Own grinding software know-how combined with the NUMROTO infrastructure

WALTER PROTOTYP
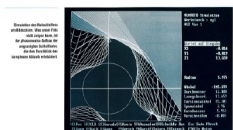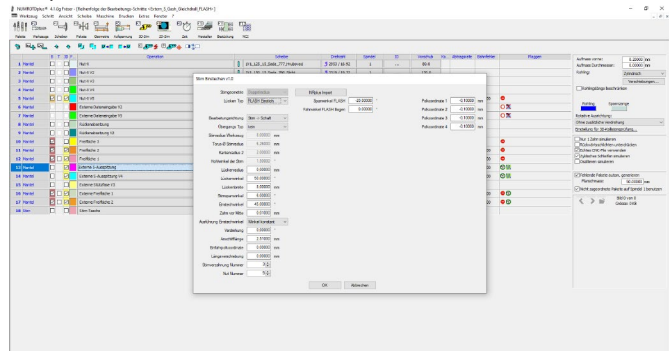
numroto®
Total solution for tool grinding

In Zell am Harmersbach (Germany), in the beautiful Black Forest, you will find Prototyp-Werke GmbH, a production site of Walter AG. Since 2007, Prototyp-Werke has been integrated into Walter as the competence brand „Walter Prototyp" in the field of threading and milling tools. Walter celebrated its 100th anniversary in 2019. The company was originally founded by Richard Walter in Düsseldorf, where sintered carbide alloys and new metallurgical processes were researched. Nowadays, the threading and milling tools are manufactured in a plant with a production area of some 8,000 m² that employs approximately 450 people, working shifts.

Other competence brands of the Walter Group are "Walter Titex" (drilling tools), "Walter Multiply" (digital solutions, tool management, training and production process planning) and "Walter" (carbide inserts, tool systems for milling, insert drilling, turning and grooving). References to these can be found as vertical elements in the Walter logo, "Yellow" stands for the Walter Prototyp competence brand. Walter employs about 3,500 people worldwide. The company is headquartered in Tübingen, south of Stuttgart. Customers in over 80 countries are served and supported by numerous subsidiaries and sales partners. The focus is on the automotive and rail industries, aerospace, the energy sector and general mechanical engineering.

The production department in Zell am Harmersbach and NUM have collaborated successfully for almost three decades. Proof of this is, among other things, the customer report from 1993 on NUMROTO with the significant title "Farewell to black art", attached below.

tool shapes to be realized for customers. With a hundred years of company history, it is therefore not surprising that the internal transfer of knowledge is of central importance and must be ensured. This is where NUMROTO comes into its own. Thanks to the "External Calculation" function, the company's own algorithms and path calculations, and thus their know-how, can be integrated and merged with the comprehensive NUMROTO software solution.

Screenshots External calculation within the NUMROTO*plus®* *user interface.*

Mr. Martin Marx, software developer TEWL, has been in the service of Prototyp-Werke since 1982. He was present at the 1993 report, as was Mr. Jörg Federer from NUM. The two men have therefore enjoyed a long and fruitful business relationship.

The Walter production site in the Black Forest has acquired comprehensive know-how in tool grinding over the last decades. For many years, a proprietary software development has been used on tool grinding machines equipped with NUM controls, in parallel with NUMROTO, enabling many complex

Prototyp uses a large part of the NUMROTO infrastructure, including the high-precision and comprehensive 3D simulation, post-processor (machine-specific calculation of the 5-axis path), database, wheel management, multi-language support and also the X-machining. Prototyp's path calculations are integrated into NUMROTO as "external calculations". Since the company only uses its own path calculations internally, they are not accessible to other
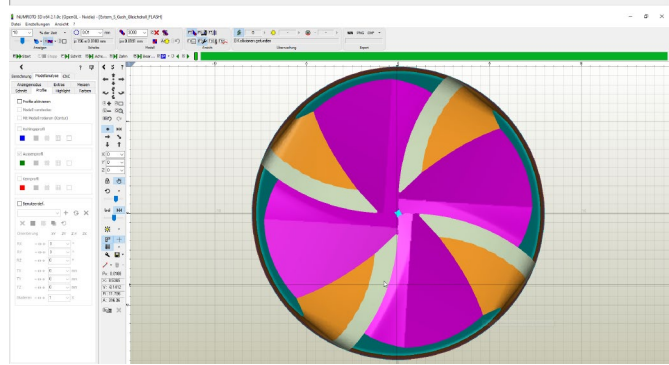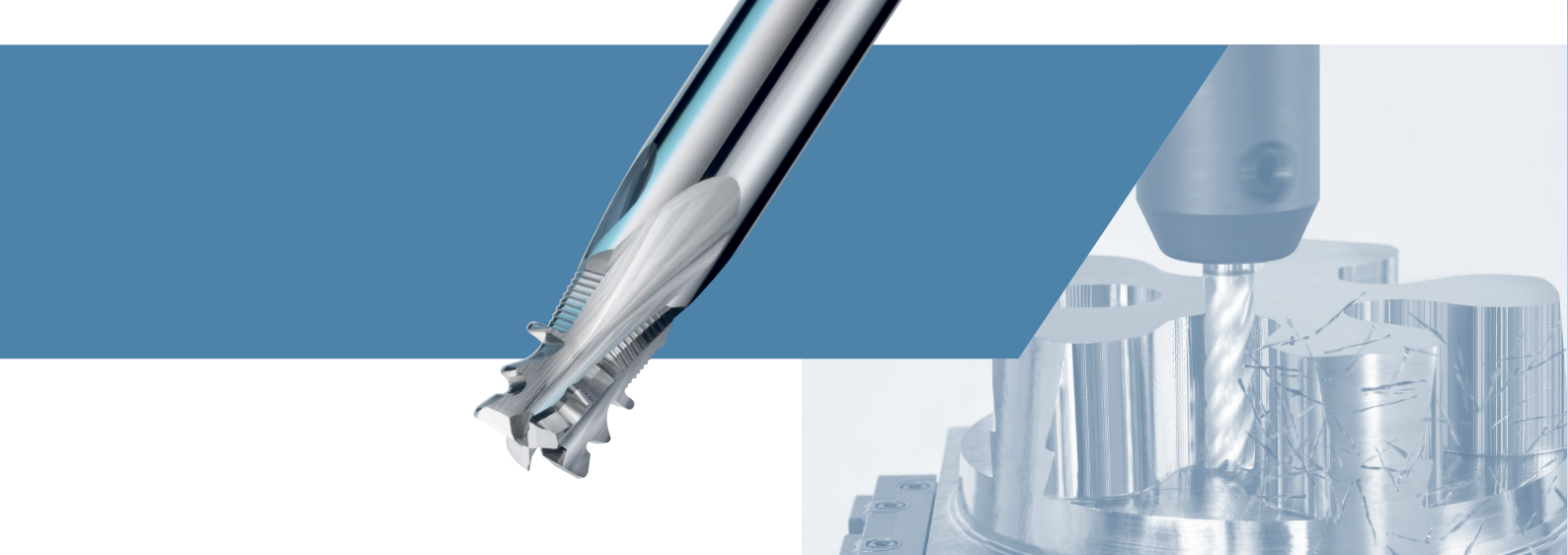
customers – and thus the know-how of the tool manufacturer is protected! This flexible concept allows the knowledge built up by the internal development team to be passed on and also further developed across generations, while the remaining infrastructure of the programming system is maintained and transferred into the future by NUMROTO. "The external computation feature allows us to produce tools that NUMROTO does not offer as standard", reports Martin Marx, and adds: "the proven NUMROTO platform is very good; it is very valuable for us from the development side when in-house developments are quickly and easily geometrically tested with the 3D simulation and then automatically ground on the machine with collision checks".

High feed milling cutter MD025 Supreme "Flash".

An example of this fusion of knowledge is the "Flash" high-feed milling cutter (the names of the milling cutter and our customer magazine are, of course, coincidentally identical). The specific face sharpening and the double radius flutes are designed as external calculations, while the rest is according to the NUMROTO standard.

Technologically top-class is the new MD133 Supreme solid carbide milling cutter. As it follows a machining path on the milling machine with circular movements at high speed, a tooth geometry tailored to this is required. This can be achieved thanks to the optimum interaction of the programming systems.

Differently coated solid carbide milling cutters of type MD133 Supreme for use in a wide range of applications. The tool family, which has been specially designed for the requirements of dynamic milling, is characterized by high chip volumes and at the same time enables large cutting depths.

Fabian Lehmann, Team Leader Technology Development at Walter in Zell, Germany, says: "NUMROTO offers a cross-platform advantage through 'external calculation', which as far as we are aware is not available from any other provider." Martin Marx sees further advantages of NUMROTO in the quality of the implemented work: "Even if

Solid carbide milling cutter MD133 Supreme from Walter Prototyp in use.

Examples of milling cutters with ConeFit replaceable head; they have been supplementing the product diversity at Walter Prototyp since 2009.

the development time sometimes takes a little longer than hoped for, there have never been problems with updates – they are always tested. In addition, existing functions are always upward compatible, even after many years".
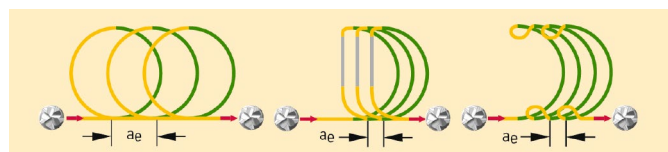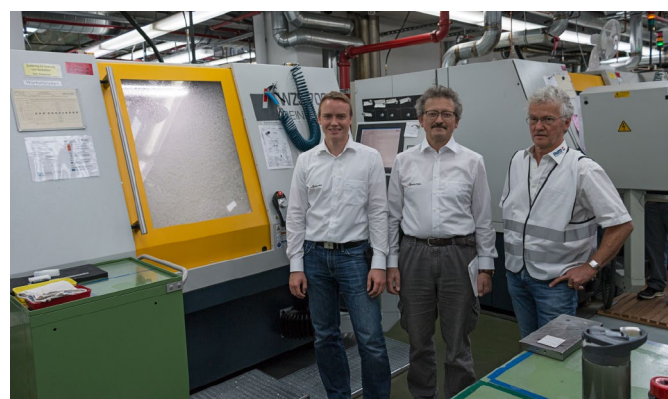
Other services include the coating, marking, cleaning and surface treatment of tools. Walter's production site in Zell is certified according to DIN EN ISO 9001, 14001, 45001 and 50001. With its in-house Walter Academy, Walter AG also focuses on continuous professional qualification and further development of the personal skills of its employees.

From left to right: Mr. Fabian Lehmann (Teamleader Technology Development, Walter), Mr. Martin Marx (Software Developer TEWL, Walter), Mr. Jörg Federer (Manager Application Technology NUMROTO, NUM AG).

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Powering into the new decade

The next GrindTec exhibition is just around the corner. As usual, we will be exhibiting at this, the International Trade Fair for Grinding Technology, which is now in its 12th year. You will find us at Booth 7100 in Hall 7; we would be very pleased to welcome you to our stand.

For our customer report we were allowed to visit Prototyp-Werke GmbH in Zell am Harmersbach (Germany), which is a production site of Walter AG. We have been working together for almost three decades, as a user report from 1993 shows. The focus of this report was on the use of the "External Calculation" function, which enables Prototyp-Werke GmbH to optimally combine its own know-how with NUMROTO.

From a technical point of view we present the most important new functions of NUMROTO version 4.1.2. In particular, we will discuss NUMROTO's own form compensation, which is available as a new option to the "form cutter" module.

Finally, I want to mention that we are now officially in possession of the copyright of NUMROTO in China. This gives us the opportunity to enforce this right worldwide – an important step in protecting our know-how and strengthening your position in this highly competitive market.

I wish you interesting reading and look forward to welcoming you personally at GrindTec or one of the other trade fairs.

Sébastien Perroud, Managing Director

GrindTec 2020

CCMT 2020   April 7–11

IMTS 2020
September 14 - 19, 2020 · McCormick Place · Chicago
DIGITAL MANUFACTURING. IMPLEMENTED.

TMTS   Taiwan International Machine Tool Show
Nov. 10-14, 2020 | Taichung, Taiwan

Grinding Technology Japan 2021

Exhibitions 2020/21
NUMROTO is there

With NUMROTO, NUM will once again take part in various trade fairs around the world this year. We will present the latest NUMROTO innovations and are ready for constructive discussions. Visit us at the above-mentioned trade fairs. Our team is looking forward to meeting you.

Go to our website **www.num.com** to find our respective stand numbers before the start of the trade fairs.

And of course, there will also be many machine manufacturers on site with machines that are equipped with NUM CNC systems and NUMROTO.

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num
CNC HighEnd Applications

Form compensation
Fully integrated solution for the last µ
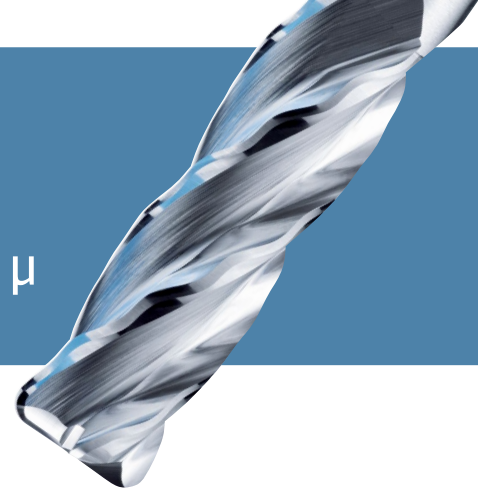
Tool grinding machines have become more and more accurate in recent years thanks to computer-aided development tools and standardized and very accurate components from the supply industry. This has also increased the accuracy of the ground tools. Especially with special tools, whose market share is constantly increasing, where remarkable results in terms of accuracy and quality can be achieved. Nevertheless, many applications require a further increase in accuracy, as well as a very high level of consistency and process reliability. This can be achieved by measuring ground tools on a measuring machine and feeding the measurement results back into the production process. The programming system analyses the difference between the nominal and measured profile with the aim of reducing this to zero during subsequent machining. This makes the production process much more accurate and at the same time less sensitive to disturbance variables such as temperature fluctuations or grinding wheel wear.

This closed loop is also called "form compensation". Up to now this form compensation was generated by external software and then a corrected target profile was read into NUMROTO.

NUM, in cooperation with various NUMROTO end users, has subsequently developed, thoroughly tested and optimized a form compensation facility that is directly integrated in NUMROTO. This fully developed version is now available for all NUMROTO customers as an additional option to the form cutter module.
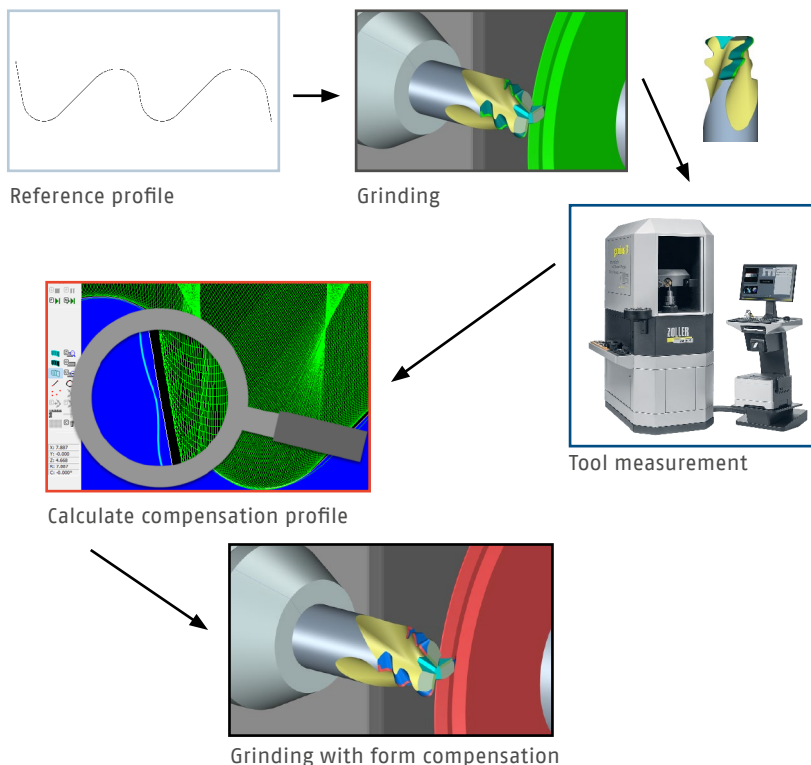
The form compensation facility is characterized by the following features:
- The measuring machine only has to return the measured profile as a DXF file to NUMROTO. No external compensation software is required.
- The compensation can be performed once, several times or cumulatively over a series.
- Thanks to the best possible filtering of the measured profile a very steady course of compensation is achieved. This filtering is clearly visible in Figure 3: Two clear "outliers" can be seen in the measured profile. These are filtered out in the compensation profile.
- The grinding wheel orientation and the path speed are always calculated on the basis of the original profile. Only the position of the contact point on the cutting edge is compensated and not the orientation of the grinding wheel. Consequently, the surface quality is not affected by the compensation.
- Overhanging shapes can also be compensated.
- The compensation also works in conjunction with clamping system transformation and/or multi-axis oscillation.

The correction strategy can be managed in two ways:
- By direct correction of the current workpiece. This requires the following:
  - The clamping error during unclamping and re-clamping must be determined exactly. NUMROTO provides a "calibration measurement" key function for this purpose.
  - The tool must be ground with a slight oversize so that it can be corrected.
- By correcting the subsequent workpiece. In this case, the compensation is carried out cumulatively via a series of tools.

The data exchange between NUMROTO and the measuring machine can be achieved via the XML data interface or by export/import of the DXF profile (e.g. via a local network). In the following dialog you can see the imported measured profile at the top and the setting of the filter parameters at the bottom.
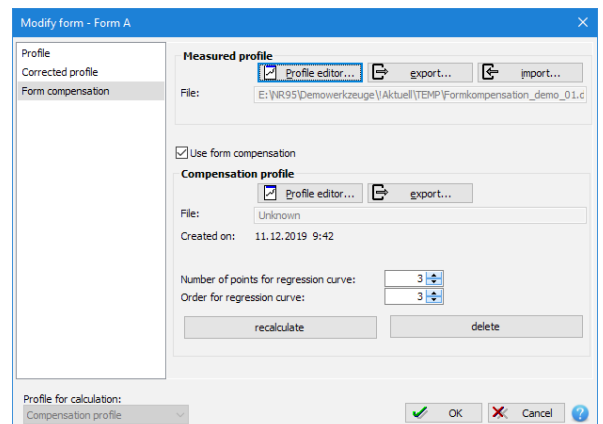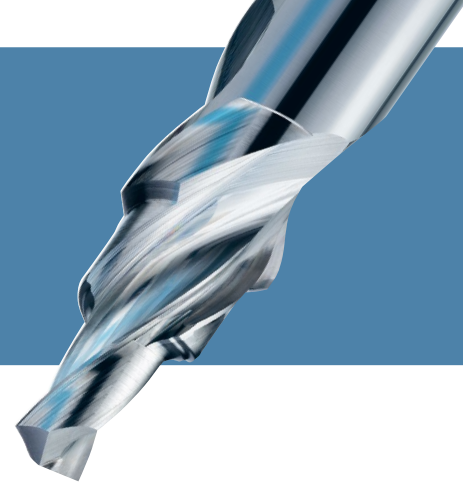

Reference profile

Grinding

Calculate compensation profile

Tool measurement

Grinding with form compensation

Figure 1: Shape compensation (closed circuit).

Figure 2: Dialogue.

Form compensation
Release Notes 4.1.1a – 4.1.2c

After import, a new compensation profile is calculated by pressing the "recalculate" button. This is superimposed on the existing compensation profile. If a new compensation profile is to be determined, the existing one must first be deleted.

The form compensation option is available from NUMROTO version 4.1.2 on as an addition to the package form cutter. It can be ordered from the machine manufacturer with the number CH-50052890.
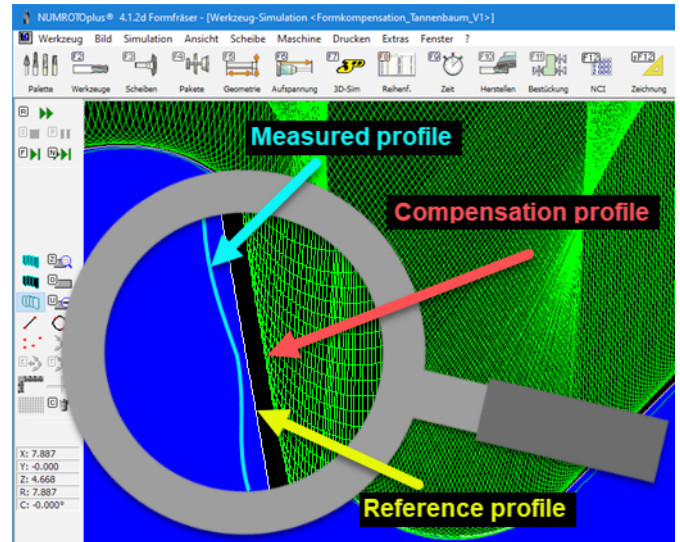

Figure 3: Nominal profile-measured profile-compensation profile.

Release Notes 4.1.1a – 4.1.2c

General
- The automatic data backup in the multi-user system can be executed several times per day.
- For collets, a maximum stick-in depth can be defined, which is then also monitored.
- Operations that are locked for „Edit", „2D-Simulation" and „3D-Simulation" can optionally be hidden in the sequence of operations.
- The individual assignment of collets to machines can be reset at the push of a button.
- STL attachments can now be opened directly from NUMROTO.

Cutters
- Up to 6 reliefs are available in the complex milling cutters.

The Complex milling cutters option CH-50052360 is required.
- There is now a separate increment for the widening of the gash-out.
- Various optimizations for the flute-X operation (calculation for length modification, improved automatic function for the „calculation points for flute fitting").
- For the widening of gash-out X and gash-out X flat, the preview of the tooth group selection is displayed again.

- New default values for the following combo boxes:
  – Ball diameter / Ball radius for ball nose cutter
  – Torus diameter / cylinder diameter for corner radius milling cutter
  – Core diameter / flute depth for production and resharpening separately

Drills
- The machining direction can be selected for the operation „manual step face cam".
- Many additional values are scaled automatically when the outside diameter is changed. For example, the coolant hole pitch circle diameter, coolant hole diameter and shank diameter are now part of the diameter-dependent data and are therefore scaled when the diameter is changed.
- New default values for tip relief operations: cutting angle, rotation angle, length modification, machining type.
- The „Thread Grinding" operation is now also available for drills if the „Forming tap" option is active in the key file.
- Optimization of the engagement and disengagement movements for S-gash out operation.

Form cutters
- Cylindrical sections of a form relief can be ground as radial relief.
- If a form relief is programmed using the function „Cam relief with constant infeed" it is now possible to active the feature „Alternating cam grinding".
- Like this the grinding time can be reduced. A separate feed rate can be programmed for the reverse movement.
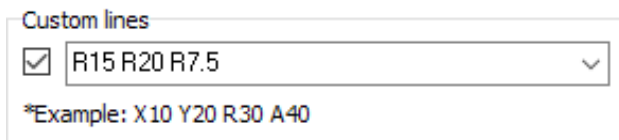
- Significant improvements of the form compensation feature: See separate text.

3D simulation
- In the view options under „Grid", custom grid lines and circles can be defined.

- NUMROTO uses the inverse time feedrate (G93). This inverse time can now be displayed in the graphics analysis of NUMROTO-3D. It is also possible to mark critical sections where the CNC cannot maintain the programmed feedrate due to excessive block density.
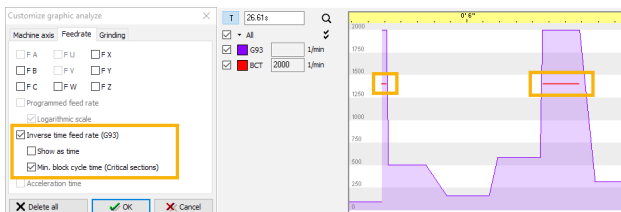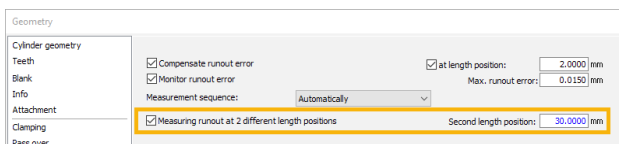

NR-Draw
- SVG files can be displayed.
- Dimensions can be edited individually.

Probing
- The concentricity error can now optionally be measured at two different length positions.

- For straight fluted drills and form cutters, as well as for form cutters with shear angle, the probe was moved laterally by the dimension before the center when probing the rotation position of the cutting edge. This can now be switched off per tool under „Probe Position", so that the probe is always at the zenith to probe the rotation.
- In the default values „Probe wheels" the „Measuring depth flange dimension" can now be defined per wheel type.
- In the case of the form wheel, a „Measuring depth flange dimension" and an „Offset diameter measurement" can be defined for the external measurement side.
- In wheel probing there is now an option to probe the diameter before the flange dimension.

Wheel dressing / sticking
- It is now possible to select that the friction speed is maintained if the wheel diameter changes after wheel dressing.
- For wheel sticking, it is now possible to optionally move to the approach distance when offsetting for the next sticking plunge.

NR-Control
- In a production sequence, the prediction of the grinding time can optionally be calculated using the average of the already processed, identical tools.
- New in NR-Control is the possibility to read and process an XML file with tool data or measured values between two tools. This requires the „Data interface" option as well as detailed instructions.

NUMROTO Copyright in China

We are pleased to announce that we are now officially in possession of the copyright of NUMROTO software in China.

This will make it easier for us and our lawyers to seek prosecution of any providers or users of unlicensed versions of NUMROTO worldwide.

On our website you will find a list of our machine partners who use official NUMROTO versions.

If you find that you are using an unlicensed version of NUMROTO (e.g. on a CNC machine that is not from one of our machine partners), please contact us. We will try to find a solution for the problem together with you.

Our lawyers are convinced that the measures we intend taking in the coming months will further enhance our support of all legal users of NUMROTO.