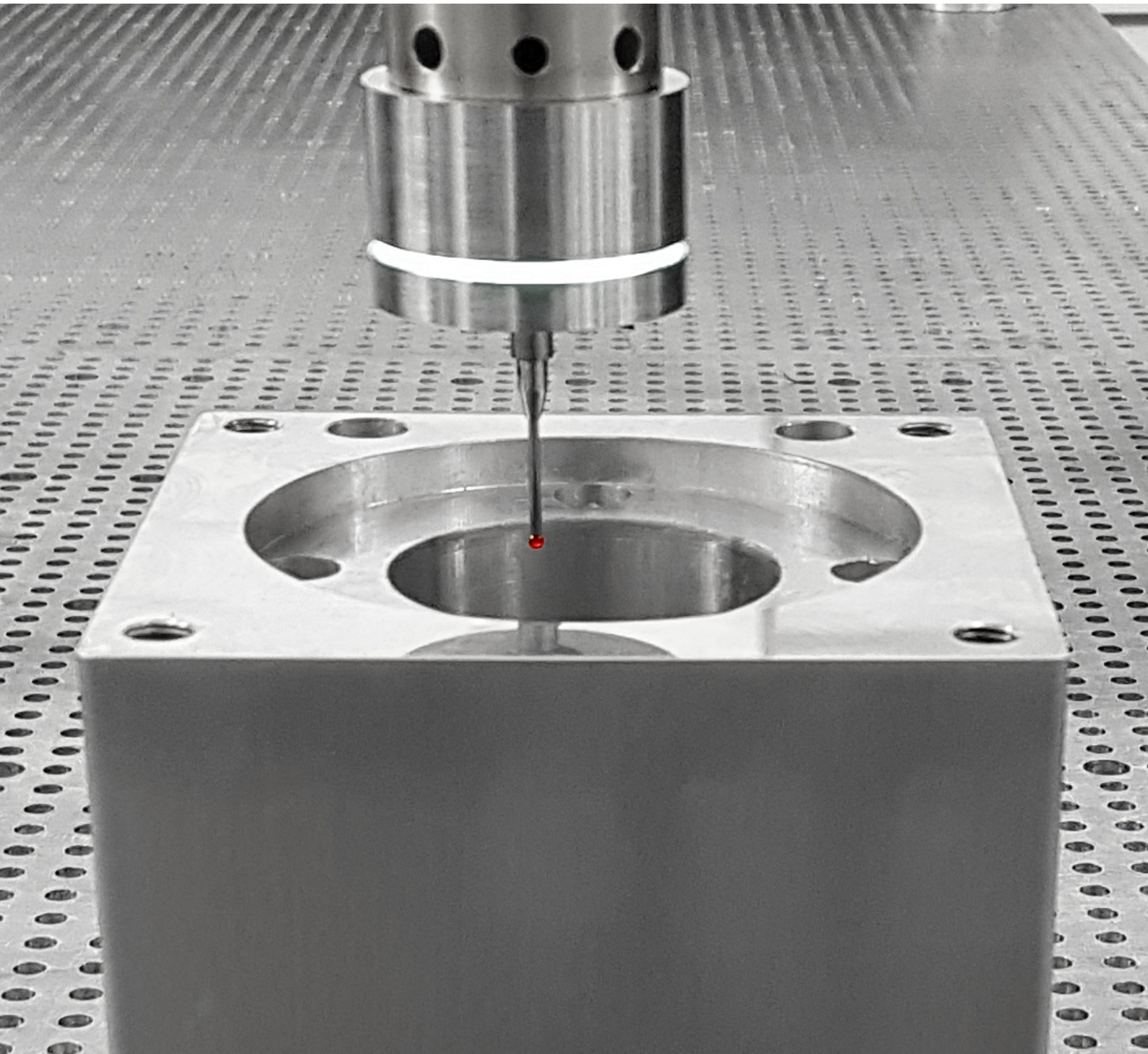
3D-finder Touch Probe

3Df-MK Rev: 07



3D-finder Touch Probe

The **3D-finder** touch probe is used for measuring workpiece geometries such as edges, holes, grooves, studs, angles and corners.
This probe has been developed for high measurement precision and high repeatability.

To achieve a high measurement precision, the touch probe must be mechanically calibrated, so that its axis aligns perfectly with the spindle axis of the machine.
Value-priced touch probes targeting the hobby market do not offer the possibility to align the probe axis with the spindle axis.
Without such a calibration capability, measurement results can be very inaccurate and may be unusable even for hobby purposes.
Touch probes with alignment capability are the norm in the industrial sector, but they are priced high up in the 4-digit range.

The development of our **3D-finder** was focused particularly on achieving an affordable price without sacrificing precision, repeatability and reliability.
Furthermore, the **3D-finder** is not just a simple switch, but it also includes electronics to ensure a stable and reliable switching behavior.

Tehnical Data 3D-finder Touch probe

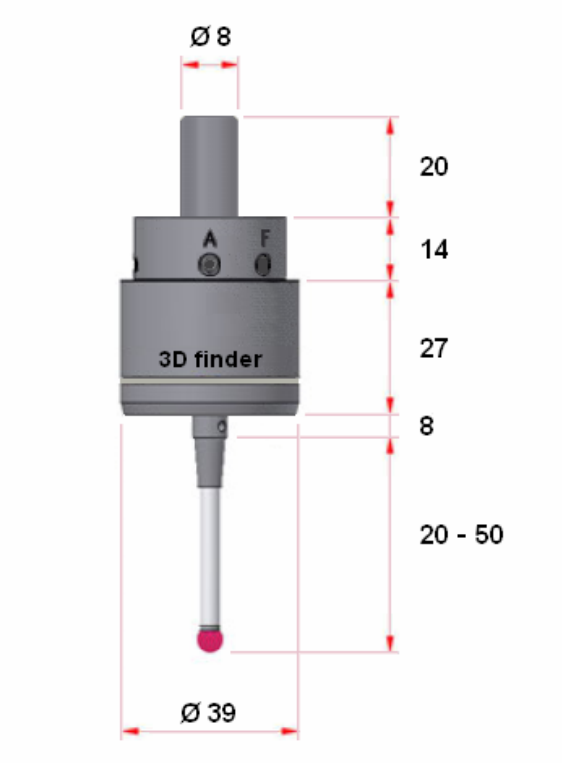
Sensing directions:	±X; ±Y; -Z
Max. Stylus overtravel:	XY = 12°; Z = 5mm
Trigger force:	XY = 0.5 - 1N; Z = 2.,5N
Repeatability (unidirectional):	1 µm with 30 mm Stylus and max. 200 mm/min probing feed rate
Output function:	electronic high-speed switch as normally closed contact
Switching current:	max. 30 mA
Functional notification:	switching point notification by LED
Operating voltage:	12 – 24V DC
Cable length:	1 Meter (without connector)
Enclosure:	stainless steel
Tool holder:	with alignment function and 8mm cylindrical shaft
Stylus:	Stylus with 2 mm ruby ball (included)
Dimensions (without holder):	(D) 40mm, (H) 27mm

Connection

4-wire cable:	brown	=	+ 12V to 24VDC
	blue	=	0V (GND)
	green, white	=	switch

Dimensions

Dimensions in mm ±0.5

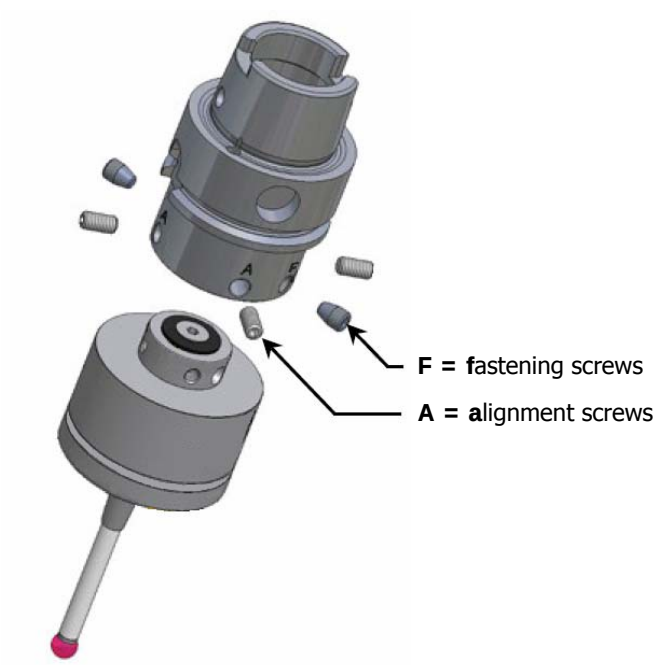


Tool holder assembly / disassembly

Insert the probe into the tool holder and align **f**astening screws "**F**" with the respective holes on the probe.

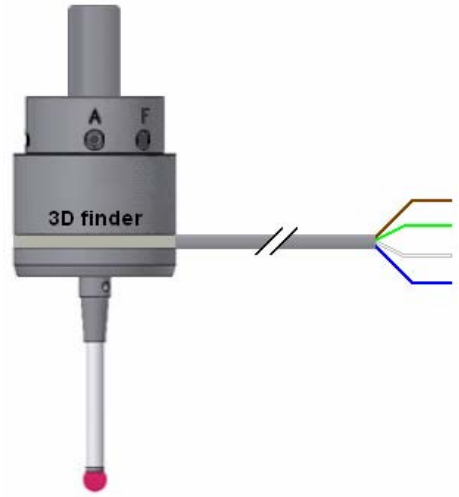
- Screw in both **f**astening screws "**F**" and gently tighten them
- Screw in all 4 **a**lignment screws "**A**" and gently tighten them

Align the probe to the spindle center (see chapter *" Probe Alignment and Calibration "*)

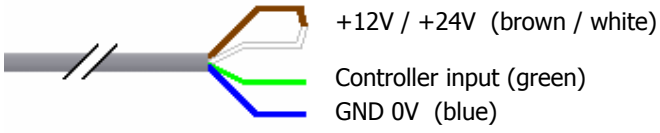


Connection of the 3D-finder to the CNC controller

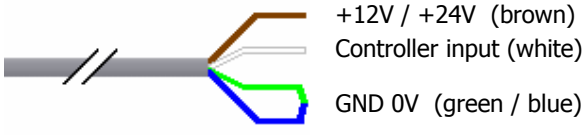
- The **3D-finder** can be powered with either 12V or 24V DC
- The switching outputs can be connected to the CNC controller like an ordinary switch, regardless of whether this has an NPN or PNP input
- As standard, the switch output operates as a normally closed contact; a normally open contact version is available on request
- The switching current must not exceed 30 mA – please observe the connection instructions of your CNC controller
- The switching voltage must not exceed the own supply voltage of the **3D-finder**
- The switching outputs can be connected in series with NPN and PNP inductive sensors



Connection to Controller with PNP input



Connection to Controller with NPN input



<u>Attention:</u> When using the PNP or NPN connection, it is important to respect the order of the wire colors as pictured !

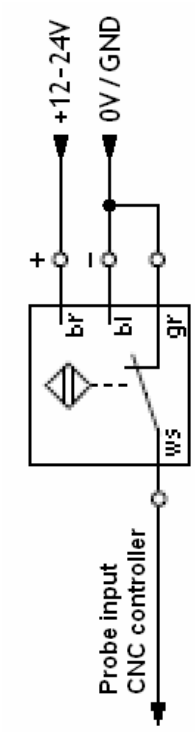
We recommend to switch off the controller respectively the power supply before the **3D-finder** is connected. An improper connection can damage the **3D-finder**.

Hot-Plug
If a voltage-free connection can not be realised, the power supply of the **3D-finder** (brown / blue) must be connected before the switching contacts (green / white).

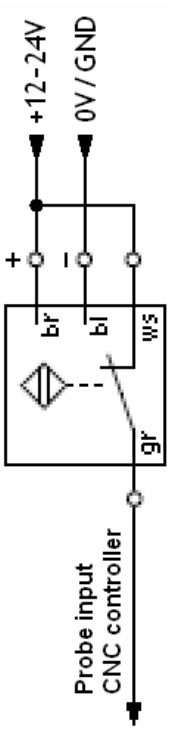
For a safe hot-plug operation of the **3D-finder** and the other sensors you use, we strongly recommend the usage of our specially designed connection box – **Sensor Hot-Plug Interface**.

Connection diagrams

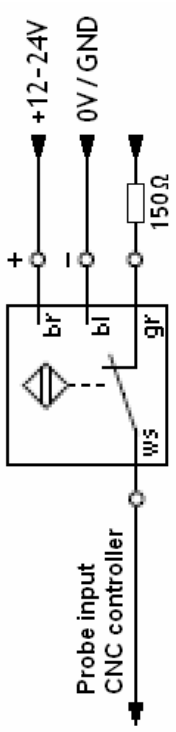
NPN connection
Sink / Ground / Open Collector



PNP connection
Source / supply voltage



Potential free connection
Recommended with 150 Ohm resistor



- Improper operation or disregard of the guidelines will void all warranty claims -

Probe Alignment and Calibration

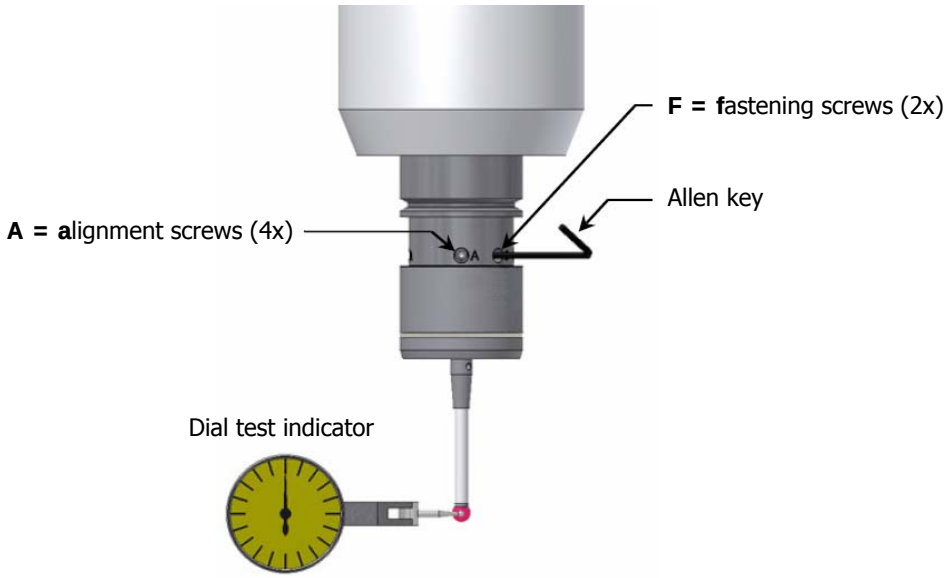
In order to perform accurate measurements, the probe must be calibrated. The calibration must be performed in each of the following situations:

- initial start-up
- stylus replacement
- change of measurement/probing feed rate

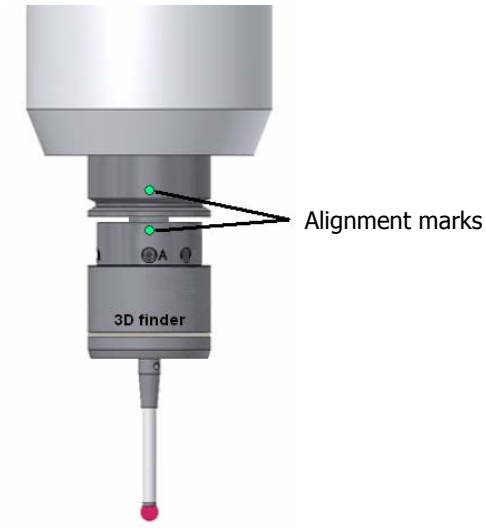
Alignment with the spindle center

The probe axis does not usually align exactly with the spindle axis. The alignment with the spindle center enables the mechanical compensation of the offset between the probe axis and the spindle axis. As a result, the touch probe can be used with high precision to probe from any direction.
For Probe-Spindle Center alignment, proceed as follows (see illustration below):

- Loosen both **f**astening screws "**F**" and retighten them with medium torque
- Spin the probe and align it to <20µm using the 4 **a**lignment screws "**A**"
- Tighten both **f**astening screws "**F**" slightly more
- Spin the probe and align it to <5µm using the 4 **a**lignment screws "**A**"
- Tighten both **f**astening screws "**F**" in their final position, to lock the alignment
- Tighten the 4 **a**djusting screws "**A**" against each other
- Verify the alignment



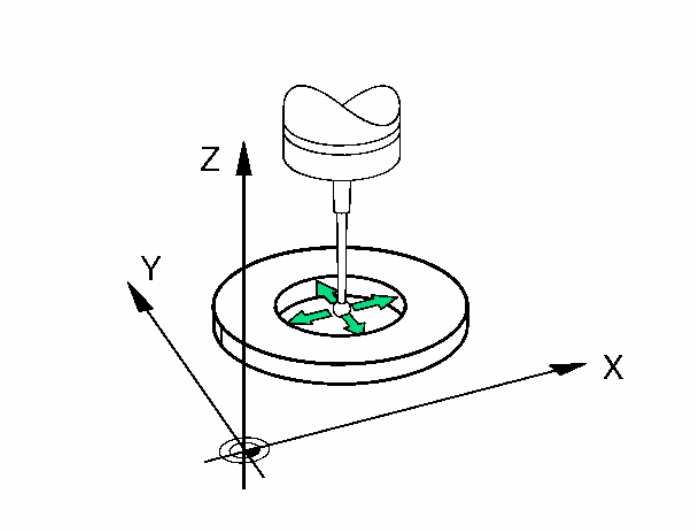
NOTE: Mark the position of the probe relative to the spindle holder (e.g., mark a dot on the spindle holder and a corresponding dot on the probe). For the best measurement precision, ensure that the two alignment marks are aligned correctly when the probe is re-clamped in the spindle holder.



After the mechanical alignment has been completed, the calibration of the effective radius (radius offset) must be performed.

Radius Offset Calibration
During the measurement of a circular diameter (for example a calibration ring) a deviation between the measured and the true value normally occurs. This measurement deviation is caused by your machine, e.g., by the deviation of the spindle pitch, by the set resolution of the drive motors, as well as by the set acceleration & braking ramps of the drive motors. To compensate for these deviations, a calibration for radius offset must be performed:

- Mount a calibration ring on the working surface
- Use the **3D-finder** to measure the diameter of the calibration ring
- Repeat the measurement of the calibration ring two more times
- Calculate the difference between the last measured value and the nominal radius of the calibration ring
- Enter this difference (radius offset) in the parameter settings of the machine



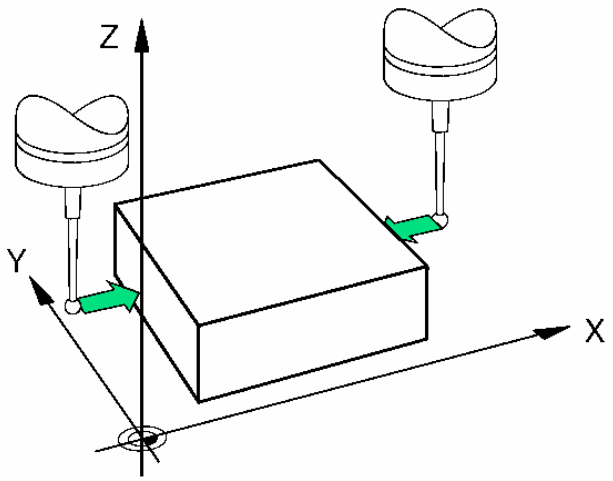
The radius offset must be taken into account for each subsequent measurement.

For the **Eding CNC** software, we have developed a routine for software calibration.
The calibration routine takes 25 measurements automatically and afterwards calculates the radius offset from the resulting dataset. This offset is then automatically taken into account in all measurement routines.

We have also developed **Eding CNC** routines for very precise measurements of circular profiles (interior & exterior), as well as for workpiece measurements (interior & exterior) and workpiece zero point setting.

These routines are available on request (see chapter *"Routines for **Eding CNC** Software"*).

Manual Measurement of Workpieces
You can also utilise the probe in manual operating mode by using the handwheel to perform simple measurements on the workpiece.
Move the probe slowly towards the workpiece until the probe switch is triggered. Then slowly return from the workpiece until the probe switch is triggered again. Consider the radius of the stylus ball at this position and take this coordinate as the position of the workpiece edge.



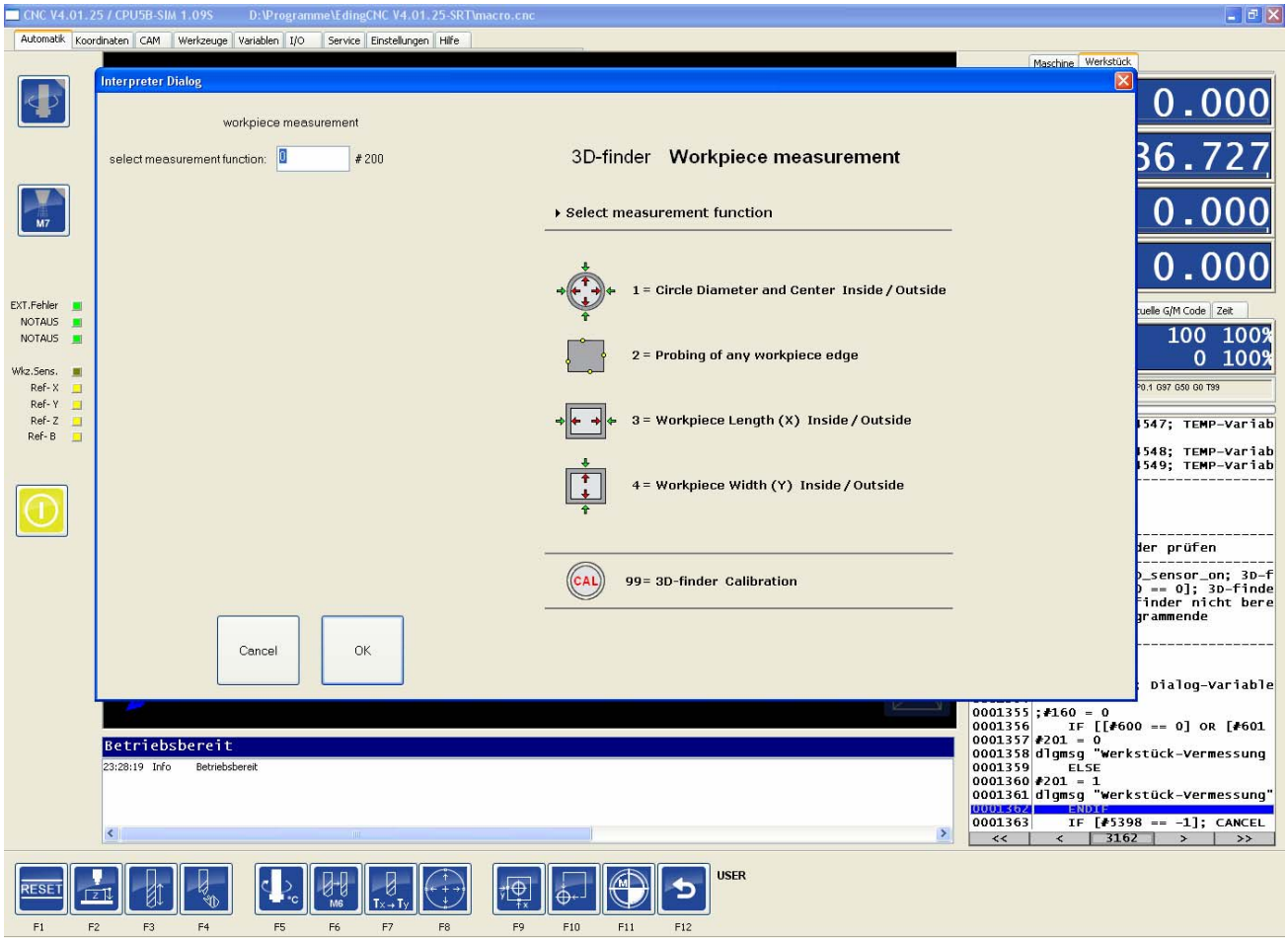
Utilisation Recommendations

In order to ensure accurate and reliable operation of the probe, please observe the following recommendations:

- Do NOT clean the probe with compressed air or with a pressure washer!
- Clean and dry the probe thoroughly after the disassembly of the tool holder!
- Do NOT connect the power supply directly to the switch outputs (green/white) - this will destroy the internal electronic switch!
- Do NOT switch voltages larger than the own power supply voltage of the **3D-finder**, this means: when for example the supply voltage of the **3D-finder** is 12V, then it is not allowed to switch loads that are supplied with more than 12V
- The probing feed rate must NOT exceed 1000mm/min, otherwise the probe can be damaged
- The smaller the measurement feed rate, the higher the repeatability
- After the disassembly of the tool holder, the probe must be re-aligned and calibrated
- After changing the stylus, the probe must be re-aligned and calibrated
- Do NOT use high torque when screwing in the stylus!
- If the **3D-finder** is mounted in the machine, the milling spindle must NOT be switched on!

Routines for Eding CNC software

As mentioned above, routines for calibration and workpiece measurement are available for the **Eding CNC** software.
After integration in the **Eding CNC** software, these routines can be invoked via a function menu.
The measurement routines were carefully designed for ease of use.

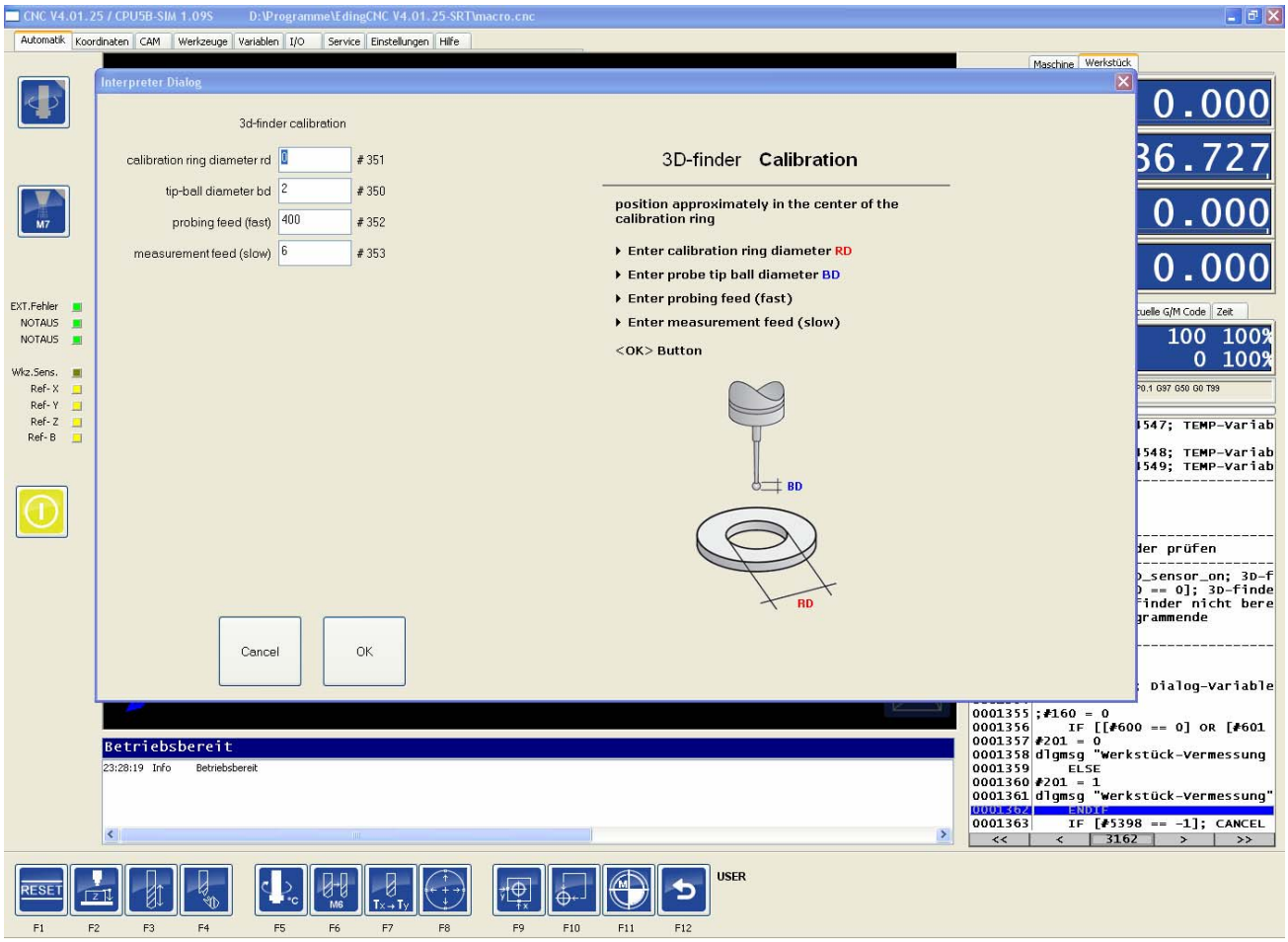


Before the workpiece measurement function can be used, the software calibration of the **3D-finder** must be performed on your machine (measurement function 99).

The software calibration must be repeated at:

- Disassembly/assembly of the tool holder
- Stylus replacement
- Change of the measurement/probing feed rate in your CNC software
- Change of machine parameters (acceleration ramp, etc.)

The software calibration routine calculates a so-called "offset", that will afterwards be used to compensate for any mechanical or system induced inaccuracies.
Inaccuracies are caused by deviations in the spindle pitches, acceleration ramps of the drive motors and reaction times of the CNC controller.
Without software calibration, the high mechanical precision of the **3D-finder** would not be optimally utilized.



To perform the software calibration, a calibration ring must be used.
It is recommended to use a calibration ring with an interior diameter of min. 20 mm.

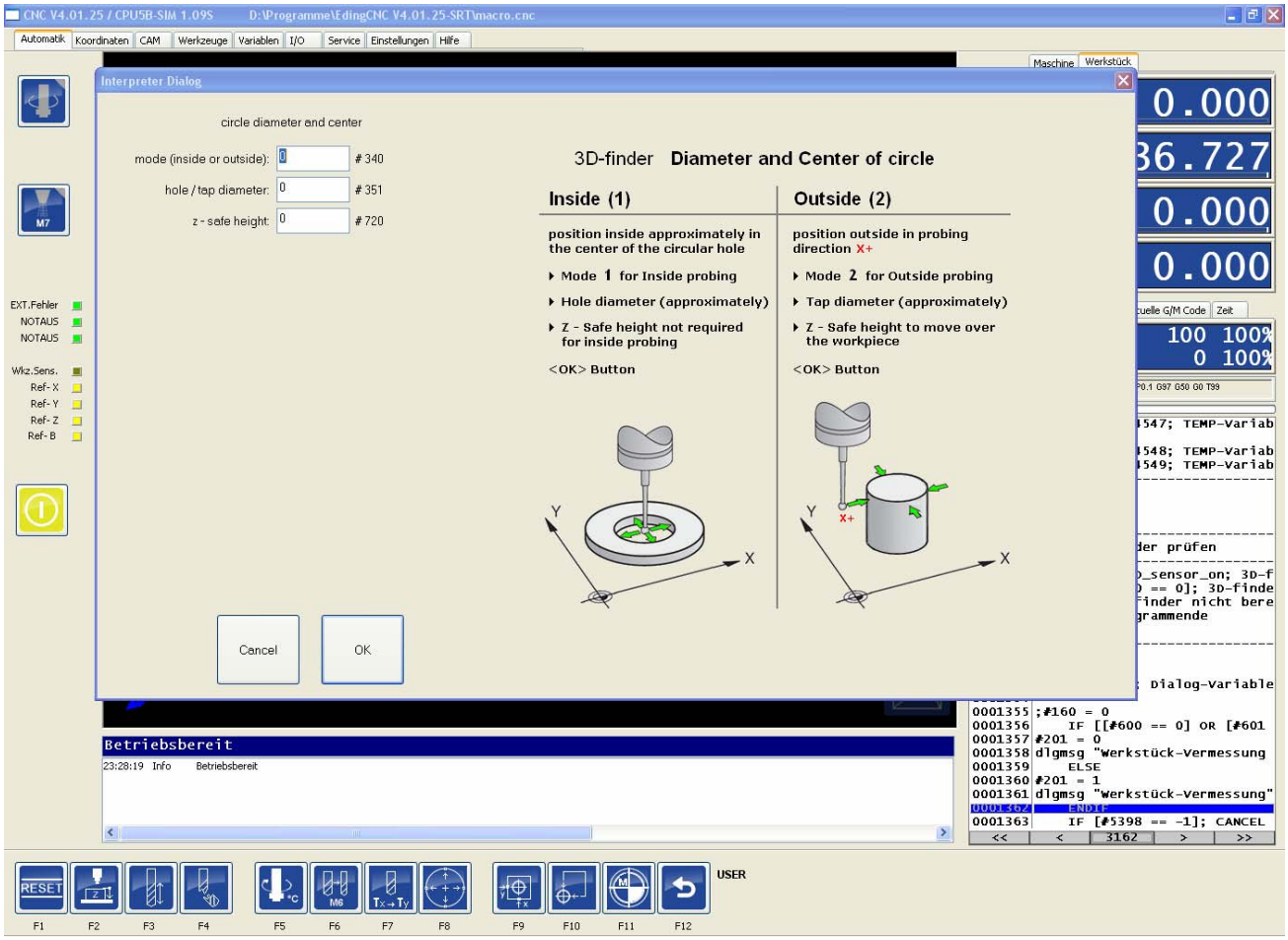
If you do not have a calibration ring, you can also use a ball bearing with a large interior diameter.
Please bear in mind though that a ball bearing does not have the high precision of a calibration ring. However, this precision may be sufficient for many applications.

To perform the software calibration, mount the calibration ring to the machine table and position the **3D-finder** probe's stylus ball inside the calibration ring at the intended measurement height.

To achieve the best measurement accuracy, the lowest possible measurement feed rate should be chosen.
The probing feed rate can, of course, be significantly higher than the measurement feed rate, but not more than 1000 mm/min.
The **3D-finder** can be damaged if the probing feed rate exceeds 1000 mm/min.
Recommended values: 400 mm/min for the probing feed rate and 6 mm/min for the measurement feed rate.

Note: The software calibration entails several measurements and takes about 30 minutes.

Once the software calibration has been completed, the workpiece measurement routines become available for use.
Individual material edges, circles and rectangular workpieces can be measured.
The desired workpiece zero point can also be set, when several zero points are possible.
Screenshots of these routines are presented over the next pages.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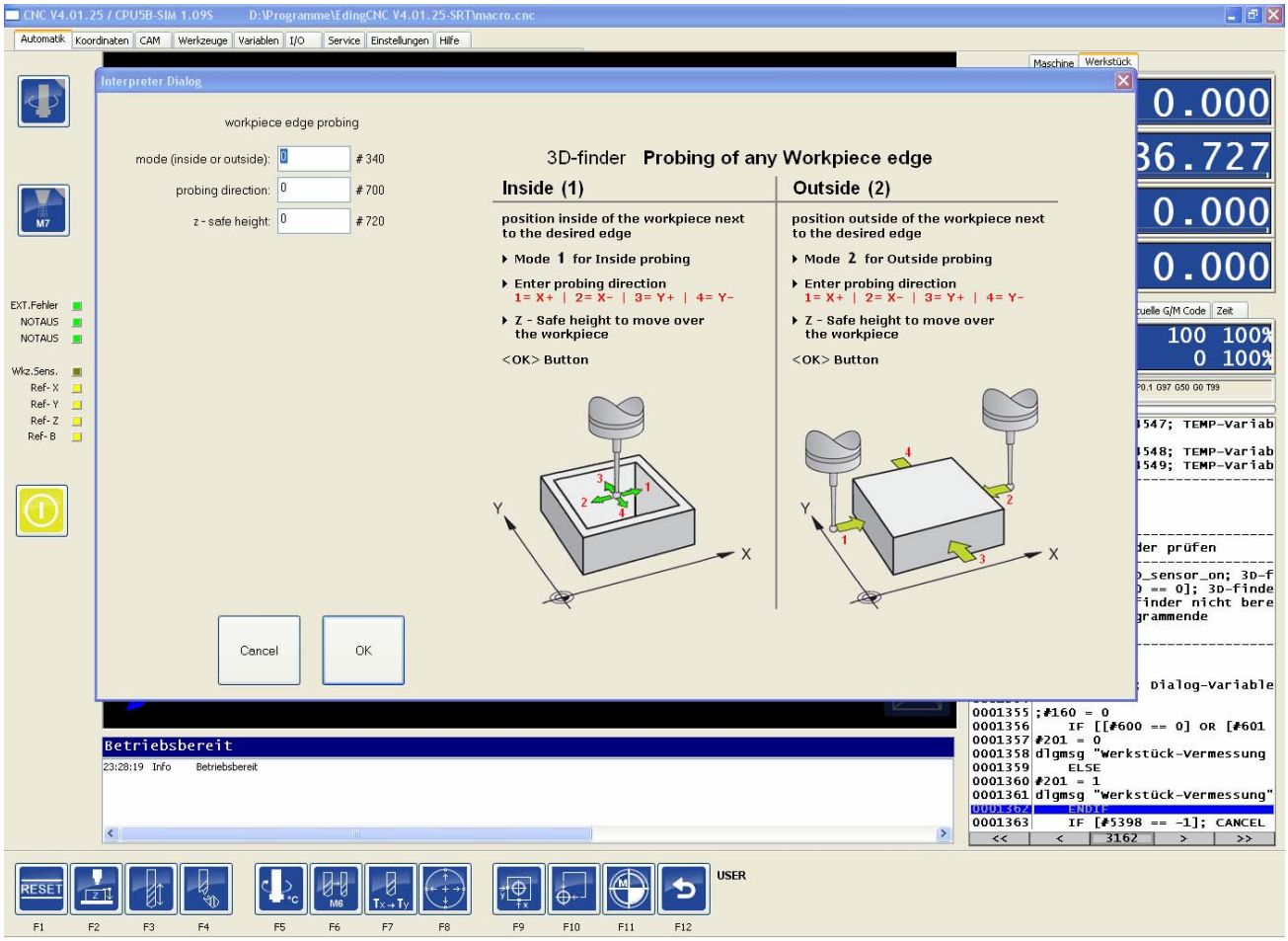
Automatik
Koordinaten
CAM
Werkzeuge
Variablen
I/O
Service
Einstellungen
Hilfe
Interpreter Dialog
circle diameter and center
mode (inside or outside):
340
hole / tap diameter:
351
z - safe height:
720
3D-finder Diameter and Center of circle
Inside (1)
position inside approximately in the center of the circular hole
Mode 1 for Inside probing
Hole diameter (approximately)
Z - Safe height not required for inside probing
<OK> Button
Outside (2)
position outside in probing direction X+
Mode 2 for Outside probing
Tap diameter (approximately)
Z - Safe height to move over the workpiece
<OK> Button
Cancel
OK
Betriebsbereit
23:28:19 Info Betriebsbereit
USER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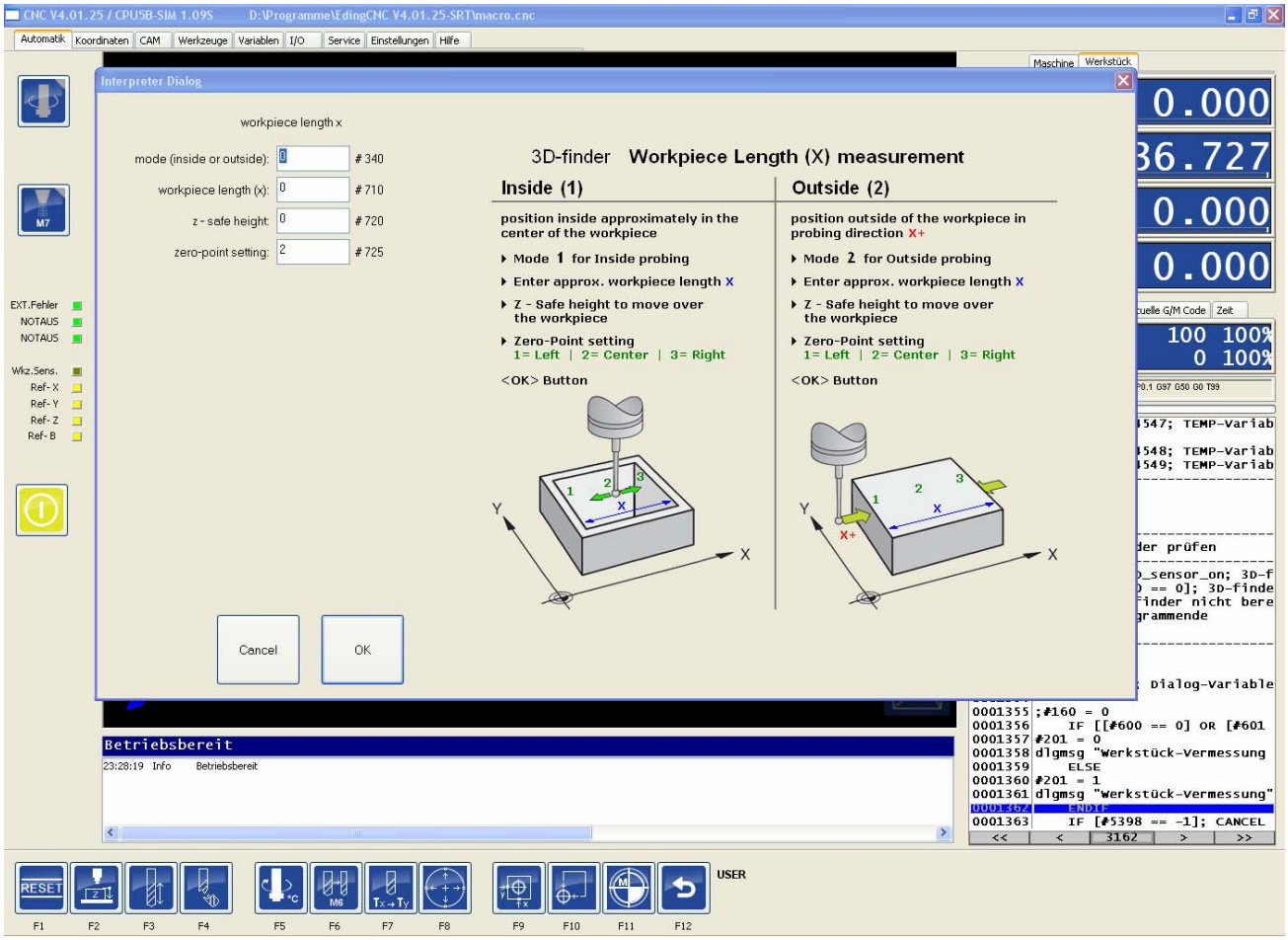
Interpreter Dialog
workpiece edge probing
mode (inside or outside):
340
probing direction:
700
z - safe height:
720
3D-finder Probing of any Workpiece edge
Inside (1)
position inside of the workpiece next to the desired edge
Mode 1 for Inside probing
Enter probing direction
1= X+ | 2= X- | 3= Y+ | 4= Y-
Z - Safe height to move over the workpiece
<OK> Button
Outside (2)
position outside of the workpiece next to the desired edge
Mode 2 for Outside probing
Enter probing direction
1= X+ | 2= X- | 3= Y+ | 4= Y-
Z - Safe height to move over the workpiece
<OK> Button
Cancel
OK
Betriebsbereit
23:28:19 Info Betriebsbereit
USER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Automatik
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Hilfe
Interpreter Dialog
workpiece length x
mode (inside or outside): 0 # 340
workpiece length (x): 0 # 710
z - safe height: 0 # 720
zero-point setting: 2 # 725
3D-finder Workpiece Length (X) measurement
Inside (1)
position inside approximately in the center of the workpiece
Mode 1 for Inside probing
Enter approx. workpiece length X
Z - Safe height to move over the workpiece
Zero-Point setting
1= Left | 2= Center | 3= Right
<OK> Button
Outside (2)
position outside of the workpiece in probing direction X+
Mode 2 for Outside probing
Enter approx. workpiece length X
Z - Safe height to move over the workpiece
Zero-Point setting
1= Left | 2= Center | 3= Right
<OK> Button
Cancel
OK
Betriebsbereit
23:28:19 Info Betriebsbereit
Maschine
Werkstück
0.000
36.727
0.000
0.000
EXT.Fehler
NOTAUS
NOTAUS
Wkz.Sens.
Ref- X
Ref- Y
Ref- Z
Ref- B
USER
F1
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F3
F4
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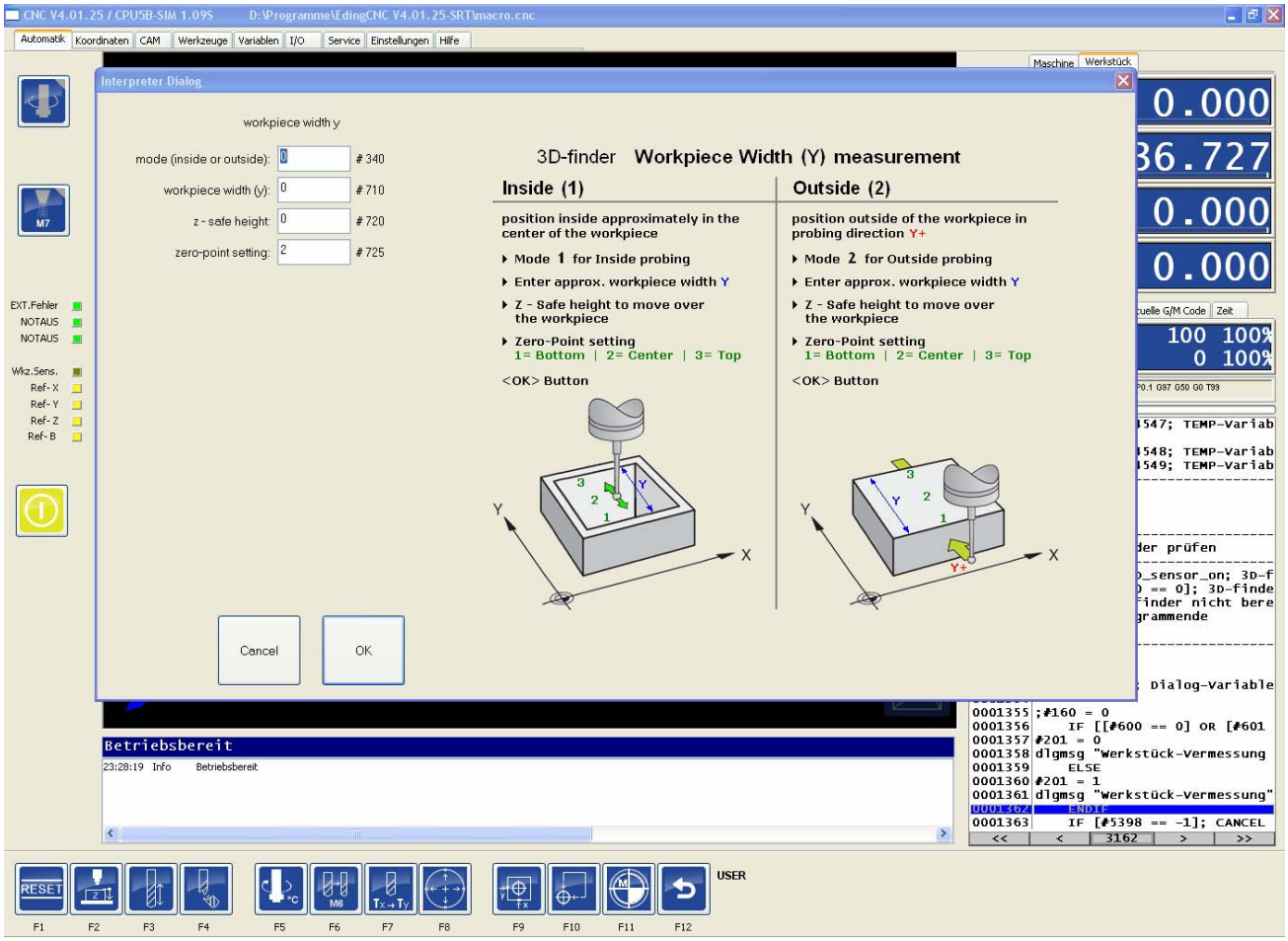
F11
F12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Automatik
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CAM
Werkzeuge
Variablen
I/O
Service
Einstellungen
Hilfe
Interpreter Dialog
workpiece width y
mode (inside or outside): 0 # 340
workpiece width (y): 0 # 710
z - safe height: 0 # 720
zero-point setting: 2 # 725
3D-finder Workpiece Width (Y) measurement
Inside (1)
position inside approximately in the center of the workpiece
Mode 1 for Inside probing
Enter approx. workpiece width Y
Z - Safe height to move over the workpiece
Zero-Point setting
1= Bottom | 2= Center | 3= Top
<OK> Button
Outside (2)
position outside of the workpiece in probing direction Y+
Mode 2 for Outside probing
Enter approx. workpiece width Y
Z - Safe height to move over the workpiece
Zero-Point setting
1= Bottom | 2= Center | 3= Top
<OK> Button
Cancel
OK
Betriebsbereit
23:28:19 Info Betriebsbereit
Maschine
Werkstück
0.000
36.727
0.000
0.000
EXT.Fehler
NOTAUS
NOTAUS
Wkz.Sens.
Ref- X
Ref- Y
Ref- Z
Ref- B
USER
F1
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F11
F12

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