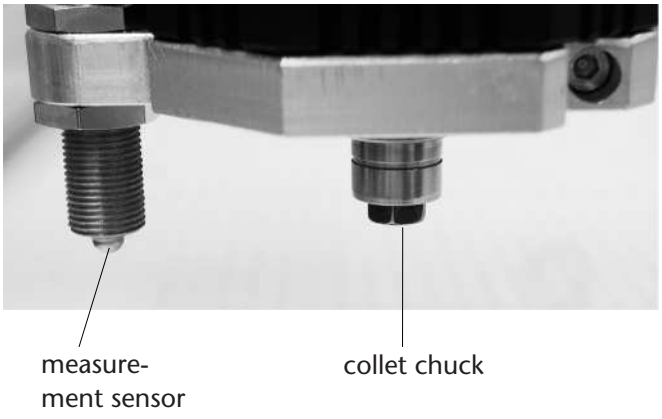
All spindles can additionally be equipped with a height measurement device which allows for correcting unevenness of a material. It is mounted beside the spindle and consists basically of a measuring sensor used for measuring the surface of the workpiece. The control electronics use the measurements to calculate a height profile of the workpiece and corrects the differences automatically.



[Illustration: Height measurement unit, mounted beside the spindle]

The height measurement function has to be supported by the production software (e. g. Cenon). For using this function, please see also the appropriate documentation of your software.

The measurement of a workpiece functions as follows: In the production software you define an area and the number of measuring points in the directions x and y that have to be measured. The more uneven your workpiece is, the higher the number of measuring points should be. You must ensure that the pin of the measurement sensor is below the collet chuck and that it can be pressed in fully without the collet chuck touching the workpiece during the measurement.



[Illustration: The pin of the measurement sensor must be some way below the collet chuck]

Before beginning the measurement of the workpiece, a tool that may be mounted in the collet chuck has to be removed. If you have an automatic tool change, the tool will generally be laid away automatically. If you use a spindle with manual tool change, this has to be done by hand, of course. As soon as you start the measuring process, the measurement unit will move to all measuring points in a defined height, descend and move up again as soon the pin of the measurement sensor has touched the material.

The control unit CNC 580 determines a matrix from these measured points. The mean is taken arithmetically for the areas between the points. The height compensation only functions within certain boundaries, and the maximum tilt of the workpiece surface should be relatively small as you have to ensure that the collet chuck does not touch the workpiece surface during measurement. Therefore,

this kind of workpiece measurement only serves to compensate thickness variations of the workpiece material to ensure an even working depth when making fine engravings etc.

3.5 Tool Parameters

In this chapter you will find basic information about what to keep in mind when you have to set the parameters for your tools.

In order to set the optimal values for lowering speed, cutting depth, rate of feed and rotational speed for processing your workpiece, a number of factors have to be observed.

- what kind of material does the workpiece consist of?
- the kind of cooling and/or lubrication
- power and range of rotational speed of the spindle
- minimal/maximal feed rate of the machine
- features of the controller

Regarding the multitude of parameters that partake in the working process, it is not possible to give generally valid information about the tool parameters in this chapter. Instead, general advice is given about the points that should be given attention. In any case, the safety and protective regulations mentioned in chapter 2.4 have to be observed.

3.5.1 General Advice

All specifications given are our own experimental values, for which we can give no form of guarantee. Therefore, approach the given values from the safe side, i. e. choose a smaller lowering speed, cutting depth and rate of feed for most materials - while keeping the given rotational speeds.

When using tools with a diameter of more than 3 mm in (hard) materials which are difficult to cut, like stainless steel, please observe the spindle load display, if present. At best the spindle load should not exceed 80%. Therefore, approach the given cutting depth only stepwise and always observe the spindle load.

The given cutting depth depends on the power of the spindle. In case of doubt (e. g. when using the spindle SF 170 or SF 300) rather degrade the material in several runs than cutting too deep in one.

Especially for fine engravings, choose a value from the chart that stays below the given maximal rate of feed. Because small fonts, for example, consist of many short vectors, a fast rate of feed could, in spite of the constant velocity along the path function of the CNC 580, lead to jolting of the machine and produce a disagreeable result. Therefore, break off the output process as soon as the machine starts jolting and restart the process with a lower rate of feed.

The speed limitations of the controller CNC 580 are:

- minimal feed rate: 0,3 mm/s
- maximal feed rate: 50 - 100 mm/s (depending on the machine type)

If the tool or material data would allow a higher rate of feed than that which the controller CNC 580 or your machine permits, choose the appropriate maximum speed and reduce the rotational speed accordingly (please keep in mind the remarks about fine engraving of small fonts mentioned above). If, according to a chart, you are to apply a rate of feed that lies below the minimal rate of the controller CNC 580 (e. g. working stainless steel), increase the feed to 0,3 mm/s and reduce the cutting depth per run.

3.5.2 What to do in Case of Problems?

- If especially plastics start melting, reduce the rotational speed and increase the rate of feed.
- Should the milling tool clog up, reduce the cutting depth and the rate of feed.
- Should burrs be created, cooling has to be increased and possibly an additional smoothing run has to be applied.
- If tools often break off, the cutting speed is too high or the spindle is not precise enough. In this case, reduce the rate of feed and/or the cutting depth.
- Should your material be found in no chart, evaluate it according to its cutting property (hardness). For example, evaluate brass rather like aluminium than like stainless steel, while for common structural steel you should rather be guided by the values for stainless steel than by those for aluminium.

3.5.3 Charts

In the following charts you will find reference values for processing the most commonly used materials with tools of different diameters:

3.5.3.1 High-Resistance Foam

Cooling/Lubrication: none

Engraving: gravers of all angles

Mlilling: single tooth cutters with polished flute or single tooth cutters Varius

tool diameter	lowering speed (max.)	cutting depth (max.)	feed rate (max.)	rotational speed
conical:				
0.2 mm	5.0 mm/s	2.0 - 4.0 mm	15 mm/s	35,000 RPM
0.3 mm	10.0 mm/s	3.0 - 6.0 mm	25 mm/s	30,000 RPM
0.5 mm	15.0 mm/s	5.0 - 10.0 mm	30 mm/s	25,000 RPM
1.0 mm	20.0 mm/s	10.0 - 20.0 mm	35 mm/s	20,000 RPM
cylindrical:				
1.0 mm	2.0 mm/s	5.0 - 10.0 mm	20 mm/s	40,000 RPM
2.0 mm	3.0 mm/s	10.0 - 20.0 mm	35 mm/s	33,000 RPM
3.0 mm	4.0 mm/s	15.0 - 30.0 mm	50 mm/s	28,000 RPM
4.0 mm	3.0 mm/s	20.0 - 40.0 mm	60 mm/s	22,000 RPM
5.0 mm	2.0 mm/s	25.0 - 50.0 mm	80 mm/s	18,000 RPM
6.0 mm	1.0 mm/s	30.0 - 60.0 mm	100 mm/s	16,000 RPM

3.5.3.2 Acrylic

Cooling/Lubrication: none or air only

Engraving: gravers of all angles

Milling: single tooth cutters with polished flute or single tooth cutters Varius

tool diameter	lowering speed (max.)	cutting depth (max.)	feed rate (max.)	rotational speed
conical:				
0.2 mm	1.0 mm/s	0.2 - 0.8 mm	10 mm/s	55,000 RPM
0.3 mm	2.0 mm/s	0.3 - 1.2 mm	20 mm/s	50,000 RPM
0.5 mm	3.0 mm/s	0.5 - 2.0 mm	30 mm/s	40,000 RPM
1.0 mm	4.0 mm/s	1.0 - 4.0 mm	35 mm/s	30,000 RPM
cylindrical:				
1.0 mm	2.0 mm/s	0.5 - 2.0 mm	15 mm/s	50,000 RPM
2.0 mm	3.0 mm/s	1.0 - 4.0 mm	20 mm/s	45,000 RPM
3.0 mm	4.0 mm/s	1.5 - 6.0 mm	25 mm/s	40,000 RPM
4.0 mm	3.0 mm/s	2.0 - 8.0 mm	30 mm/s	35,000 RPM
5.0 mm	2.0 mm/s	2.5 - 10.0 mm	35 mm/s	30,000 RPM
6.0 mm	1.0 mm/s	3.0 - 12.0 mm	40 mm/s	25,000 RPM

3.5.3.3 Aluminium

Cooling/Lubrication: special lubricant (e. g. spray lubricant ALU-N or minimum quantity lubricant WST 20)

Engraving: gravers of all angles

Milling: single tooth cutters with hawk beak profile or single tooth cutters Varius

tool diameter	lowering speed (max.)	cutting depth (max.)	feed rate (max.)	rotational speed
conical:				
0.2 mm	0.5 mm/s	0.1 - 0.2 mm	10 mm/s	55,000 RPM
0.3 mm	1.0 mm/s	0.1 - 0.3 mm	20 mm/s	50,000 RPM
0.5 mm	2.0 mm/s	0.2 - 0.5 mm	30 mm/s	40,000 RPM
1.0 mm	3.0 mm/s	0.4 - 1.0 mm	35 mm/s	30,000 RPM
cylindrical:				
1.0 mm	1.0 mm/s	0.2 - 0.5 mm	15 mm/s	50,000 RPM
2.0 mm	2.0 mm/s	0.4 - 1.0 mm	20 mm/s	45,000 RPM
3.0 mm	2.0 mm/s	0.6 - 1.5 mm	25 mm/s	40,000 RPM
4.0 mm	1.5 mm/s	0.8 - 2.0 mm	30 mm/s	35,000 RPM
5.0 mm	1.0 mm/s	1.0 - 2.5 mm	35 mm/s	30,000 RPM
6.0 mm	0.5 mm/s	1.2 - 3.0 mm	40 mm/s	25,000 RPM

3.5.3.4 Stainless Steel

Cooling/Lubrication: special lubricant (e. g. spray lubricant Emulgan-D or minimum quantity lubricant WST 20)

Engraving: engraver's milling cutters for stainless steel or gravers with 60 or 90 degrees top angle

Milling: triple tooth cutters for stainless steel or multi-tooth cutters Varius

tool diameter	lowering speed (max.)	cutting depth (max.)	feed rate (max.)	rotational speed
conical:				
0.2 mm	0.2 mm/s	0.02 - 0.04 mm	3 mm/s	25.000 RPM
0.3 mm	0.3 mm/s	0.03 - 0.06 mm	4 mm/s	20.000 RPM
0.5 mm	0.4 mm/s	0.05 - 0.1 mm	8 mm/s	18.000 RPM
1.0 mm	0.5 mm/s	0.1 - 0.2 mm	10 mm/s	17.000 RPM
cylindrical:				
1.0 mm	0.2 mm/s	0.05 - 0.1 mm	3 mm/s	15.000 RPM
2.0 mm	0.3 mm/s	0.1 - 0.2 mm	5 mm/s	12.000 RPM
3.0 mm	0.4 mm/s	0.15 - 0.3 mm	8 mm/s	10.000 RPM
4.0 mm	0.4 mm/s	0.2 - 0.4 mm	8 mm/s	8.000 RPM
5.0 mm	0.3 mm/s	0.25 - 0.5 mm	8 mm/s	6.000 RPM
6.0 mm	0.3 mm/s	0.3 - 0.6 mm	8 mm/s	5.000 RPM

Chapter 4

Fixing Devices

4.1 T-Slot Fixing Set

4.1.1 Content of Delivery

The T-slot fixing set consists of 2 cheeks each in three different lengths (125/175/225 mm), 2 hand lever clamping devices and 4 fastening clamps.

4.1.2 Installation/Handling

The cheeks can be fixed onto the machine table of your CAM system with the included T-slot nuts and will give sideway stability to the workpiece.

[Illustration: Cheeks in 3 lengths]

The hand lever clamping devices are used for pressing the workpiece against the cheeks. By applying 100 N of manual force, 2000 N of fastening force are exerted on the workpiece. Also the hand lever clamping devices are fixed onto the worktable with T-slot nuts.

[Illustration: Hand Lever Clamping Devices SH 1 and SH 2]

The fastening clamps are used to press workpieces onto the worktable. The fastening height can be adjusted with a regulating screw.

[Illustration: Fastening clamp]

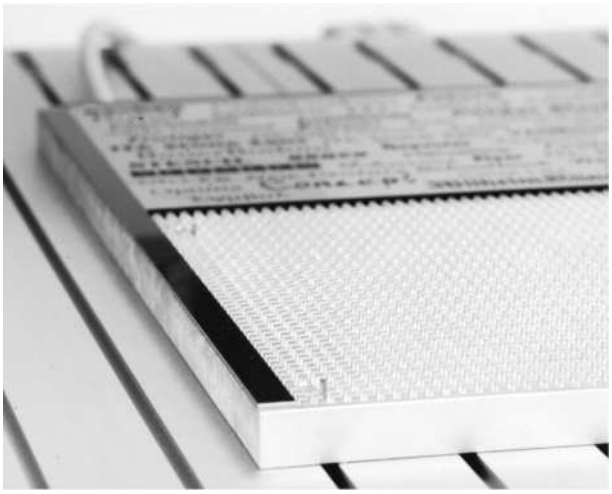
As great forces can act on the workpiece during processing, you must ensure in every case that the workpiece cannot become loose and fly around uncontrollably. Please regard the protective and safety regulations in chapter 2.4.

4.2 Grid Vacuum Table

4.2.1 Concept

The grid vacuum table is advisable if you preferably engrave or mill pockets. Simply place the workpiece against the limit stop and switch on the vacuum pump. The workpiece will be held down and cannot be shifted any more.

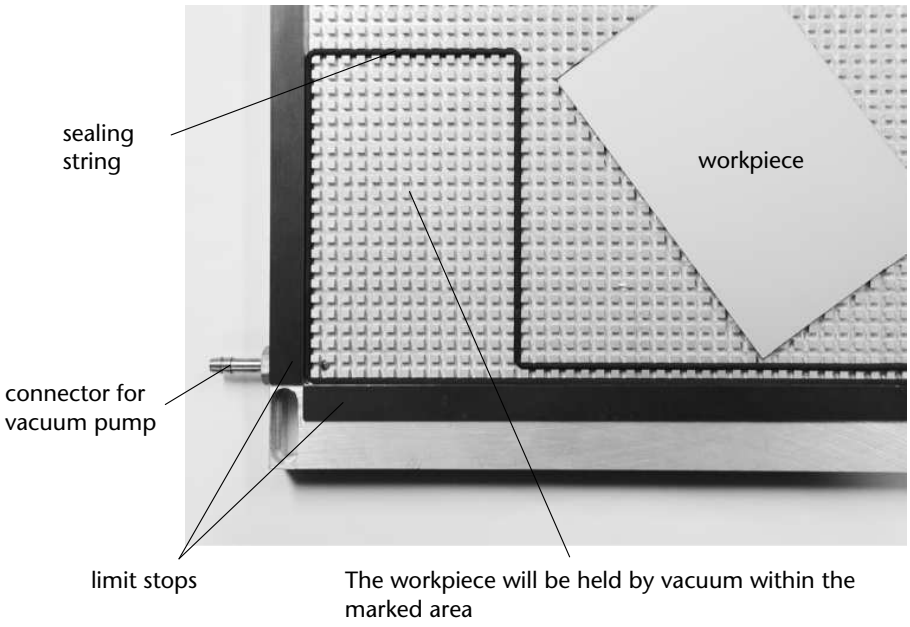
The vacuum grid plates develop a very strong fastening power, also against side-way shifting. The vacuum area is defined by a sealing-string that can be laid into the aluminium grid according to demand. The vacuum grid plates are ground on both sides, highly plane-parallel and therefore ideally suited for finest engravings without the need to apply a height regulation. The vacuum tables are levelled onto the corresponding CAM system.



[Illustration: Grid vacuum table]

4.2.2 Handling

Together with the grid vacuum table you will receive a sealing-string which is used to seal the area that is covered by the workpiece. The suction hole has to lie in the area defined by the sealing-string. No air may enter between the sealing-string and the workpiece, as otherwise no appropriate vacuum can be built up to hold the workpiece securely.



[Illustration: Sealing the vacuum area]

After you have aligned the workpiece exactly along the limit stops, activate the electric or pneumatic vacuum pump (see separate manual) and press the workpiece onto the table with equal pressure. This is to ensure that no air can enter between workpiece and vacuum table so that the vacuum can build up.

Caution!

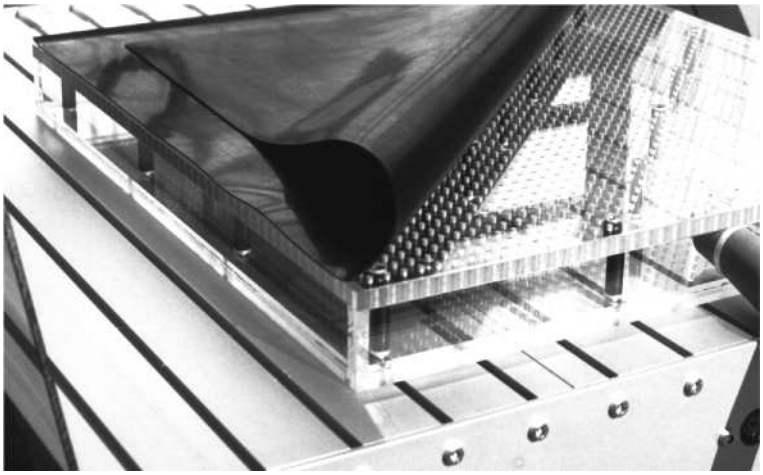
Make certain in all cases that the workpiece is securely held before starting the working process. Ensure that the workpiece is not drilled or milled through as in that case the vacuum would break down, the workpiece would be thrown out and could fly through the air uncontrollably, creating a high risk of injury.

Generally, the rate of feed should be increased in steps only. A very high abrasive performance simultaneously creates strong sideway forces that act on the workpiece. If these forces exceed the holding power of the vacuum, the workpiece can also tear loose, fly around and cause injury. Please observe the protective and safety regulations in chapter 2.4.

4.3 Special Vacuum Table

4.3.1 Concept

A characteristic feature of this newly developed special vacuum table is that it enables you to mill openings and outside contours. On most vacuum tables the complete milling-through of workpieces is not possible and time-consuming manual cutting-out and de-grating is required. The special vacuum table makes this unnecessary because it is protected by a perforated rubber adapter mat.



[Illustration: Special vacuum table]

It does not matter where on the vacuum table you place your workpiece. The even depression in the large chamber holds your workpiece everywhere. The special vacuum table decreases the time needed for changing the workpieces to a few seconds. The special vacuum table consists of sturdy plastic and is available in the following basic sizes:

- 250 x 500 mm
- 500 x 500 mm

other dimensions can be achieved by combining these basic sizes.

4.3.2 Handling

The supplied vacuum adapter mat is simply laid on top of the vacuum table and positioned onto the fitting pins. In order to increase the suction power, unused areas can be covered with material or paper strips. Depending on the size of the workpiece respectively the remaining free area, different vacuum adapter mats can be used. vhf supplies adapter mats with 5 different perforation diameters ranging from 0,5 mm to 1,5 mm. In addition to this, there is also a special vacuum fleece available.

In case of greater free areas on the vacuum table (i. e. areas not covered by the workpiece) adapter mats with a smaller perforation diameter should be used. You have to consider, though, that the absolute fastening power is decreased by this. Please note that the mentioned free areas are also increased through processing workpieces. Therefore, the fastening power acting on the workpiece will be reduced more and more during the milling process.

One possibility to prevent this effect is not to mill through the workpiece in one run. The danger that single pieces loosen is reduced when a last cut is done with a low abrasive performance (i. e. small cutting depth or small rate of feed). A rule-of-thumb is: the faster the processing and the larger the cutting depth, the higher is the force acting on the workpiece and the higher is the fastening power needed.

A further aspect concerns the tool: the thinner the tool, the less force acts on the workpiece and the less vacuum area is laid bare thus also the holding power acting on the workpiece stays greater.

When milling out small pieces from a larger workpiece it can also be useful to let stand small fixing links to prevent the workpiece from loosening from the rest of of the material. For pure engraving works it can be useful not to cover the vacuum table completely so that a little air can enter and the vacuum unit does not have to struggle against a complete vacuum.

The negative pressure created on this vacuum table is relatively low with approximately 0,2 bar per hole. Decisive for the fastening power is rather the so-called suction cup effect, resulting from the high friction-coefficient of the rubber mat. Please regard the protective and safety regulations in chapter 2.4 in any case.

Safety Advice:

- Be careful when using liquid cooling – no liquid may get into the vacuum table! The liquid could cause a short circuit in the vacuum device. If you are

cooling with spirit alcohol or other flammable liquids, there is an additional danger of explosion inside the vacuum device. Please adjust the spraying unit to produce a very fine spray drizzle that reaches the tool tip directly. Areas not covered by the workpiece should be covered with other material. Also take care that no liquid enters the table through the milling channels created during processing. Empty the dust bag of the vacuum device regularly.

- Use only the supplied vacuum device and in no case a usual (industrial) vacuum cleaner. Only with the supplied vacuum device, it is ensured that the vacuum performance is sufficient and that the device functions in full-time use. Industrial vacuum cleaners often trigger a safety-turn-off when the air intake is blocked for a longer period of time (e. g. when the vacuum table is fully covered). In such cases the vacuum collapses and the workpiece can loosen, fly around uncontrollably and cause injury.

- Do not forget to remove the fitting pins before planing the surface of the vacuum table.

4.3.3 Tips & Tricks

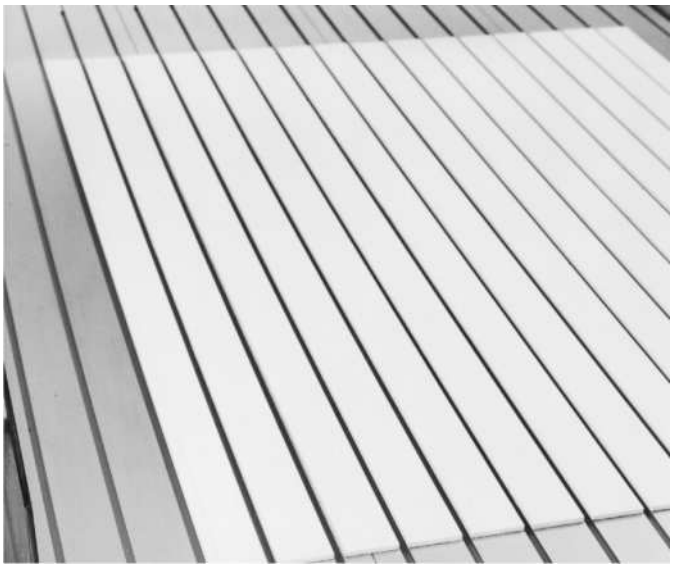
- A limit stop can be installed using the screw holes for the fitting pins.

4.4 Polystyrene Surface

4.4.1 Concept

The workpieces can be mounted onto the polystyrene surface with a special adhesive film. An advantage of the polystyrene strip surface is that the T-slots of the machine table stay freely accessible, so that the hand lever clamping devices and other parts of the T-slot fixing set can be utilised (see chapter 4.1). We advise the polystyrene strip surface as standard mounting surface.

The polystyrene surface too is milled plane directly on the machine, so that an optimally plane-parallel working surface is guaranteed. It can be planed several times and therefore does not has to be replaced often.



[Illustration: Polystyrene strip surface]

4.4.2 Handling

The workpieces can be fixed onto the polystyrene strip surface with the vhf special adhesive film DX1 or DX2 (double adhesive power). If you are working with liquid cooling, please take care that not too much cooling liquid can get under the workpiece. Under unfavourable circumstances the workpiece could loosen and fly around uncontrollably. Please also see the further protective and safety regulations in chapter 2.4.

Chapter 5

Accessories

5.1 Tool Cooling

5.1.1 Cooling and Spraying Unit

5.1.1.1 Concept

A cooling and spraying unit is sensible for processing many materials. Under high pressure a spray drizzle is created, that ensures that especially at high rotational speeds the cooling agent reaches the point of the tool. With a cooling and spraying unit you will obtain clean cuts and the lifetime of the tools will be increased. Aluminium and brass should in all cases be processed with a cooling and lubricating liquid while for softer plastics air cooling is sufficient.

[Illustration: Cooling and spraying unit]

5.1.1.2 Handling

Manually Controlled Cooling and Spraying Unit

Place the open end of the intake hose of the cooling and spraying device into a vessel well filled with lubricant and make sure that neither the vessel can topple over nor that the hose can slip out accidentally. The vessel should be placed at about the same height as the spray nozzle. Control the level of cooling liquid from time to time during work.

After having ensured that the compressed air has been connected and adjusted properly, you can activate the cooling and spraying device by pulling the black knob that is located on the side of the z-axis. The cooling liquid will automatically be pulled up from the vessel though the intake hose. Beside the black knob is an adjustment screw (the shank of the knob goes through this screw) for regulating the amount of compressed air used while the amount of liquid in the spray drizzle is adjusted by turning the tip of the nozzle.

Please note that the metal of the spray nozzle may contract because of the resulting evaporative cooling which can cause less liquid to pass through the nozzle. Therefore, please observe the amount of spray drizzle from time to time or adjust it stronger to begin with.

Caution!

No explosive or harmful liquids may be used for cooling. Please observe further protective and safety regulations in chapter 2.4.

Software-Controlled Cooling and Spraying Unit

In addition to the points mentioned above, the following applies:

As soon as the spindle starts, the cooling and spraying device will be automatically started too. If the intake hose for cooling liquid is still empty before use, it will take several seconds, especially with a longer hose, until the cooling liquid arrives at the nozzle. Please be aware of this and possibly wait a little while after the spindle has started, before you begin with the output process.

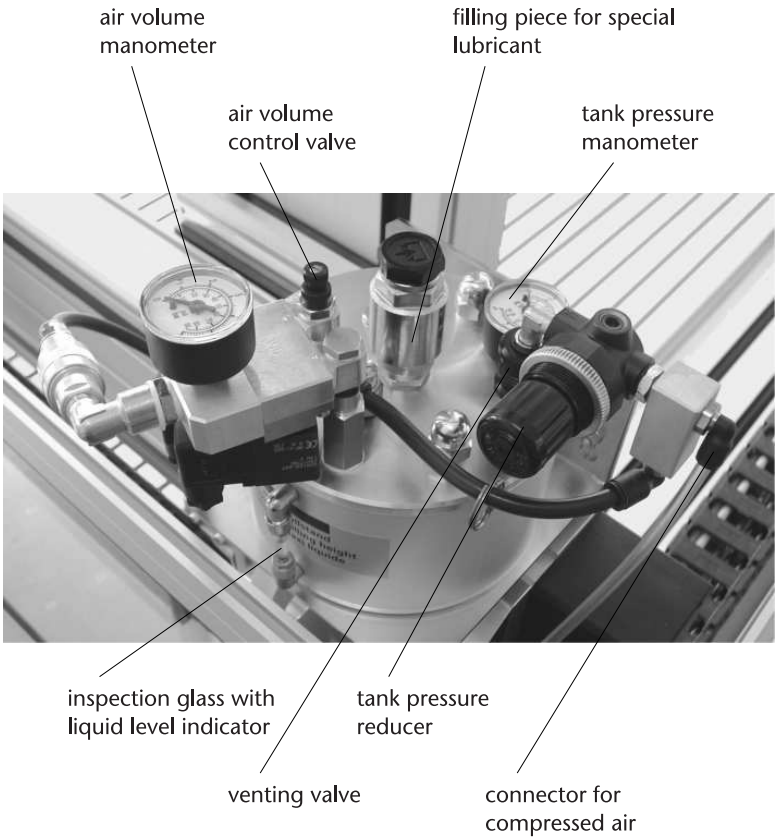
If you are processing materials that may not be cooled or sprayed, press the black knob of the cooling and spraying device all the way in, because the automatic pneumatic valve will open every time the spindle is started, even if you do not want to cool. Reversely, ensure that the knob is pulled out far enough before each working process that you want to have cooled.

5.1.2 Minimum Quantity Lubrication Unit

5.1.2.1 Concept

The electronically controlled minimum quantity lubrication unit reduces the consumption of lubricants to a few milliliters per hour. This lowers not only costs and workplace exposure, but improves the quality of the treated workpieces at the same time. This tool cooling system combines the advantages of dry processing with those of flood lubrication – the necessity of cleaning machines and workpieces is being reduced, just as disposal problems. On top of that, the workplace exposure to harmful vapors or skin contact to cooling liquids will be reduced considerably. The tools, however, remain within their optimum temperature range during the machining process.

The system will be put under pressure by a constant supply of compressed air, so that air and oil can stream through the nozzle hoses and escape as oil/air mixture from the two-component nozzle. The fine oil droplets will be protected here by an air stream surrounding them. It makes sure that the oil will actually reach the tool and that it will not be swirled before.



[Illustration: pressure tank with controls and instruments of the minimum quantity lubrication unit]

5.1.2.2 Filling the system

The inspection glass at the side of the tank allows you to check the fluid level in the tank. The tank has to be filled only at zero pressure. Please do always note the safety advices written at the tank, too.

For deflating the compressed air, push the venting valve to the top. The air will exhaust clearly audible. When the tank is at zero pressure, open the filling neck for the cooling liquid and screw in the funnel; it will open the valve then. However, watch carefully that both, the funnel and the filling neck, are completely free of chips or any other kind of dirt. Then please fill the tank with special lubricant WST 20 until the maximum filling level in the inspection glass has been reached. The maximum filling capacity is 1 litre because it is essential for the function of this system that a certain space of air remains between the level of the cooling liquid and the lid of the tank. Finally, close the filling neck with the screw cap again.

Attention!

Use only the special lubricant WST 20 which is approved for the use in this minimum quantity lubrication unit.

Only fill in lubricant to such an extent that the liquid level remains visible in the inspection glass. So you can avoid to fill the tank twice accidentally.

5.1.2.3 Operating the system

Oil consumption

The oil consumption depends on the pressure in the tank which may lie between 1 and 6 bar (from a pressure of 7 bar on, the safety valve will open). A higher pressures means a higher oil consumption. In most cases, a pressure between 1 and 2 bar will be sufficient, for heavier milling works there are rarely more than 4 bar necessary. You control the pressure manually by the tank pressure reducer and can check it via the tank pressure manometer. After you have set the desired pressure, you should lock the pressure reducer by pushing the button in.

Air consumption

The required air for atomizing the oil and for the surrounding air stream of the two-component nozzle will be adjusted by the air volume control valve with the knurled head screw and can be checked via the air volume manometer. The size of the oil droplets depends on the air volume, too. The more air is supplied, the finer becomes the oil/air mixture which escapes from the nozzle opening. A higher rotational speed of the spindle or a bigger tool diameter demands a greater air volume to override the existing swirlings and to lead the oil in its air stream reliably to the tool. Usually, the air pressure can lie between 1 and 2 bar. The air consumption for each nozzle, depending on the setting, amounts to 30 to 50 liters per minute.

After a change of the oil fill level or the tank pressure, the required air volume for atomizing the oil in the nozzle probably has to be re-adjusted by the air volume control valve.

Attention!

During the initial startup or after certain modifications in the system, it may last between one and six minutes until oil escapes from the nozzles.

If the venting valve is open (upper position) while the system is not in operation, oil may possibly leak through the nozzles. So please ensure that this valve is shut then (lower position).

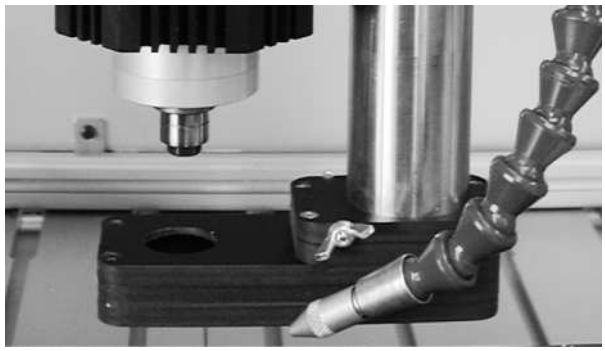
Adjustment of the nozzles

The procedure of minimum quantity lubrictation primarily has not the aim to discharge heat by cooling liquid, but to avoid the development of heat by lubrication. So please adjust the nozzles in such a way that the oil/air mixture that has been atomized into micro-fine particles gets directly onto the effective area between tool and workpiece. Usually for that purpose the nozzles should be set rather steeply so that the lubrication still works also in deeper slots.

5.2 Dust Extraction Unit

5.2.1 Concept

The dust extraction is mounted on the side of the spindle, so that there can be no collisions with other tools in the change station. A large extraction chamber and a large tube diameter without winding ensures optimal extraction results.



[Illustration: Dust extraction unit, here with cooling/spraying unit in the foreground]

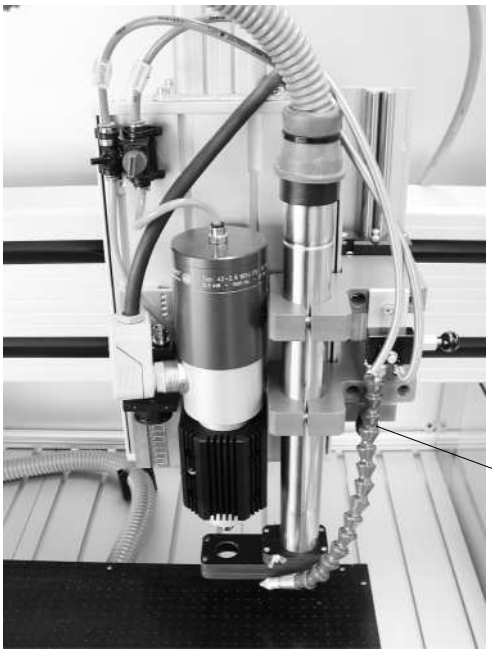
Security advice:

Please consider that, because of reasons of machine security, machines without a covering cap/housing must be equipped with a dust extraction unit to serve as touch protection for the spindle. This is to prevent injuries through touching the moving tool.

5.2.2 Handling

The dust extraction device is already adjusted to a minimal positioning height that ensures that no collisions can occur with the tool-shafts pointing out of the change station. The minimal positioning height may not be changed by the user.

A locking screw (black, plastic-capped, see illustration) is used to determine how far the dust extraction is lowered for processing when the z-axis is moved down towards the workpiece. The processing height must be adjusted so that the dust extraction device is a little bit above the highest elevation of the workpiece respectively the fixing devices.



Caution!

Except for this locking screw, no installation of the dust extraction device may be changed by the user as otherwise there is the danger of colliding with parts of the

machine.

Please keep in mind that your vacuum-cleaner must be suited for this application (protected against the danger of explosion when using inflammable cooling liquids, micro-filter for processing hazardous materials etc..)

In all cases, heed the instructions and the safety regulations given by the manufacturer of your vacuum-cleaner.

Kurzanleitung • Quick reference guide

Benutzung des Multi-Aggregats • Use of the multi unit

DE Dieses Dokument ist eine zusätzliche Anleitung für das Schneiden von Werkstoffen mit vhf-Fräsmaschinen. Die hier aufgeführten Warnhinweise gelten zusätzlich zu den Warnhinweisen des Maschinenhandbuchs.

Dieses Dokument beschreibt, wie sie das oszillierende Tangentialmesser und anschließend den Universalkopf benutzen. Sollten Sie nur den Universalkopf benutzen, überspringen Sie die Punkte 5 bis 8.

EN This document is a supplementary manual on cutting materials with the vhf milling machines. The safety messages in this document supplement the safety messages in the machine manual.

This document describes how to use the oscillating tangential knife and thereafter how to use the universal head. If you only use the universal head, skip the steps 5 to 8.

⚠ WARNUNG

Schnittverletzungen an Messerwerkzeugen

- ➤ Bleiben Sie von der Maschine weg, während die Maschine arbeitet.
- ➤ Benutzen Sie immer Handschuhe und den mitgelieferten Klingenschutz, wenn Sie die Schneidwerkzeuge wechseln.
- ➤ Halten Sie die Messer und Lanzen nie an der Schneide.

⚠ WARNING

Cutting injuries caused by cutting tools

- ➤ Stay away from the machine while it is operating.
- ➤ Always use gloves and the supplied knife protection when you change the cutting tools.
- ➤ Never touch the knives and lances at the cutting edge.

DE Legende

- ★ Voraussetzung
- **M1.** Erster Handlungsschritt (M steht für manuell)
- **S2.** Zweiter Handlungsschritt (S steht für Software)
- **M3.** Dritter Handlungsschritt (M steht für manuell)
- ➨ Ergebnis

⚠ GEFAHR Lebensgefahr oder schwerwiegende Verletzung bei Nichtbeachtung

⚠ WARNUNG Lebensgefahr oder schwerwiegende Verletzung möglich bei Nichtbeachtung

⚠ VORSICHT Leichte bis mittelschwere Verletzung möglich bei Nichtbeachtung

HINWEIS Sachschaden möglich bei Nichtbeachtung

WICHTIG Anwenderhinweise und andere wichtige Informationen

TIPP Informationen zur Arbeitserleichterung

EN Legend

- ★ Requirement
- **M1.** First action (M stands for manually)
- **S2.** Second action (S stands for Software)
- **M3.** Third action (M stands for manually)
- ➨ Result

⚠ DANGER Danger to life or serious injury in case of disregard

⚠ WARNING Danger to life or serious injury possible in case of disregard

⚠ CAUTION Minor or medium injury possible in case of disregard

NOTICE Material damage possible in case of disregard

IMPORTANT Operating instructions and other important information

HINT Information to make work easier

Schneiden mit Cenon • Cutting with Cenon

1

DE **Voreinstellungen in Cenon**

S1. Klicken Sie in der Menüleiste auf Cenon → Voreinstellungen.

S2. Wählen Sie im Reiter **CAM** die korrekte Definitonsdatei für das Schneiden aus (voreingestellt: Kundenname_cut).

S3. Starten Sie Cenon und die Maschinensteuerung neu.

S4. Wählen Sie im Reiter Magazin das korrekte Werkzeugmagazin zum Schneiden aus (voreingestellt: Multikopf).

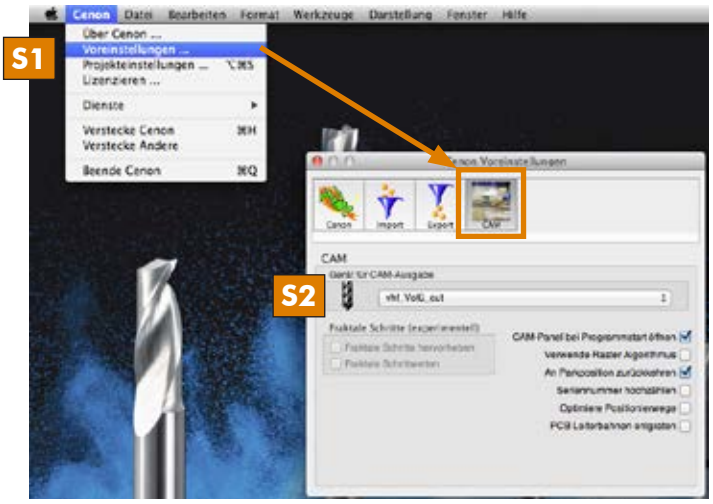
EN **Settings in Cenon**

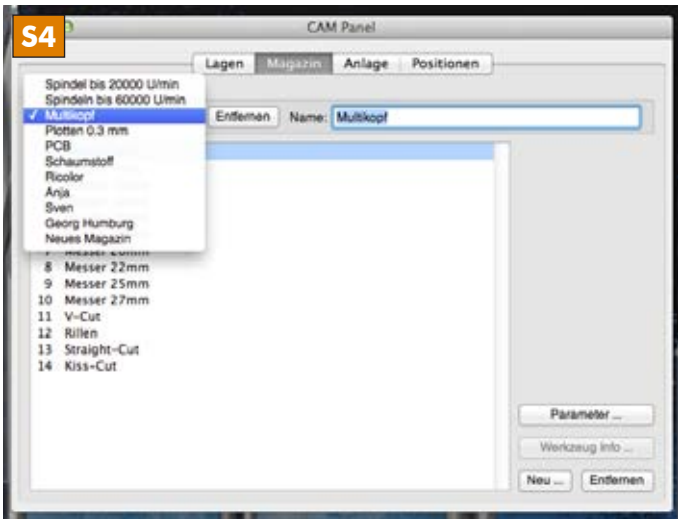
S1. In the menu bar click on Cenon → Preferences.

S2. On the **CAM** tab select the correct definition file for cutting (by default: customer name_cut).

S3. Restart Cenon and the machine control unit.

S4. On the Magazine tab select the correct tool magazine for cutting (by default: multi unit).





2

DE **Schneidkontur erstellen in Cenon**

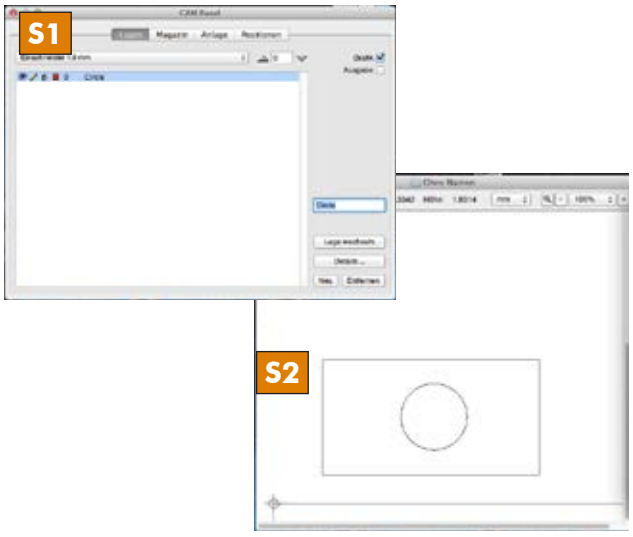
S1. Erstellen Sie eine neue Lage in Cenon und geben Sie ihr einen Namen.

S2. Erstellen Sie oder importieren Sie eine Schneidkontur in Cenon. Ein Füllen der Pfade ist nicht nötig, da es beim Schneiden keine Innenkonturen oder Außenkonturen gibt.

EN **Creating a cutting contour in Cenon**

S1. Create a new layer in Cenon and name it.

S2. Create or import a cutting contour in Cenon. Filling the paths is not necessary because there are no inner or outer contours when cutting.



3 DE Lage komplett editieren

S1. Wählen Sie die Schnitttiefe aus (falls Sie durchschneiden wollen: Tiefe des Materials + 1 mm).

HINWEIS Bevor Sie fortfahren, prüfen Sie die Schnitttiefe. Wenn Sie einen falschen Wert eingeben schneiden Sie direkt in den Vakuumtisch und zerstören das Werkzeug.

S2. Wählen Sie das gewünschte Werkzeug aus.

S3. Kontrollieren Sie, ob alle Lagendetails (von rechts nach links, siehe Screenshot) in jeder Lage richtig ausgefüllt sind.

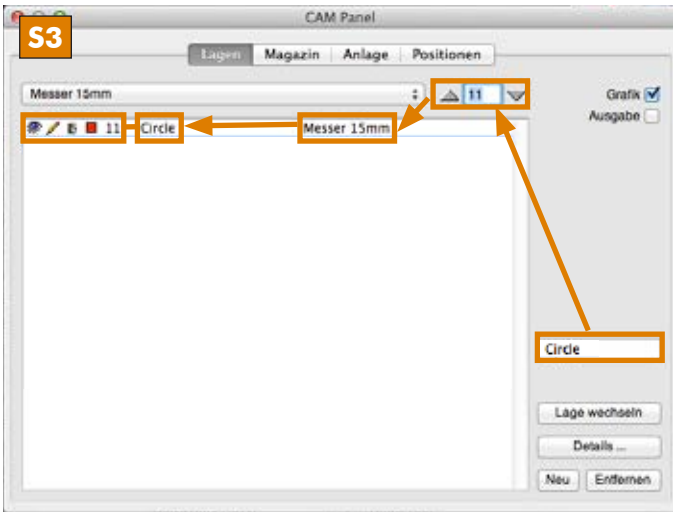
EN Editing the layer completely

S1. Select the cutting depth (if you want to cut through: depth of the material + 1 mm).

NOTICE Before you continue check the cutting depth. If you enter a wrong value, you will cut directly into the vacuum table and destroy the tool.

S2. Select the desired tool.

S3. Check if all layer details (from right to left, see screenshot) are filled out correctly for each layer.



---

4 DE Einmessvorgang vorbereiten

HINWEIS Schieben Sie einstellbare Bauteile (Staubabsaugung, Nivelliertaster) komplett nach oben und nehmen Sie das Werkzeug aus der Frässpindel, bevor Sie das Schneidwerkzeug einmessen!

M1. Schieben Sie alle einstellbaren Bauteile der Frässpindel nach oben.

S2. Fahren Sie die Z-Achse auf 0 (ganz nach oben) und fahren Sie die Position für einen bequemen Werkzeugwechsel an.

HINWEIS Verwenden Sie niemals die automatische Z-Justage für den Umgang mit dem Multi-Aggregat, da die Z-Justage sonst beschädigt wird.

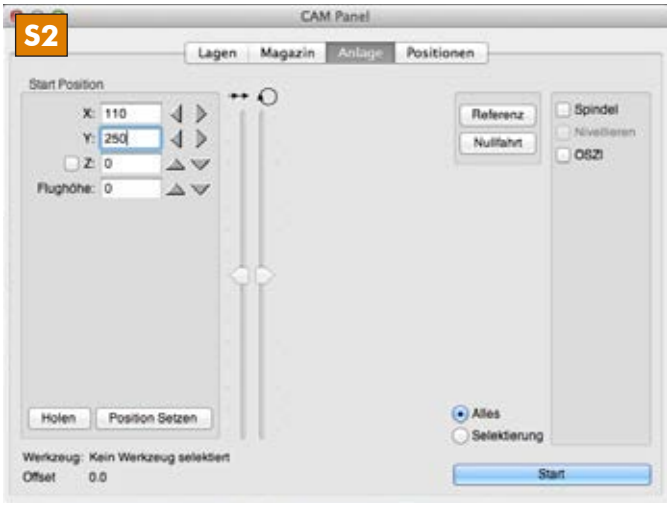
EN Preparing the measuring process

NOTICE Push the height adjustable components (dust extraction, leveling key) upwards completely and remove the tool from the milling spindle before measuring the cutting tool!

M1. Push all height adjustable components of the milling spindle upwards.

S2. Move the Z axis to 0 (all to the top) and then move the X and Y axes to the position for a comfortable tool change.

NOTICE Never use the automatic Z adjustment when working with the Multi Unit because otherwise the Z adjustment will be damaged.



Oszillierendes Tangentialmesser • Oscillating tangential knife

5 DE Werkzeug lösen

⚠ **WARNUNG** **Verletzungsgefahr:** Warten Sie, bis die Achsen vollständig referenziert haben, bevor Sie in die Nähe des Multikopfs gehen!

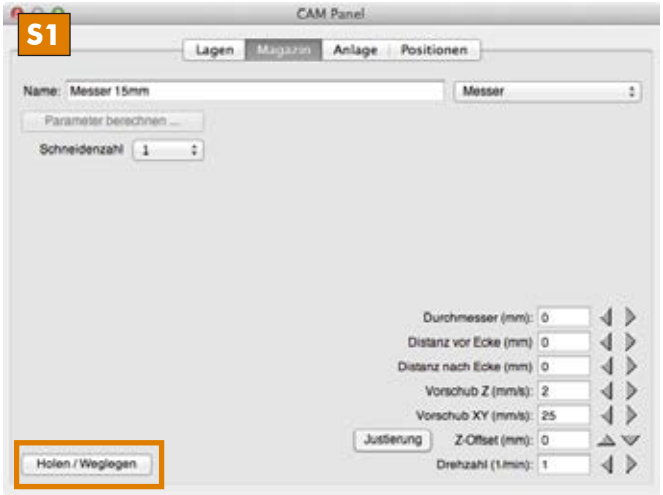
S1. Doppelklicken Sie auf das gewünschte Schneidwerkzeug in der Lagenansicht. Klicken Sie auf Holen/Weglegen in der Werkzeugansicht.

➨ Das Multi-Aggregat referenziert.

M2. Falls eine Klinge im Universalkopf eingespannt ist, bringen Sie dort den Klingenschutz an!

M3. Lösen Sie das eingespannte Werkzeug im oszillierenden Tangentialmesser.

HINWEIS Halten Sie das Werkzeug fest, da es sonst herunterfällt und beschädigt werden kann!



EN Removing the tool

⚠ **WARNING** **Risk of injury:** Wait until the axes have stopped referencing before going near the multi head!

S1. In the layer view double-click on the desired cutting tool. In the tool view click on Select/Deselect.

➨ The Multi Unit starts referencing.

M2. If a blade is inserted in the universal head, install the blade protection to it!

M3. Remove the tool inserted in the oscillating tangential knife.

NOTICE Keep on holding the tool because otherwise it will drop and may get damaged!

6 DE Gewünschtes Werkzeug einsetzen

M1. Setzen Sie das Werkzeug so ein, dass die Planfläche in Richtung des Bohrlochs zeigt und halten Sie das Werkzeug fest.

M2. Ziehen Sie den Gewindestift an, bis das Werkzeug innerhalb der Schrägen verschiebbar ist.

M3. Halten Sie mit einer Hand das Werkzeug hoch und schrauben Sie mit der anderen Hand den Gewindestift langsam fest.

WICHTIG Der Gewindestift darf nicht auf der Schräge angezogen werden!

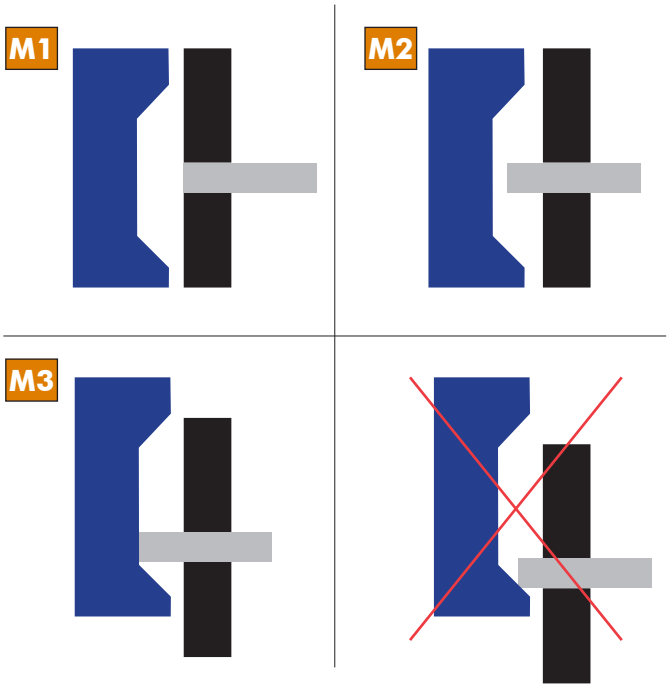
EN Inserting the desired tool

M1. Insert the tool in such a way that the flat surface points into the direction of the drilling hole and keep on holding the tool in this position.

M2. Tighten the set screw until the tool can be moved within the slope.

M3. Hold the tool up with one hand and slowly tighten the set screw with the other hand.

IMPORTANT The set screw may not be tightened on the slope!



7 DE Werkzeughöhe einmessen

⚠ WARNUNG Verwenden Sie niemals die automatische Z-Justage für den Umgang mit dem oszillierenden Tangentialmesser, da das oszillierende Werkzeug auf der Z-Justage abbrechen und herausgeschleudert werden kann.

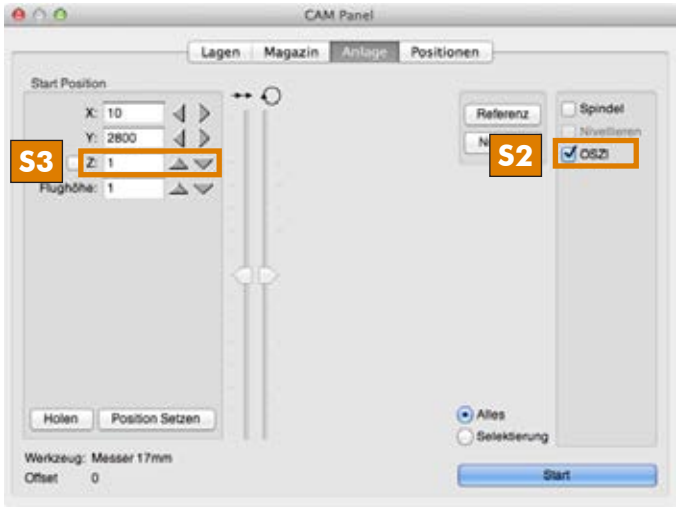
M1. Falls ein Klingenschutz auf dem Universalkopf angebracht ist, entfernen Sie diesen.

S2. Aktivieren Sie den Vakuumtisch und das oszillierende Tangentialmesser.

S3. Fahren Sie in der Z-Achse Stück für Stück nach unten, bis das Werkstück berührt wird.

➨ Das Werkstück wird durch das *aktivierte* oszillierende Tangentialmesser angekratzt.

WICHTIG Falls Sie ein Material mit starken Höhentoleranzen bearbeiten, erhöhen Sie die Flughöhe im Reiter **Anlage**. Die Voreinstellung mit 1 mm kann bei einigen Materialien nicht ausreichend sein!



EN Measuring the tool height

⚠ WARNING Never use the automatic Z adjustment when working with the oscillating tangential knife because the oscillating tool can break and get tossed out when touching the Z adjustment.

M1. If a blade protection is installed to the Universal Head, remove it.

S2. Activate the vacuum table and the oscillating tangential knife.

S3. Move the Z axes downwards step by step until the workpiece is being touched.

➨ The workpiece is being scraped by the *activated* oscillating tangential knife.

IMPORTANT If you process materials with a strong height tolerance increase the move height on the **Machine** tab. The default value of 1 mm may not be sufficient for some materials!

---

8 DE Datei starten

⚠ WARNUNG **Verletzungsgefahr:** Halten Sie während der Bearbeitung genügend Abstand zur Bearbeitungsfläche!

S1. Starten Sie die Datei in Cenon.

➨ Die Datei ist fertig durchgelaufen.

★ Der Multikopf bewegt sich nicht mehr und das oszillierende Tangentialmesser ist ausgeschaltet.

M2. Kontrollieren Sie das bearbeitete Werkstück.

TIPP Falls der Schnitt nicht ganz durch das Werkstück durchgeht, erhöhen Sie die Schnitttiefe in der Lagenansicht entsprechend. Falls die Schnittkante perforiert ist, reduzieren Sie den Vorschub (X,Y) im Werkzeugfenster.

EN Starting the file

⚠ WARNING **Risk of injury:** Keep a safe distance to the machining surface during processing!

S1. Start the file in Cenon.

➨ The file has been processed completely.

★ The Multi unit is no longer moving, and the oscillating tangential knife is switched off.

M2. Check the machined workpiece.

HINT If the cut does not completely go through the workpiece, increase the cutting depth in the layer view accordingly. If the cut edge is perforated, reduce the feed (X, Y) in the tool window.

Universalkopf • Universal head

9 **DE** **Werkzeugplatte entnehmen**

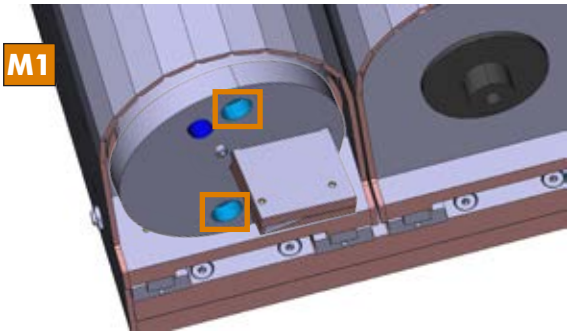
⚠ WARNUNG **Verletzungsgefahr:** Wechseln Sie das Werkzeug des Universalkopfs nie an der Maschine! Nehmen Sie immer erst mit angebrachtem Klingenschutz die Werkzeugplatte ab und wechseln Sie dann das Werkzeug.

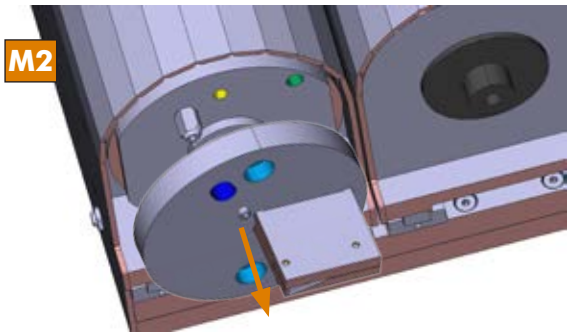
⚠ WARNUNG **Verletzungsgefahr:** Falls sich eine Lanze im oszillierenden Tangentialmesser befindet, entfernen Sie dort zuerst die Lanze oder bringen Sie ein Stück Schaumstoff oder Styropor als Schnittschutz an.

Bevor Sie mit dem Universalkopf arbeiten, prüfen Sie die Lanze im oszillierenden Tangentialmesser. Falls die Lanze eine Schneidenlänge von mehr als 27 mm hat, entfernen Sie sie.

M1. Bringen Sie den Klingenschutz an.

M2. Lösen Sie die 2 Schrauben der Werkzeugplatte und entnehmen Sie die Platte.





EN **Removing the tool plate**

⚠ WARNING **Risk of injury:** Never change the tool of the Universal Head at the machine! Always remove the tool plate with the blade protection installed first and then change the tool.

⚠ WARNING **Risk of injury:** If there is a lance installed in the oscillating tangential knife, remove this blade first or install a piece of foam or polystyrene as a cut protection.

Before you work with the universal head check the lance in the oscillating tangential knife. If the lance has a cutting edge length of more than 27 mm, remove it.

M1. Install the blade protection.

M2. Untighten the 2 screws of the tool plate and remove it.

---

10 **DE** **Werkzeug in Werkzeugplatte wechseln**

M1. Um an das Werkzeug zu kommen, lösen Sie die Schrauben .

M2. Tauschen Sie das Werkzeug aus und bringen Sie den Klingenschutz auf das neue Werkzeug an.

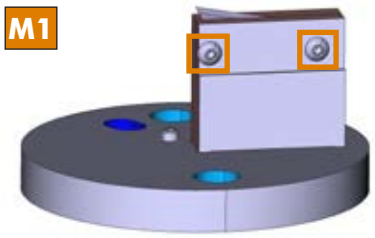
M3. Bringen Sie die Schrauben wieder an die Werkzeugplatte an.

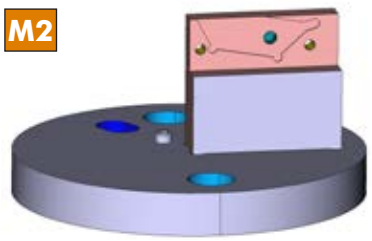
EN **Changing the tools in the tool plate**

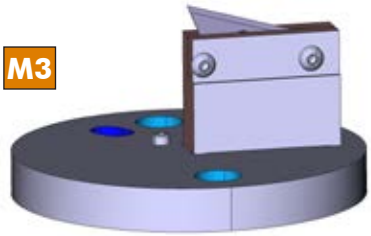
M1. To access the tool, untighten the screws.

M2. Exchange the tool and install the blade protection to the new tool.

M3. Install the screws to the tool plate again.







11 **DE** **Werkzeugplatte auf Maschine anbringen**

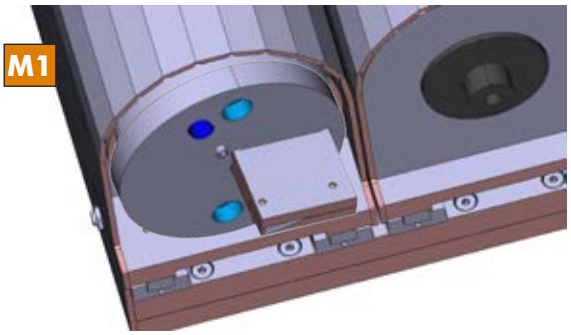
M1. Halten Sie die Werkzeugplatte an den Universalkopf.

M2. Fixieren Sie die Werkzeugplatte, indem Sie die zwei Schrauben anziehen.

EN **Installing the tool plate to the machine**

M1. Hold the tool plate to the Universal Head.

M2. Fix the tool plate by tightening the two screws.



---

12 **DE** **Werkzeug einmessen**

Falls dieselbe Werkstückhöhe benutzt wird und die Höhe in Z bereits mit dem oszillierenden Tangentialmesser abgenommen wurde, brauchen Sie nichts mehr unternehmen. Cenon übernimmt die Z-Höhe für den Universalkopf entsprechend.

Ansonsten kratzen Sie das Werkstück bei eingeschaltetem Vakuumtisch mit dem Werkzeug im Universalkopf an (entsprechend Punkt 7).

EN **Measuring the tool**

If the same tool height is used and the height in Z has already been measured with the oscillating tangential knife, you need not take any further action. Cenon uses the Z height for the Universal Head accordingly.

Otherwise turn on the vacuum table and scrap the workpiece with the tool installed in the Universal Head (as described in point 7).

---

13 **DE** **Besonderheiten Kiss-Cut-Aufsatz**

M1. Drehen Sie an dem Metallring, damit Sie den weißen Niederhalter einstellen können.

M2. Halten Sie den Metallring und drehen Sie den weißen Niederhalter gegen den Metallring, bis die Klinge weit genug herausragt.

➨ Der Abstand der Klinge zum weißen Niederhalter ist korrekt.

S3. Messen Sie das Werkzeug ein, bis das Werkstück von der Klinge berührt wird.

S4. Stellen Sie als Bearbeitungstiefe 1-3 mm in der Lage ein. Dadurch ist eine genügende Vorspannung sichergestellt, damit die Feder des Kiss-Cut-Aufsatzes genügend Druck aufbringt, um die Folie zu schneiden.

EN **Special characteristics of the Kiss-Cut attachment**

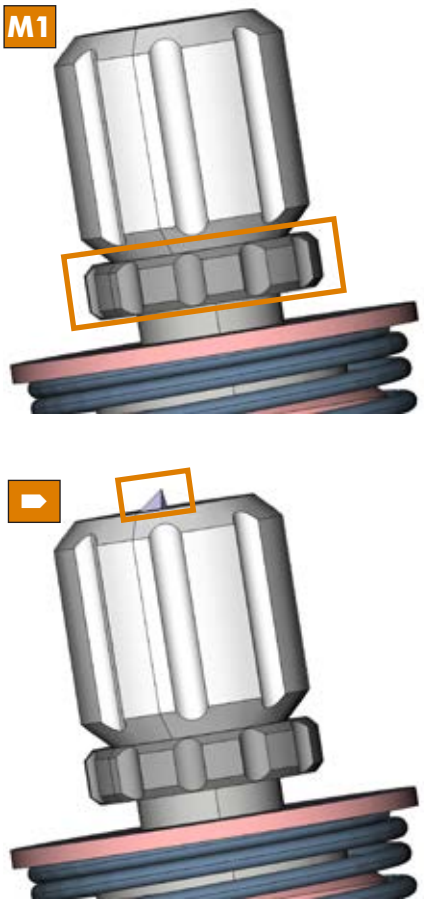
M1. Turn the metal ring so that you can set the white press pad.

M2. Hold the metal ring and turn the white press pad against the metal ring until the blade sticks out far enough.

➨ The distance of the blade to the white press pad is correct.

S3. Measure the tool until the workpiece is being touched by the tool.

S4. Set the processing depth of the layer to 1-3 mm. This secures a sufficient pretensioning so that the spring of the Kiss Cut attachment has enough pressure to cut the foil.



14 **DE** **Besonderheiten Rillrad-Aufsatz**

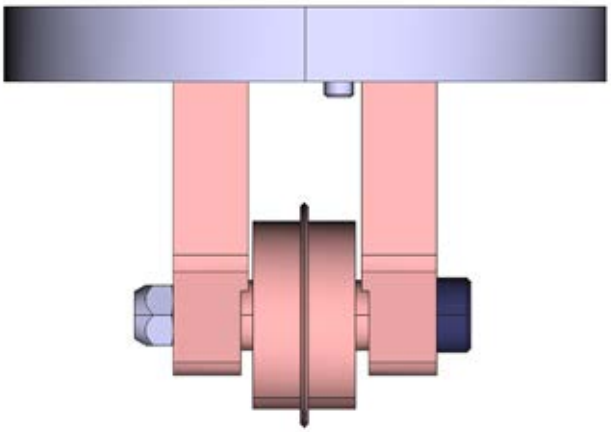
Die Bearbeitungstiefe beim Rillrad ist von Material zu Material sehr unterschiedlich.

S1. Messen Sie das Werkzeug ein (entsprechend Punkt 12), bis das Werkstück von dem Rillrad berührt wird.

S2. Stellen Sie als Bearbeitungstiefe 0,5 mm ein und starten Sie die Datei.

M3. Kontrollieren Sie das Ergebnis.

S4. Sollte die Rille nicht tief genug sein, erhöhen Sie jeweils die Bearbeitungstiefe und lassen Sie die Datei so oft durchlaufen, bis das Ergebnis zufriedenstellend ist.



EN **Special characteristics of the creasing attachment**

When using the creasing attachment, the processing depth is very different from material to material.

S1. Measure the tool (as described in point 12) until the workpiece is being touched by the creasing wheel.

S2. Set a processing depth of 0.5 mm and start the file.

M3. Check the result.

S4. If the crease is not deep enough, increase the processing depth and run the file as often as it is necessary to get a satisfactory result.

Index

EC Declaration of conformity

according to EC directive for machinery 2006/42/EC Annex II A

We,

vhf camfacture AG
Lettenstraße 10
72119 Ammerbuch
Deutschland

hereby declare expressly, that the

Machine: **CNC Portal milling machine**
Type: **Active Pro ; Classic ; Premium ; Active Mold**

fulfils all the relevant provisions of the following directives:

- **2006/42/EC** Machinery directive
- **2014/30/EU** EMC directive

References of the applied harmonised standards according to article 7 passage 2:

- **EN 614-1:2006 + A1:2009**
- **EN ISO 12100:2010**
- **EN ISO 16090-1:2018**
- **EN ISO 13849-1:2015**
- **EN ISO 13849-2:2012**
- **EN 60204-1:2018**
- **EN 61326-1:2013**
- **EN 61326-2-1:2013**
- **EN IEC 61000-3-2:2019**
- **EN 61000-3-3:2013**

The manufacturer undertakes to transmit, in response to a reasoned request by the national authorities, relevant information on the machinery electronically. Person being established in the community, who is authorised to compile the technical file:

Dipl.-Ing. (FH) Frank Benzinger
Vorstandsvorsitzender / Chief Executive Officer (CEO)
vhf camfacture AG
Lettenstraße 10
D-72119 Ammerbuch

Ammerbuch, 2020/01/13

(Frank Benzinger, CEO)