



# HEIDENHAIN



## Options and Accessories For TNC Controls

HEIDENHAIN controls are known for their complete range of features and extensive functionality. Thanks to a series of control options and accessories, they can also be optimally adapted to the given application. This brochure provides a broad overview of the available options and the most important hardware enhancements for the current control versions. Along with a detailed description of its functionality, each option or hardware enhancement contains a list of the software versions with which it is available.

**Options** are functions already integrated into the control, allowing you to tailor the TNC's functionality to your specific needs at any time. Some options, however, must be adapted by the machine manufacturer. Options are conveniently enabled via a keyword.

HEIDENHAIN offers **software** as practical tools for applications external to the TNC, from supporting data transfer or creating a PLC program all the way to a complete programming station.

**Hardware enhancements** make work on the machine easier, faster, and more reliable. An electronic handwheel, for example, permits fine manual control, and a workpiece touch probe significantly reduces workpiece setup times.



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# Overview

| Option number              | Option  | TNC 320 | TNC 620 | TNC 640 | Must be adapted by the OEM | ID                                 | Page |
|----------------------------|---|---------|---------|---------|----------------------------|------------------------------------|------|
| <b>Machining functions</b> |   |         |         |         |                            |                                    |      |
| 8                          | <b>Advanced Function Set 1:</b> rotary table machining<br>• Programming cylindrical contours on an unrolled cylinder<br>• Feed rate in mm/min or degrees/min  | •       | •       | •       | Yes                        | 617920-01<br>TNC 320:<br>536164-01 | 13   |
|                            | <b>Advanced Function Set 1:</b> coordinate transformation<br>Tilting the working plane, PLANE function  | •       | •       | •       | Yes                        | 617920-01<br>TNC 320:<br>536164-01 | 14   |
|                            | <b>Advanced Function Set 1:</b> interpolation, circular in 3 axes with tilted working plane   | •       | •       | •       | No                         | 617920-01<br>TNC 320:<br>536164-01 | 14   |
| 9                          | <b>Advanced Function Set 2:</b> interpolation, linear in 5 axes   | –       | •       | •       | No                         | 617921-01<br>TNC 320:<br>536164-01 | –    |
|                            | <b>Advanced Function Set 2:</b> 5-axis simultaneous machining<br>• 3D tool compensation via surface normal vectors<br>• Changing the swivel-head angle with the electronic handwheel during program run without affecting the tool tip position (TCPM = Tool Center Point Management)<br>• Keeping the tool perpendicular to the contour<br>• Tool radius compensation perpendicular to the tool direction<br>• Manual traverse in the active tool-axis system  | –       | •       | •       | Yes                        | 617921-01<br>TNC 320:<br>536164-01 | 38   |
| 17                         | <b>Touch Probe Functions:</b> probing cycles<br>• Workpiece misalignment compensation, preset setting<br>• Automatic tool and workpiece measurement<br>• Touch-probe input enabling for non-HEIDENHAIN systems  | ✓       | •       | ✓       | Yes                        | 634063-01                          | 15   |
| 19                         | <b>Advanced Programming Features:</b> expanded programming functions<br>• FK free contour programming<br>• Canned cycles<br>• Peck drilling, reaming, boring, counterboring, centering<br>• Milling internal and external threads<br>• Clearing level and oblique surfaces<br>• Complete machining of straight and circular slots<br>• Complete machining of rectangular and circular pockets<br>• Circular and linear point patterns<br>• Contour train, contour pocket, including contour-parallel machining<br>• Integration of cycles created by machine manufacturer<br>• Engraving cycle: engrave text or numbers in a straight line or on an arc<br>• Contour slot with trochoidal milling | ✓       | •       | ✓       | No                         | 628252-01                          | 16   |
| 20                         | <b>Advanced Graphic Features:</b> verification graphics, program run graphics<br>• Plan view<br>• Projection in three planes<br>• 3D view   | ✓       | •       | ✓       | No                         | 628253-01                          | 17   |
|                            | <b>Advanced Graphic Features:</b> detailed 3D view  | ✓       | •       | ✓       | No                         | 628253-01                          | 18   |

• = Available as option  
– = Not available  
✓ = Standard function

| Option number              | Option   | TNC 320 | TNC 620 | TNC 640 | Must be adapted by the OEM | ID         | Page |
|----------------------------|--|---------|---------|---------|----------------------------|------------|------|
| <b>Machining functions</b> |  |         |         |         |                            |            |      |
| 21                         | <b>Advanced Function Set 3:</b> handwheel superimpositioning, handwheel positioning during program run   | ✓       | •       | ✓       | Yes                        | 628254-01  | 39   |
|                            | <b>Advanced Function Set 3:</b> tool compensation, pre-calculating radius-compensated contours (LOOK AHEAD)  | ✓       | •       | ✓       | No                         | 628254-01  | 40   |
| 22                         | <b>Pallet Management</b>   | –       | •       | ✓       | Yes                        | 628255-01  | 19   |
| 23                         | <b>Display Step</b> down to 0.01 µm or 0.00001°  | –       | ✓       | ✓       | No                         | 632986-01  | –    |
| 40                         | <b>Dynamic Collision Monitoring (DCM)</b>  | –       | –       | •       | Yes                        | 526452-01  | 41   |
| 42                         | <b>CAD Import:</b> DXF converter, importing contours and machining positions from DXF files  | •       | •       | •       | No                         | 526450-01  | 21   |
|                            | <b>CAD Import:</b> importing contours from 3D models   | •       | •       | •       | No                         | 526450-01  | 22   |
| 44                         | <b>Global PGM Settings:</b> global program settings  | –       | –       | •       | Yes                        | 576057-01  | 42   |
| 45                         | <b>Adaptive Feed Control (AFC)</b>   | –       | –       | •       | Yes                        | 579648-01  | 43   |
| 50                         | <b>Turning:</b> turning functions<br>• Turning tool management<br>• Tool radius compensation<br>• Switching between milling and turning mode<br>• Turning-specific contour elements<br>• Package of turning cycles | –       | –       | •       | Yes                        | 634608-01  | 23   |
|                            | <b>Turning:</b> eccentric turning  | –       | –       | •       | Yes                        | 634608-01  | 24   |
| 92                         | <b>3D-ToolComp:</b> 3D radius compensation based on tool inclination (only in conjunction with option 9)   | –       | –       | •       | No                         | 679678-01  | 47   |
| 93                         | <b>Extended Tool Management</b>  | •       | •       | •       | Yes                        | 676938-01  | 26   |
| 96                         | <b>Advanced Spindle Interpolation:</b> interpolating spindle, interpolation turning  | –       | –       | •       | Yes                        | 751653-01  | 27   |
| 131                        | <b>Spindle Synchronism:</b> spindle synchronism of two or more spindles<br>• Hobbing cycle   | –       | –       | •       | Yes                        | 806270-01  | 28   |
| 136                        | <b>Visual Setup Control (VSC):</b> camera-based inspection of the clamping situation   | –       | –       | •       | Yes                        | 1099457-01 | 48   |
| 145                        | <b>Active Chatter Control (ACC)</b>  | –       | •       | •       | Yes                        | 800547-01  | 44   |
| 154                        | <b>Batch Process Manager:</b> convenient interface for pallet management   | –       | •       | •       | Yes                        | 1219521-01 | 20   |

• = Available as option  
– = Not available  
✓ = Standard function

# Overview

| Option number              | Option   | TNC 320 | TNC 620 | TNC 640 | Must be adapted by the OEM | ID                            | Page |
|----------------------------|--|---------|---------|---------|----------------------------|-------------------------------|------|
| <b>Machining functions</b> |  |         |         |         |                            |                               |      |
| 156                        | <b>Grinding:</b> grinding and dressing functions   | –       | –       | •       | Yes                        | 1237232-01                    | 29   |
| 157                        | <b>Gear Cutting:</b> function for gear manufacturing   | –       | –       | •       | Yes                        | 1237235-01                    | 30   |
| 158                        | <b>Advanced Function Set Turning:</b> expanded turning cycles and functions                            | –       | –       | •       | Yes                        | 1237237-01                    | 25   |
| 167                        | <b>Optimized Contour Milling (OCM):</b> optimize roughing processes                                    | –       | •       | •       | No                         | 1289547-01                    | 45   |
| <b>Machine accuracy</b>    |  |         |         |         |                            |                               |      |
| 48                         | <b>KinematicsOpt:</b> touch probe cycles for automatic measurement of rotary axes                      | –       | •       | •       | Yes                        | 630916-01                     | 31   |
| 52                         | <b>KinematicsComp:</b> 3D spatial compensation   | –       | –       | •       | Yes                        | 661879-01                     | 32   |
| 141                        | <b>Cross Talk Compensation (CTC):</b> compensation of position errors through axis coupling            | –       | •       | •       | Yes                        | 800542-01                     | 33   |
| 142                        | <b>Positon Adaptive Control (PAC):</b> position-dependent adaptation of control parameters             | –       | •       | •       | Yes                        | 800544-01                     | 34   |
| 143                        | <b>Load Adaptive Control (LAC):</b> load-dependent adaptation of control parameters                    | –       | •       | •       | Yes                        | 800545-01                     | 35   |
| 144                        | <b>Motion Adaptive Control (MAC):</b> motion-dependent adaptation of control parameters                | –       | •       | •       | Yes                        | 800546-01                     | 36   |
| 146                        | <b>Machine Vibration Control (MVC)</b>   | –       | •       | •       | Yes                        | 800548-01                     | 37   |
| 155                        | <b>Component Monitoring:</b> monitoring for component overload and wear                                | –       | •       | •       | Yes                        | 1226833-01                    | 46   |
| <b>Communication</b>       |  |         |         |         |                            |                               |      |
| 18                         | <b>HEIDENHAIN DNC:</b> communication with external Windows applications via COM components             | •       | •       | •       | No                         | 526451-01                     | 49   |
| 56 – 61                    | <b>OPC UA NC Server 1 to 6:</b> standardized interface for access to data and functions of the control | –       | •       | •       | No                         | 1291434-01<br>–<br>1291434-06 | 52   |
| 133                        | <b>Remote Desktop Manager:</b> display and remote operation of external computers (e.g., Windows PC)   | •       | •       | •       | Yes                        | 894423-01                     | 50   |
| 137                        | <b>State Reporting:</b> State Reporting Interface (SRI) for making operating statuses available        | •       | •       | •       | No                         | 1232242-01                    | 51   |

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| Option number                    | Option   | TNC 320 | TNC 620 | TNC 640 | Must be adapted by the OEM | ID                          | Page |
|----------------------------------|--|---------|---------|---------|----------------------------|-----------------------------|------|
| <b>Adaptation to the machine</b> |  |         |         |         |                            |                             |      |
| 0                                | <b>Additional Axis 1 to 8:</b> additional control loops  | •       | •       | •       | Yes                        | 354540-01                   | 53   |
| 1                                |  | •       | •       | •       | Yes                        | 353904-01                   |      |
| 2                                |  | –       | •       | •       | Yes                        | 353905-01                   |      |
| 3                                |  | –       | •       | •       | Yes                        | 367867-01                   |      |
| 4                                |  | –       | –       | •       | Yes                        | 367868-01                   |      |
| 5                                |  | –       | –       | •       | Yes                        | 370291-01                   |      |
| 6                                |  | –       | –       | •       | Yes                        | 370292-01                   |      |
| 7                                |  | –       | –       | •       | Yes                        | 370293-01                   |      |
| 24                               | <b>Gantry Axes:</b> synchronized axes: gantry axes, tandem tables  | •       | •       | ✓       | Yes                        | 634621-01                   | 55   |
| 46                               | <b>Python OEM Process:</b> python applications: realize special functions  | •       | •       | •       | Yes                        | 579650-01                   | 56   |
| 49                               | <b>Double Speed Axes:</b> double speed control loops; short control loop cycle times for direct drive motors                     | –       | •       | •       | Yes                        | 632223-01                   | 57   |
| 77                               | <b>4 Additional Axes:</b> 4 additional control loops   | –       | –       | •       | Yes                        | 634613-01                   | 53   |
| 78                               | <b>8 Additional Axes:</b> 8 additional control loops   | –       | –       | •       | Yes                        | 634614-01                   |      |
| 101 – 130                        | <b>OEM Option</b>  | –       | –       | •       | Yes                        | 579651-01<br>–<br>579651-30 | 58   |
| 135                              | <b>Synchronizing Functions:</b> RTC, real-time coupling function for synchronizing axes and spindles                             | –       | –       | •       | Yes                        | 1085731-01                  | 59   |
| 160                              | <b>Integrated FS: Basic</b> (Gen 3 exclusive): enabling of functional safety (FS) and four safe control loops                    | –       | •       | •       | Yes                        | 1249928-01                  | 54   |
| 161                              | <b>Integrated FS: Full</b> (Gen 3 exclusive): enabling of functional safety (FS) and maximum number of safe control loops (≥ 10) | –       | •       | •       | Yes                        | 1249929-01                  |      |
| 162                              | <b>Add. FS Ctrl. Loop 1</b> (Gen 3 exclusive): additional safe control loop 1  | –       | •       | •       | Yes                        | 1249930-01                  |      |
| 163                              | <b>Add. FS Ctrl. Loop 2</b> (Gen 3 exclusive): additional safe control loop 2  | –       | •       | •       | Yes                        | 1249931-01                  |      |
| 164                              | <b>Add. FS Ctrl. Loop 3</b> (Gen 3 exclusive): additional safe control loop 3  | –       | •       | •       | Yes                        | 1249932-01                  |      |
| 165                              | <b>Add. FS Ctrl. Loop 4</b> (Gen 3 exclusive): additional safe control loop 4  | –       | •       | •       | Yes                        | 1249933-01                  |      |
| 166                              | <b>Add. FS Ctrl. Loop 5</b> (Gen 3 exclusive): additional safe control loop 5  | –       | •       | •       | Yes                        | 1249934-01                  |      |
| 169                              | <b>Add. FS Full</b> (Gen 3 exclusive): enable remaining safe control loops   | –       | •       | •       | Yes                        | 1319091-01                  |      |

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# Overview

| Software  | TNC 320 | TNC 620 | TNC 640 | Subject to a charge | Page |
|---|---------|---------|---------|---------------------|------|
| <b>PLCdesign:</b> PLC diagnostics for all HEIDENHAIN controls   | •       | •       | •       |                     | 63   |
| <b>ConfigDesign:</b> configuration of the machine parameters  | •       | •       | •       |                     | –    |
| <b>PLCtext:</b> processing and managing of language-sensitive texts   | •       | •       | •       |                     | –    |
| <b>CycleDesign:</b> incorporation of developed NC subprograms as cycles   | •       | •       | •       |                     | 65   |
| <b>KinematicsDesign:</b> creation of control kinematic models   | •       | •       | •       |                     | 64   |
| <b>M3D Converter:</b> creation of high-resolution collision bodies  | •       | •       | •       | •                   | 64   |
| <b>IOconfig:</b> configuration of, for example, handwheels, Gen 3   | •       | •       | •       |                     | 69   |
| <b>BMXdesign:</b> designing language-sensitive soft keys  | •       | •       | •       |                     | 71   |
| <b>TNCopt:</b> initial setup of digital control loops   | –       | •       | •       |                     | 68   |
| <b>TNCtest:</b> creation and execution of acceptance tests  | •       | •       | •       |                     | –    |
| <b>TNCscope:</b> recording and evaluation of, for example, axis curves of HEIDENHAIN controls                           | •       | •       | •       |                     | 66   |
| <b>TNCanalyzer:</b> analysis and evaluation of service files  | •       | •       | •       |                     |      |
| <b>TNCdiag:</b> evaluation of diagnostic information of digital motor systems   | –       | •       | •       |                     | 67   |
| <b>TNCremo:</b> data transfer software  | •       | •       | •       |                     | 60   |
| <b>TNCremoPlus:</b> data transfer software with “live” screen   | •       | •       | •       | •                   | 60   |
| <b>TeleService:</b> software for remote diagnostics   | •       | •       | •       | •                   | 61   |
| <b>RemoTools SDK:</b> function library for the development of one’s own communication applications (option 18 required) | •       | •       | •       | •                   | 49   |
| <b>PCtoolsUpdateManager:</b> update manager for HEIDENHAIN software   | •       | •       | •       |                     | –    |
| <b>TNCkeygen:</b> contains TNC OEMOption and TNC OEMNumber  | •       | •       | •       |                     | 70   |
| <b>TNC OEMOption:</b> key generator for enabling options for a limited time   | •       | •       | •       |                     | –    |
| <b>TNC OEMNumber:</b> day code generator for the machine manufacturer area  | •       | •       | •       |                     | –    |
| <b>StateMonitor</b>   | •       | •       | •       | •                   | 62   |
| <b>Programming station</b>  | •       | •       | •       |                     | 72   |
| <b>virtualTNC:</b> for PC-based machine simulation  | –       | •       | •       | •                   | 73   |

• = Available for download  
– = Not available

| Hardware enhancements                          | TNC 320   | TNC 620     | TNC 640 | Must be adapted by the OEM | ID  | Page                     |                          |    |
|--|---|-------------|---------|----------------------------|-----|--------------------------|--------------------------|----|
| <b>Handwheel</b>                               | <b>HR 130</b> TTL; panel mounted  | With detent | •       | •                          | •   | No                       | 540940-01<br>540940-03   | 74 |
|  |   | W/o detent  | •       | •                          | •   | No                       | 1120313-xx<br>1119971-xx |    |
|  | <b>HR 510</b> portable handwheel  | With detent | •       | •                          | •   | No                       | 1119974-xx<br>1120311-xx |    |
|  |   | W/o detent  | •       | •                          | •   | No                       | 670303-xx<br>670302-xx   |    |
|  | <b>HR 520</b> portable handwheel with display                                   | With detent | •       | •                          | •   | No                       | 670305-xx<br>670304-xx   |    |
|  |   | W/o detent  | •       | •                          | •   | No                       | 1183021-xx<br>1200495-xx |    |
|  | <b>HR 550FS</b> portable radio handwheel with display                           | With detent | •       | •                          | •   | No                       | 1119052-xx               |    |
| <b>HRA 551FS</b> handwheel holder for HR 550FS | •   | •           | •       | No                         |     |                          |                          |    |
| <b>Workpiece touch probe</b>                   | <b>TS 260</b> with cable  | •           | •       | •                          | Yes | 738283-xx                | 75                       |    |
|  | <b>TS 460</b> with radio or infrared transmission                               | •           | •       | •                          | Yes | 1178530-xx               |                          |    |
|  | <b>TS 642</b> with infrared transmission  | •           | •       | •                          | Yes | 653217-xx                |                          |    |
|  | <b>TS 740</b> with infrared transmission  | •           | •       | •                          | Yes | 573757-xx                |                          |    |
| <b>Tool touch probe</b>                        | <b>TT 160</b> with cable  | •           | •       | •                          | Yes | 729763-xx                | 76                       |    |
|  | <b>TT 460</b> with radio or infrared transmission                               | •           | •       | •                          | Yes | 1192582-xx               |                          |    |
| <b>Additional operating station</b>            | <b>ITC 755</b> with touchscreen and ASCII keyboard                              | –           | –       | •                          | Yes | 1039527-xx               | 77                       |    |
|  | <b>ITC 750</b> 15-inch screen; separate TNC keyboard required                   | –           | •       | •                          | Yes | 1039544-xx               |                          |    |
|  | <b>ITC 860</b> 19-inch touchscreen; separate TNC keyboard required              | –           | –       | •                          | Yes | 1174935-xx               |                          |    |
| <b>Industrial PC</b>                           | <b>IPC 6641</b> for Windows interface on TNC with 8 GB of RAM with 16 GB of RAM | –           | •       | •                          | Yes | 1039543-01<br>1039543-02 | 78                       |    |
| <b>Camera system</b>                           | <b>VS 101</b> for workspace monitoring  | –           | –       | •                          | Yes | 1137063-01               | 79                       |    |

• = Available as option  
– = Not available  
✓ = Standard function

The term **Dynamic Precision** refers to optional functions for HEIDENHAIN controls that reduce the dynamic error of machine tools. By improving the machine's dynamic performance and increasing TCP accuracy, these functions take milling to the limits of the technologically possible—regardless of the machine's age and load or machining position. No mechanical modifications are needed.

Attaining precise workpieces with high surface quality no longer requires working slowly. That's because, with Dynamic Precision, machine tools work **fast and accurately** at the same time.

High precision and fast machining are the basis for increased productivity. Unit cost is therefore reduced without sacrificing accuracy or surface quality. Dynamic Precision even ensures that accuracy is maintained regardless of the operating time and load. As a result, feed rates no longer need to be reduced on account of machine age or load.

The functions of Dynamic Precision are available as options for HEIDENHAIN controls. The machine manufacturer can deploy individual functions alone or in combination.

- CTC: compensation of acceleration-dependent position error at the tool center point, thus increasing accuracy during acceleration phases
- MVC: damping of machine vibrations for improved surface finishes
- PAC: position-dependent adaptation of control parameters
- LAC: load-dependent adaptation of control parameters for high accuracy, regardless of machine age and load
- MAC: motion-dependent adaptation of control parameters

The functions of Dynamic Precision are adapted to the movements and loads of the machine tool through a high clock rate in the controller unit (a component of HEIDENHAIN controls).

Because Dynamic Precision is made up of software functions, it requires no intervention in the machine's mechanics or power train. Nevertheless, the machine manufacturer must enable the individual functions, enter their parameters, and adapt them to the machine.



|   | TNC 640 | TNC 620 | Page |
|---|---------|---------|------|
| <b>Dynamic Precision</b>  | ✓       | ✓       |      |
| <b>CTC:</b> compensation of position errors arising from machine compliance | Option  | Option  | 33   |
| <b>MVC:</b> damping of machine vibrations                                   | Option  | Option  | 37   |
| <b>PAC:</b> position-dependent adaptation of control parameters             | Option  | Option  | 34   |
| <b>LAC:</b> load-dependent adaptation of control parameters                 | Option  | Option  | 35   |
| <b>MAC:</b> motion-dependent adaptation of control parameters               | Option  | Option  | 36   |

**Installation** by the machine manufacturer

**For more information**, see the *Dynamic Precision* Technical Information document, and visit [www.klartext-portal.com](http://www.klartext-portal.com).

At HEIDENHAIN, the term **Dynamic Efficiency** refers to innovative TNC functions that help the user make heavy machining and roughing processes more efficient and reliable. These software functions not only support the machine operator but also make the manufacturing process itself faster, more stable, and more predictable—in short, more efficient. Dynamic Efficiency helps boost the metal removal rate and reduce machining time.

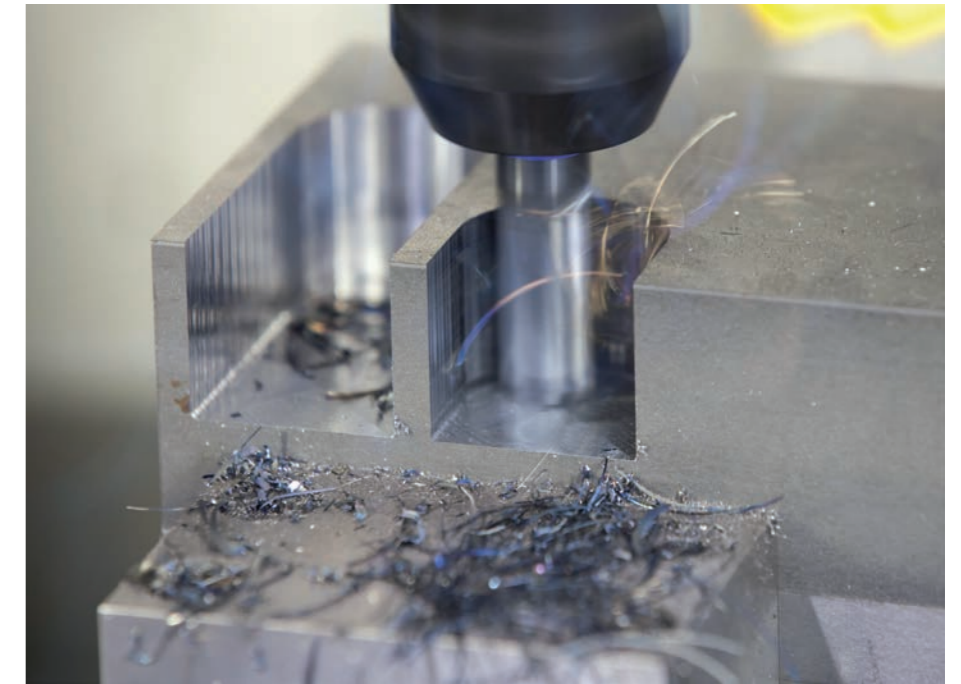
Dynamic Efficiency encompasses four software functions:

- ACC: reduces chatter susceptibility, thus permitting higher feed rates and greater infeeds
- AFC: controls the feed rate based on the machining situation
- Trochoidal milling: a function for tool-friendly roughing of slots and pockets
- OCM: optimizes roughing processes for fast and low-wear machining

The AFC, ACC, and OCM functions are described in greater detail later in this brochure and are identifiable by their Dynamic Efficiency logo.

Individually, each of these solutions delivers key improvements to the machining process. But in combination, these TNC functions bring out the full potential of the machine and tool while reducing the mechanical load. They are also of great value under changing machining conditions, such as during interrupted cuts, various plunging processes, or simple roughing operations. In practice, a 20- to 25-percent increase in the removal rate is possible.

By permitting higher removal rates, Dynamic Efficiency boosts productivity without requiring users to resort to special tools. The avoidance of tool overloading and premature tool wear, as well as the additional gain in process reliability, significantly contributes to more economical production.



|                                     | TNC 640  | TNC 620  | Page |
|-------------------------------------|----------|----------|------|
| <b>Dynamic Efficiency</b>           | ✓        | –        |      |
| <b>Active Chatter Control (ACC)</b> | Option   | Option   | 44   |
| <b>Adaptive Feed Control (AFC)</b>  | Option   | –        | 43   |
| <b>Trochoidal milling</b>           | Standard | Standard | –    |
| <b>OCM</b>                          | Option   | Option   | 45   |

**Installation** by the machine manufacturer/user

**For more information**, see the *Dynamic Efficiency* Technical Information document, and visit [www.klartext-portal.com](http://www.klartext-portal.com).



With its Connected Machining package of functions, HEIDENHAIN offers solutions for the customized networking of manufacturing processes. These solutions put the user at the center of digital job management through the control on his milling machine or lathe. The HEIDENHAIN control can be linked as desired to every production-related area of the company, featuring adaptability to already existing structures and extensibility for future innovation.

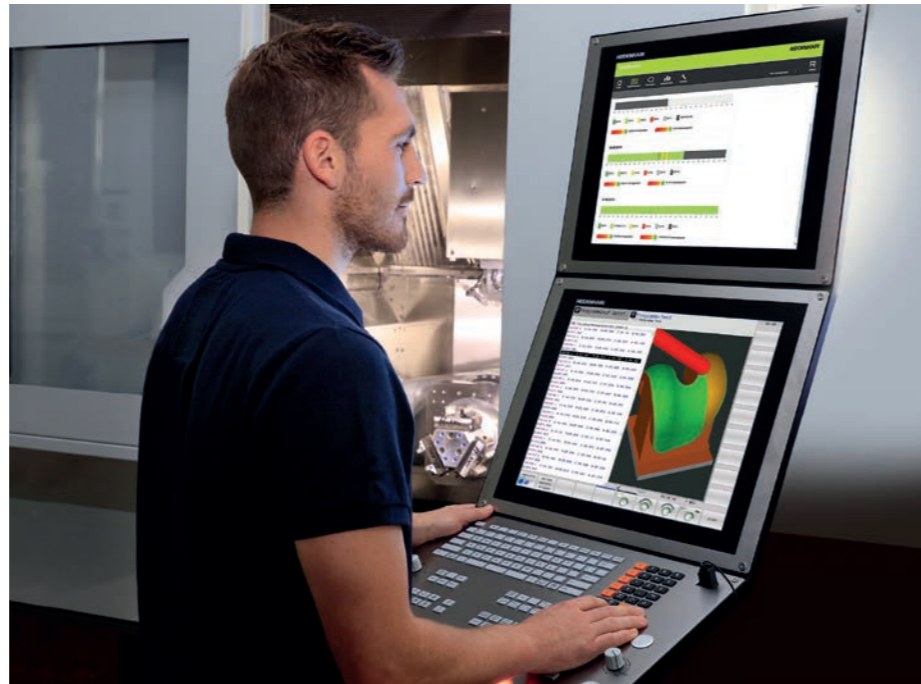
The benefits are time-saving workflows, workload reduction through easy data usage, and transparent processes in all areas of the company—not just in the shop but also in design, production planning, management, logistics, servicing, and more. Purely digital job management with Connected Machining augments the strong manufacturing capabilities of modern equipment and machines.

Even the standard functions of a simple TNC control, linked via Ethernet to the corporate network, offer a variety of approaches for receiving and leveraging digital job data right on the control:

- PDF viewer (e.g., for displaying fixture diagrams and design drawings)
- CAD Viewer (e.g., for displaying 3D models)
- Image display (e.g., for displaying fixture setups and production notes)
- Web browser for accessing web-based applications, such as ERP and MES clients, e-mail clients, and HTML5 clients

The following solutions and options are offered as well:

- The **StateMonitor** software enables transparent processes through data collection and analysis.
- **Remote Desktop Manager** (option 133) allows the user to access PCs and their installed software from the control.
- The **HEIDENHAIN DNC** interface (option 18) links the control to enterprise-resource planning and production-activity control systems.
- **Extended Workspace** displays processes and depicts job data at the machine in a large and clear format.
- The **OPC UA NC Server** option enables a convenient cross-platform connection to your IT system landscape.



|                               | TNC 640 | TNC 620 | Page |
|-------------------------------|---------|---------|------|
| <b>Connected Machining</b>    | ✓       | ✓       |      |
| <b>StateMonitor</b>           | ✓       | ✓       | 62   |
| <b>Remote Desktop Manager</b> | Option  | Option  | 50   |
| <b>HEIDENHAIN DNC</b>         | Option  | Option  | 49   |
| <b>OPC UA NC Server</b>       | Option  | Option  | 52   |
| <b>Extended Workspace</b>     | ✓       | –       | 77   |

**Installation** by the machine manufacturer

**For more information**, see the TNC brochures.

Many five-axis operations that initially seem very complex can actually be reduced to conventional 2D movements executed on a cylindrical surface. For creating and editing these programs quickly and easily without a CAM system, the TNC comes to your aid with helpful functions.

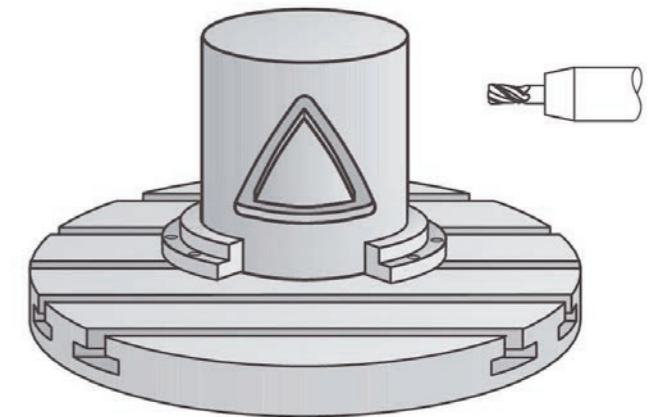
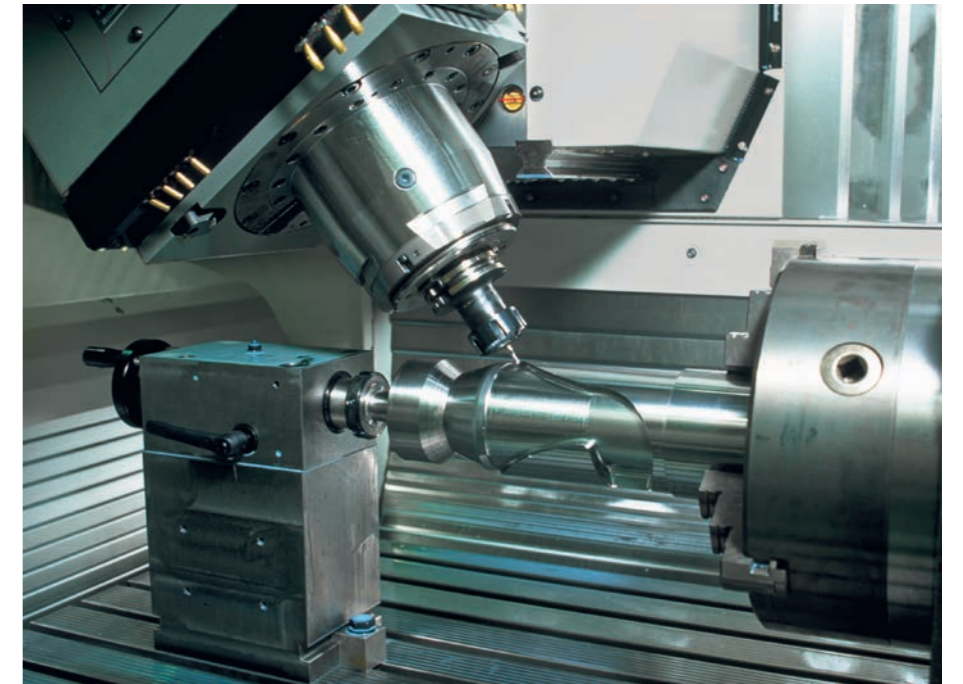
**Cylinder surface machining**  
The TNC makes it easy for you to program straight-line and arc contours on cylindrical surfaces for rotary and tilting tables by conveniently allowing you to program the contour on the plane of an unrolled cylinder (axis-independently on the TNC 640, TNC 620, and TNC 320). The TNC then executes the programmed machining operation on the cylinder surface.

The TNC provides four cycles for cylinder surface machining:

- Slot milling (the slot width and tool diameter are equivalent)
- Guide-groove milling (the slot width is greater than the tool diameter)
- Ridge milling
- Outside contour milling

**Feed rate for rotary axes and tables in mm/min**

By default, rotary axis feed rates are programmed in degrees/min, but the TNC can also interpret these feed rates in mm/min. This makes the feed rate at the contour independent of the distance between the tool center point and the center of the rotary axis.



|  |          |                              |
|--|----------|------------------------------|
| <b>Advanced Function Set 1</b><br>TNC 640 HSCI/TNC 620 HSCI<br>TNC 320 | Option 8 | ID 617920-01<br>ID 536146-01 |
|--|----------|------------------------------|

|  |  |
|--|--|
| <b>TNC 640 HSCI</b><br><b>TNC 620 HSCI</b><br><b>TNC 320</b> | NC SW 34059x-01 or later<br>NC SW 34056x-01/73498x-01/81760x-01 or later<br>NC SW 34055x-01/771851-01 or later |
|--|--|

**Installation** by the machine manufacturer

**For more information**, see the TNC brochures.



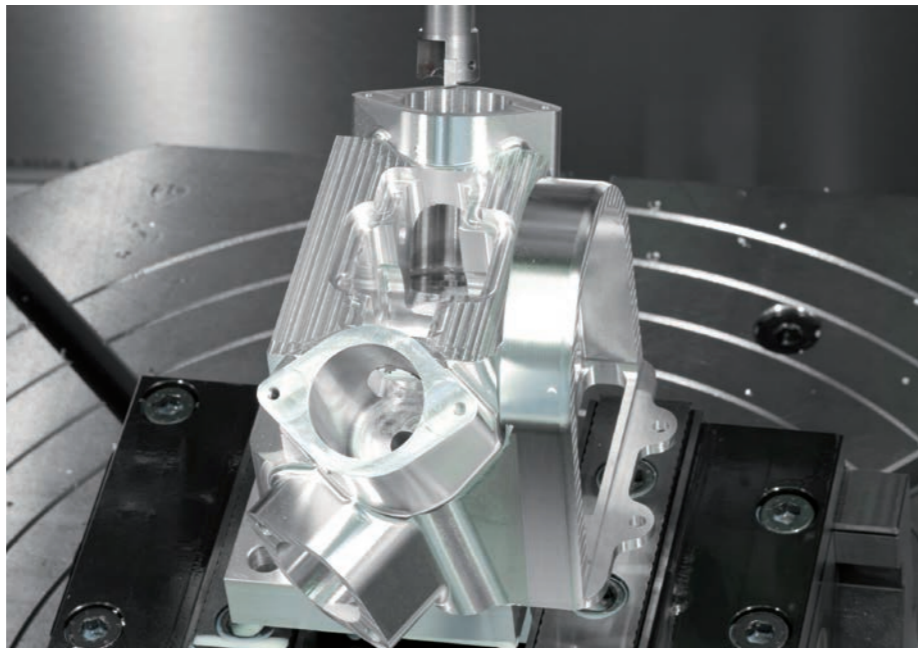
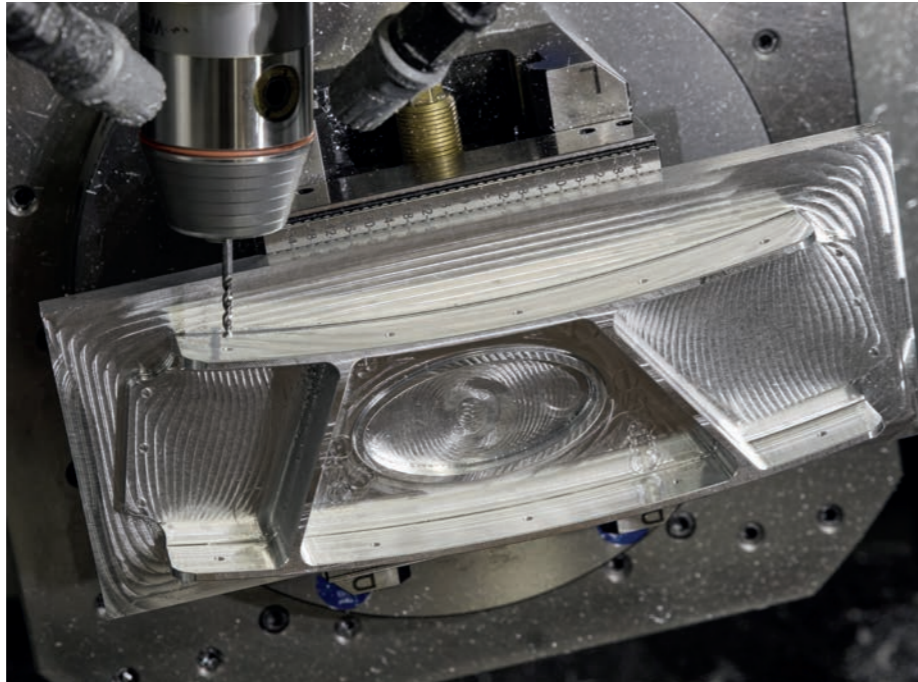
## Programming and operation

### Coordinate transformation: tilting the working plane, and PLANE function

Programs for contours and holes on inclined surfaces are usually very complex, requiring significant computing resources and programming work. In cases like these, the TNC can save you a great deal of programming time. You simply program the machining operation as usual in the main plane (e.g., in XY). The machine then runs the program in a plane that has been tilted with respect to the main plane about one or more rotary axes.

The PLANE function makes it easy to define a tilted working plane and, based on the information in the workpiece drawing, offers seven different methods for doing so. In order to keep this complex function as easy to use as possible, each plane definition has its own animation that you can view prior to selecting the function. Intuitive help graphics assist you during programming.

You can also use the PLANE function to define the positioning behavior during tilting to avoid unpleasant surprises when the program is run. The settings for defining the positioning behavior are identical for all PLANE functions, making operation much easier.



|   |  |                              |
|---|--|------------------------------|
| <b>Advanced Function Set 1</b><br>TNC 640 HSCI/TNC 620 HSCI<br>TNC 320  | Option 8   | ID 617920-01<br>ID 536164-01 |
| <b>TNC 640 HSCI</b><br><b>TNC 620 HSCI</b><br><b>TNC 320</b>  | NC SW 34059x-01 or later<br>NC SW 34056x-01/73498x-01/81760x-01 or later<br>NC SW 34055x-01/771851-01 or later |                              |
| <b>Installation</b> by the machine manufacturer   |  |                              |
| <b>For more information</b> , see the TNC brochures, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> . |  |                              |

## Programming and operation

### Touch probe cycles

#### Workpiece alignment

The HEIDENHAIN touch probes and probing functions of the TNC reduce the need for tedious manual alignment of the workpiece:

- You start by simply clamping the workpiece in any position.
- The touch probe determines the actual clamping situation by probing a surface.
- The TNC compensates for this misalignment with a "basic rotation," either by rotating the NC program to the ascertained angle or by correcting the actual misalignment through a turn of the rotary table.
- The TNC offers manual, automatic, and semiautomatic cycles for correcting misalignments in two or three dimensions.

#### Preset setting

Being able to define the preset quickly and reliably reduces nonproductive time and increases machining accuracy. The TNC features a myriad of probing cycles for automatic preset setting.

#### Workpiece inspection

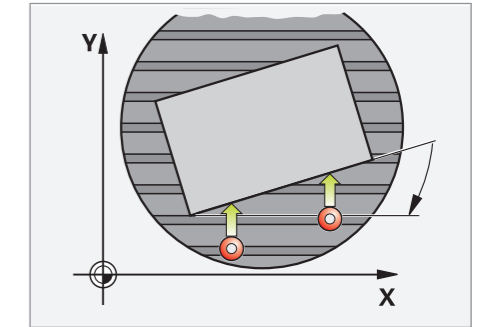
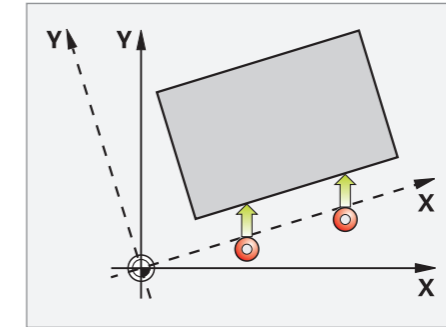
The TNC features numerous measuring cycles for inspecting the geometry of machined workpieces. This allows you to do the following:

- Identify a workpiece and call an appropriate part program
- Check for correct execution of all machining operations
- Detect and compensate for tool wear, etc.

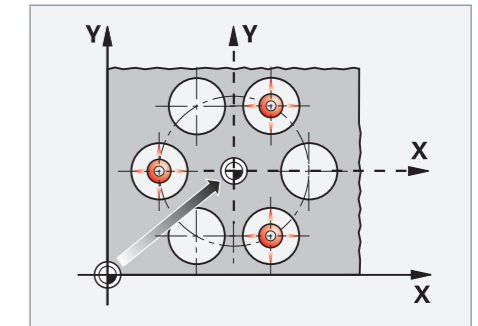
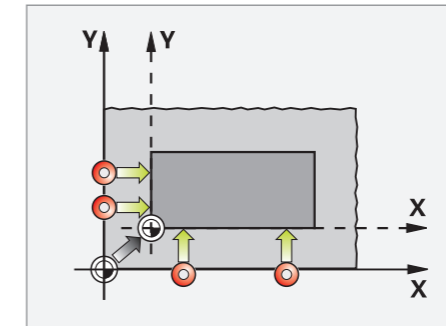
#### Tool measurement

In conjunction with the TT touch probes for tool measurement, the TNC makes it possible to automatically measure tools inside the machine. The measured tool length and radius are stored by the TNC in its central tool memory. In-process tool measurement allows you to immediately identify wear or breakage, thus avoiding scrap and rework.

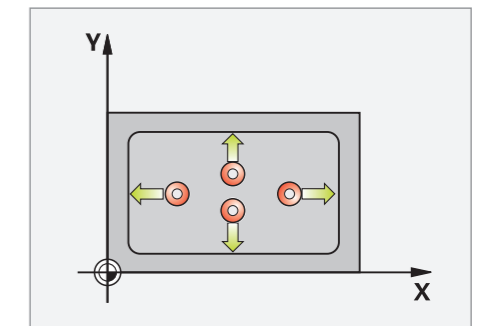
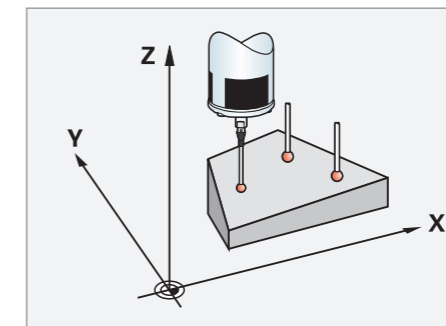
On the TNC 620, the touch probe cycles are available only with option 17. This option is automatically enabled with the use of HEIDENHAIN touch probes featuring the EnDat interface (NC-SW 81760x-06 or later). The TNC 640 and TNC 320 already include the touch probe cycles as part of their standard functions.



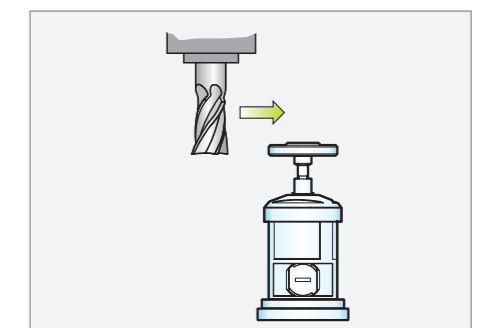
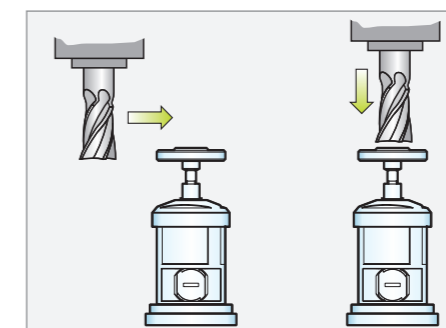
**Compensating for workpiece misalignment** by rotating the coordinate system or rotating the table



**Setting a preset** (e.g., at a corner or in the center of a circular hole pattern)



**Workpiece measurement** (e.g., angle of a plane or rectangular pocket)



**Tool measurement** (e.g., tool length and radius or tool wear)

|   |  |              |
|---|--|--------------|
| <b>Touch Probe Functions</b>  | Option 17  | ID 634063-01 |
| <b>TNC 640 HSCI</b><br><b>TNC 620 HSCI</b><br><b>TNC 320</b>                              | Standard function<br>NC SW 34056x-01/73498x-01/81760x-01 or later<br>Standard function |              |
| <b>Installation</b> by the machine manufacturer   |  |              |
| <b>For more information</b> , see the TNC brochures and the <i>Touch Probes</i> brochure. |  |              |

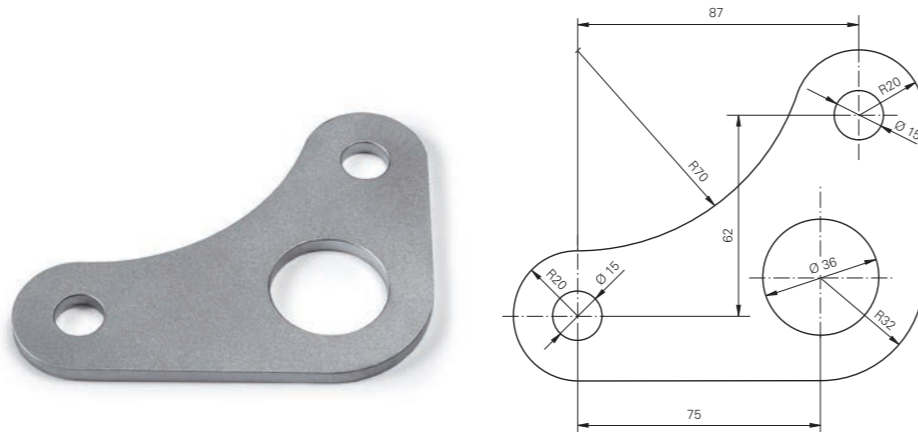


# Programming and operation

## Advanced programming functions: FK free contour programming, canned cycles

### FK free contour programming

Not all workpieces are suitably dimensioned for conventional NC programming. In this case, the FK free contour programming function lets you simply enter data from the drawing without performing additional conversions or calculations! In the process, you can leave individual contour elements undefined as long as the overall contour is defined. If the data allow for more than one mathematical solution, then the TNC programming graphics helpfully render the possible variants to choose from.



### Standard cycles

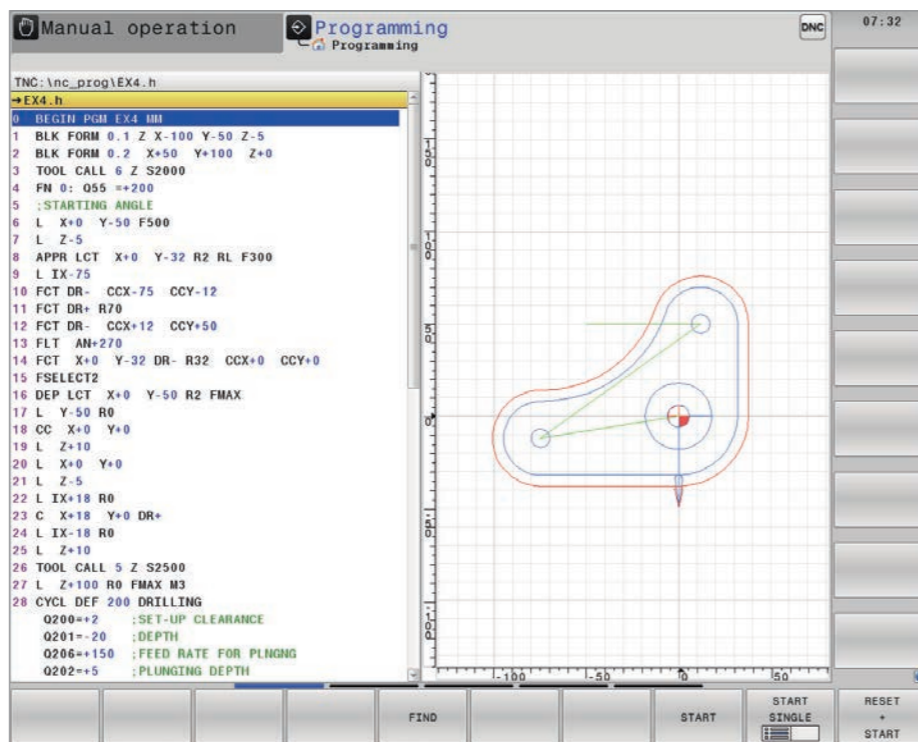
In addition to the canned cycles for drilling and tapping (with or without a floating tap holder), option 19 also gives you cycles for thread milling, reaming, boring, and hole patterns, as well as milling cycles for plane-surface face milling and for roughing and finishing pockets, slots, and studs.

### Cycles for complex contours

Special help for roughing pockets with any contour is provided by the Subcontour List (SL) cycles and the Optimized Contour Milling (OCM) option. These groups of cycles each contain canned cycles for roughing and finishing. The contour or subcontours are defined in subprograms. As a result, a single contour description can be used for various operations with different tools.

### OEM cycles

Machine manufacturers can bring their specialized production expertise to bear in the form of additional canned cycles that can be stored in the TNC. The end user is likewise given the option of programming his own cycles. HEIDENHAIN provides help in programming these cycles with its CycleDesign PC software. CycleDesign lets you arrange the input parameters and soft-key structure of the TNC as desired.



# Programming and operation

## Verification graphics, program-run graphics

### Programming graphics

HEIDENHAIN controls support you with detailed programming graphics. These graphics are a standard feature on all controls and are described in their respective brochures.

Other graphical views are available as options:

### Verification graphics

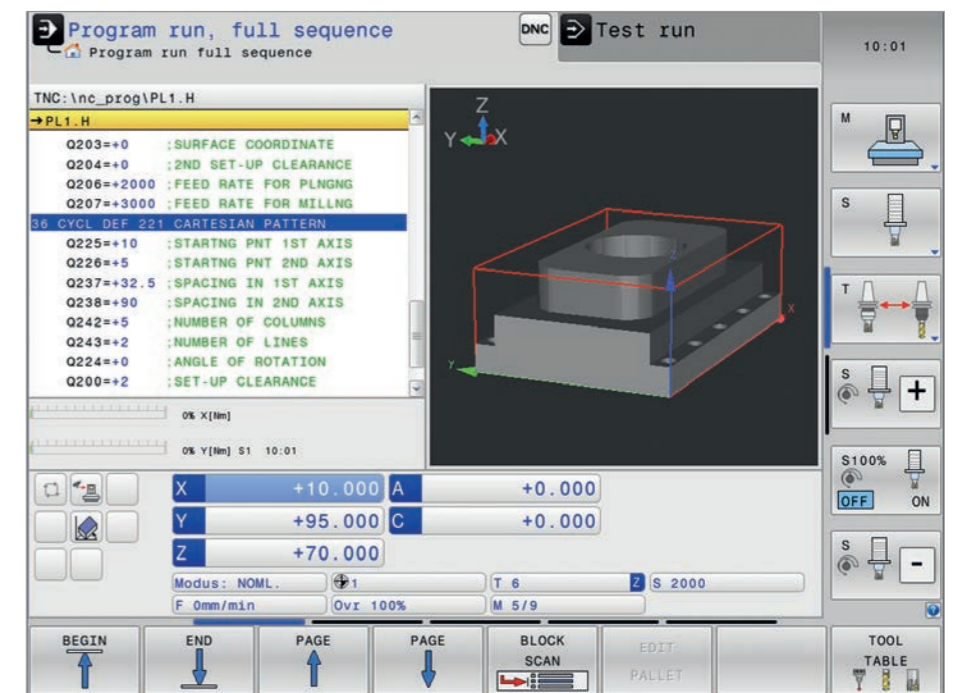
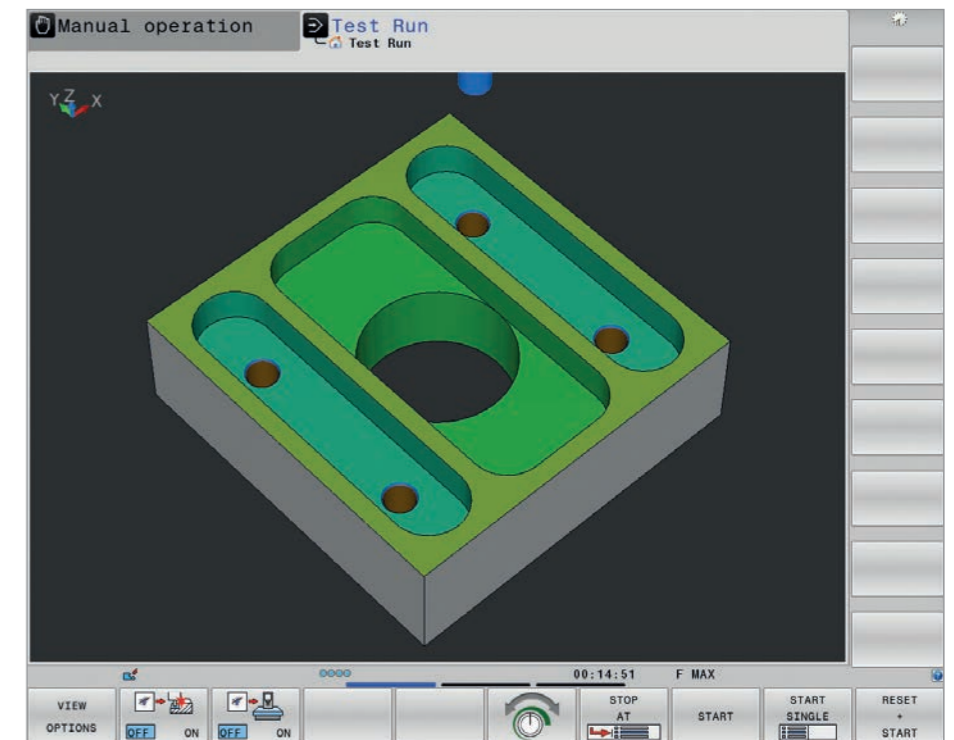
To be on the safe side before running a program, the TNC can graphically simulate the machining operation. The TNC can display this simulation in the following ways:

- In plan view with different shades of depth
- In three projections (as in the workpiece drawing)
- In 3D view

Details can be shown under magnification. In addition, the TNC displays the calculated machining time in hours, minutes, and seconds. During the simulation, the TNC 640 and TNC 620 controls can also detect collisions between the workpiece and the tool holder, as well as output appropriate warning messages.

### Program-run graphics

The TNC graphically renders the current machining operation in real time. Although coolant spray and the safety enclosure may obstruct your view, the mere press of a button lets you check the current machining operation while programming.



|   |  |              |
|---|--|--------------|
| <b>Advanced Programming Features</b>  | Option 19  | ID 628252-01 |
| <b>TNC 640 HSCI</b><br><b>TNC 620 HSCI</b><br><b>TNC 320</b>  | Standard function<br>NC SW 34056x-01/73498x-01/81760x-01 or later<br>Standard function |              |
| <b>Installation</b> by the user   |  |              |
| <b>For more information</b> , see the TNC brochures, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> . |  |              |

|   |  |              |
|---|--|--------------|
| <b>Advanced Graphic Features</b>  | Option 20  | ID 628253-01 |
| <b>TNC 640 HSCI</b><br><b>TNC 620 HSCI</b><br><b>TNC 320</b>  | Standard function<br>NC SW 34056x-01/73498x-01/81760x-01 or later<br>Standard function |              |
| <b>Installation</b> by the user   |  |              |
| <b>For more information</b> , see the TNC brochures, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> . |  |              |



## Programming and operation

### Detailed 3D view in the verification and program-run graphics

#### Finely detailed 3D view

The program-verification and program-run graphics of the TNC 640, TNC 620, and TNC 320 also include additional viewing functions with detailed 3D rendering. These functions help you evaluate the workpiece quality in the simulation prior to machining, as well as in real time during machining.

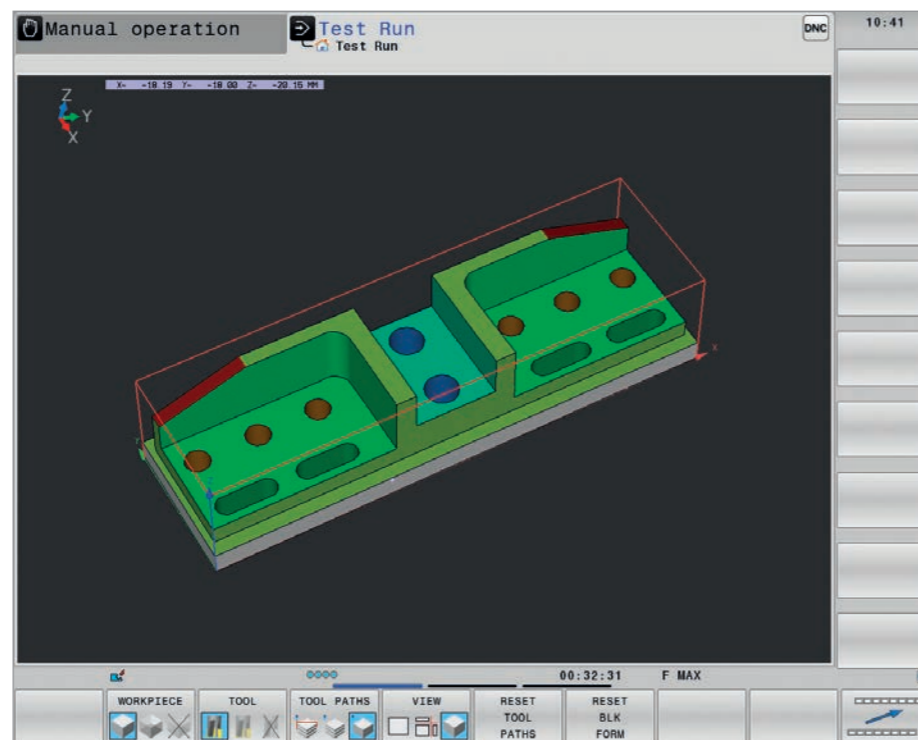
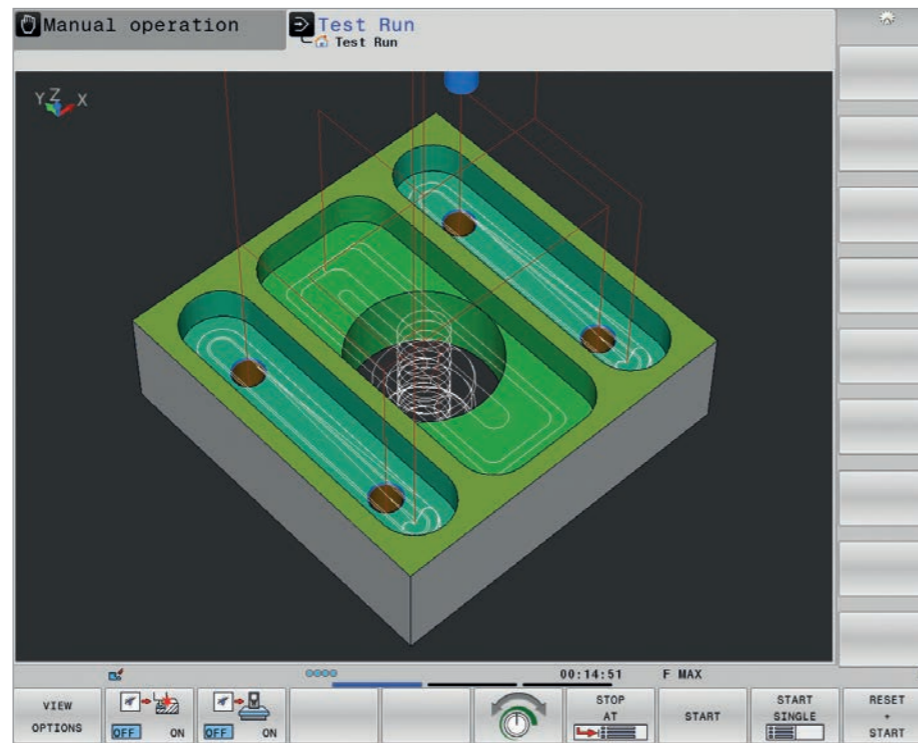
The high-resolution 3D view with strong zoom factors reveals even the tiniest program errors on the workpiece surface. For an even more precise view of the NC data analysis, you can also display the tool paths and their corresponding block numbers. Of particular help is the selectable workpiece transparency feature, which allows you to see hidden cavities and undercuts.

Enhanced graphics also make tool-specific machining operations easier to see: each machining operation performed with the same tool is shown in its own unique color. In 3D view, the TNC also includes a measuring function that displays the coordinates of wherever your mouse happens to be within the graphics.

If you just need a quick overview of the contour and the machining time, you can change the resolution and simulation mode to boost the calculation speed.

With NC SW 34059x-09 or later, the TNC 640 simulates not only material removal but also the complete 3D machine model, allowing the user to precisely evaluate processes in the working space before machining. The machine's collision objects are configured and activated by the machine manufacturer.

The importing of STL files enables the convenient incorporation of complex workpiece blanks and finished parts, such as 3D models from CAM systems. In addition, the current machining status can be saved as an STL file during the simulation in order to integrate it into other programs as a workpiece blank (with NC SW 34059x-11 or later on the TNC 640, and with NC SW 81760x-08 or later on the TNC 620).



|   |  |              |
|---|--|--------------|
| <b>Advanced Graphic Features</b>  | Option 20                                      | ID 628253-01 |
| <b>TNC 640 HSCI</b>   | Standard feature with NC SW 34059x-04 or later |              |
| <b>TNC 620 HSCI</b>   | NC SW 81760x-01 or later                       |              |
| <b>TNC 320</b>  | Standard feature in NC SW 771851-01 or later   |              |
| <b>Installation</b> by the user   |  |              |
| <b>For more information</b> , see the TNC brochures, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> . |  |              |

## Programming and operation

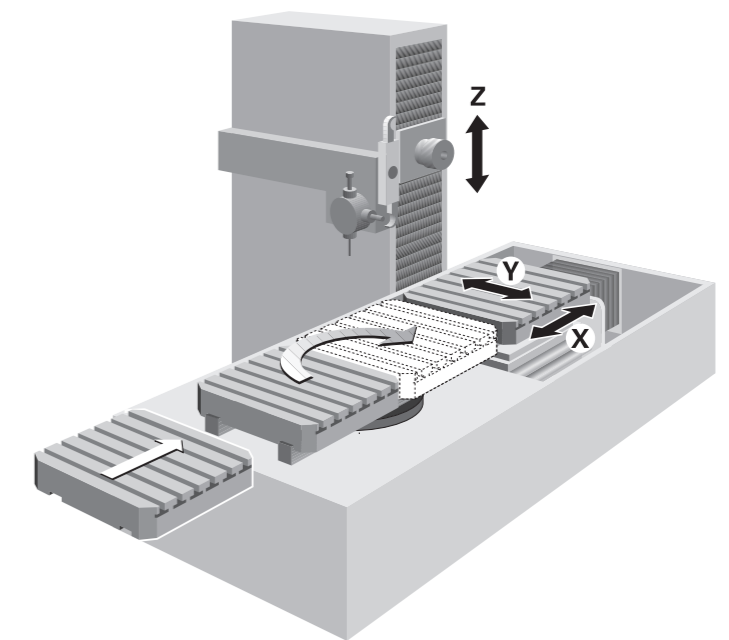
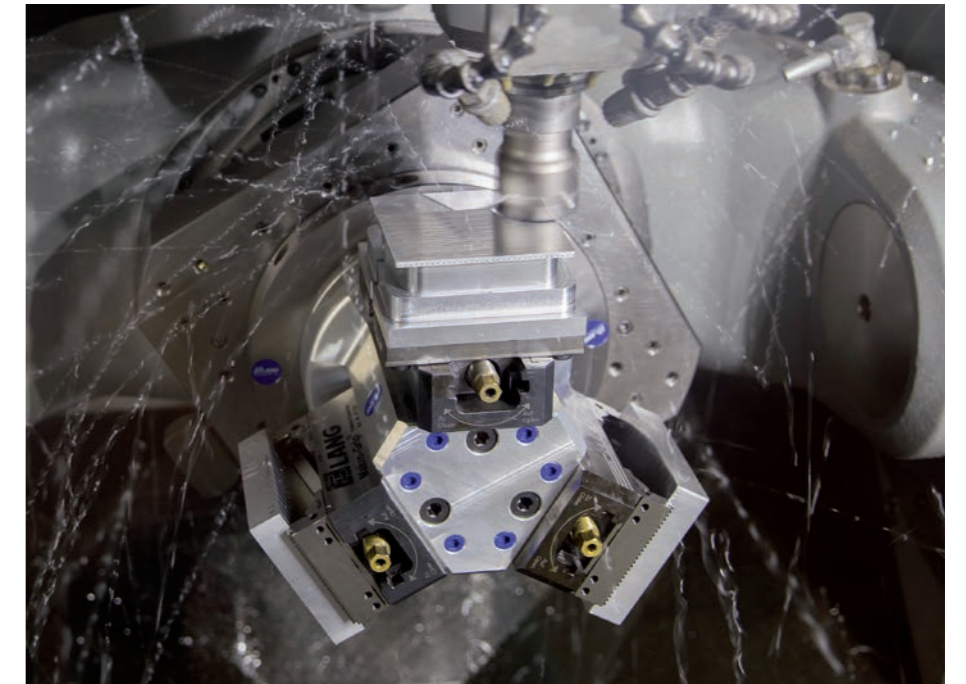
### Pallet management

For any sequence of different workpieces loaded on pallets, the TNC is able to identify the proper machining program and datum shift.

When a pallet is loaded for machining, the TNC automatically calls the correct program. This allows different parts to be machined in any order desired.

Pallet insertions can be controlled via PLC axes. The desired sequence and presets for the pallet and workpieces are defined in the pallet table by the user. The machine manufacturer is free to configure the pallet tables as desired; any information can be stored in the tables and called via the PLC.

Execution of the pallet tables can be either workpiece- or tool-oriented (with NC SW 34059x-08 or later on the TNC 640; with NC SW 81760x-05 or later on the TNC 620).



|   |  |              |
|---|--|--------------|
| <b>Pallet Management</b>  | Option 22                                    | ID 628255-01 |
| <b>TNC 640 HSCI</b>   | Standard function                            |              |
| <b>TNC 620 HSCI</b>   | NC SW 34056x-01/73498x-01/81760x-01 or later |              |
| <b>TNC 320</b>  | -  |              |
| <b>Installation</b> by the machine manufacturer   |  |              |
| <b>For more information</b> , see the TNC brochures, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> . |  |              |



## Programming and operation

### Batch Process Manager: intuitive display of pallet management

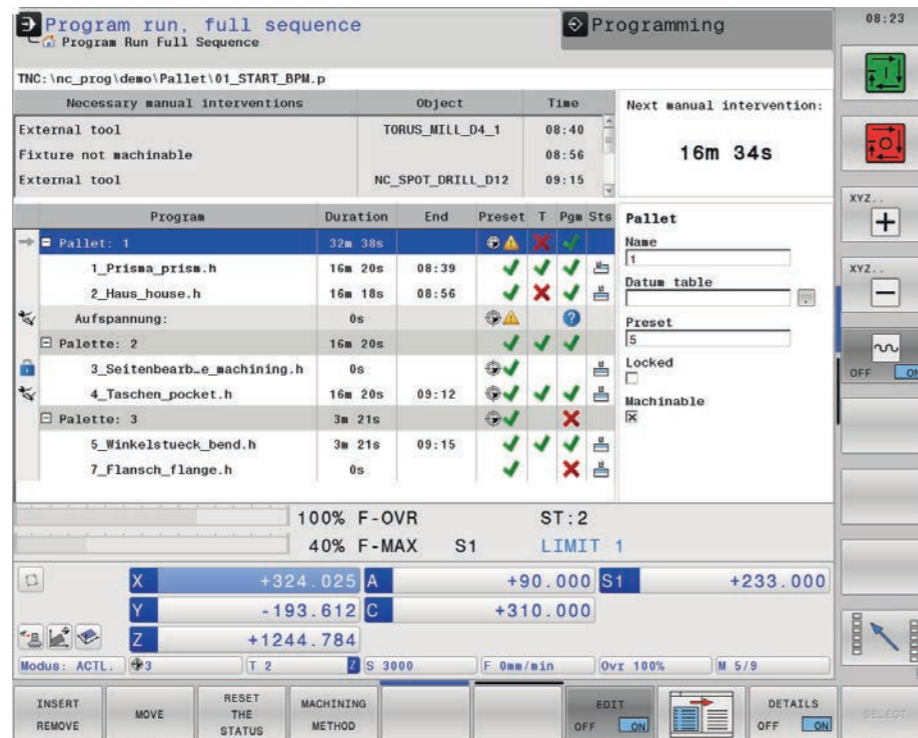
Batch Process Manager is a powerful function for pallet machining and series production. With its intuitive user interface, you can plan your production process and receive important information about upcoming machining operations.

Batch Process Manager makes it possible to easily edit pallets and to change the sequence of pending jobs. Batch Process Manager also performs a duration calculation for all planned jobs or NC programs. BPM checks whether, for example, all NC programs will be able to run without error or whether all necessary tools are available with sufficient remaining service life. BPM displays the results of these checks in the status overview. Batch Process Manager thereby ensures the smooth execution of the planned jobs.

Batch Process Manager shows the following information in advance:

- The machining sequence
- The time of the next manual intervention
- The program duration and run time
- Status information about preset, tool, and program

Batch Process Manager requires the additional enabling of Pallet Management (option 22). On controls with NC software versions up to 34059x-08 or 81760x-05, Extended Tool Management (option 93) must be enabled as well.



## Programming and operation

### CAD Import: import contours and machining positions from DXF files

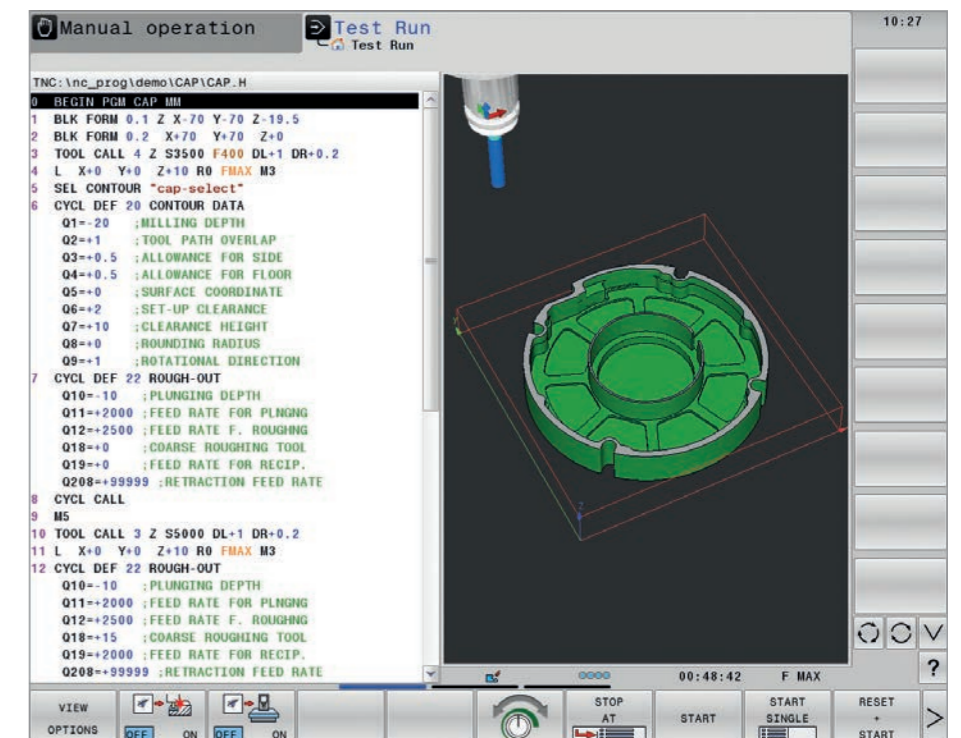
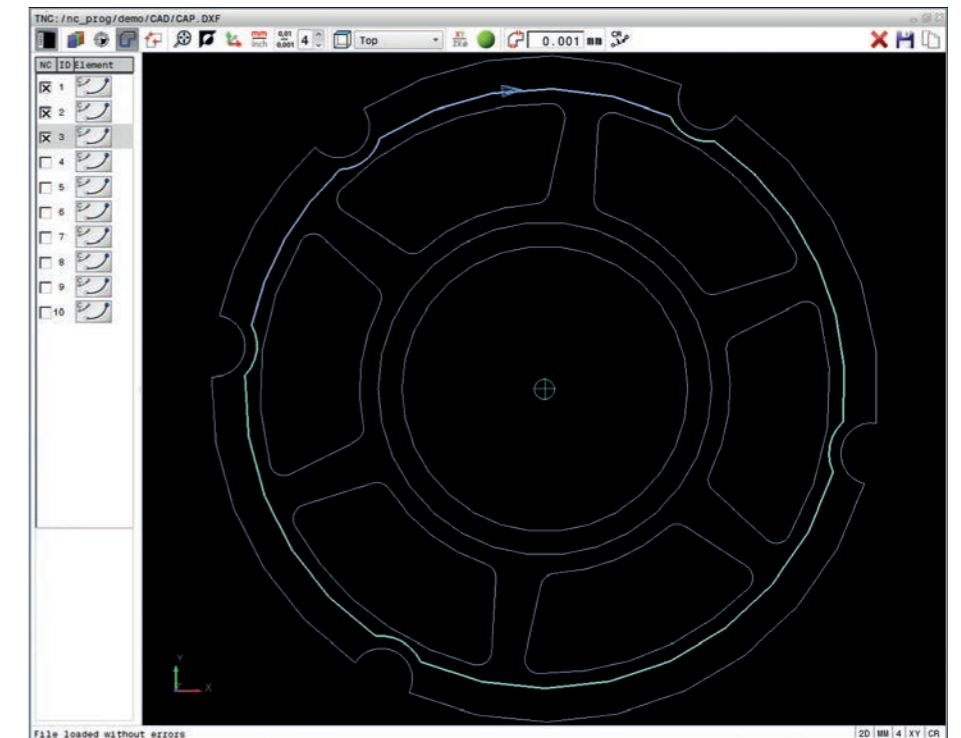
Why program contours when you already have the drawing as a DXF file? You can open DXF files directly on the TNC in order to extract contours or machining positions from them. This not only saves time otherwise spent on programming and testing but also provides assurance that the finished contour precisely complies with the design engineer's specifications.

DXF files usually contain multiple layers used by the design engineer to organize the drawing. In order to minimize unneeded information on your screen during contour selection, you can hide all of the **inessential layers** in the DXF file with just a click of your mouse. This feature requires an operating panel with a touchpad or an external pointing device. The TNC can select a contour train even if it has been stored across **different layers**.

The TNC also supports you in **defining the workpiece preset**. For this purpose, the TNC provides a function that allows you to move the drawing's datum to a useful position by simply clicking an element. Selecting contours is also very convenient: you can select any element by clicking it with the mouse. Once you select a second element, the TNC detects your desired machining direction and initiates **automatic contour detection**. In doing so, the TNC automatically selects all clearly identifiable contour elements until the contour closes or branches out. At that point, you can select the next contour element. In this way, you can define even extensive contours with just a few clicks. You can even shorten, lengthen, or interrupt the contour elements as needed.

In addition, you can easily select **machining positions** and save them as point files, especially for transferring drilling positions or starting points for pocket machining. Of course, the TNC saves the machining positions in such a way that they are approached via the shortest path.

With the CAD Import option, you can also import contours and machining positions from 3D models (see *CAD Import*, p. 22).



|   |                          |                               |
|---|--------------------------|-------------------------------|
| <b>Batch Process Manager</b>  | Option 154<br>Option 22  | ID 1219521-01<br>ID 628255-01 |
| <b>TNC 640 HSCI</b>   | NC SW 34059x-08 or later |                               |
| <b>TNC 620 HSCI</b>   | NC SW 81760x-05 or later |                               |
| <b>TNC 320</b>  | —                        |                               |
| <b>Installation</b> by the machine manufacturer   |                          |                               |
| <b>For more information</b> , see the TNC brochures, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> . |                          |                               |

|   |                                    |              |
|---|------------------------------------|--------------|
| <b>CAD Import</b>   | Option 42                          | ID 526450-01 |
| <b>TNC 640 HSCI</b>   | NC SW 34059x-02 or later           |              |
| <b>TNC 620 HSCI</b>   | NC SW 73498x-02/81760x-01 or later |              |
| <b>TNC 320</b>  | NC SW 771851-01 or later           |              |
| <b>Installation</b> by the user   |                                    |              |
| <b>For more information</b> , see the TNC brochures, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> . |                                    |              |



## Programming and operation

### CAD Import: import contours from 3D models

#### CAD Import (option 42)

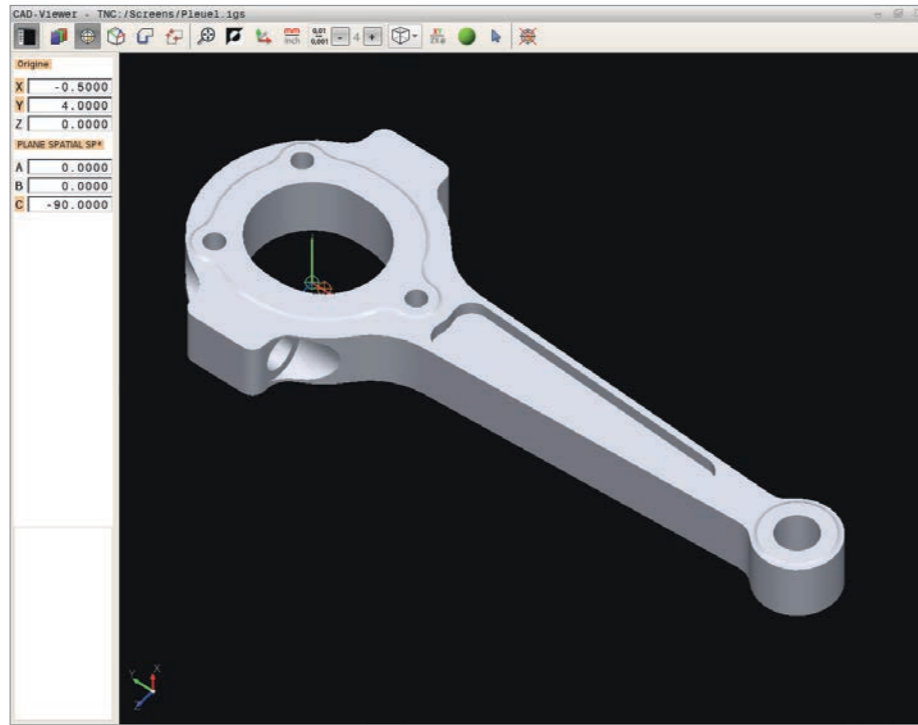
CAD Viewer enables the display of **2D and 3D models** right on the TNC (e.g., DXF, Step, or IGES files). Using the CAD Import option, you can easily incorporate contours and machining positions from these CAD files directly into your Klartext program. You can thereby reduce the amount of programming work and avoid input errors resulting from transposed digits, incorrectly placed decimal points, and the like.

In particular, extracting machining information directly from CAD data provides additional possibilities for creating NC programs with a tilted working plane. You can also define the preset on the 3D model with a **3D basic rotation**. In addition, you can place a datum with the appropriate 3D rotation on the desired working plane.

The working plane can be conveniently saved to the clipboard and transferred to the NC program with the proper transformation and relevant **PLANE command**. On the defined working plane, you can extract contours and machining positions, and transfer them to the NC program.

Selecting contours is very convenient: you can select any element by clicking it with the mouse. Once you select a second element, the TNC detects your desired machining direction and initiates automatic contour detection. In doing so, the TNC automatically selects all clearly identifiable contour elements until the contour closes or branches out. This method lets you define elaborate contours with just a few clicks of the mouse. You can then easily copy the selected contour via clipboard to an existing Klartext program.

The CAD Import option is an expansion to the DXF Converter. All previous functions have been adopted and enhanced to include 3D import functions. Nearly all of the common DXF, Step, and IGES file formats can be used. The CAD Import option is available for the TNC 640, TNC 620, and TNC 320 controls.



|   |                          |              |
|---|--------------------------|--------------|
| <b>CAD Import</b>   | Option 42                | ID 526450-01 |
| <b>TNC 640 HSCI</b>   | NC SW 34059x-08 or later |              |
| <b>TNC 620 HSCI</b>   | NC SW 81760x-05 or later |              |
| <b>TNC 320</b>  | NC SW 771851-05 or later |              |
| <b>Installation</b> by the user   |                          |              |
| <b>For more information</b> , see the TNC brochures, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> . |                          |              |

## Programming and operation

### Turning functions: milling and turning on the same machine

The TNC 640 provides powerful functions for NC-program-driven switching between turning mode and milling mode. You are completely free to decide how and when you wish to combine these two machining modes.

#### Machining simple contours

Various cycles are available for the longitudinal and transverse machining of simple contours. The area to be machined can also be inclined, thus requiring a plunging movement. Of course, the TNC 640 automatically takes the angle of the turning tool into account.

#### Machining any contours

If the contours to be machined are complex and can no longer be defined with simple cycle parameters, you can still describe them using contour subprograms. This process is identical to the procedure used for SL cycles in milling, for which you use Cycle 14 to define the subprogram describing the finished contour. You can define the technology parameters in the respective turning cycle.

For the contour description, you use exactly the same Klartext functions as you would for defining a milling contour. FK free contour programming is included as well.

Turning-specific recess and undercut contour elements are also available, which you can insert between contour elements in the same manner as chamfers and rounding arcs. Besides radial and axis recesses, E, F, H, K, and U undercuts are available, as are thread undercuts.

Depending on the cycle, the TNC 640 machines parallel to the axis or the contour. You define the machining operations (roughing, finishing) or the oversize with dialog guidance in the corresponding parameters.

Other machining operations:

- Recessing
- Thread machining
- Blank form update
- Orientation of the turning tool



#### Turning with a facing slide

A facing slide allows you to perform turning operations on a stationary workpiece. This, in turn, makes it possible to implement off-center or tilted-plane turning operations.

With a facing slide, the spindle provides the rotational motion while an axis integrated into the facing head laterally extends the tool (plan stroke). With the TNC 640, you don't need to worry about the complex motion involved. You simply select the facing-slide mode with a programming command and program as always with standard turning cycles. The TNC 640 handles all of the calculations and executes the motion sequences.



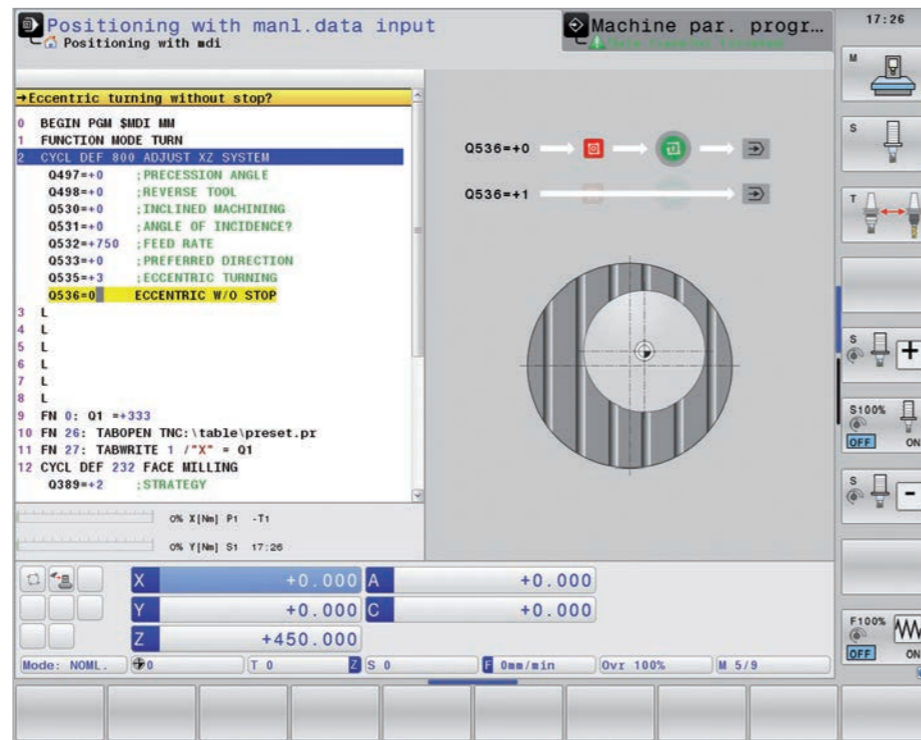
|   |                          |              |
|---|--------------------------|--------------|
| <b>Turning</b>  | Option 50                | ID 634608-01 |
| <b>TNC 640 HSCI</b>   | NC SW 34059x-01 or later |              |
| <b>TNC 620 HSCI</b>   | –                        |              |
| <b>TNC 320</b>  | –                        |              |
| <b>Installation</b> by the machine manufacturer   |                          |              |
| <b>For more information</b> , see the <i>TNC 640</i> brochure, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> . |                          |              |

## Programming and operation

### Turning functions: eccentric turning

The eccentric turning function lets you perform turning operations even when the workpiece axis is misaligned with the axis of rotation due to the setup. During machining, the TNC 640 then compensates for any eccentricity through corrective movements of the rotary spindle coupled with the linear axis. This can significantly reduce your setup times.

\* On controls with NC software version 34059x04, RTC (option 135) must be enabled.



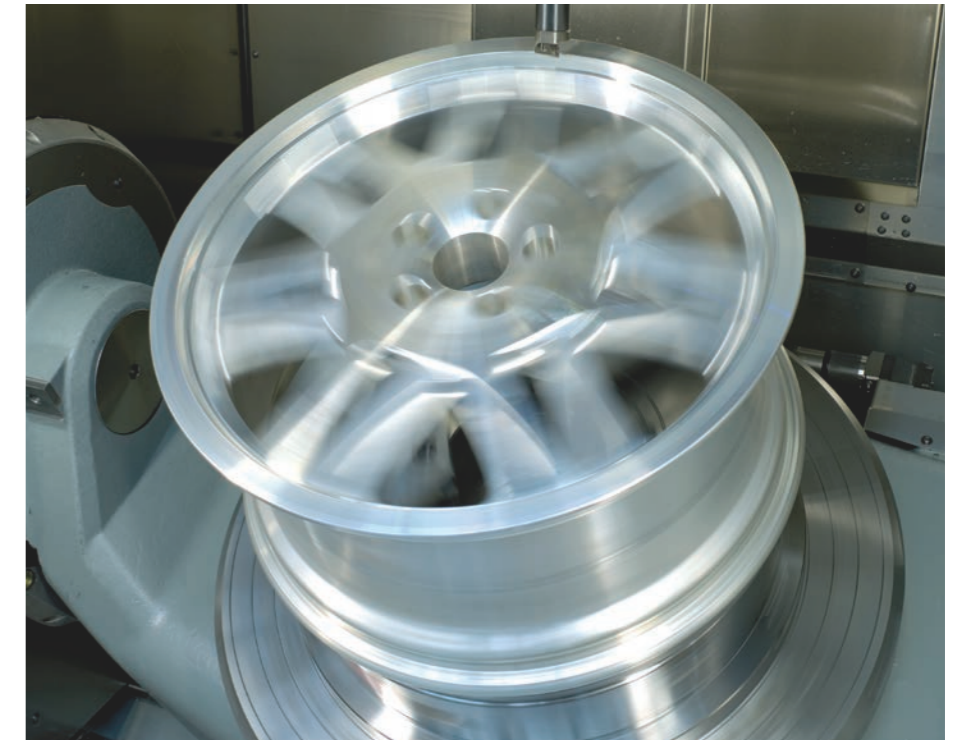
## Programming and operation

### Turning functions: simultaneous turning

This option allows you to produce complex contours that require machining at varying tool angles. This allows you, for example, to machine undercut contours with just one tool. For simple contours, this option can prolong tool life by using a larger area of the indexable insert. This involves at least three-axis motion (two linear axes and one rotary axis).

The cycles for simultaneous turning monitor the workpiece contour relative to the tool and the tool carrier. To attain optimal surface finishes, these cycles avoid unnecessary tilting movements. However, if you wish to force tilting movements, you still have the option of defining start and finish angles. With NC SW 34059x-11 or later, a cycle is also available for simultaneous roughing.

Along with option 158 (Advanced Function Set Turning), simultaneous turning also requires option 50 (turning function).



|   |                          |              |
|---|--------------------------|--------------|
| <b>Turning</b>  | Option 50                | ID 634608-01 |
| <b>TNC 640 HSCI</b>   | NC SW 34059x-04 or later |              |
| <b>TNC 620 HSCI</b>   | -                        |              |
| <b>TNC 320</b>  | -                        |              |
| <b>Installation</b> by the machine manufacturer   |                          |              |
| <b>For more information</b> , see the <i>TNC 640</i> brochure, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> |                          |              |

|   |                          |               |
|---|--------------------------|---------------|
| <b>Advanced Function Set Turning</b>  | Option 158               | ID 1237237-01 |
| <b>TNC 640 HSCI</b>   | NC SW 34059x-09 or later |               |
| <b>TNC 620 HSCI</b>   | -                        |               |
| <b>TNC 320</b>  | -                        |               |
| <b>Installation</b> by the machine manufacturer   |                          |               |
| <b>For more information</b> , see the <i>TNC 640</i> brochure, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> |                          |               |



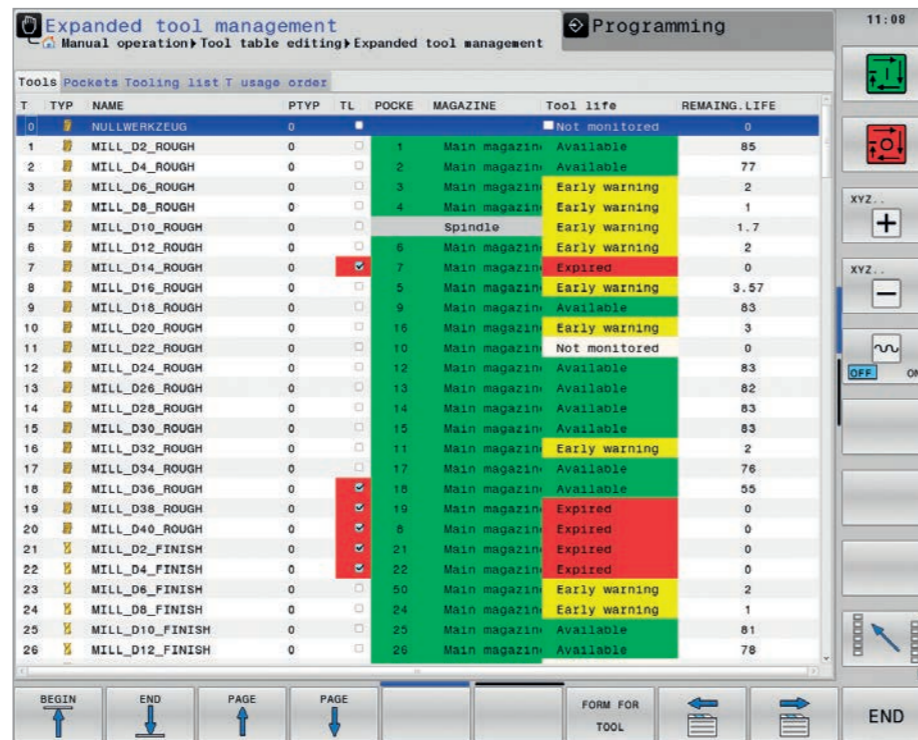
# Programming and operation

## Extended Tool Management

The Extended Tool Management option provides numerous functions that bring considerable transparency to tool and tool-magazine management. Loading and unloading processes can be managed via drag-and-drop, a tool usage list provides information about which tools will be used for what duration, and intuitive tables use color coding to indicate various tool statuses. All of the tools used in the selected program can be displayed in a tooling list.

An import function also allows CSV files to be imported and exported. The Comma Separated Values (CSV) text file format enables the exchange of simply structured data. This function lets you implement convenient data exchange, particularly when using external presetters to measure your tool. The CSV file format can be opened and saved in Excel.

There is also a simple way to quickly and accurately delete tool data. The TNC displays the tool data to be deleted in a pop-up window, giving you a second chance to ensure that important data are not being accidentally deleted.



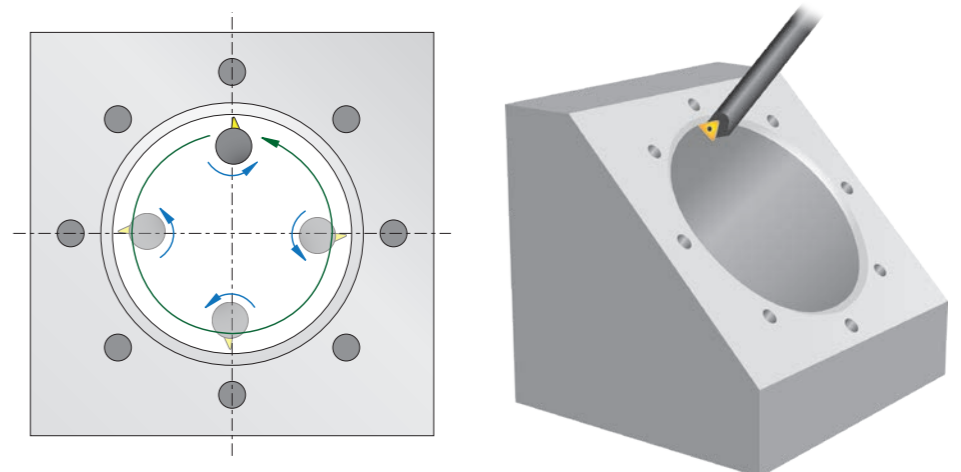
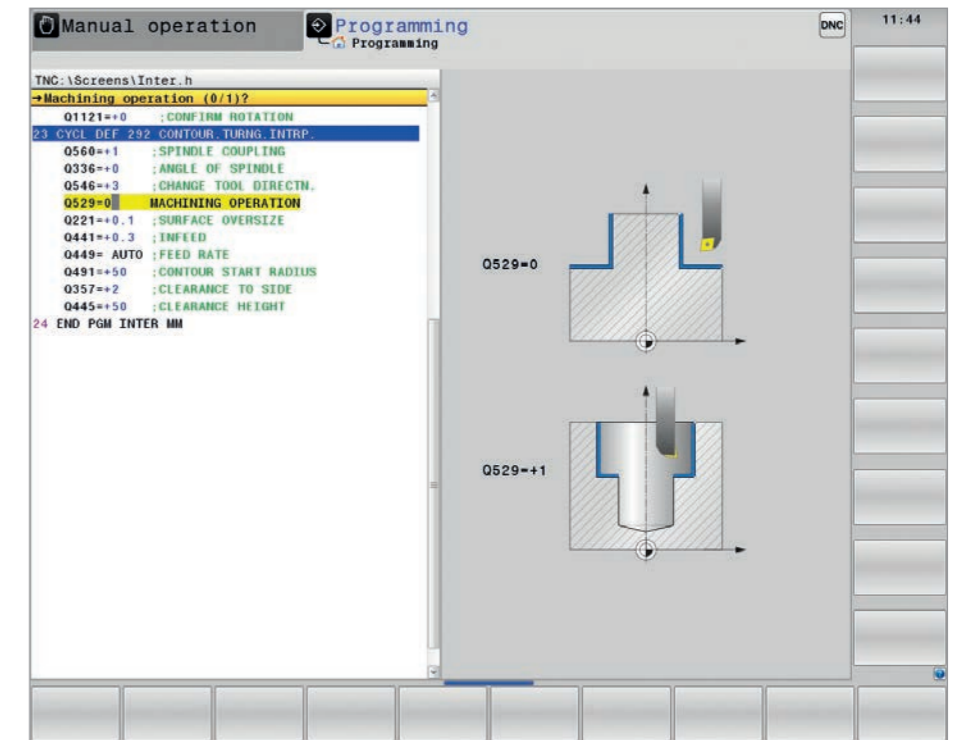
# Programming and operation

## Interpolating spindle: interpolation turning

In interpolation turning, the tool's cutting edge describes a circular motion, with the cutting edge always oriented either toward the center of the circle (outside machining) or away from the center (inside machining). By varying the circle radius and the axial position, any rotationally symmetric object can be produced in any working plane.

With the interpolation turning cycle, the TNC can create a rotationally symmetrical shoulder defined by its start and end point in the active working plane. The center of rotation is the starting point in the working plane when the cycle is called. The rotational surfaces can be inclined or rounded away from each other.

This cycle can be used only for finishing work and does not permit roughing operations with multiple passes. The machining strategy can be selected as needed: both inside machining and outside machining are possible. The TNC 640 also lets you machine any rotationally symmetrical contour (without undercuts).



|   |                          |              |
|---|--------------------------|--------------|
| <b>Extended Tool Management</b>   | Option 93                | ID 676938-01 |
| <b>TNC 640 HSCI</b>   | NC SW 34059x-01 or later |              |
| <b>TNC 620 HSCI</b>   | NC SW 81760x-03 or later |              |
| <b>TNC 320</b>  | NC SW 771851-02 or later |              |
| <b>Installation</b> by the machine manufacturer   |                          |              |
| <b>For more information</b> , see the TNC brochures, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> . |                          |              |

|  |                          |              |
|--|--------------------------|--------------|
| <b>Advanced Spindle Interpolation</b>  | Option 96                | ID 751653-01 |
| <b>TNC 640 HSCI</b>  | NC SW 34059x-05 or later |              |
| <b>TNC 620 HSCI</b>  | -                        |              |
| <b>TNC 320</b>   | -                        |              |
| <b>Installation</b> by the machine manufacturer  |                          |              |
| <b>For more information</b> , see the TNC 640 brochure, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> . |                          |              |



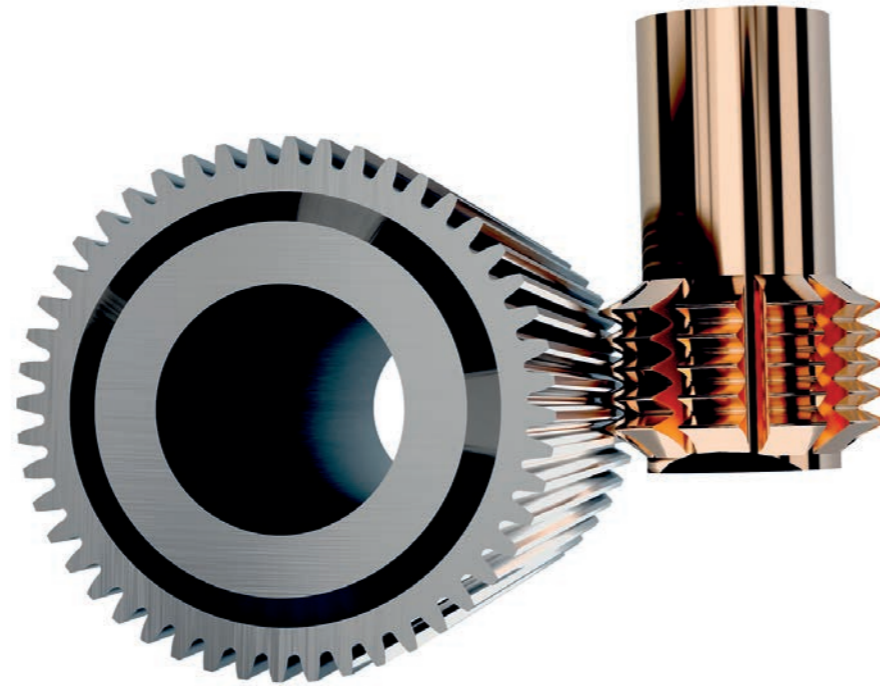
## Programming and operation

### Spindle synchronization

For certain machining operations, the rotations of the tool spindle must be synchronized with the movement of other axes. This is the case, for example, during the production of external gears via hobbing.

In connection with option 50 (Turning) and option 131 (Spindle Synchronism), the TNC 640 offers Cycle 880 GEAR HOBGING, which allows you to machine external cylindrical gears or helical gears at any angle. During hobbing, the rotation of the tool spindle and rotary table are synchronized while the gear hob moves axially along the workpiece. Cycle 880 automatically controls these complex movements and lets you easily enter all of the relevant values. You can utilize the tooth parameters straight out of your drawing, which the cycle then uses to calculate the required five-axis motion.

With NC SW 34059x-11 and later, tapping with one or more spindles is supported. The spindles can be coupled for this purpose. Tapping is performed with the master spindle. The coupled slave spindles follow the machining operation.



|  |                          |              |
|--|--------------------------|--------------|
| <b>Spindle Synchronism</b>                                     | Option 131               | ID 806270-01 |
| <b>TNC 640 HSCI</b>  | NC SW 34059x-05 or later |              |
| <b>TNC 620 HSCI</b>  | –                        |              |
| <b>TNC 320</b>   | –                        |              |
| <b>Installation</b> by the machine manufacturer                |                          |              |
| <b>For more information</b> , see the <i>TNC 640</i> brochure. |                          |              |

## Programming and operation

### Grinding and dressing functions

With the TNC 640, you can even perform grinding operations on your machine. Cycles for jig grinding and dressing make programming these functions easy. The TNC 640 can also superimpose a tool-axis reciprocating stroke onto the programmed movements. Optimized tool management supports the user during every process, including grinding and dressing. The TNC 640 is therefore the ideal basis for attaining exceptional surface quality and accuracy in your applications.

#### Jig grinding\*

Jig grinding is the grinding of a 2D contour. On a milling machine, jig grinding is primarily used for finishing holes or pre-machined contours using a grinding tool. The grinding contour can be programmed in the defined grinding cycles and then machined.

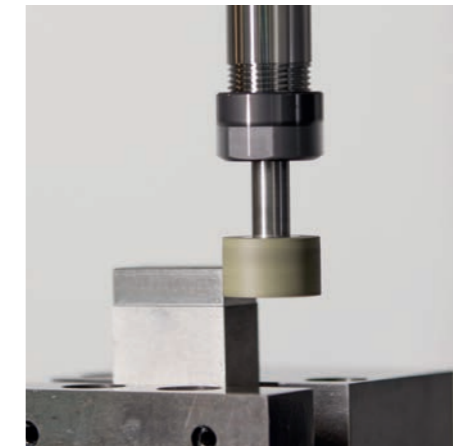
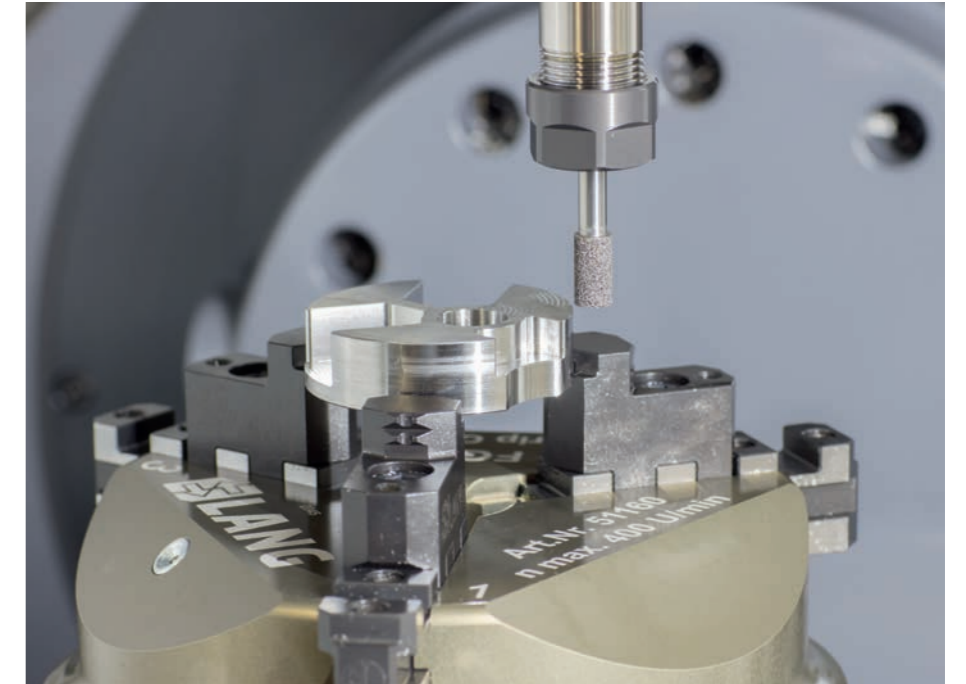
#### Grinding open and closed contours

You also have the option of superimposing a tool-axis reciprocating stroke onto the tool's motion. Special cycles allow you to define, start, and stop the reciprocating stroke. The reciprocating stroke enables uniform wear on the grinding tool and precise geometries on ground surfaces.

#### Dressing\*

Dressing cycles allow you "true up" grinding tools inside the machine. During dressing, the grinding tool is machined with a special dressing tool. Klartext cycles are available for dressing the grinding tool's diameter or profile.

\* The machine must be adapted for this function by the machine manufacturer.



|   |                          |               |
|---|--------------------------|---------------|
| <b>Grinding</b>   | Option 156               | ID 1237232-01 |
| <b>TNC 640 HSCI</b>   | NC SW 34059x-10 or later |               |
| <b>TNC 620 HSCI</b>   | –                        |               |
| <b>TNC 320</b>  | –                        |               |
| <b>Installation</b> by the machine manufacturer   |                          |               |
| <b>For more information</b> , see the <i>TNC 640</i> brochure, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> . |                          |               |



## Programming and operation

### Gear machining in a single setup

Because gears are typically manufactured on specialized machine tools, time-consuming rechucking is often required.

With the Gear Cutting function, however, you can completely machine spur and helical gears in a single setup using skiving or hobbing operations. If you wish to use the Gear Cutting option in turning mode, then option 50 will need to be enabled. The Gear Cutting function helps you program complex sequences by letting you define just the gear geometry and tool data. All other calculations are handled by the TNC 640, particularly those needed for the complex, synchronized movements. As a result, internal gear machining becomes an easily mastered standard process.

#### Skiving

Skiving owes its current success to its significantly higher efficiency and throughput compared with traditional gear shaping.

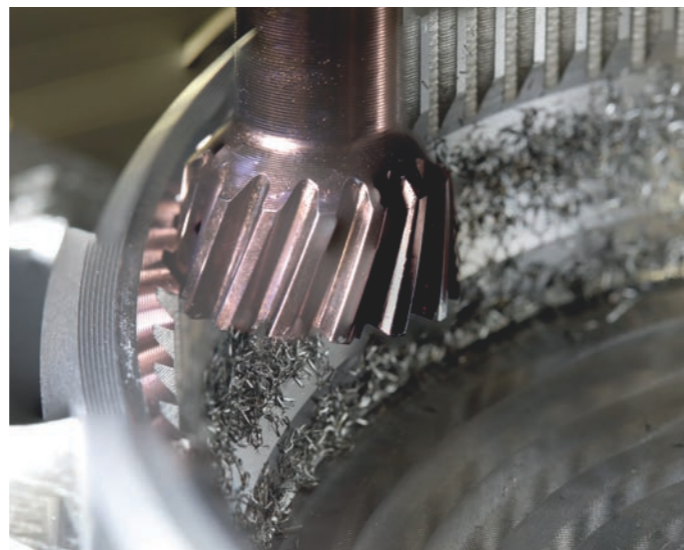
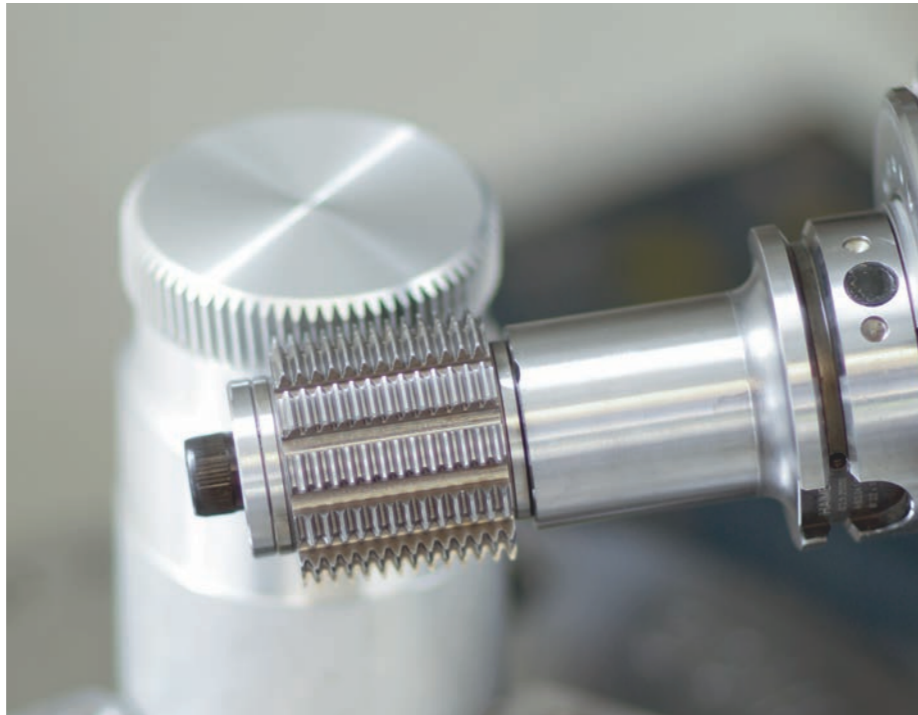
With skiving, external and internal gears can be produced on machines with synchronized spindles.

#### Hobbing

Hobbing is particularly well suited to external gear machining. Its benefits include high throughput and a wide variety of tooth shapes that can be produced with relatively easy-to-make tools.

#### Lift-off

This option not only makes programming easier but also provides better protection for your equipment. To prevent damage during unforeseen program interruptions (e.g., a power outage), its cycles support optimized lift-off capability. These cycles automatically define the tool direction and path for retraction from the workpiece.



|   |                          |               |
|---|--------------------------|---------------|
| <b>Gear Cutting</b>   | Option 157               | ID 1237235-01 |
| <b>TNC 640 HSCI</b>   | NC SW 34059x-09 or later |               |
| <b>TNC 620 HSCI</b>   | —                        |               |
| <b>TNC 320</b>  | —                        |               |
| <b>Installation</b> by the machine manufacturer   |                          |               |
| <b>For more information</b> , see the <i>TNC 640</i> brochure, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> . |                          |               |

## Machine accuracy

### KinematicsOpt: easy calibration of rotary axes

Accuracy requirements are becoming increasingly stringent, particularly when it comes to five-axis machining. Complex parts are expected to be machined to exact specifications with reproducible accuracy over extended periods.

The TNC **KinematicsOpt** function is a key ingredient in helping you meet these high demands. First, a probing cycle automatically measures your machine's rotary axes with a HEIDENHAIN touch probe. The measuring process is the same, regardless of whether the rotary axis is a rotary table, tilting table, or a swivel head.

For calibrating the rotary axes, a calibration sphere is mounted at any position on the machine table and probed with the HEIDENHAIN touch probe. Prior to probing, you can set the resolution and define a different measuring range for each rotary axis.

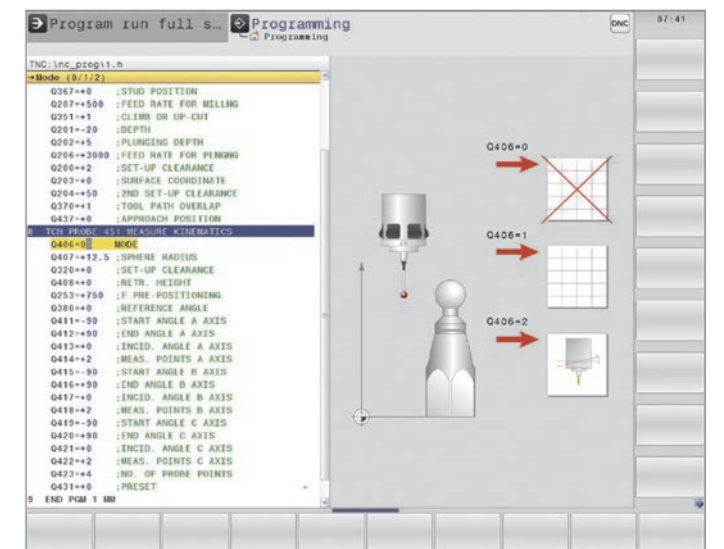
Based on the measured values, the TNC determines the spatial errors that arise from axis tilting. The cycle then calculates an optimized kinematic machine description that minimizes these errors and saves it as the machine's kinematic model.

Of course, a detailed log file is also available containing the actual measured values, the measured and optimized dispersion (for the static tilting accuracy), and the actual compensation values.

Optimal use of KinematicsOpt requires a highly rigid calibration sphere for reducing the deformations caused by probing forces. For this purpose, HEIDENHAIN offers calibration spheres with highly rigid holders of various lengths.

**Calibration spheres** are available as accessories:

KKH 80 Height: 80 mm ID 655475-03  
KKH 250 Height: 250 mm ID 655475-01



|   |  |              |
|---|--|--------------|
| <b>KinematicsOpt</b>  | Option 48                                    | ID 630916-01 |
| <b>TNC 640 HSCI</b>   | NC SW 34059x-01 or later                     |              |
| <b>TNC 620 HSCI</b>   | NC SW 34056x-03/73498x-01/81760x-01 or later |              |
| <b>TNC 320</b>  | —  |              |
| <b>Installation</b> by the machine manufacturer   |  |              |
| <b>For more information</b> , see the TNC brochures, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> . |  |              |

## Machine accuracy

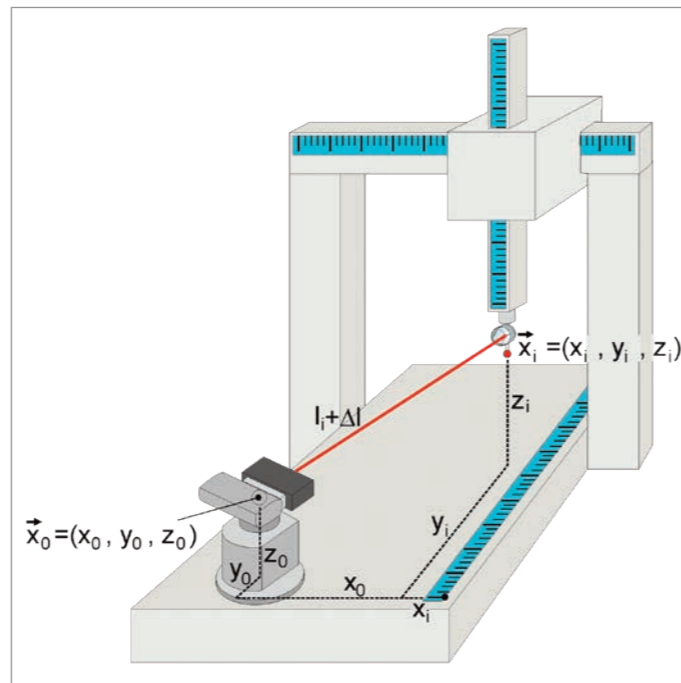
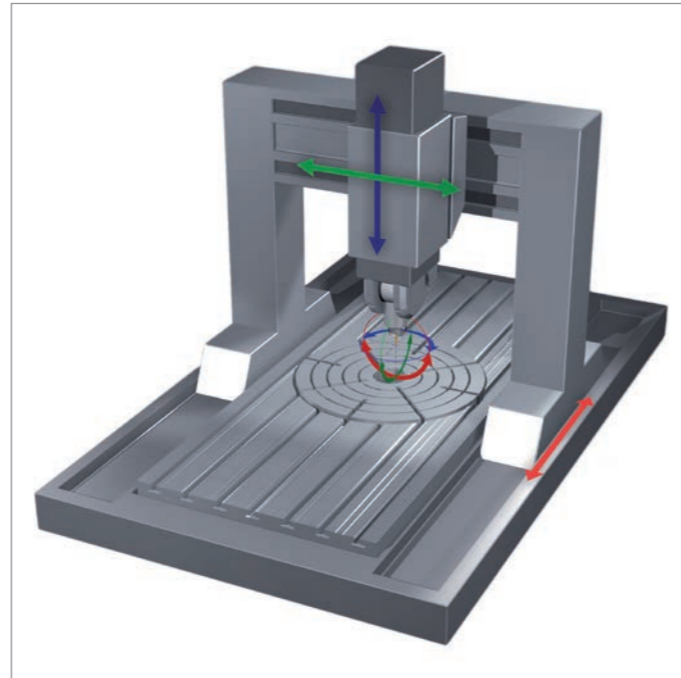
### KinematicsComp: 3D spatial compensation

Tight workpiece tolerances require high machine accuracy. However, machine tools inevitably exhibit installation- or production-related errors.

The more axes a machine has, the more sources of error there are. The ISO 230-1 standard, for example, lists eight relevant types of error for a linear axis (six component errors and two relevant position errors) and eleven for a rotary axis (six component errors and five relevant position errors). Counteracting such errors at the mechanical level requires extraordinary design effort. Moreover, these errors are particularly noticeable on five-axis machines and very large machines. What should also not be neglected is thermal expansion, which can cause highly complex changes in the geometry of machine components.

The **KinematicsComp** function gives the machine manufacturer a way to significantly improve his machine's accuracy. The TNC's standard kinematic model describes the machine's degrees of freedom and the rotational centers of its rotary axes. The enhanced kinematics description of KinematicsComp, however, includes the option of importing compensation tables capable of describing most of a machine's geometric errors. These errors are then compensated for, allowing the tool center point (TCP) to exactly follow the ideal nominal contour. Even thermally induced errors can be compensated for after being detected by sensors and the PLC. The spatial errors of the tool center point, for example, can be measured with a laser tracer or laser interferometer and converted into compensation tables.

The KinematicsComp option is not available in export versions.



Ascertaining geometric error with a laser coordinate measuring device (source: PTB Notification 117)

|  |                          |              |
|--|--------------------------|--------------|
| <b>KinematicsComp</b>  | Option 52                | ID 661879-01 |
| <b>TNC 640 HSCI</b>  | NC SW 34059x-05 or later |              |
| <b>TNC 620 HSCI</b>  | –                        |              |
| <b>TNC 320</b>   | –                        |              |
| <b>Installation</b> by the machine manufacturer  |                          |              |
| <b>For more information</b> , visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> , and see the <i>Information for the Machine Tool Builder</i> brochure. |                          |              |

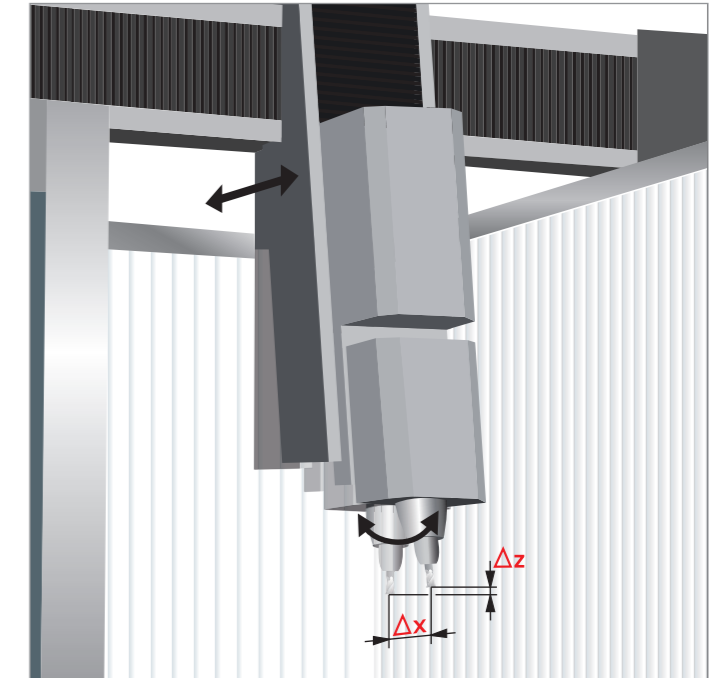
## Machine accuracy

### CTC: compensation of position errors due to axis couplings

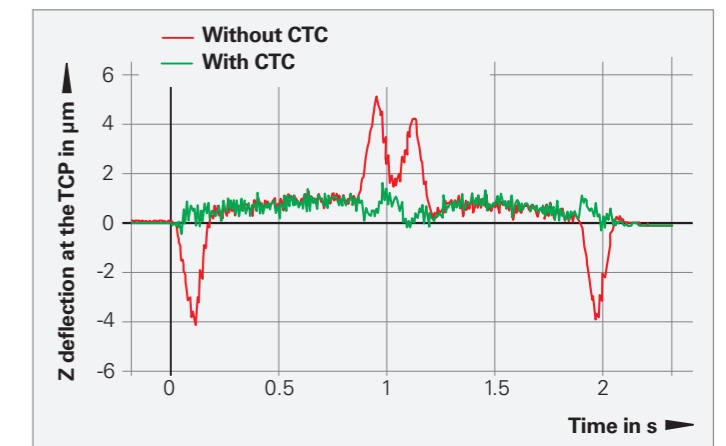
During dynamic acceleration processes, a machine tool's structure undergoes forces capable of deforming machine components, resulting in errors at the tool center point (TCP). The dynamic acceleration of an axis causes not only axial deformations but also deformations that are lateral to the direction of acceleration (due to mechanical axis couplings). This is especially the case if the point of force application on an axis does not coincide with its center of gravity, thus potentially resulting in pitching motion during braking and acceleration phases. The resulting position error at the TCP in the direction of the accelerated axis and lateral axes is proportional to the amount of acceleration.

If the dynamic position error as a function of the axis acceleration is known from measurements at the TCP, then this acceleration-dependent error can be compensated for with the **CTC** (Cross Talk Compensation) servo-control option in order to prevent negative effects on the surface quality and accuracy of the workpiece.

A grid encoder (KGM) in the plane defined by two mechanically coupled axes can be used to measure the acceleration-dependent position error of these axes. The resulting error at the TCP often depends not only on the acceleration but also on the position of the axes in the working space. The CTC servo-control option can take this into account as well.



Deflection at the TCP in the Z axis during movement in the X direction



Servo control optimized for Z = 0; following error within the tolerance band

|   |  |              |
|---|--|--------------|
| <b>Cross Talk Compensation</b>  | Option 141                                   | ID 800542-01 |
| <b>TNC 640 HSCI</b>   | NC SW 34059x-02 or later                     |              |
| <b>TNC 620 HSCI</b>   | NC SW 34056x-04/73498x-02/81760x-01 or later |              |
| <b>TNC 320</b>  | –  |              |
| <b>Installation</b> by the machine manufacturer   |  |              |
| <b>For more information</b> , see the <i>Dynamic Precision</i> Technical Information document, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> . |  |              |

dynamic + precision



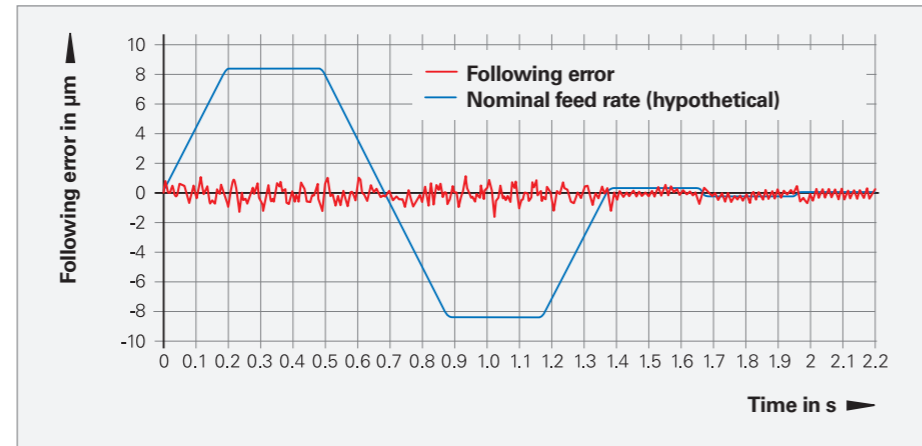
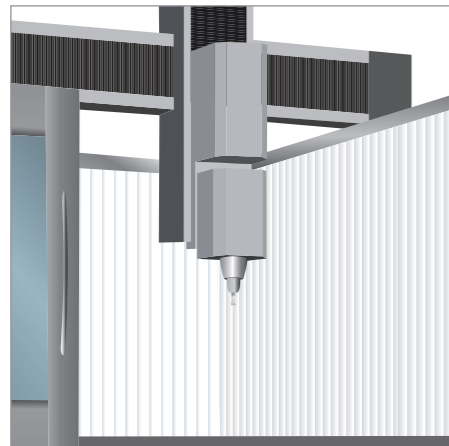
# Machine accuracy

## PAC: position-dependent adaptation of control parameters

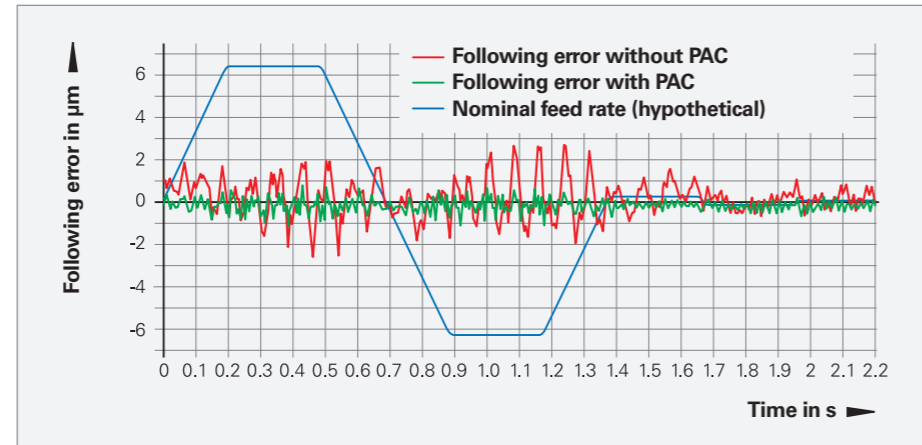
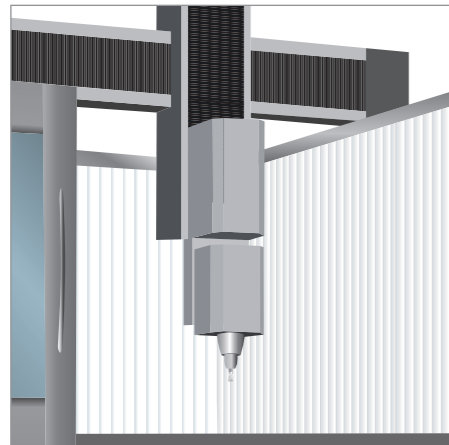
Depending on the positions of the axes in the working space, a machine's kinematics give rise to variable dynamic behavior that can adversely affect servo-control stability.

To fully exploit the machine's dynamic performance, you can use the **PAC** option (Position Adaptive Control) to modify machine parameters based on position.

This permits full use of the machine's dynamic performance, thus permitting assignment of the respective optimal loop gain to defined interpolation points. Additional position-dependent filter parameters can be defined in order to further increase control loop stability.



Servo control optimized for Z = 0; following error within the tolerance band ( $\pm 1 \mu\text{m}$ )



- Servo control at Z = -500
- Without PAC: clearly visible oscillations and following error ( $\pm 3 \mu\text{m}$ ) outside of the tolerance band
  - With active PAC: following error within the tolerance band ( $\pm 1 \mu\text{m}$ )



|   |  |              |
|---|--|--------------|
| <b>Position adaptive control</b>  | Option 142                                   | ID 800544-01 |
| TNC 640 HSCI  | NC SW 34059x-02 or later                     |              |
| TNC 620 HSCI  | NC SW 34056x-04/73498x-02/81760x-01 or later |              |
| TNC 320   | -  |              |
| <b>Installation</b> by the machine manufacturer   |  |              |
| <b>For more information</b> , see the <i>Dynamic Precision</i> Technical Information document, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> . |  |              |

# Machine accuracy

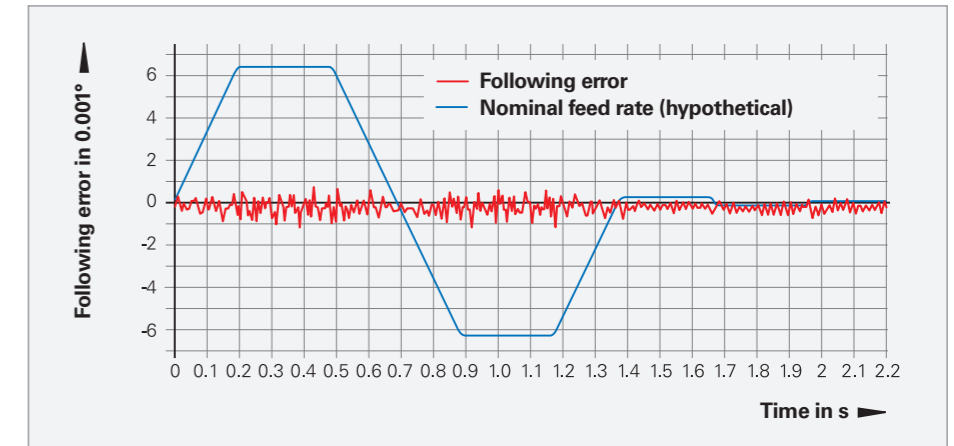
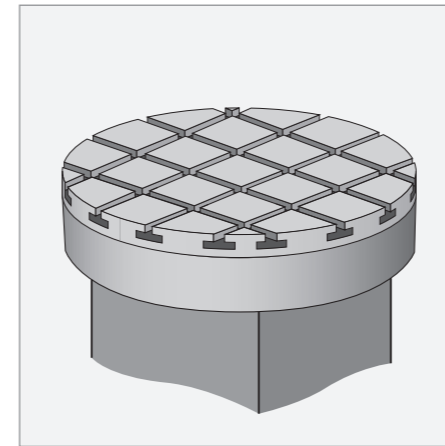
## LAC: load-dependent adaptation of control parameters

The dynamic behavior of machines with moving tables can vary depending on the mass or mass moment of inertia of the clamped workpiece.

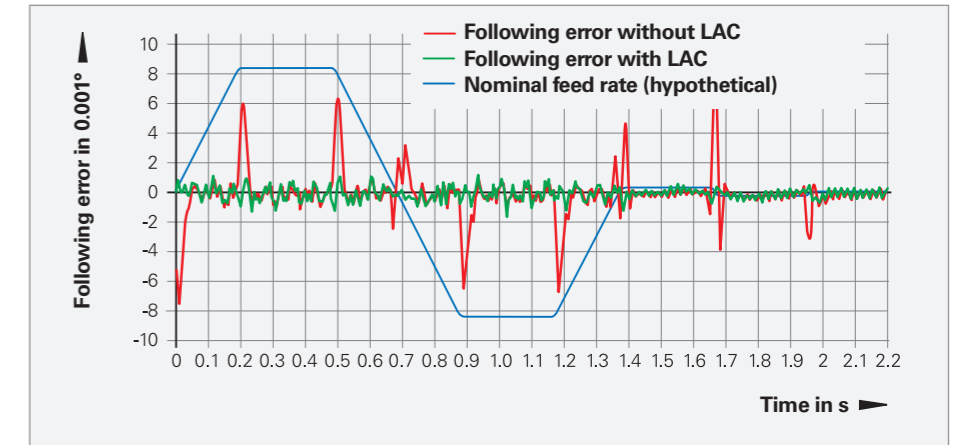
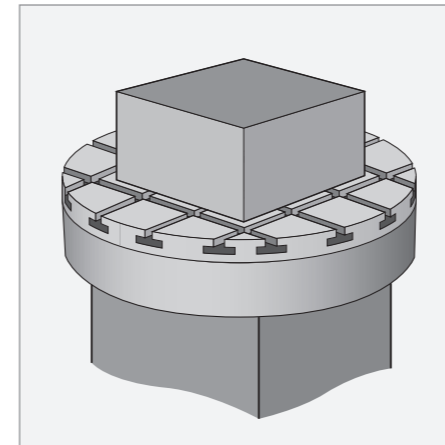
The **LAC** option (Load Adaptive Control) enables the control to automatically ascertain the current workpiece mass or mass moment of inertia and the acting frictional forces. In order to ensure an optimum response to changes in machine behavior at different loads, adaptive feedforward controls can be activated,

and the control loop gain can be changed based on the load. During machining, the control can also continuously adjust the parameters of the feedforward control to the current mass of the workpiece.

In order to allow rapid adjustment in response to sudden changes in the load (e.g., from loading and unloading the workpiece), the TNC 620 and the TNC 640 provide Cycle 239 for ascertaining the current load status.



Optimal feedforward control for rotary tables without additional load and with following error within the tolerance band ( $\pm 0.001^\circ$ )



- With change in load
- Without LAC: with unchanged feedforward control, the following error ( $\pm 0.008^\circ$ ) is outside of the tolerance band
  - With LAC: with feed-forward control and active LAC, the following error is within the tolerance band ( $\pm 0.001^\circ$ )



|   |  |              |
|---|--|--------------|
| <b>Load adaptive control</b>  | Option 143                                   | ID 800545-01 |
| TNC 640 HSCI  | NC SW 34059x-02 or later                     |              |
| TNC 620 HSCI  | NC SW 34056x-04/73498x-02/81760x-01 or later |              |
| TNC 320   | -  |              |
| <b>Installation</b> by the machine manufacturer   |  |              |
| <b>For more information</b> , see the <i>Dynamic Precision</i> Technical Information document, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> . |  |              |

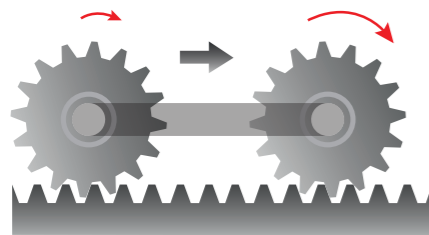
## Machine accuracy

### MAC: motion-dependent adaptation of control parameters

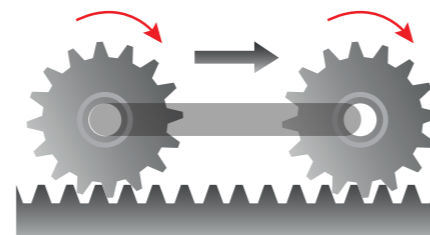
In addition to the position-dependent adaptation of control parameters through the PAC option, the **MAC** option (Motion Adaptive Control) provides a way of changing machine parameters based on other input quantities such as speed, following error, or motor acceleration. This motion-dependent adaptation of the control parameters makes it possible, for example, to implement speed-dependent adaptation of the  $k_v$  factor for drive systems exhibiting stability changes at different traversing speeds.

A further application is the acceleration-dependent change of the tensioning torque between the master and slave axes for master-slave torque control.

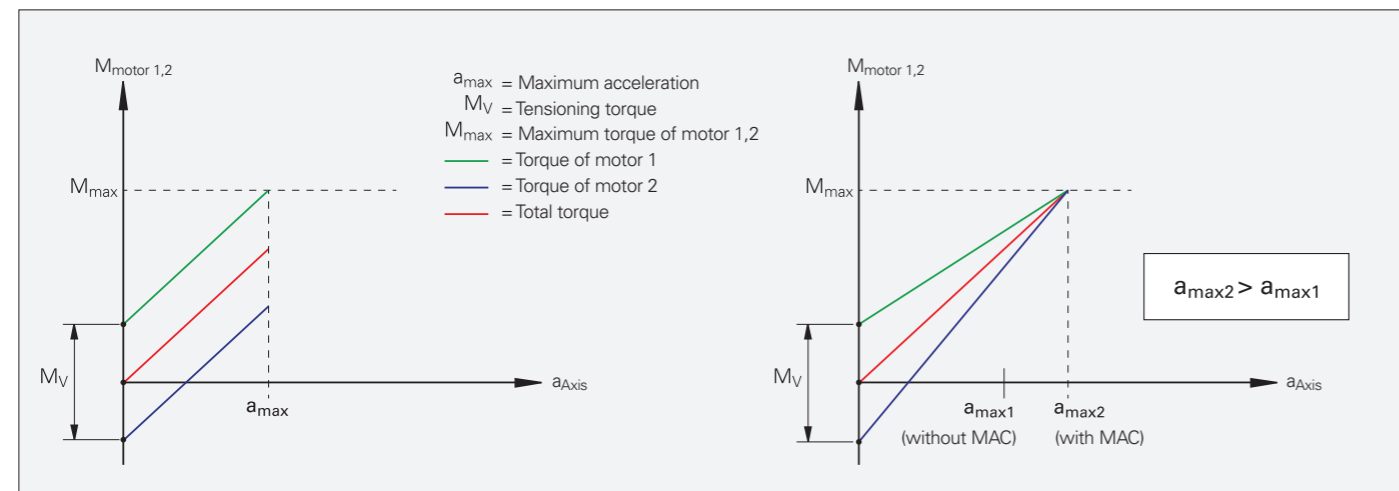
With the MAC option, this configuration makes it possible to attain a significantly higher maximum acceleration at rapid traverse; for example, through parameter-based reduction of the tensioning torque at increasing acceleration.



Without MAC



With MAC



dynamic + precision

|   |  |              |
|---|--|--------------|
| <b>Motion adaptive control</b>  | Option 144                                   | ID 800546-01 |
| <b>TNC 640 HSCI</b>   | NC SW 34059x-02 or later                     |              |
| <b>TNC 620 HSCI</b>   | NC SW 34056x-04/73498x-02/81760x-01 or later |              |
| <b>TNC 320</b>  | —  |              |
| <b>Installation</b> by the machine manufacturer   |  |              |
| <b>For more information</b> , see the <i>Dynamic Precision</i> Technical Information document, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> . |  |              |

## Machine accuracy

### MVC: active vibration damping

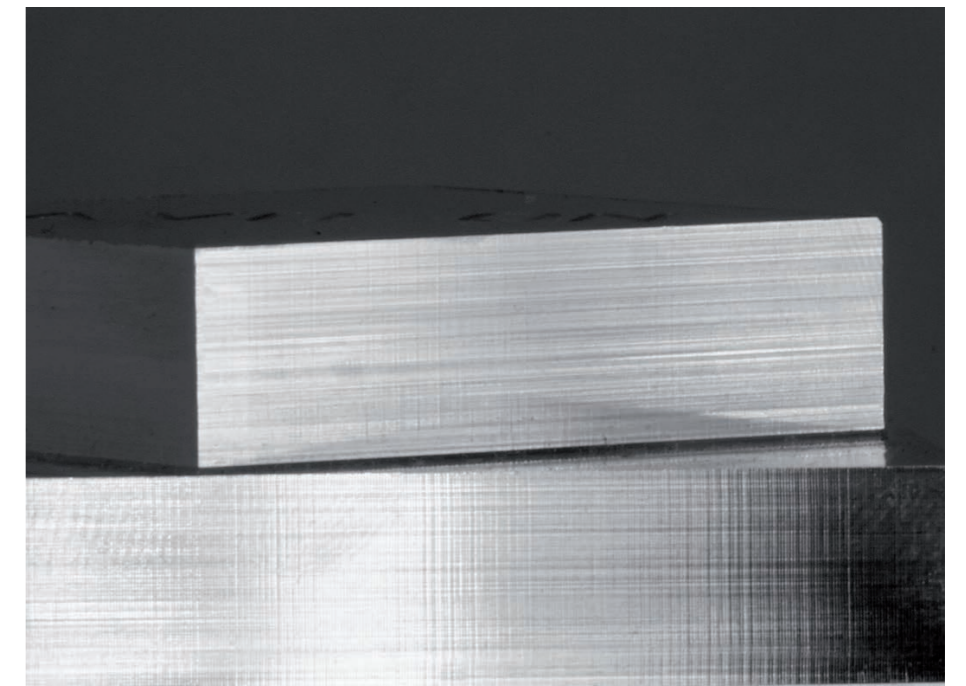
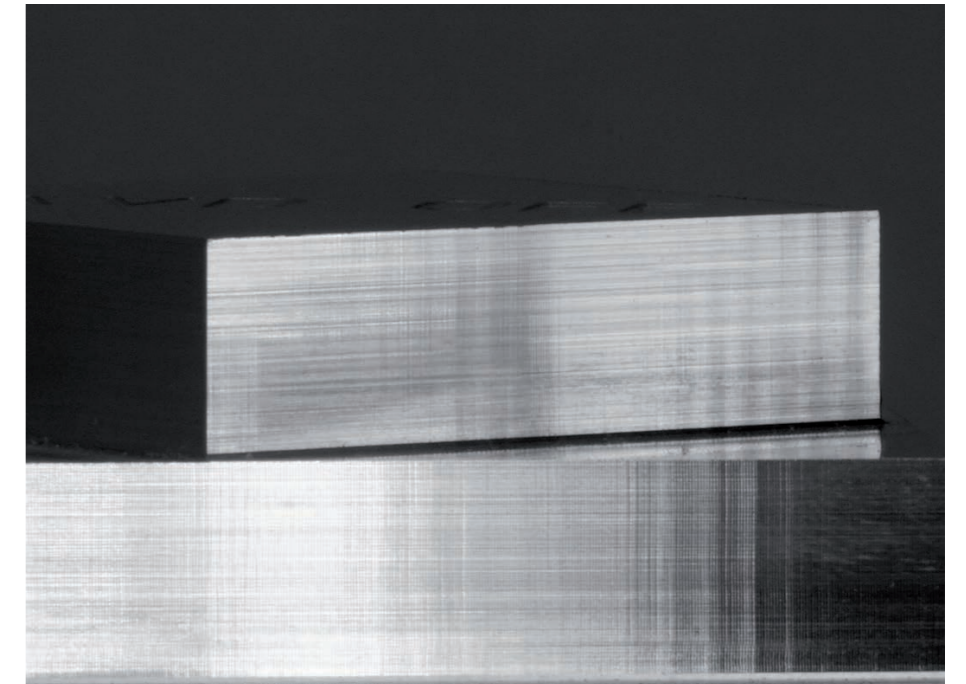
In the presence of low-frequency vibrations on a machine tool, inclined or curved surfaces can often exhibit surface-finish problems in the form of visible shadows or inconsistent contrast. Peaks as small as  $1 \mu\text{m}$  or smaller may be visually noticeable on a workpiece. These disturbances often necessitate surface rework, which comes with additional cost.

Low-frequency disturbances are often caused by elasticity in the drive train, such as vibrations between the motor and the slides, or machine setup vibrations, in which high accelerations of the machine axes cause disturbances in the machine tool through its fastening elements or connected base.

Excitations due to high accelerations can be lowered by reducing the jerk, but this results in longer machining times.

The Machine Vibration Control (MVC) option suppresses low-frequency vibrations via the control loop of the control. To this end, the Active Vibration Damping (AVD) and Frequency Shaping Control (FSC) functions are available with this option. MVC works in two ways: it causes a clean workpiece surface because any vibrations that would be visible on the workpiece surface are suppressed. MVC also enables fast and low-vibration milling.

MVC thus increases the productivity of a machine tool and/or improves the surface quality of workpieces.



dynamic + precision

|   |  |              |
|---|--|--------------|
| <b>Machine Vibration Control</b>  | Option 146                                   | ID 800548-01 |
| <b>TNC 640 HSCI</b>   | NC SW 34059x-04 or later                     |              |
| <b>TNC 620 HSCI</b>   | NC SW 34056x-04/73498x-02/81760x-01 or later |              |
| <b>TNC 320</b>  | —  |              |
| <b>Installation</b> by the machine manufacturer   |  |              |
| <b>For more information</b> , see the <i>Dynamic Precision</i> Technical Information document, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> . |  |              |



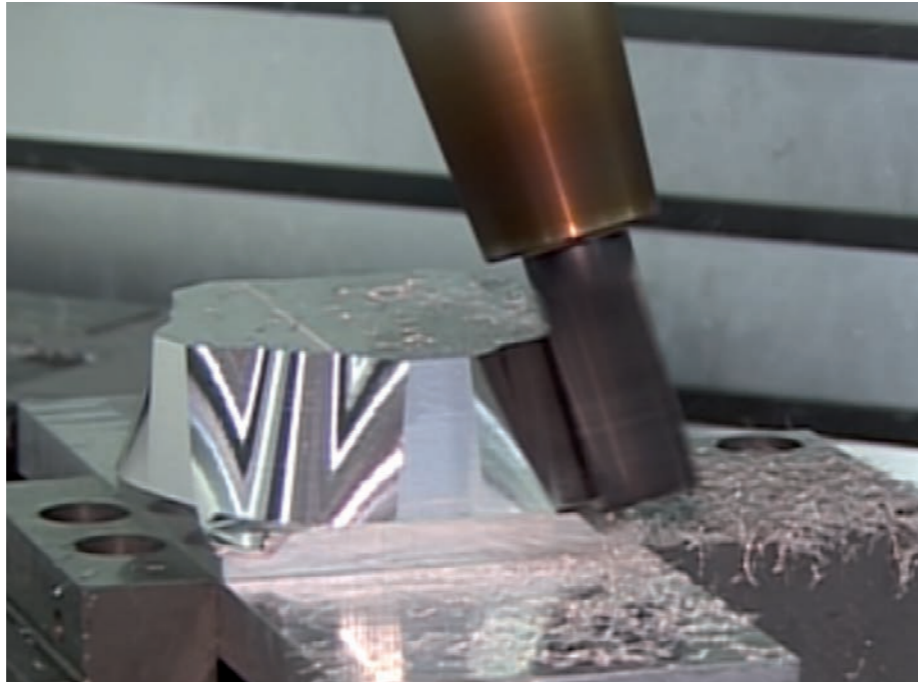
## Machining functions

### 5-axis simultaneous machining

The TNC provides many powerful functions specifically developed for five-axis simultaneous machining.

The NC programs for five-axis simultaneous machining are created with CAM systems in conjunction with postprocessors. In principle, such programs contain either all of the coordinates of the machine's existing NC axes or NC blocks with surface normal vectors. During five-axis machining with three linear axes and two additional tilting axes, the tool is always perpendicular to the workpiece surface or is tilted at a specific angle relative to it (inclined tool machining).

Regardless of the type of five-axis programs you wish to run, the TNC performs all of the necessary compensating movements in the linear axes arising from movements in the tilting axes. The TNC's tool center point management feature (TCPM)—an improvement on the proven TNC function M128—provides optimal tool guidance and prevents contour gouging.

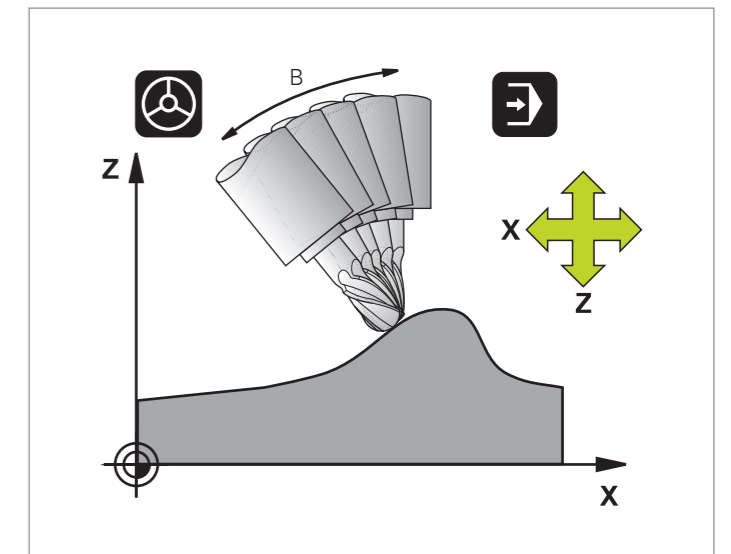


|  |  |              |
|--|--|--------------|
| <b>Advanced Function Set 2</b>                       | Option 9                                     | ID 617921-01 |
| <b>TNC 640 HSCI</b>                                  | NC SW 34059x-01 or later                     |              |
| <b>TNC 620 HSCI</b>                                  | NC SW 34056x-01/73498x-01/81760x-01 or later |              |
| <b>TNC 320</b>                                       | —  |              |
| <b>Installation</b> by the machine manufacturer      |  |              |
| <b>For more information</b> , see the TNC brochures. |  |              |

## Machining functions

### Handwheel superimpositioning: superimpose handwheel positioning during program run

The **Handwheel Superimpositioning** function (M118) enables you to make manual corrections with the handwheel during program run. This is particularly helpful when you wish to change the inclination angles of rotary axes: in externally written NC programs such changes often cause collisions between the tilting head and the workpiece. You can also use handwheel superimpositioning to adjust the offset compensation in linear axes without having to change the NC program.



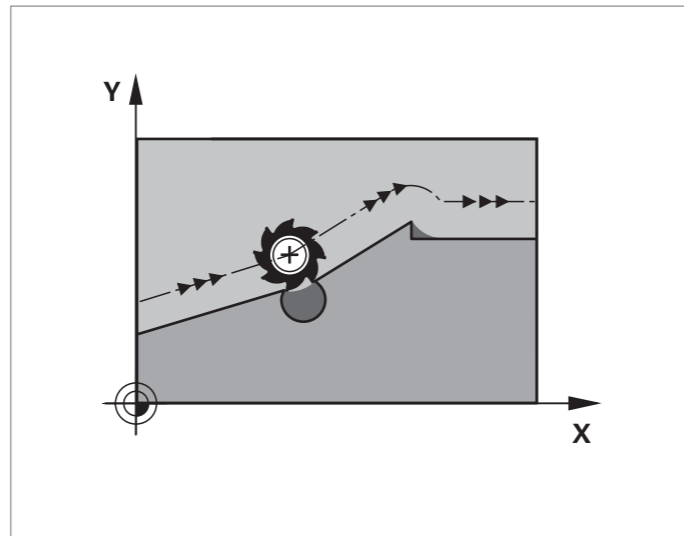
|  |  |              |
|--|--|--------------|
| <b>Advanced Function Set 3</b>                       | Option 21                                    | ID 628254-01 |
| <b>TNC 640 HSCI</b>                                  | Standard function                            |              |
| <b>TNC 620 HSCI</b>                                  | NC SW 34056x-01/73498x-01/81760x-01 or later |              |
| <b>TNC 320</b>                                       | Standard function                            |              |
| <b>Installation</b> by the machine manufacturer      |  |              |
| <b>For more information</b> , see the TNC brochures. |  |              |



## Machining functions

### Tool compensation: radius-compensated contour precalculation (LOOK AHEAD)

The LOOK AHEAD function in the TNC's geometry processing system monitors radius-compensated contours for undercuts and intersections, and calculates the tool path in advance starting from the current block. Sections of the contour that would be damaged by the tool are simply not machined (dark areas in the figure) and can be reworked with a smaller tool at a later time. You can also use this function to add tool radius compensation to NC programs created with an external programming system and output as an uncompensated contour. Consequently, inaccuracies in the NC programs arising from calculations in the CAM system can be compensated for.



|  |  |              |
|--|--|--------------|
| <b>Advanced Function Set 3</b>                       | Option 21                                    | ID 628254-01 |
| <b>TNC 640 HSCI</b>                                  | Standard function                            |              |
| <b>TNC 620 HSCI</b>                                  | NC SW 34056x-01/73498x-01/81760x-01 or later |              |
| <b>TNC 320</b>                                       | Standard function                            |              |
| <b>Installation</b> by the machine manufacturer      |  |              |
| <b>For more information</b> , see the TNC brochures. |  |              |

## Machining functions

### Dynamic Collision Monitoring (DCM)

The complex machine movements and normally high traversing speeds of five-axis machining make axis movements difficult to predict. Collision monitoring is thus a valuable function that makes things easier for the machine operator and protects the machine from damage.

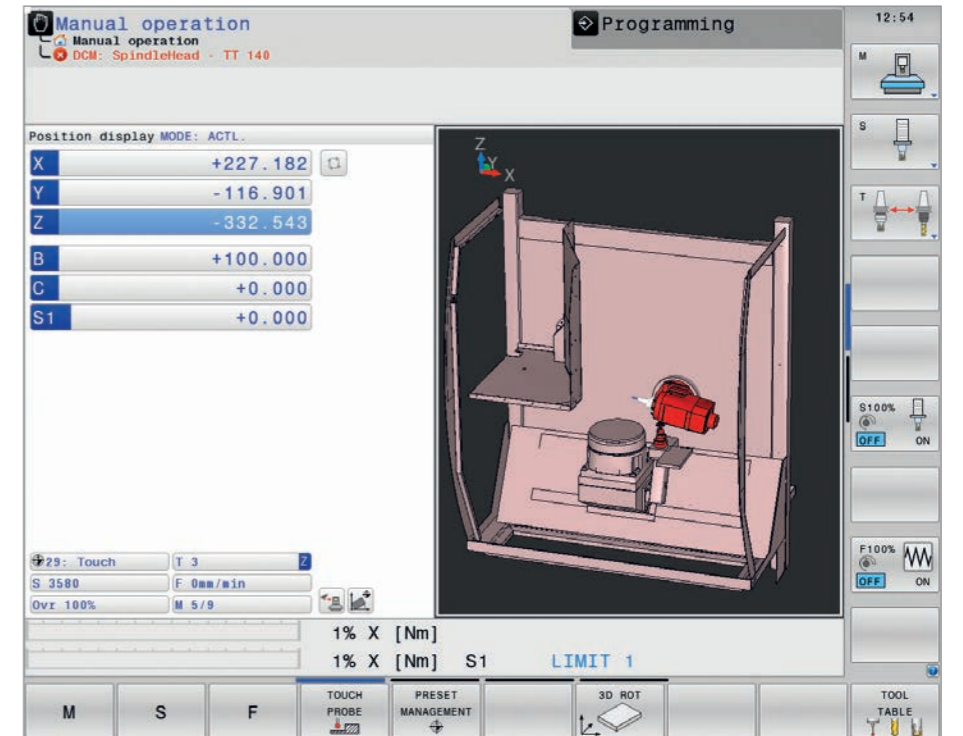
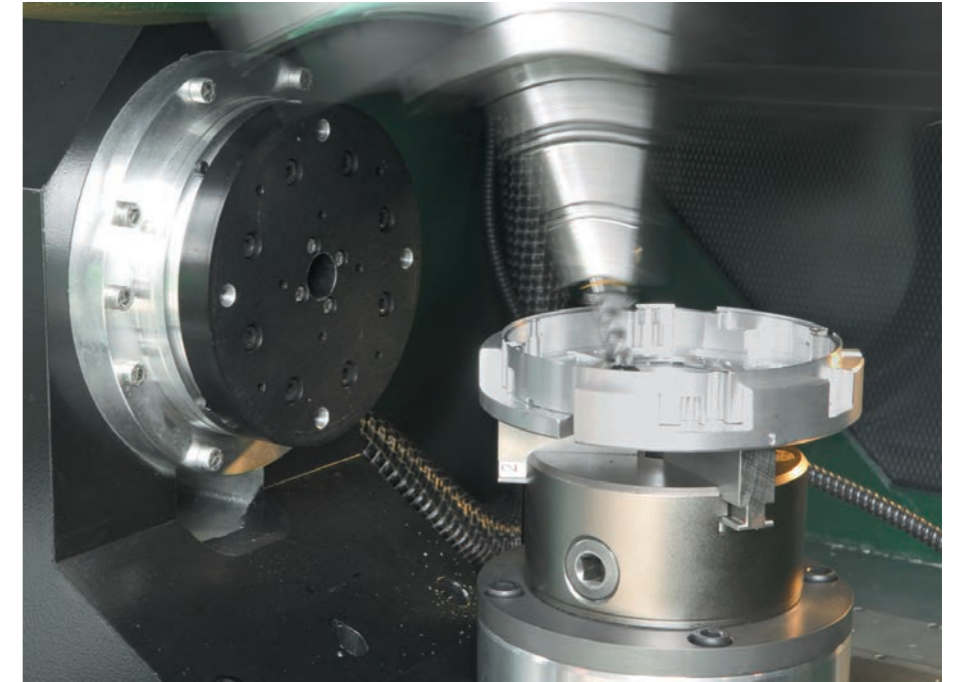
In these cases, the machine operator is supported by the TNC's **Dynamic Collision Monitoring (DCM)** option. The control interrupts the machining process whenever a collision is imminent, thereby improving safety for both the machine and its operator. Machine damage and the resulting costly downtime can thus be prevented. Unattended shifts also become more reliable.

The DCM option works not only in **automatic mode** but is also active in **manual mode**. If, for example, the machine operator is on a collision course during setup, the TNC detects this, stops axis movement, and issues an error message. Before actually machining a part, you can also check for collisions in the Test Run mode, with a real preset and real tools.

Of course, the TNC also shows the machine operator which machine components are at risk, both by means of an error message and graphically. If a collision warning occurs, the TNC permits tool retraction only in directions that will increase the clearance between the colliding objects.

With NC software 34059x-05 or later, the TNC 640 also offers a convenient way to import collision objects from standard CAD models (e.g., STL) into the control as M3D data. This permits highly detailed modelling of the machine components and better utilization of the machine's working space.

With NC SW 34059x-11 or later, clamping setups can be incorporated in \*.cfg, \*.m3d, or \*.stl formats, including via Klartext commands.



|  |                          |              |
|--|--------------------------|--------------|
| <b>DCM Collision</b>   | Option 40                | ID 526452-01 |
| <b>TNC 640 HSCI</b>  | NC SW 34059x-02 or later |              |
| <b>TNC 620 HSCI</b>  | -                        |              |
| <b>TNC 320</b>   | -                        |              |
| <b>Installation</b> by the machine manufacturer  |                          |              |
| <b>For more information</b> , see the TNC 640 brochure, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> . |                          |              |



# Machining functions

## Global Program Settings

The Global Program Settings option is especially used in large-scale moldmaking and is available in Program Run and MDI modes. This option lets you define global and overriding coordinate transformations and settings for the NC program without actually changing the NC program.

You can change the Global Program Settings during a program stop, even mid-program. A clearly structured form is provided for this. Upon starting, the TNC then moves as needed to a new position in accordance with a positioning logic that you can define.

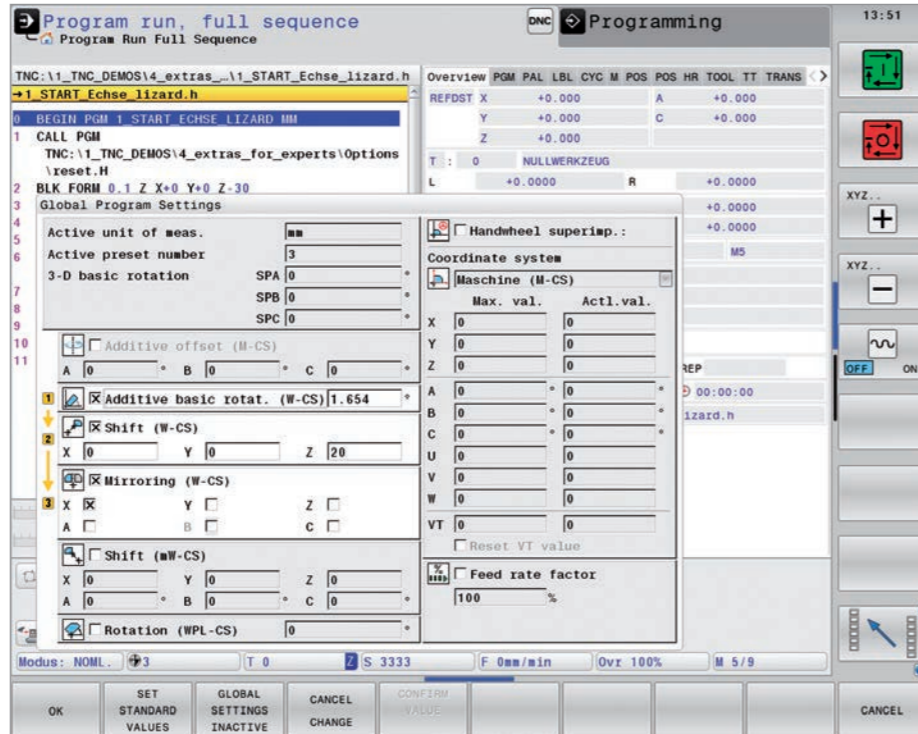
The following functions are available:

- Additional, additive datum shift
- Superimposed mirroring
- Handwheel superimpositioning with axis-specific memory of paths covered via the handwheel, including in a virtual axis direction
- Superimposed basic rotation
- Superimposed rotation
- Globally valid feed-rate factor
- Mirroring of axes

Handwheel superimpositioning is possible in various coordinate systems:

- Machine coordinate system
- Workpiece coordinate system (the active basic rotation is taken into account)
- Tilted coordinate system

You can select the desired coordinate system in a clearly structured form.



|  |                          |              |
|--|--------------------------|--------------|
| <b>Global PGM Settings</b>                                     | Option 44                | ID 576057-01 |
| TNC 640 HSCI   | NC SW 34059x-08 or later |              |
| TNC 620 HSCI   | -                        |              |
| TNC 320  | -                        |              |
| <b>Installation</b> by the machine manufacturer                |                          |              |
| <b>For more information</b> , see the <i>TNC 640</i> brochure. |                          |              |

# Machining functions

## Adaptive Feed Control (AFC)

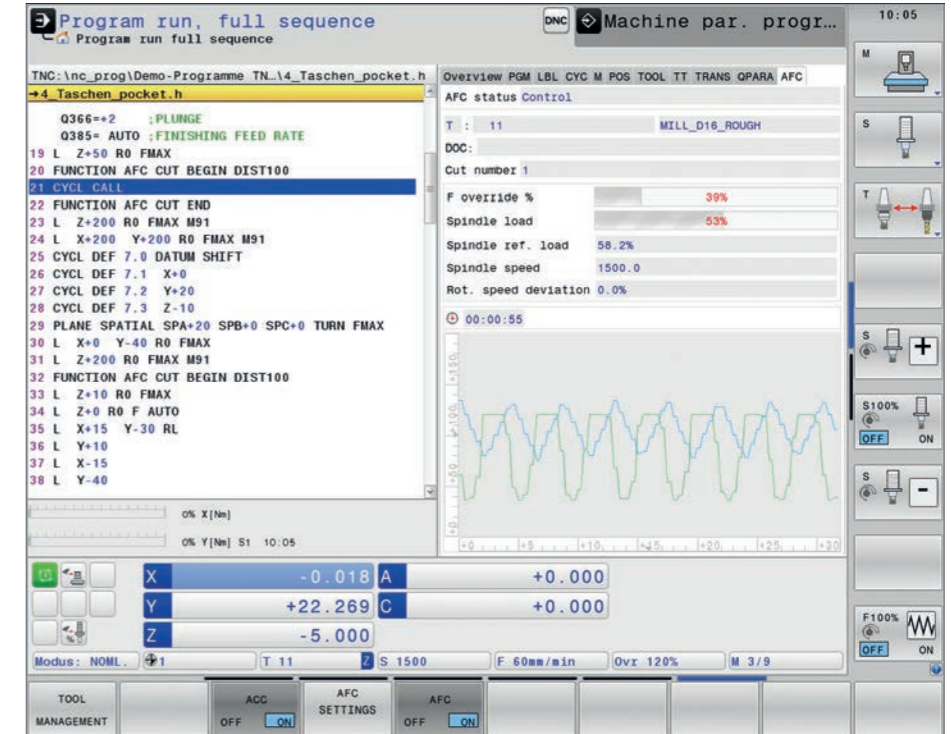
**Adaptive Feed Control (AFC)** automatically regulates the feed rate of the TNC based on the present spindle power and other process data. During a teach-in cut, the TNC records the maximum occurring spindle power. Prior to machining, you define the limits (in a table) within which the TNC is allowed to influence the feed rate in "control" mode. Naturally, various overload reactions can be specified as well, including by your machine manufacturer.

The TNC's Adaptive Feed Control option offers a series of benefits:

**Optimization of the machining time**  
Particularly in the case of cast parts, oversizes and material irregularities (cavities) can occur to varying degrees. By controlling the feed rate, the control strives to stay within the bounds of the previously "learned" maximum spindle power throughout the entire machining time. Increasing the feed rate in areas requiring less material removal shortens the overall machining time.

**Tool monitoring**  
The Adaptive Feed Control option continuously compares the spindle power with the feed rate. As a tool becomes blunt, the spindle power increases, causing the TNC to reduce the feed rate. As soon as the feed rate falls below a specified minimum, the TNC reacts with an NC stop or warning, or automatically replaces the tool. This prevents secondary damage after tool breakage or wear.

**Protecting machine components**  
When the feed rate is reduced in response to the exceeded maximum spindle power, machine components undergo less strain. This protects the main spindle from overloading.



|  |                          |              |
|--|--------------------------|--------------|
| <b>Adaptive Feed Control (AFC)</b>   | Option 45                | ID 579648-01 |
| TNC 640 HSCI   | NC SW 34059x-02 or later |              |
| TNC 620 HSCI   | -                        |              |
| TNC 320  | -                        |              |
| <b>Installation</b> by the machine manufacturer  |                          |              |
| <b>For more information</b> , see the <i>Dynamic Efficiency</i> Technical Information document, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> . |                          |              |



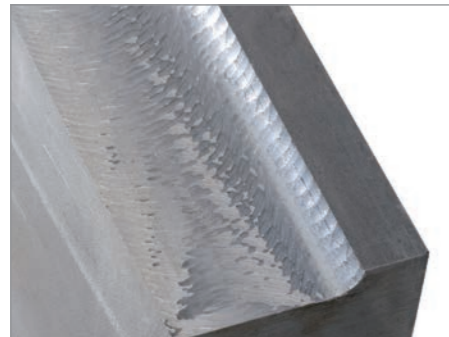


# Machining functions

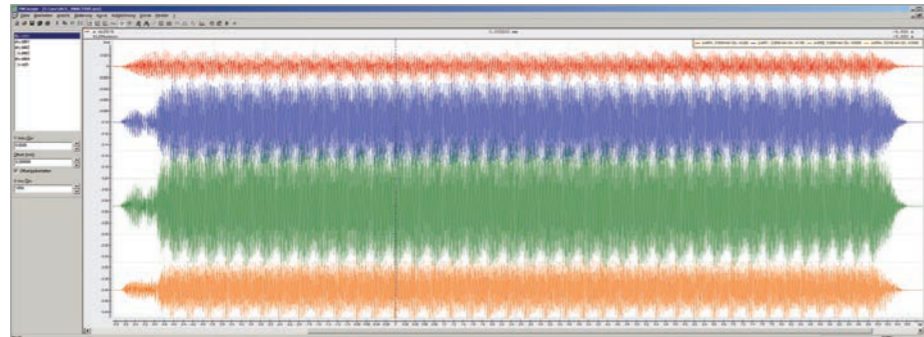
## Active Chatter Control (ACC)

Strong forces come into play during roughing (power milling). Depending on the rotational tool speed, the resonances in the machine tool, and the chip volume (metal-removal rate during milling), a phenomenon known as “chatter” may occur. Chatter induces heavy strain on the machine and causes ugly marks on the workpiece surface. It also increases the progress and irregularity of tool wear, even leading to tool breakage under extreme circumstances.

With **Active Chatter Control (ACC)**, HEIDENHAIN now provides an effective control function for reducing a machine’s tendency to chatter. This control function is particularly advantageous when used during heavy machining. Thanks to ACC, substantially higher removal rates are possible. Depending on the type of machine, the removal rate can be increased by up to 25 percent or more. At the same time, you are reducing strain on the machine and increasing tool life.



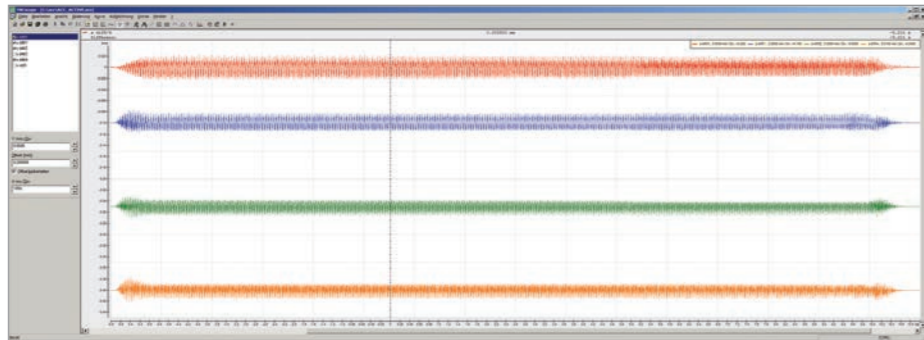
Heavy machining without ACC



Following error without ACC



Heavy machining with ACC



Reduced following error with ACC

**dynamic** + **efficiency**

|  |  |              |
|--|--|--------------|
| <b>Active Chatter Control</b>  | Option 145                                   | ID 800547-01 |
| TNC 640 HSCI   | NC SW 34059x-02 or later                     |              |
| TNC 620 HSCI   | NC SW 34056x-04/73498x-02/81760x-01 or later |              |
| TNC 320  | –  |              |
| <b>Installation</b> by the machine manufacturer  |  |              |
| <b>For more information</b> , see the <i>Dynamic Efficiency</i> Technical Information document, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> . |  |              |

# Machining functions

## Optimized Contour Milling (OCM)

Efficient machining strategies are a key basis for economical NC manufacturing. Roughing processes, in particular, offer great potential for optimization because they usually make up a sizeable portion of the total machining time.

Process reliability and maximum removal rates require optimal adaptation of the cutting data to the characteristics of the tool and workpiece material. For this purpose, **Optimized Contour Milling (OCM)** provides a cutting data calculator that draws on an extensive integrated material database. The user can adapt the automatically calculated cutting values with regard to the mechanical and thermal load on the tool. Tool service life can be managed with process reliability even at the highest possible removal rates.

With OCM, you can rough out any pocket and island with high process reliability and lower tool wear thanks to highly consistent process conditions. You simply program the contour as usual directly in Klartext or make use of the convenient CAD Import function. The control then automatically calculates the complex movements required for maintaining consistent process conditions.

**Advantages of OCM over conventional machining:**

- Reduced thermal load on the tool
- Superior chip removal
- Consistent tool contact conditions
  - Higher cutting parameters
  - Higher material removal rates

**OCM is an effective, reliable, and convenient way to improve your throughput:**

- Create programs on the shop floor for any pocket or island
- Significantly higher machining speed
- Considerable reduction in tool wear
- More chips in less time

The OCM option provides practical cycles for roughing, side-wall finishing, and floor finishing.

**dynamic** + **efficiency**

With NC SW 34059x-11 (TNC 640) or later, or NC SW 81760x-07 (TNC 620) or later, OCM cycles for chamfering or deburring and standard figures are available as well. The cutting data can also be conveniently calculated for the given machining operation with the integrated cutting data calculator.

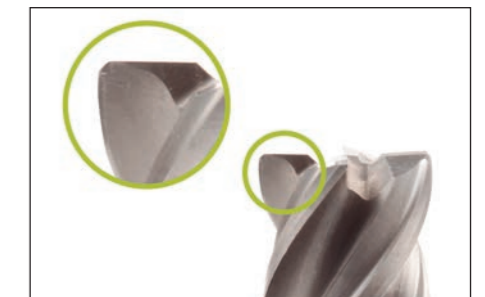
|                               |
|-------------------------------|
| <b>Conventional machining</b> |
| S5000, F1200, $a_p$ : 5.5 mm  |
| Overlap factor: 5 mm          |
| Machining time: 21 min 35 s   |
| Tool: VHM end mill Ø 10 mm    |
| Workpiece material: 1.4104    |

|                             |
|-----------------------------|
| <b>Machining with OCM</b>   |
| S8000, F4800, $a_p$ : 22 mm |
| Overlap factor: 1.4 mm      |
| Machining time: 6 min 59 s  |
| Tool: VHM end mill Ø 10 mm  |
| Workpiece material: 1.4104  |

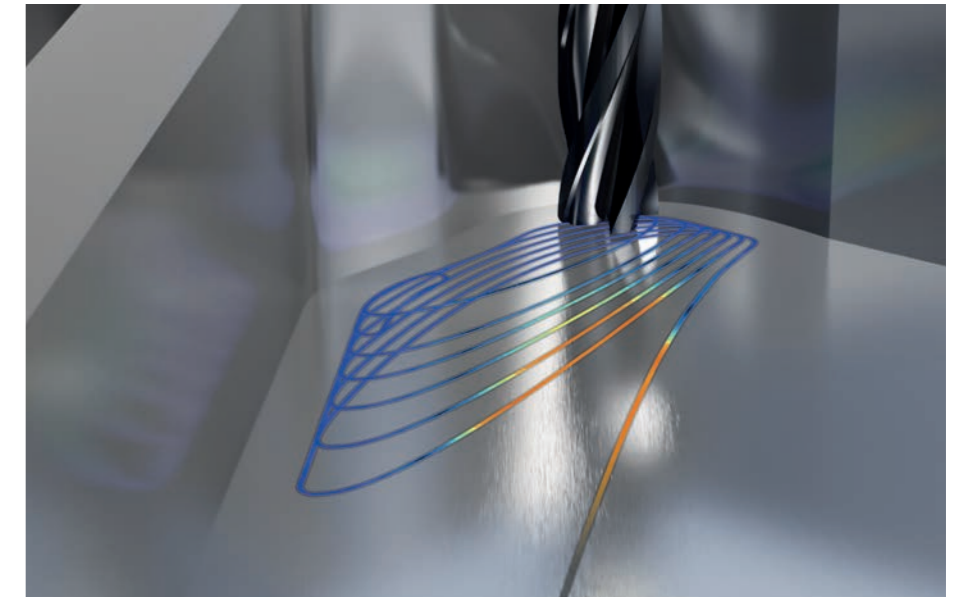
In the following machining example, both the machining time and tool wear were reduced **by a factor of three**.



Tool after two parts



Tool after six parts



|   |                          |               |
|---|--------------------------|---------------|
| <b>Optimized Contour Milling</b>  | Option 167               | ID 1289547-01 |
| TNC 640 HSCI  | NC SW 34059x-10 or later |               |
| TNC 620 HSCI  | NC SW 81760x-07 or later |               |
| TNC 320   | –                        |               |
| <b>Installation</b> by the machine manufacturer   |                          |               |
| <b>For more information</b> , see the TNC brochures, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> . |                          |               |



# Machining functions

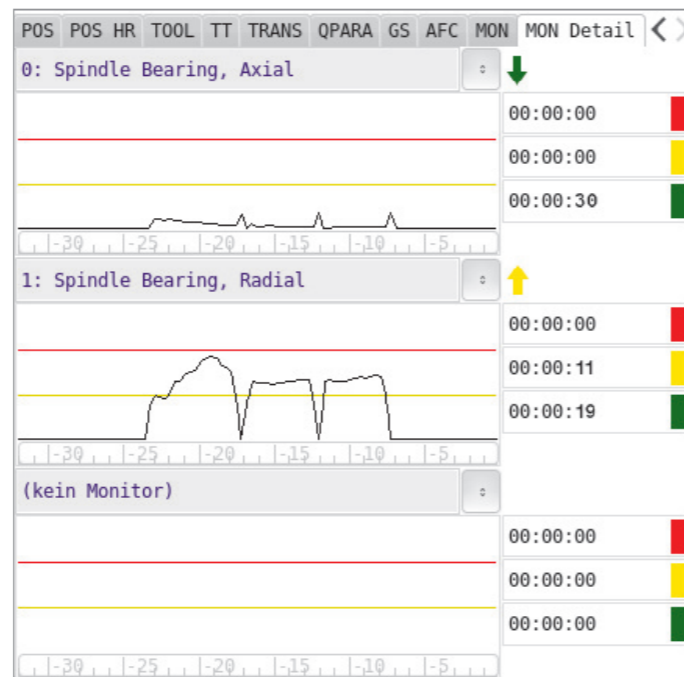
## Component Monitoring

Defective main-spindle bearings are one of the most common causes of machine standstill. During the milling process, the main-spindle bearings are often subjected to very high loads. Both excessive continuous loading and short-term overloading can damage the spindle bearing. Unfortunately, the machine operator cannot readily assess whether the spindle bearing will incur damage from a given machining process.

Component Monitoring (software option 155), however, allows you to detect machine-component overloading and wear based on internal control signals, letting you react early enough to avoid machine downtime. These control signals can be evaluated with formulas provided by the machine manufacturer for determining the amount of load on the components. The machine manufacturer can also define warning and error thresholds, as well as appropriate reactions when these thresholds are exceeded. Significant damage can thus be avoided.

Cycle 238, MEASURE MACHINE STATUS\*, is part of software option 155, Component Monitoring. This cycle allows you to ascertain and record the current machine status. Through data comparison, deviations in machine parameters can be detected and documented over extended periods of time, allowing you to track the machine aging processes.

\* Available with NC SW 34059x-10 (TNC 640) or later, or 81760x-07 (TNC 620) or later



| Component Monitoring   | Option 155               | ID 1226833-01 |
|--|--------------------------|---------------|
| TNC 640 HSCI   | NC SW 34059x-09 or later |               |
| TNC 620 HSCI   | NC SW 81760x-06 or later |               |
| TNC 320  | -                        |               |
| Installation by the machine manufacturer   |                          |               |
| For more information, see the <i>Information for the Machine Tool Builder</i> brochures. |                          |               |

# Machining functions

## 3D-ToolComp: 3D radius compensation based on tool inclination

**3D-ToolComp** is a powerful option for three-dimensional tool radius compensation. In a compensation table, angle-dependent delta values are defined describing the tool's deviation from an ideal circular form (see figure).

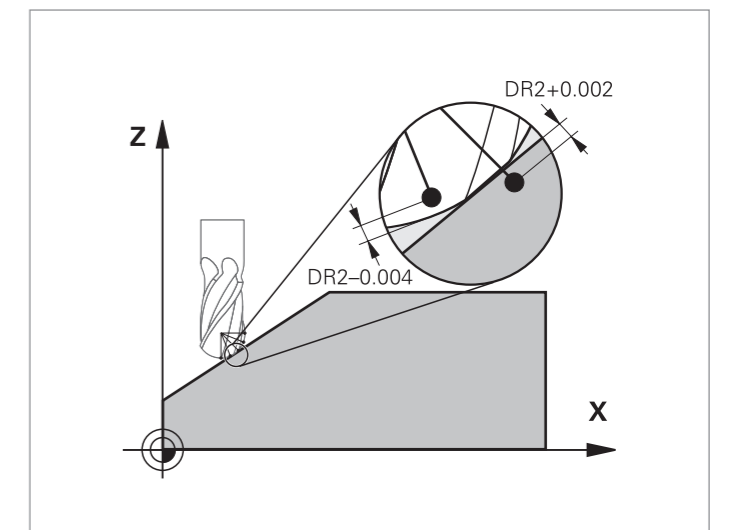
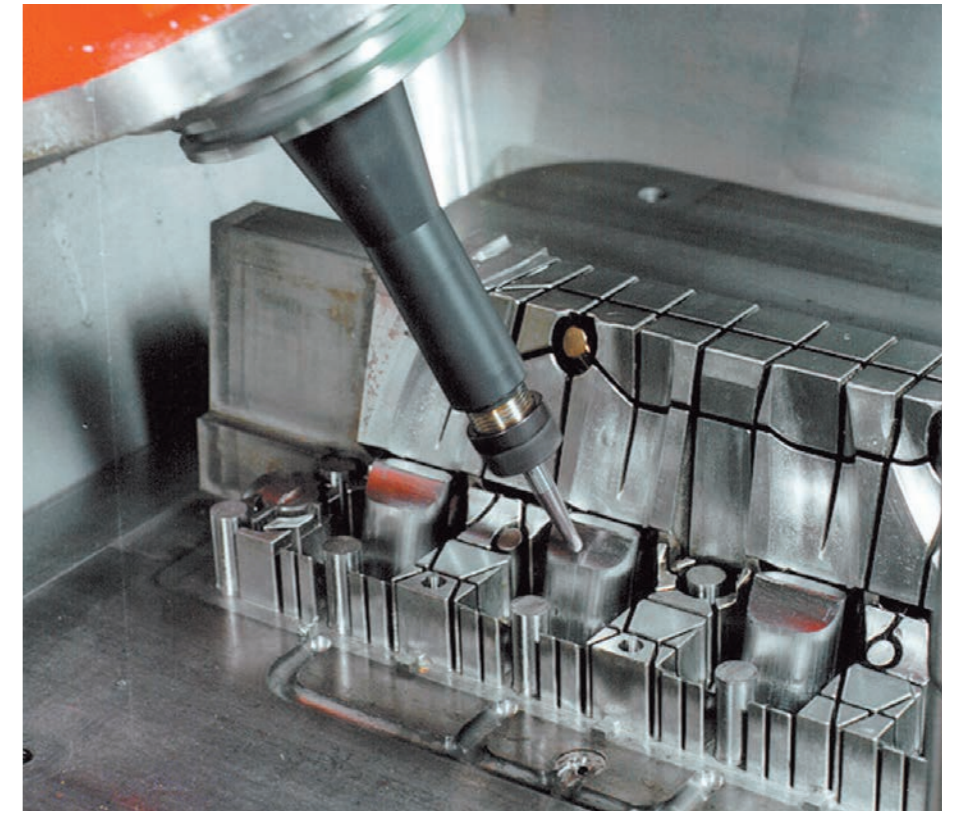
The TNC then corrects the radius value defined for the tool's current point of contact with the workpiece. In order for the exact point of contact to be determined, the NC program must be created by the CAM system with surface-normal blocks (LN blocks). The surface-normal blocks specify the theoretical center point of the radius cutter and the tool orientation relative to the workpiece surface as needed.

The ideal method is to create the compensation table fully automatically. This is done by measuring the shape of the tool with a laser system and a special cycle such that the TNC can make immediate use of the table. If the form errors of the tool are already available to you in a calibration chart provided by the tool manufacturer, then you can also create a compensation table manually.

### Measuring 3D geometries

The TNC 640 features a cycle that allows you to measure points on 3D geometries. To do so, you simply enter the point to be measured, along with its coordinates and associated normal vectors, into Cycle 444, 3D PROBING. After probing, the TNC automatically calculates whether the measured point is within a specified tolerance. You can then call the result via system parameters in order, for example, to have the program initiate rework. You can also trigger a program stop and output a message. After measurement, the cycle automatically generates a straightforward measurement report in HTML format.

To obtain even more accurate results, you can perform a 3D calibration of the touch probe prior to running Cycle 444. The cycle then compensates for the switching behavior of the individual touch probe in all directions. Software option 92 (3D-ToolComp) is required for 3D calibration.



| 3D-ToolComp   | Option 92                | ID 679678-01 |
|---|--------------------------|--------------|
| TNC 640 HSCI  | NC SW 34059x-07 or later |              |
| TNC 620 HSCI  | -                        |              |
| TNC 320   | -                        |              |
| Installation by the machine manufacturer  |                          |              |
| For more information, see the <i>TNC 640</i> brochure, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> . |                          |              |



## Machining functions

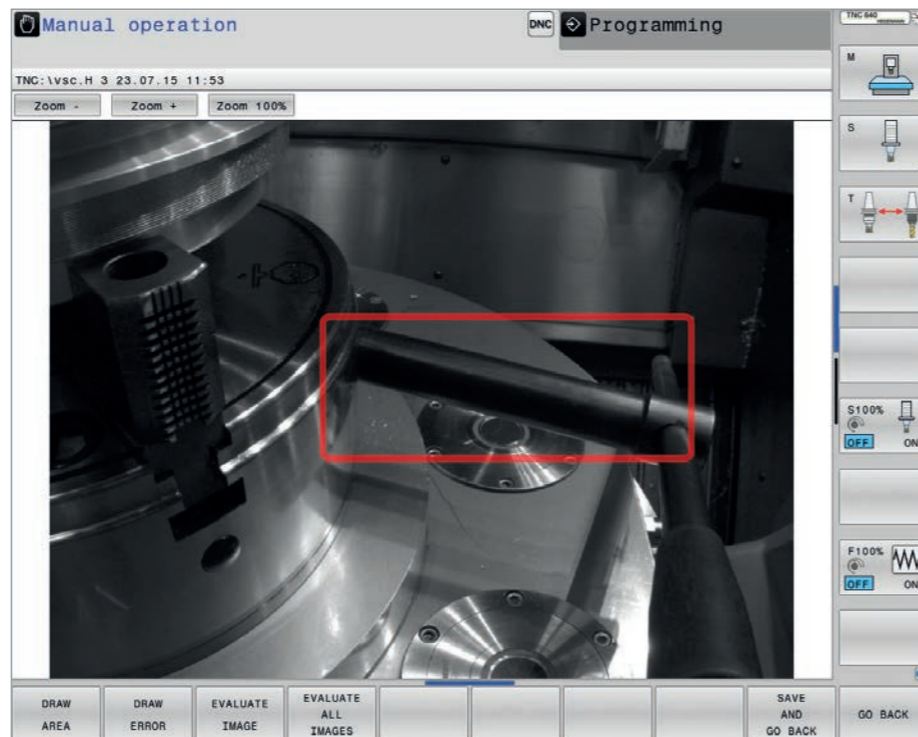
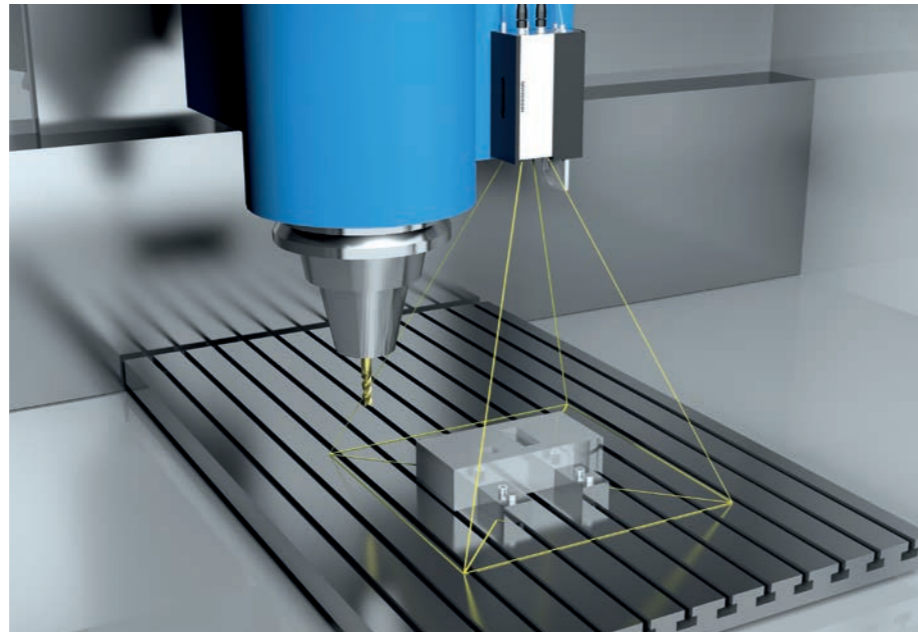
### VSC: camera-based monitoring of the workpiece setup

With the **Visual Setup Control** option (VSC), the TNC can automatically monitor the current setup or machining situation while the program is running. To make this possible, the VS 101 camera system takes reference photos of the first parts in a series and compares them with photos of subsequent parts. User-friendly cycles let you specify multiple locations within the NC program at which you want the control to perform a visual comparison between the nominal and actual conditions. If an error is detected, the TNC reacts in a manner selected by the user.

VSC is able to detect the following scenarios:

- Missing machining operations or faulty workpieces
- Incorrectly positioned workpieces
- Incorrectly mounted or missing fixtures
- Residual chips (prior to measurements, for example)

The VSC option not only helps you avoid expensive damage to the tool, workpiece, and machine but also lets you store images for documenting the setup. The VSC option improves the reliability of your everyday production process and unattended shifts.



|   |                          |               |
|---|--------------------------|---------------|
| <b>Visual Setup Control</b>   | Option 136               | ID 1099457-01 |
| <b>TNC 640 HSCi</b>   | NC SW 34059x-06 or later |               |
| <b>TNC 620 HSCi</b>   | –                        |               |
| <b>TNC 320</b>  | –                        |               |
| <b>Installation</b> by the machine manufacturer   |                          |               |
| <b>For more information</b> , see the <i>TNC 640</i> brochure, and visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> . |                          |               |

## Communication

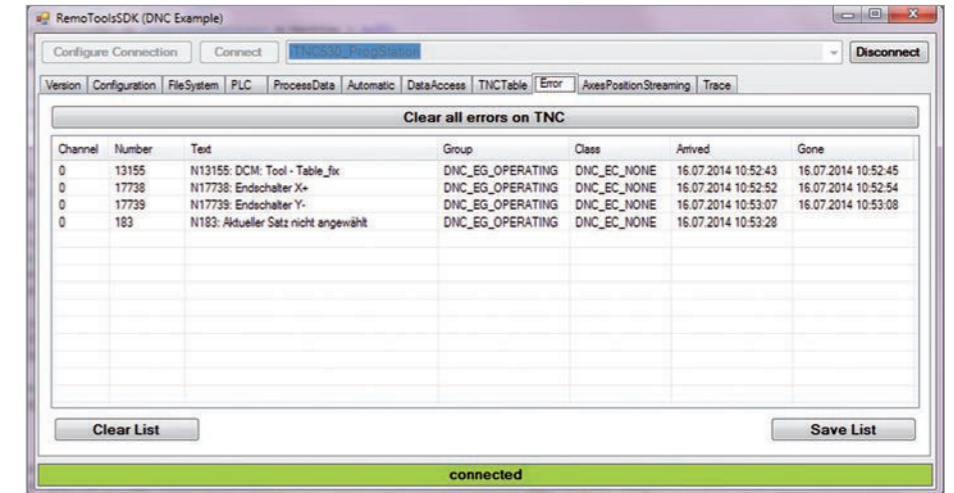
### HEIDENHAIN DNC: communication over a COM component

Paperless job management requires the seamless exchange of data about all process steps in the production process. The **HEIDENHAIN DNC** option allows a Windows application to access data on the control and change them as needed. Possible fields of application include the following:

- Software solutions for controlling the manufacturing process
  - Machine data acquisition systems and production data acquisition systems (MDA/PDA)
  - Connection to higher-level ERP/MES systems
  - Preventive maintenance planning based on the machine's actual condition
- Standardized or customized PC software
  - Greater process reliability and equipment availability
  - Error reporting systems (e.g., notifying the customer's smartphone when the current machining process encounters problems)
  - Current status overviews of all production machines
  - Database creation for extensive data mining

#### RemoTools SDK development package

In order for you to make use of the HEIDENHAIN DNC software interface, HEIDENHAIN offers the RemoTools SDK software development package. RemoTools SDK provides a Microsoft COM component for development environments on Windows operating systems, thus enabling communication with the HEIDENHAIN control. The COM component is registered in the Windows operating system during installation of RemoTools SDK.



|  |  |              |
|--|--|--------------|
| <b>HEIDENHAIN DNC</b>  | Option 18                                    | ID 526451-01 |
| <b>RemoTools SDK</b>   | Accessory                                    | ID 340442-xx |
| <b>TNC 640 HSCi</b>  | NC SW 34059x-01 or later                     |              |
| <b>TNC 620 HSCi</b>  | NC SW 34056x-01/73498x-01/81760x-01 or later |              |
| <b>TNC 320</b>   | NC SW 34055x-01/771851-01 or later           |              |
| <b>Installation</b> by the user  |  |              |
| <b>For more information</b> , see the <i>Connected Machining</i> brochure. |  |              |

## Communication

### Remote Desktop Manager: view and remotely operate external computers

A typical work day may often require data entry into planning and control systems or diagnostic testing with Windows-based software. The **Remote Desktop Manager** option provides the user with the opportunity to operate one or more Windows PCs directly from the TNC. This option fully integrates the Windows PC operating interface into the control interface on the TNC's screen.

By pressing a key on the machine operating panel, you can switch between the control's normal screen and the interface of a separate Windows PC in the local network. This functionality is available regardless of whether the Windows PC is an industrial PC (e.g., the IPC 6641) in the machine's control cabinet, in the local network as a server, or at the user's office workstation.

Possible applications range from centralized job, tool, and NC program management to the remote operation of CAD/CAM systems from the machine. With this option, the machine tool operating panel becomes a versatile and efficient workspace for tasks ranging from specialized manufacturing processes to decentralized order processing.

#### Extended Workspace

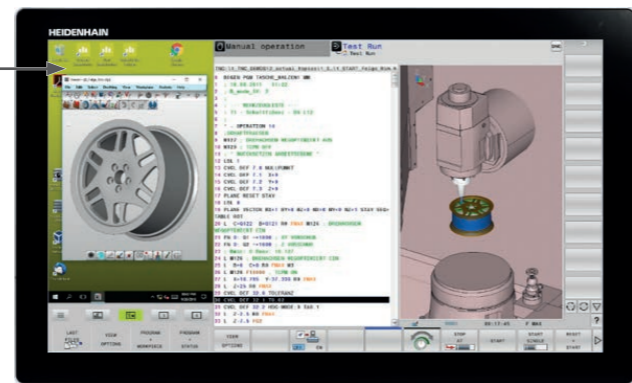
Extended Workspace seamlessly integrates external PCs and applications in the touchscreen of the TNC 640, without losing sight of the main focus: the control's screen.

**Extended Workspace Comfort** adds a second screen to the workstation.

#### Extended Workspace Compact

lets any additional applications run in an extra window on a 24-inch touchscreen. Its position alongside the familiar control screen gives you an optimum overview.

Remote Desktop Manager can be set up through the control's operating system by IT specialists.



**connected**  **machining**

|  |                          |              |
|--|--------------------------|--------------|
| <b>Remote Desktop Manager</b>  | Option 133               | ID 894423-01 |
| <b>TNC 640 HSCI</b>  | NC SW 34059x-02 or later |              |
| <b>TNC 620 HSCI</b>  | NC SW 81760x-02 or later |              |
| <b>TNC 320</b>   | NC SW 77185x-04 or later |              |
| <b>Installation</b> by IT specialists                                      |                          |              |
| <b>For more information</b> , see the <i>Connected Machining</i> brochure. |                          |              |

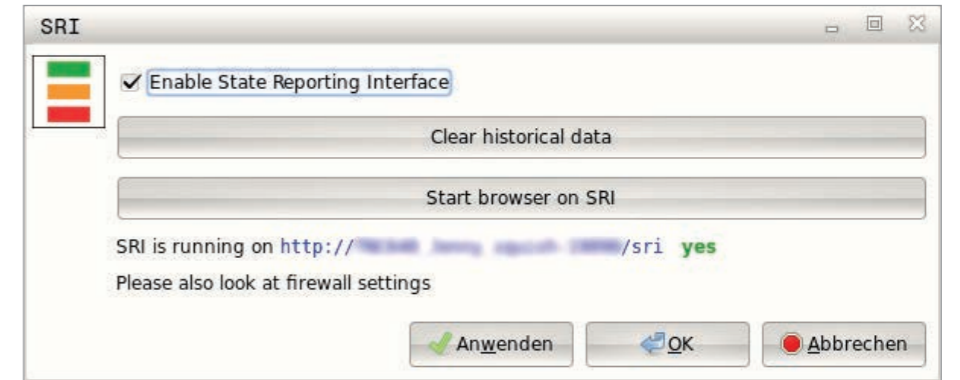
## Communication

### State Reporting Interface: production data acquisition

With batch sizes becoming ever smaller and product customization on the rise, production data acquisition systems are gaining in importance. One key subfield of data acquisition involves operating resource data, which track the statuses of operating resources across a timescale. Data types collected for machine tools include idle times, run times, and information about malfunctions. An analysis can be performed for each workpiece, taking the active NC program into account.

One of the most common uses of production data acquisition is for ascertaining equipment effectiveness. Overall Equipment Effectiveness (OEE) is a measure of a single piece of equipment's value added, providing rapid insight into a machine's productivity and losses.

With its **State Reporting Interface (SRI)**, HEIDENHAIN offers a simple and reliable interface for recording the operating states of your machines. Unlike other interfaces, SRI also provides historical production data. Even if your company network fails for several hours, your valuable operating data will not be lost. A buffer memory that twice contains 10 000 entries is available for storing the historical operating states. In this context an entry corresponds to a status change.



**connected**  **machining**

|  |                          |               |
|--|--------------------------|---------------|
| <b>State Reporting</b>   | Option 137               | ID 1232242-01 |
| <b>TNC 640 HSCI</b>  | NC SW 34059x-09 or later |               |
| <b>TNC 620 HSCI</b>  | NC SW 81760x-06 or later |               |
| <b>TNC 320</b>   | NC SW 77185x-06 or later |               |
| <b>Installation</b> by IT specialists  |                          |               |
| <b>For more information</b> , see the <i>Information for the Machine Tool Builder</i> brochures. |                          |               |



## Communication

### HEIDENHAIN OPC UA NC Server: standardized communication

#### OPC UA NC Server (options 56 to 61)

The communication framework OPC UA (Open Platform Communications Unified Architecture) has established itself in recent years as an interface for safe and reliable data exchange in an industrial environment. The new HEIDENHAIN OPC UA NC Server option makes this future-ready interface available on the TNC 640. OPC UA is a cross-operating-system interface that can connect the HEIDENHAIN control not only to widespread Windows systems but also to Linux-based systems and Apple computers with macOS.

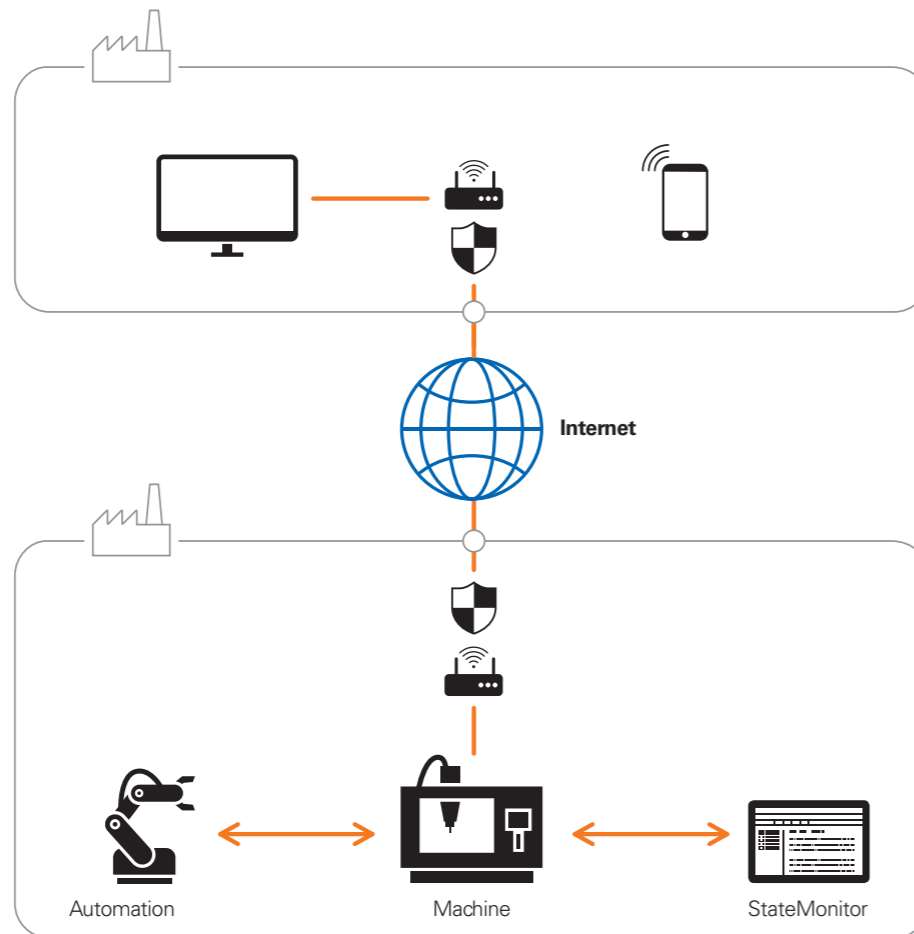
Numerous developer toolkits are available for OPC UA. RemoTools SDK is not needed. This option's standardized protocol, freely selectable toolkit, and application-oriented HEIDENHAIN information model allow standard software solutions and highly individualized applications to be developed with significantly less time to market.

#### The HEIDENHAIN OPC UA NC Server supports the following functions:

- Reading and writing variables
- Subscribing to value changes
- Executing methods
- Subscribing to events
- Transferring of files

Six SIK options are available for the HEIDENHAIN OPC UA NC Server. Each of the six SIK options enables an incoming OPC UA connection via an application certificate. Multiple connections can be configured and activated as needed on the control.

With SignAndEncrypt, HEIDENHAIN offers state-of-the-art IT security as a standard feature.



## Adaptation to the machine

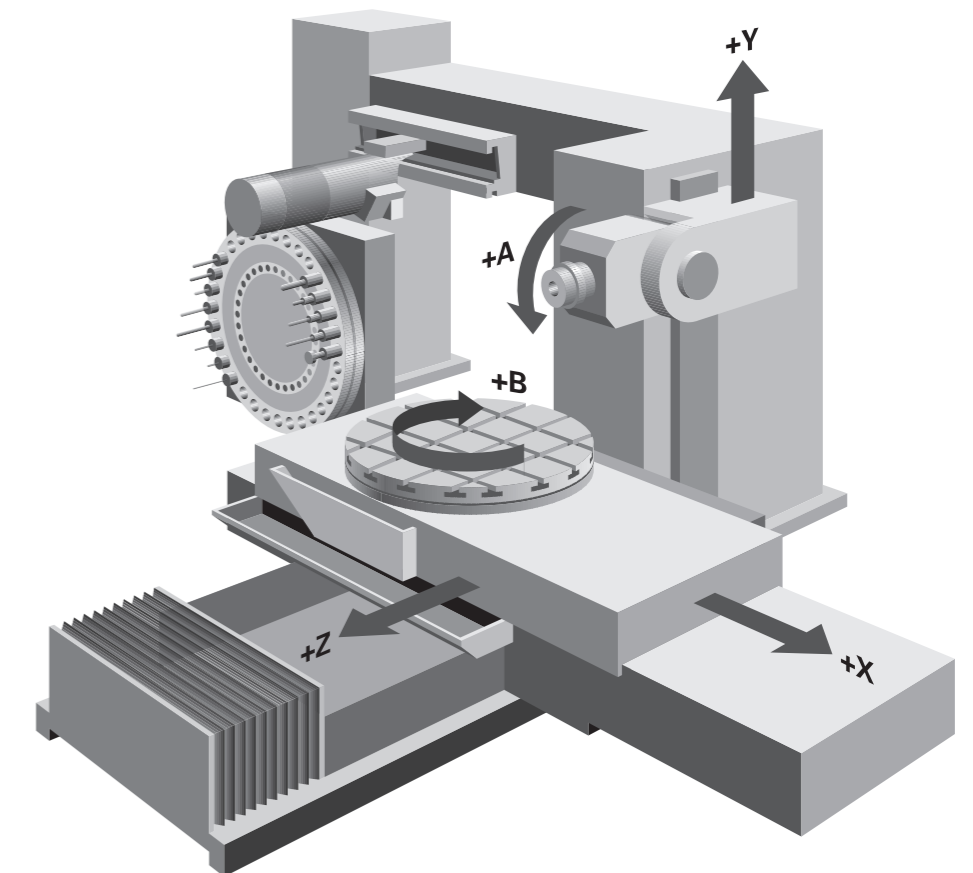
### Additional control loops

The number of enabled control loops depends on the SIK being used and on any additionally enabled control loops (which can be ordered anytime as needed).

Additional control loops can be enabled either singly or in groups. Through combinations of control-loop groups and single control loops, any number of control loops can be enabled.

The maximum possible number of control loops depends on the control:

- TNC 640: 24 control loops
- TNC 620: 8 control loops
- TNC 320: 6 control loops



| Classification  | Control            | Software                                 |
|---|--------------------|--|
| <ul style="list-style-type: none"> <li>• Machine identification</li> <li>• Production data acquisition</li> <li>• Machine messages</li> <li>• Program sequence check</li> </ul> | TNC 640<br>TNC 620 | 34059x-10 or later<br>81760x-08 or later |
| <ul style="list-style-type: none"> <li>• File transfer</li> <li>• Remote management of file systems</li> </ul>  | TNC 640<br>TNC 620 | 34059x-11 or later<br>81760x-08 or later |

|  |                          |                                |
|--|--------------------------|--------------------------------|
| <b>OPC UA NC Server</b>  | Options 56 to 61         | ID 1291434-01 to ID 1291434-06 |
| <b>TNC 640 HSCI</b>  | NC SW 34059x-10 or later |                                |
| <b>TNC 620 HSCI</b>  | NC SW 81760x-08 or later |                                |
| <b>Installation</b> by IT specialists  |                          |                                |
| <b>For more information</b> , visit <a href="http://www.heidenhain.de/opcua-nc-server">www.heidenhain.de/opcua-nc-server</a> |                          |                                |

|  |  |           |
|--|--|-----------|
| <b>Individual control loops</b>  |  | ID        |
| Additional Axis 1  | Option 0                                     | 354540-01 |
| Additional Axis 2  | Option 1                                     | 353904-01 |
| Additional Axis 3  | Option 2                                     | 353905-01 |
| Additional Axis 4  | Option 3                                     | 367867-01 |
| Additional Axis 5  | Option 4                                     | 367868-01 |
| Additional Axis 6  | Option 5                                     | 370291-01 |
| Additional Axis 7  | Option 6                                     | 370292-01 |
| Additional Axis 8  | Option 7                                     | 370293-01 |
| <b>Control-loop groups</b>   |  |           |
| 4 Additional Axes  | Option 77                                    | 634613-01 |
| 8 Additional Axes  | Option 78                                    | 634614-01 |
| <b>TNC 640 HSCI</b>  | NC SW 34059x-01 or later                     |           |
| <b>TNC 620 HSCI</b>  | NC SW 34056x-01/73498x-01/81760x-01 or later |           |
| <b>TNC 320</b>   | NC SW 34055x-01/771851-01 or later           |           |
| <b>Installation</b> by the machine manufacturer  |  |           |
| <b>For more information</b> , see the <i>Information for the Machine Tool Builder</i> brochures. |  |           |

## Adaptation to the machine

### Integrated Functional Safety (FS)

Controls featuring integrated functional safety (FS) from HEIDENHAIN can attain Safety Integrity Level 2 (SIL 2) as per EN 61508, and Performance Level “d,” Category 3, as per EN ISO 13849-1. In these standards, safety-related systems are assessed based on criteria such as the failure probabilities of integrated components and subsystems. This modular approach aids the manufacturers of safety-related machines in implementing their systems, since they can then build upon prequalified subsystems.

The controls with functional safety (FS) are based on two redundant, mutually independent safety channels. All safety-relevant signals are collected, processed, and output over two channels. Errors are detected through a reciprocal data comparison of the two channels’ states. Consequently, the occurrence of a single error in the control does not cause a loss in safety functionality.

#### Gen 3 exclusive

For Gen 3 drives, integrated functional safety (FS) is enabled through software options and is scalable. When purchasing these options, you can enable the exact number of safe control loops you actually need. For this purpose, new software options (160 to 166) are being introduced exclusively for the Gen 3 drives. Up to now, integrated functional safety (FS) has been enabled in conjunction with a PLB 62xx FS.

| Option number | Option               | ID         | Comment   |
|---------------|----------------------|------------|---|
| 160           | Integrated FS: Basic | 1249928-01 | Gen 3 exclusive: enabling of functional safety (FS) and enabling of four safe control loops                         |
| 161           | Integrated FS: Full  | 1249929-01 | Gen 3 exclusive: enabling of functional safety (FS) and enabling of the maximum number of safe control loops (≥ 10) |
| 162           | Add. FS Ctrl. Loop 1 | 1249930-01 | Only for Gen 3: additional safe control loop 1  |
| 163           | Add. FS Ctrl. Loop 2 | 1249931-01 | Only for Gen 3: additional safe control loop 2  |
| 164           | Add. FS Ctrl. Loop 3 | 1249932-01 | Only for Gen 3: additional safe control loop 3  |
| 165           | Add. FS Ctrl. Loop 4 | 1249933-01 | Only for Gen 3: additional safe control loop 4  |
| 166           | Add. FS Ctrl. Loop 5 | 1249934-01 | Only for Gen 3: additional safe control loop 5  |
| 169           | Add. FS Full         | 1319091-01 | Enabling all remaining FS control loops   |

The manufacturer needs option 169 if safe control loops are to be enabled via single options and ten or more safe control loops are needed.

Software option 169 enables all remaining FS axes if the following requirements are fulfilled:

- Software option 160 is set
- Software options 162 to 166 are set



| Integrated FS  | TNC 640 HSCI<br>Minimum NC SW | TNC 620 HSCI<br>Minimum NC SW |
|--|-------------------------------|-------------------------------|
| Options 160 to 166<br>ID 1249928-01 to 1249934-01                      | 34059x-10                     | 81760x-07                     |
| Option 169<br>ID 1319091-01  | 34059x-11                     | 81760x-08                     |
| <b>Installation</b> by the machine manufacturer                        |                               |                               |
| <b>For more information</b> , see the Technical Information documents. |                               |                               |

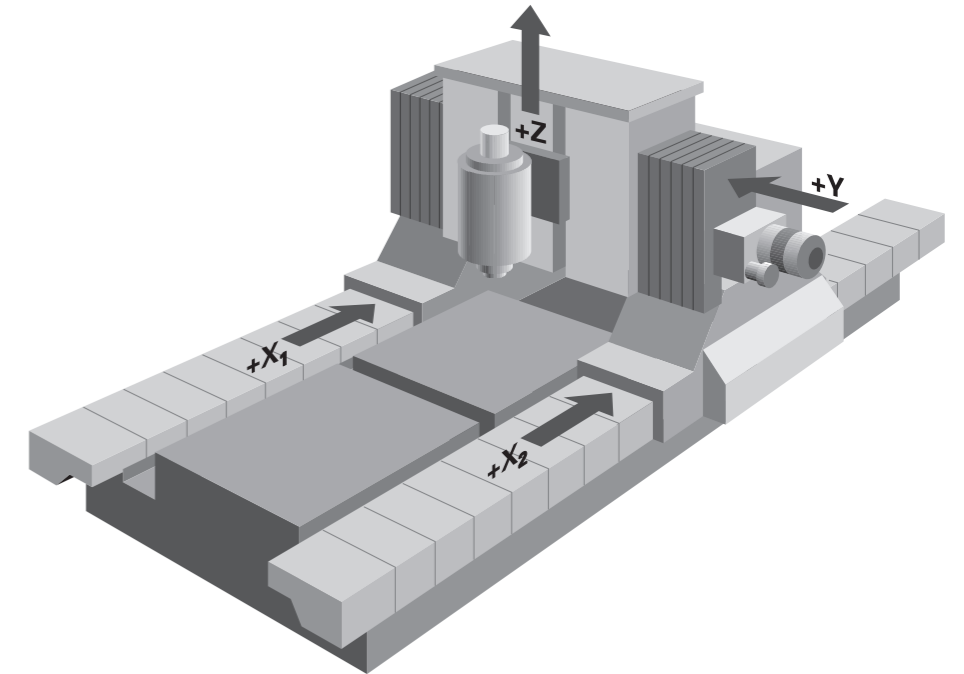
## Adaptation to the machine

### Synchronized axes: gantry axes, tandem tables

Synchronized axes are synchronously moving axes that are programmed using the same axis designation.

With HEIDENHAIN controls, parallel axis systems (gantry axes) such as those on portal-type machines or tilting tables can be moved synchronously thanks to high-accuracy, dynamic position control. The fast and particularly precise positioning movements are perfectly harmonized, thus enabling five-axis simultaneous motion for highly demanding tasks. Multiple slave axes can be assigned to a single master gantry axis.

Master-slave torque systems are typically used when large parts need to be moved or when rack and pinion drive systems require pre-stressing for backlash-free motion. Up to six drive systems can be combined into a single master-slave network and mutually pre-stressed as desired. As a result, fast and precise axis positioning becomes attainable even on large machine tools.



|  |   |              |
|--|---|--------------|
| <b>Gantry Axes</b>   | Option 24   | ID 634621-01 |
| <b>TNC 640 HSCI</b><br><b>TNC 620 HSCI</b><br><b>TNC 320</b>                                     | Standard function<br>NC SW 34056x-01/73498x-01/81760x-01 or later<br>NC SW 34055x-01/771851-01 or later |              |
| <b>Installation</b> by the machine manufacturer  |   |              |
| <b>For more information</b> , see the <i>Information for the Machine Tool Builder</i> brochures. |   |              |



## Adaptation to the machine

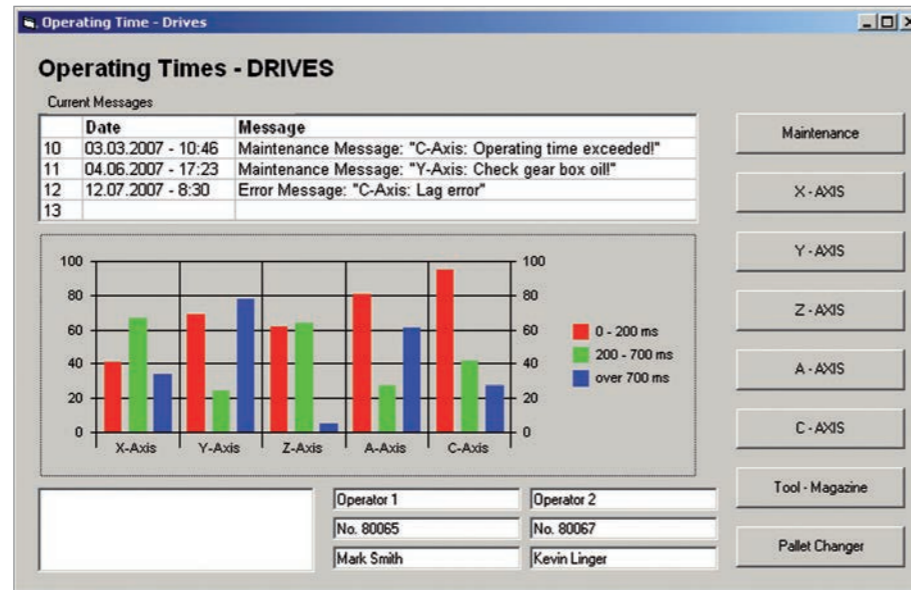
### Python OEM Process: realize special functions

The **Python OEM Process** option gives machine manufacturers a powerful tool for using an object-oriented programming language within the control. Python is an easy-to-learn script language supporting all necessary high-level language elements.

Python OEM Process can be employed universally for machine functions, complex calculations, and the display of special user interfaces. User-specific or machine-specific solutions can be efficiently implemented. Regardless of whether you intend to create special algorithms for specialized functions or separate solutions (e.g., interfaces for machine maintenance software), a myriad of existing Python- and GTK-based functions are at your disposal.

You can integrate your newly created applications through the PLC in familiar PLC windows, or you can display them in your own windows incorporated into the TNC interface, even making them as large as the control's full screen.

Simple Python scripts (e.g., for display screens) can also be executed without enabling Python OEM Process (software option 46). 10 MB of dedicated memory are reserved for this function. For more information, refer to the "Python in HEIDENHAIN Controls" Technical Manual.

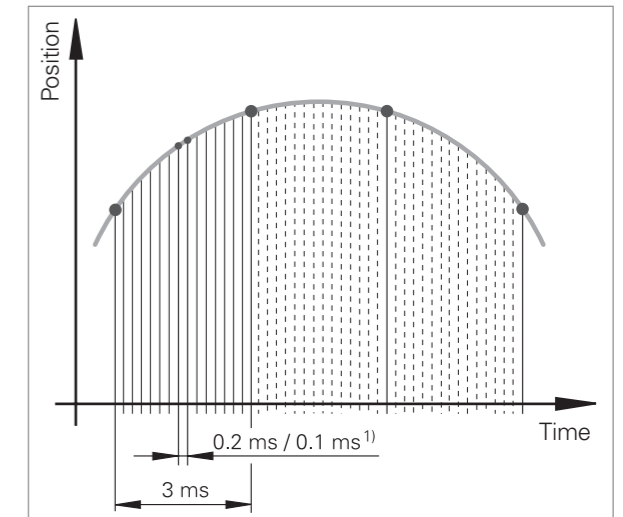


## Adaptation to the machine

### Double Speed: short control-loop cycle times for direct drive motors

Single-speed control loops are usually sufficient for linear motors, torque motors, and conventional axes. **Double-speed control loops**, however, are the go-to choice for HSC spindles and difficult-to-control axes. In the control's default settings, all axes are set to single speed. Each axis that is switched from single speed to double speed can reduce the number of available control loops by one. PWM frequencies greater than 5 kHz require double-speed control loops. Option 49 must be enabled for this.

Double-speed control loops permit higher PWM frequencies and shorter speed-controller cycle times, thereby enabling improved current control for spindles and increased controller performance for linear and torque motors.



<sup>1)</sup> Single speed/double speed (with option 49)

#### Control loop cycle times

##### Fine interpolation

Single speed: 0.2 ms  
Double speed: 0.1 ms (with option 49)

##### Position controller

Single speed: 0.2 ms  
Double speed: 0.1 ms (with option 49)

##### Speed controller

Single speed: 0.2 ms  
Double speed: 0.1 ms (with option 49)

##### Current controller

| $f_{PWM}$ | $T_{INT}$                 |
|-----------|---------------------------|
| 3 333 Hz  | 150 $\mu$ s               |
| 4 000 Hz  | 120 $\mu$ s               |
| 5 000 Hz  | 100 $\mu$ s               |
| 6 666 Hz  | 75 $\mu$ s with option 49 |
| 8 000 Hz  | 60 $\mu$ s with option 49 |
| 10 000 Hz | 50 $\mu$ s with option 49 |

| Python OEM Process   | Option 46                                    | ID 579650-01 |
|--|--|--------------|
| TNC 640 HSCI   | NC SW 34059x-01 or later                     |              |
| TNC 620 HSCI   | NC SW 34056x-01/73498x-01/81760x-01 or later |              |
| TNC 320  | NC SW 34055x-04/771851-01 or later           |              |
| <b>Installation</b> by the machine manufacturer  |  |              |
| For more information, see the <i>Information for the Machine Tool Builder</i> brochures. |  |              |

| Double-Speed Axes  | Option 49                                    | ID 632223-01 |
|--|--|--------------|
| TNC 640 HSCI   | NC SW 34059x-01 or later                     |              |
| TNC 620 HSCI   | NC SW 34056x-01/73498x-01/81760x-01 or later |              |
| TNC 320  | —  |              |
| <b>Installation</b> by the machine manufacturer  |  |              |
| For more information, see the <i>Information for the Machine Tool Builder</i> brochures. |  |              |

## Adaptation to the machine

### OEM Option

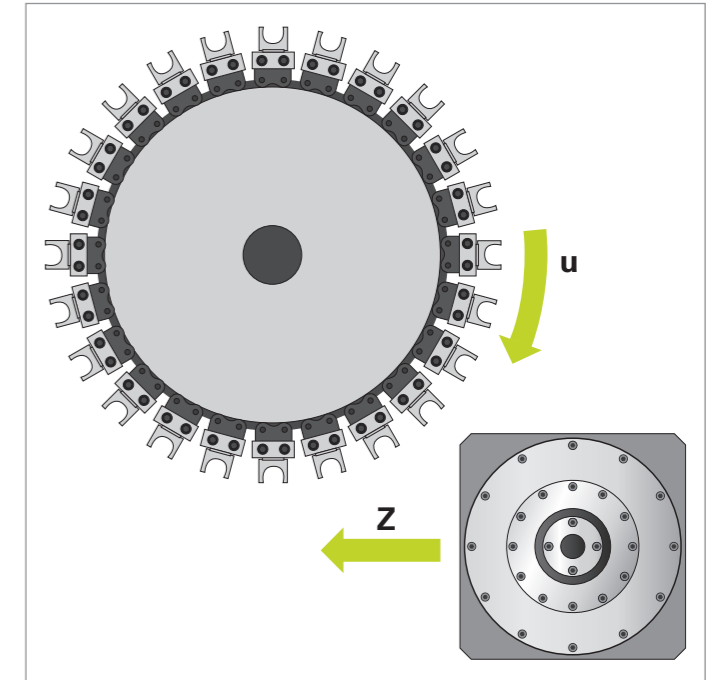
Machine manufacturers often equip their machine tools with added useful functions stored in the control's configuration parameters (e.g., PLC). These functions are then offered to the user as options. To give the user the greatest possible flexibility in enabling these options, HEIDENHAIN can reserve a range within the options menu (SIK menu) for use by the machine manufacturer as desired.

Options 101 to 130 provide thirty options that can be enabled by the machine manufacturer and enabled through his own PLC program. A particular benefit is the user's ability to enable options via the SIK menu without the need for on-site support by the machine manufacturer.

## Adaptation to the machine

### RTC: real-time coupling function for synchronizing axes and spindles

The **Real-Time Coupling** function (RTC) enables the cyclical calculation of a position offset for an axis based on the actual and nominal values of any other axes within the system. This function allows complex, simultaneous movements of multiple NC or PLC axes to be implemented. The interdependencies of the axes are defined in mathematical formulas. Possible applications, for example, are in PLC axes that need to be synchronized with an NC axis during a tool change in order to avoid collisions with the tool holders. The machine manufacturer defines these movements with RTC. The real-time coupling function makes complex traversing movements possible through the coupling of principal and secondary axes. Many new solutions are thus made possible, ranging from process-specific movements to tool changes with special requirements.



| OEM Option                 | Options 101 to 130          | ID 579651-01 to ID 579651-30 |
|----------------------------|-----------------------------|------------------------------|
| TNC 640 HSCI               | NC SW 34059x-02 or later    |                              |
| TNC 620 HSCI               | –                           |                              |
| TNC 320                    | –                           |                              |
| <b>Installation</b>        | by the machine manufacturer |                              |
| <b>Further information</b> | –                           |                              |

| Synchronizing Functions       | Option 135   | ID 1085731-01 |
|-------------------------------|--|---------------|
| TNC 640 HSCI                  | NC SW 34059x-04 or later   |               |
| TNC 620 HSCI                  | –  |               |
| TNC 320                       | –  |               |
| <b>Installation</b>           | by the machine manufacturer  |               |
| <b>For more information</b> , | see the <i>Information for the Machine Tool Builder</i> brochures. |               |



# Software

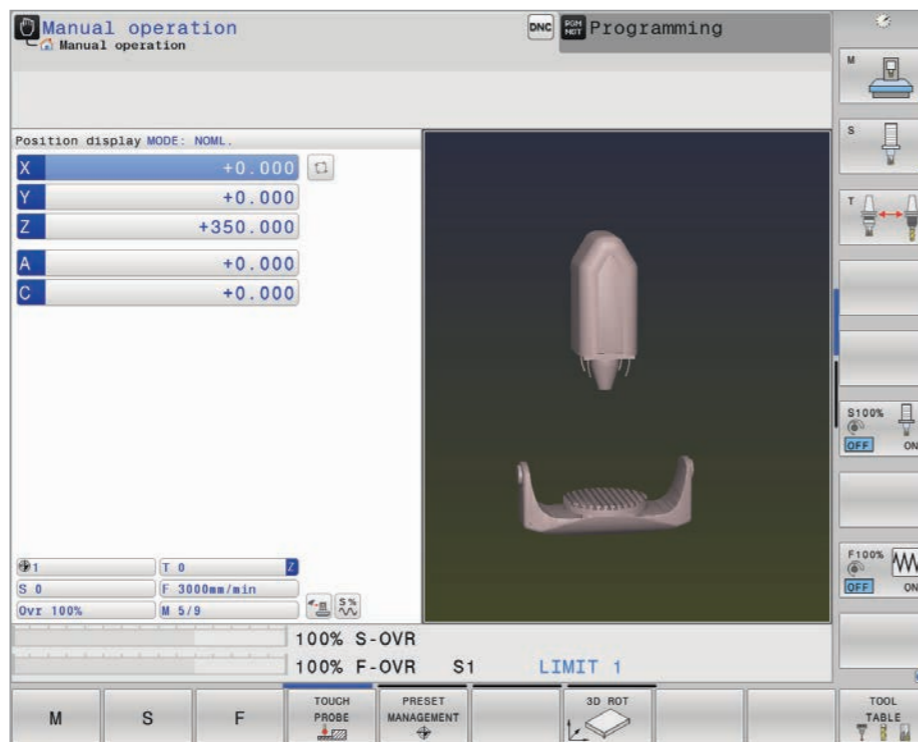
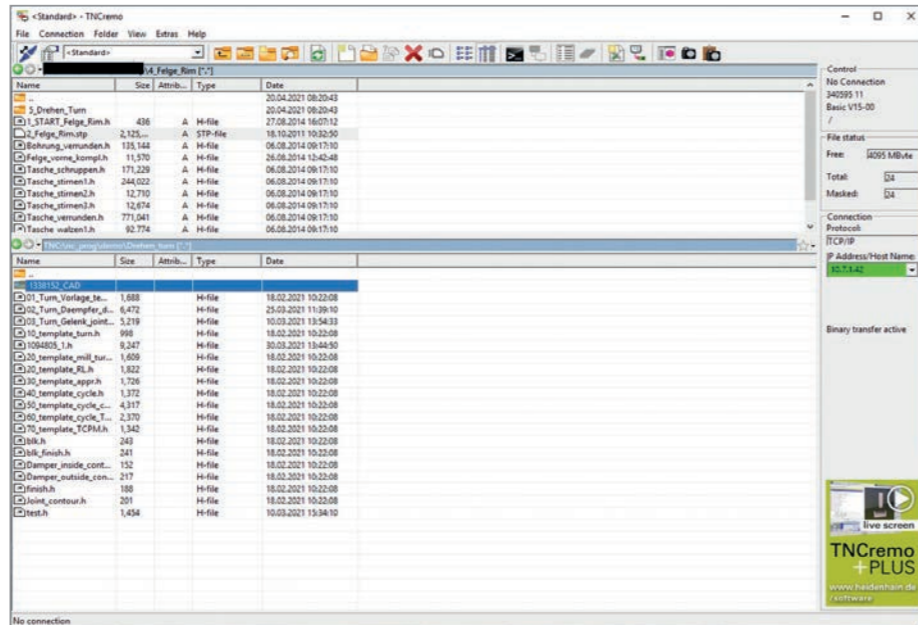
## TNCremo: programs for data transfer

The free PC software package **TNCremo** supports the user in transferring data from a PC to HEIDENHAIN controls or programming stations. TNCremo lets you bidirectionally transfer externally stored machining programs, tool tables, pallet tables, and backups of the hard drive, as well as query the operating status of the machine.

### Functions:

- Data transfer and file management
- Creation of screenshots of the control
- Reading out of the control log
- Data backup for the control
- Creation of service files

In addition to the features already familiar to you from TNCremo, **TNCremoPlus** can transfer the current content of the control's screen to the PC (live screen). This allows you to implement convenient machine monitoring. TNCremo uses the LSV2 protocol in order to control the TNC remotely.



|  |  |
|--|--|
| <b>TNCremo</b>   | Free download                                |
| <b>TNCremoPlus</b>   | Enabling module requires a fee ID 340447-xx  |
| <b>TNC 640 HSCI</b>  | NC SW 34059x-01 or later                     |
| <b>TNC 620 HSCI</b>  | NC SW 34056x-01/73498x-01/81760x-01 or later |
| <b>TNC 320</b>   | NC SW 34055x-01/771851-01 or later           |
| <b>Installation</b> by the user  |  |
| For more information, visit <a href="http://www.klartext-portal.com">www.klartext-portal.com</a> |  |

# Software

## TeleService: remote diagnostics for HEIDENHAIN controls

The PC software **TeleService** enables comprehensive remote diagnostics as well as extensive remote operation and remote monitoring capabilities for HEIDENHAIN controls. In-depth troubleshooting is thus made possible. The service technician can communicate with the control online, analyze the control, and immediately repair the issue if possible.

To request the desired information, the machine manufacturer can create a diagnostic interface that matches his servicing concept. Operation is performed through the TeleService control panel.

### Functions

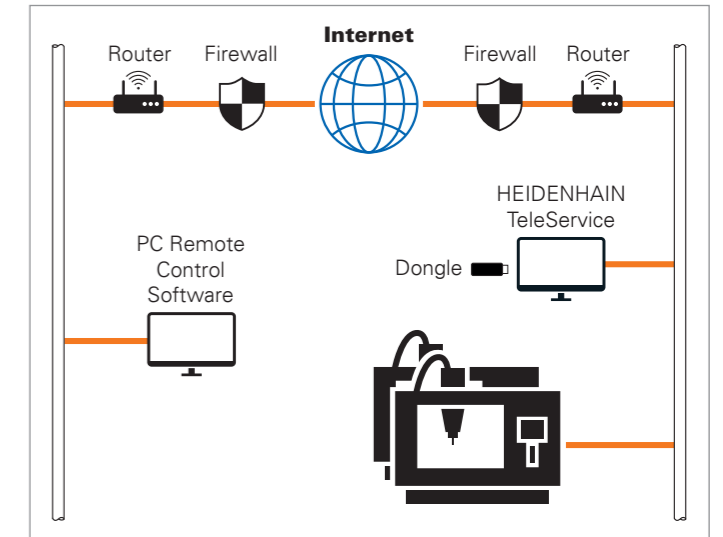
- Remote operation of the TNC with online screen transmission and virtual TNC keyboard
- Transmission of machining and PLC programs, machine parameters, tool and datum tables, etc.
- Display of machine and PLC data through TNCscope or TNCexplorer; the machine manufacturer adapts the data to TNCexplorer via form files.
- Motor diagnostics with DriveDiag
- Expansion of the TeleService Control Panel by the machine manufacturer to include his own applications, for which HEIDENHAIN provides the RemoTools SDK software development package

### TeleService by the machine manufacturer

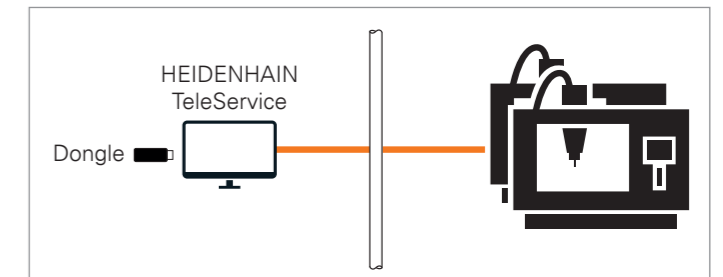
The machine manufacturer creates a network out of the end customer's TNC-equipped machines and another network from the service PCs (with TeleService software installed) in the machine manufacturer's service department. Routers connect the two networks over the public phone and data network. When the customer presses the "Service" or "Support" soft key, the routers automatically establish a connection between the customer's network and the machine manufacturer's network. Through TeleService, the service technician gains access to all of the machine data and PLC data saved on the control. Online screen transmission and a virtual TNC keyboard enable complete remote operation of the TNC.

### TeleService by the customer

TeleService can also be implemented within the customer's intranet. In this case, a PC with TeleService installed on it is connected directly (without a router) to the network of TNCs. This enables remote operation, remote monitoring, and remote diagnosis of the machines in the customer's own network.



Remote connection over PC remote control software



TeleService in the corporate network

|   |  |
|---|--|
| <b>TeleService</b>                              | CD-ROM with dongle                           |
| Single station license                          | ID 340449-xx                                 |
| Network lic. for max. 14 participants           | ID 340454-xx                                 |
| Network lic. for max. 20 participants           | ID 340455-xx                                 |
| <b>TNC 640 HSCI</b>                             | NC SW 34059x-01 or later                     |
| <b>TNC 620 HSCI</b>                             | NC SW 34056x-01/73498x-01/81760x-01 or later |
| <b>TNC 320</b>                                  | NC SW 34055x-01/771851-01 or later           |
| <b>Installation</b> by the machine manufacturer |  |
| <b>Further information</b>                      | -  |

# Software

## StateMonitor: collect and evaluate machine data

The StateMonitor software records and visualizes the statuses of machines in a manufacturing environment. By evaluating important data, such as the current machine status, machine messages, override positions, and utilization history, StateMonitor provides in-depth information about the machine's utilization level. Based on these collected data, it is possible to uncover optimization potential.

With an additional option called MaintenanceManager, maintenance can be defined based on different maintenance intervals. In addition to organizing and documenting maintenance, MaintenanceManager can be used to record malfunctions and forward information about them as desired.

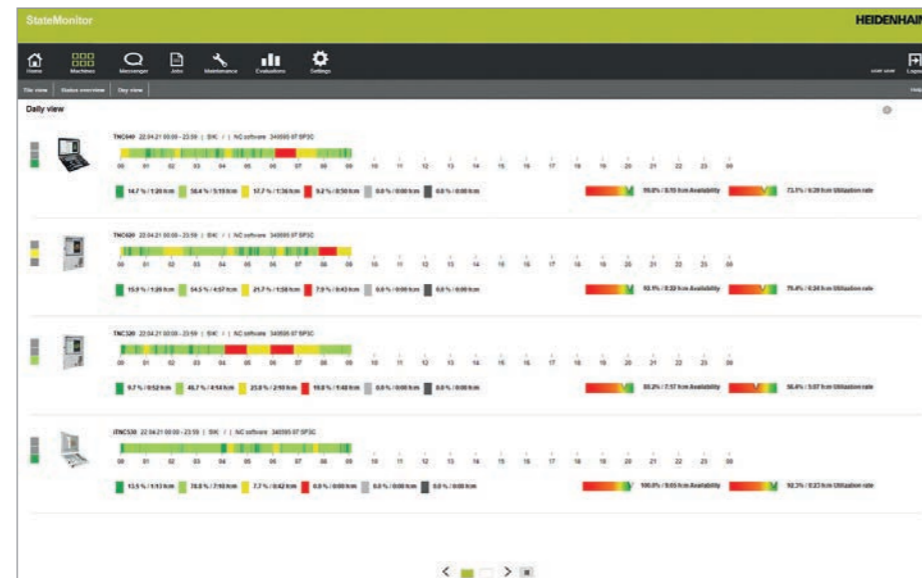
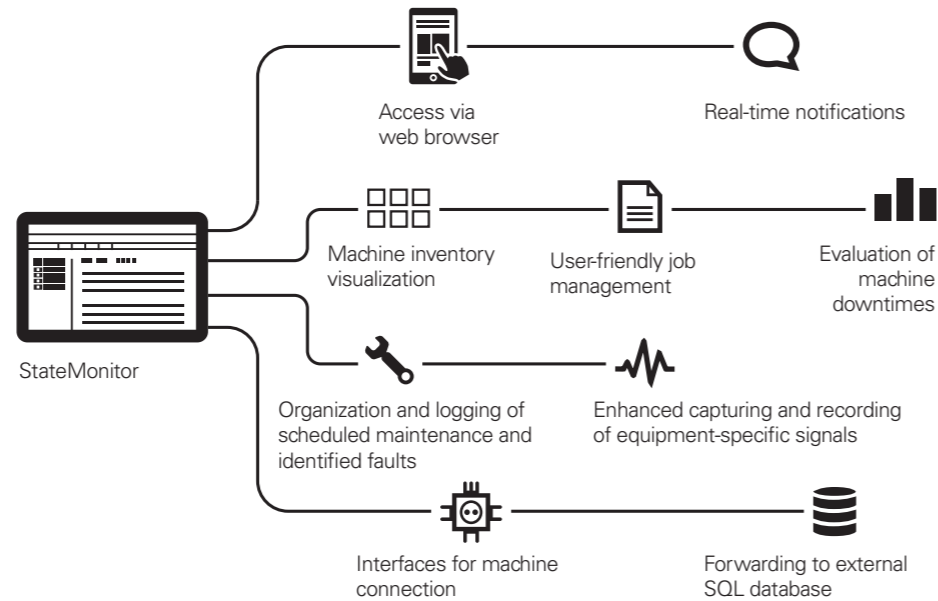
The additional option JobTerminal enables job creation and assignment right from the machine. JobTerminal also makes it possible to define machining sequences of created jobs and to save the stored data of completed jobs.

StateMonitor can record and visualize the following information:

- Operating modes
- Override positions (spindle, rapid traverse, feed rate)
- Program status and program name, as well as subprograms if applicable
- Program run time
- SIK number and software number
- Machine messages
- Maintenance entries and the maintenance history
- Job times
- Other machine-specific signal values

Machines with different controls can be connected to StateMonitor. The software supports the protocol types HEIDENHAIN DNC, OPC UA, MTConnect, and Modbus TCP.

For more information, please contact the team of the Digital Shop Floor from HEIDENHAIN.



|  |               |                               |                                    |
|--|---------------|-------------------------------|------------------------------------|
| <b>StateMonitor</b>                          | ID 1218930-xx | <b>TNC 640 HSCI</b>           | NC SW 34059x-01 or later           |
| StateMonitor for an additional five machines | ID 1220884-xx | <b>TNC 620 HSCI</b>           | NC SW 34056x-01/73498x-01          |
| MaintenanceManager                           | ID 1308520-xx |                               | /81760x-01 or later                |
| JobTerminal                                  | ID 1268674-xx | <b>TNC 320</b>                | NC SW 34055x-01/771851-01 or later |
| 5 Signals                                    | ID 1308521-xx | Prerequisite: option 18 (DNC) |                                    |
| OPC UA Interface                             | ID 1268673-xx |                               |                                    |
| MTConnect Interface                          | ID 1268675-xx |                               |                                    |
| Modbus Interface                             | ID 1268670-xx |                               |                                    |

**Installation** by the machine manufacturer or end user

For more information, visit [www.digital-shop-floor.heidenhain.com](http://www.digital-shop-floor.heidenhain.com) and [www.klartext-portal.com](http://www.klartext-portal.com), and see the Digital Shop Floor flyer.

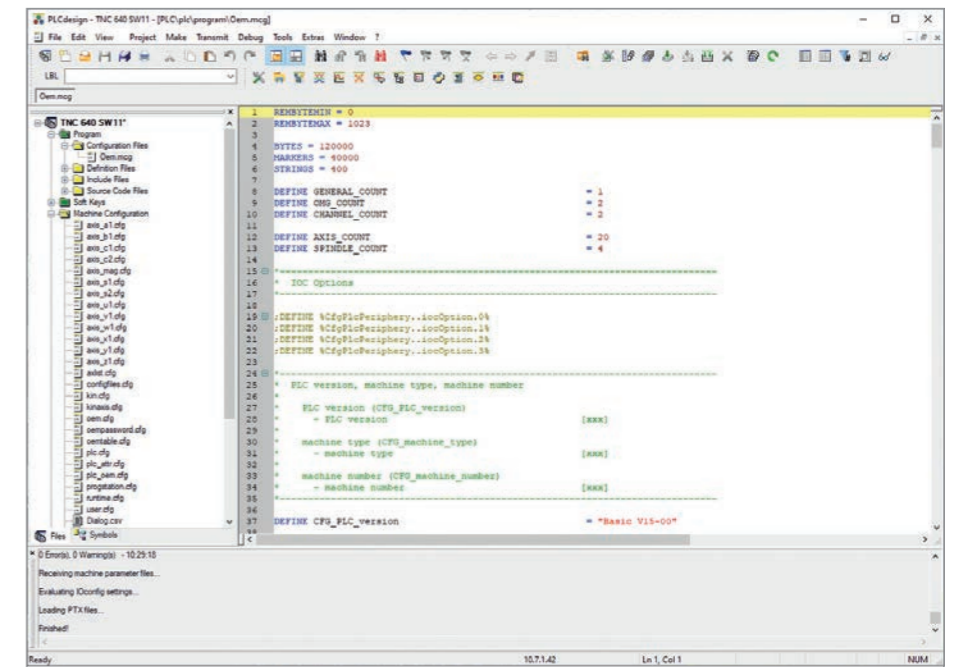
# Software

## PLCdesign: PLC program development software

The PLCdesign software is a convenient way to create PLC programs. It also comes with an extensive selection of sample PLC programs.

### Functions

- Management of all project files with integrated project management in an intuitive tree structure
- Creation of PLC programs in IL
- Integrated editor with syntax highlighting for PLC programs
- Context-sensitive output windows
- Extensive help functions
- PLC beautifier
- Soft-key creation and generation
- Postprocessor for resolving symbolic operands in generic files
- Support for machine-specific configuration
- Uploading of all files to the control
- Debug functions:
  - Source text monitoring
  - Storage table
  - Monitoring list for symbolic operands
- Source-code browser for input wizard and navigation
- Supports source-code control systems



|                     |  |
|---------------------|--|
| <b>PLCdesign</b>    |  |
| <b>TNC 640 HSCI</b> | NC SW 34059x-01 or later                     |
| <b>TNC 620 HSCI</b> | NC SW 34056x-01/73498x-01/81760x-01 or later |
| <b>TNC 320</b>      | NC SW 34055x-01/771851-01 or later           |

**Installation** by machine manufacturers or servicing providers

For more information, see the Information for the Machine Tool Builder brochures.



## Software

### KinematicsDesign: create machine kinematic models

**KinematicsDesign** is a PC software application for the graphically supported creation of kinematic descriptions for HEIDENHAIN controls. It also offers a convenient way to configure and start using the DCM collision monitoring function.

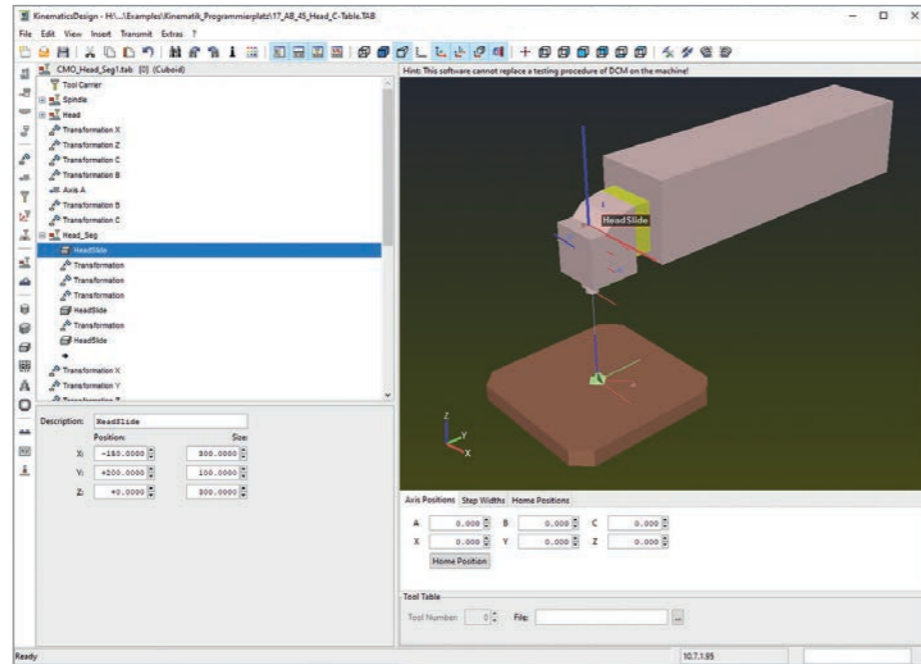
KinematicsDesign can create all objects of the kinematic chain, transfer them to and from the control, and edit them. Extensive visualization possibilities allow the user to display the information that he currently needs in a clear format. Transformations, collision objects, and designations, for example, can be shown or hidden independently of each other. Collision objects can be shown as wire models, transparently, in full, etc. Colored highlighting makes it easy in KinematicsDesign to discern which collision objects have been checked in relation to each other or are excluded from the collision inspection. These functions are also available in the KinematicsDesign tool directly in the control.

KinematicsDesign visualizes the kinematic model with the current axis positions of a connected control (or programming station) or with manually entered axis positions and displays collisions. In addition, the current tool or a specified tool from a tool table can be shown along with a kinematic model of its tool carrier. KinematicsDesign can import kinematic models from the iTNC 530 and convert them into the format of the NCK controls, as well as generate clamping equipment and tool carrier kinematic models.

The TNC 640 lets you import collision bodies from a CAD file and incorporate them as M3D data into the machine kinematics. For the creation of the M3D data, the installation package of KinematicsDesign contains the free-standing PC program M3D Converter.

#### M3D Converter

This tool can upload, check, repair, simplify, and optimize Step and STL files, thereby preparing them for use as collision objects. In the process, the user can always keep the difference from the original object in view. M3D Converter requires a software release module (ID 1124969-xx).



|  |                                |               |
|--|--------------------------------|---------------|
| <b>M3D Converter</b>   | Enabling module requires a fee | ID 1124969-xx |
| <b>TNC 640 HSCI</b>  | NC SW 34059x-05 or later       |               |
| <b>TNC 620 HSCI</b>  | NC SW 81760x-02 or later       |               |
| <b>TNC 320</b>   | NC SW 77185x-02 or later       |               |
| <b>Installation</b> by machine manufacturers or servicing providers                              |                                |               |
| <b>For more information</b> , see the <i>Information for the Machine Tool Builder</i> brochures. |                                |               |

|  |  |  |
|--|--|--|
| <b>KinematicsDesign</b>  | Registration required                        |  |
| <b>TNC 640 HSCI</b>  | NC SW 34059x-01 or later                     |  |
| <b>TNC 620 HSCI</b>  | NC SW 34056x-01/73498x-01/81760x-01 or later |  |
| <b>TNC 320</b>   | NC SW 34055x-01/771851-01 or later           |  |
| <b>Installation</b> by machine manufacturers or servicing providers                              |  |  |
| <b>For more information</b> , see the <i>Information for the Machine Tool Builder</i> brochures. |  |  |

## Software

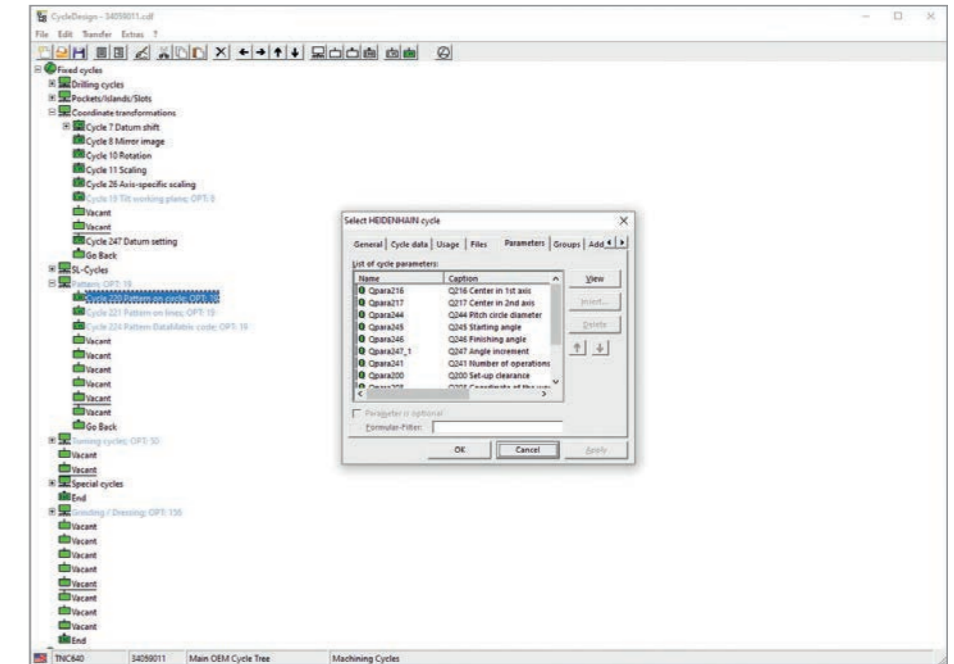
### CycleDesign: save NC subprograms as cycles

For frequently recurring operations HEIDENHAIN controls provide you with NC subprograms containing configurable parameters. These subprograms are referred to as cycles. The TNC guides you through the process of entering these parameters with prompts, questions, and help graphics.

The cycles themselves are opened using soft keys. Pressing the CYCL DEF key shows you the soft-key row for HEIDENHAIN cycles on the control.

Using **CycleDesign**, you can even incorporate your own NC subprograms as cycles into the soft-key structure of the control. You can choose whether to add your cycles to the HEIDENHAIN cycle bar on the side or completely replace the HEIDENHAIN cycle bar.

CycleDesign lets you save this cycle data in the control's memory.



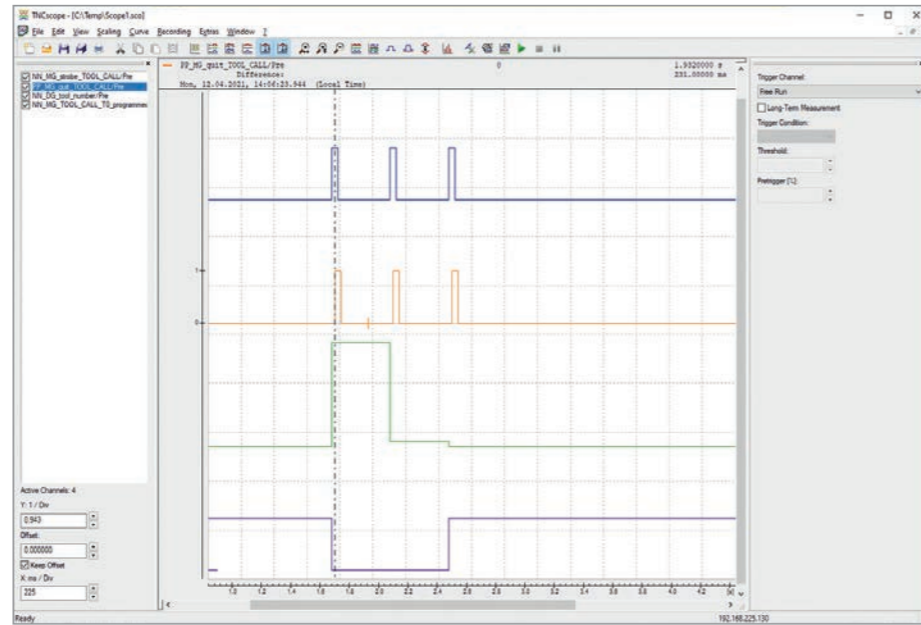
|  |  |
|--|--|
| <b>CycleDesign</b>   | Registration required                        |
| <b>TNC 640 HSCI</b>  | NC SW 34059x-01 or later                     |
| <b>TNC 620 HSCI</b>  | NC SW 34056x-01/73498x-01/81760x-01 or later |
| <b>TNC 320</b>   | NC SW 34055x-01/771851-01 or later           |
| <b>Installation</b> by users or machine manufacturers  |  |
| <b>For more information</b> , see the <i>Information for the Machine Tool Builder</i> brochures. |  |

## Software

### TNCscope: export oscilloscope files to a PC

**TNCscope** is a PC oscilloscope software for recording and evaluating control signals, drive signals, and PLC operands from HEIDENHAIN controls. TNCscope enables convenient diagnosis from a Windows PC. With a simple Ethernet connection, you can also use TNCscope to perform remote maintenance on the control. The TNCscope software also lets you display oscilloscope files that have been recorded on the control (offline mode). An extensive selection of mathematical functions is available for analysis.

- Multi-channel recording
- Various triggering options
- Convenient analysis of measured values
- Display of circular test and XY files of the control
- Display of logic-trace and HSCI-trace files
- Cursor and auxiliary cursors
- Setting of marks
- Measurement and comparison of curves
- Gating of curves with a formula
- Calculation of integrals and derivatives
- XY view
- Frequency analysis with Fast Fourier Transformation (FFT)
- Copying of curves to another file
- Printing of a graph with additional information
- Import function for any ASCII tables
- Long-term measurements
- Recording in batch mode
- Support during the initial setup of various control functions (PAC, LAC, CTC, MAC, ACC, Component Monitoring)



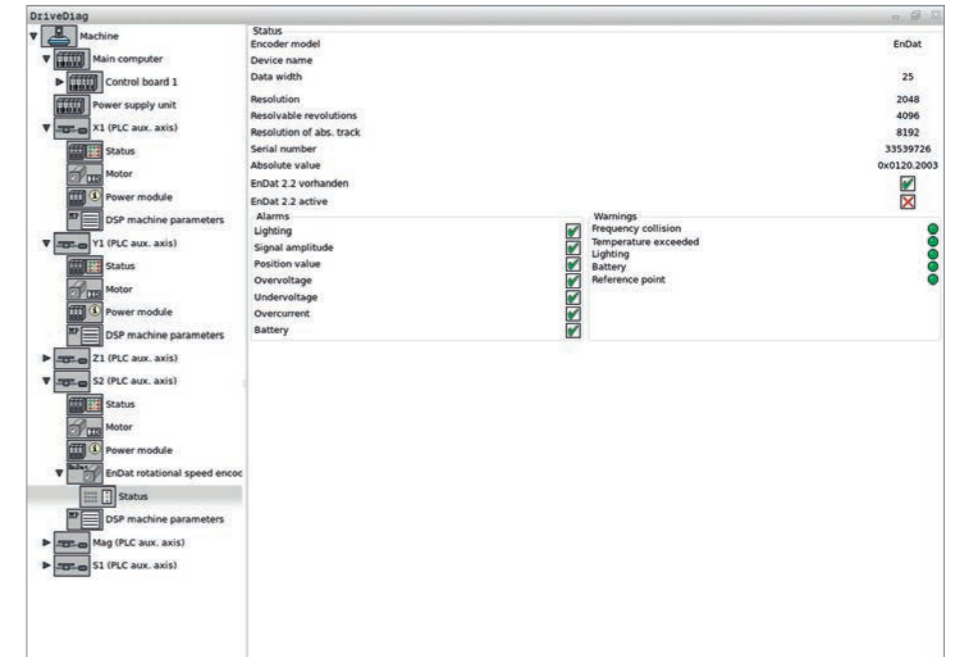
| TNCscope   | Registration required                        |
|--|--|
| <b>TNC 640 HSCI</b>  | NC SW 34059x-01 or later                     |
| <b>TNC 620 HSCI</b>  | NC SW 34056x-01/73498x-01/81760x-01 or later |
| <b>TNC 320</b>   | NC SW 34055x-01/771851-01 or later           |
| <b>Installation</b> by machine manufacturers or servicing providers                              |  |
| <b>For more information</b> , see the <i>Information for the Machine Tool Builder</i> brochures. |  |

## Software

### TNCdiag: for evaluating status information and diagnostic information

Based on the **HFL** interface (**HEIDENHAIN Fibre Link**) between the components of the Gen 3 drives, detailed diagnostic possibilities are offered during initial setup and later servicing. To this end, the visualization and presentation of the available diagnostic data have been improved in the **TNCdiag** software. TNCdiag provides all of the relevant information and statuses of the components in the control system, all the way down to the encoders. This depiction can be component- or axis-specific and is optimized for touch operation. TNCdiag is available as an application on the control for displaying live data and as a PC tool for evaluating diagnostic data, including offline from service files.

- Status and diagnostic information about the HEIDENHAIN components (drive electronics, encoders, input/output devices, etc.) connected to the control
- History of the recorded data
- Replacement of DriveDiag for Gen 3



Graphically supported, dynamic display of status signals

| TNCdiag  | Registration required    |
|--|--------------------------|
| <b>TNC 640 HSCI</b>  | NC SW 34059x-10 or later |
| <b>TNC 620 HSCI</b>  | NC SW 81760x-07 or later |
| <b>TNC 320</b>   | —                        |
| <b>Installation</b> by machine manufacturers or servicing providers                              |                          |
| <b>For more information</b> , see the <i>Information for the Machine Tool Builder</i> brochures. |                          |



# Software

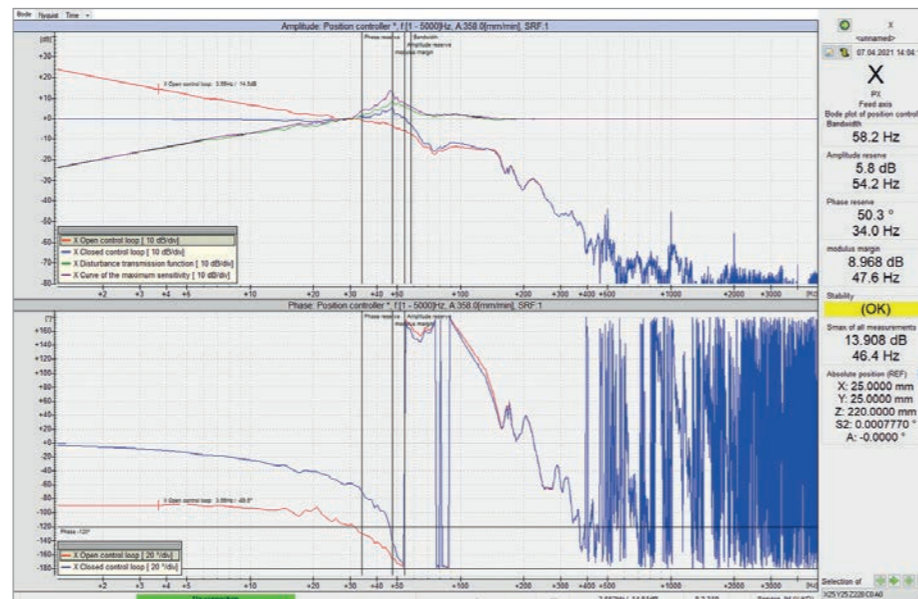
## TNCopt: for the initial setup of digital control loops

Machine tools with HEIDENHAIN controls must always meet the highest performance standards (surfaces, accuracy, fast and efficient machining, stable machining processes, etc.).

As part of this, exceptional performance is required of the drive system with servo motors and spindles. Efficient and intelligent control technology is therefore a very high priority at HEIDENHAIN. Of particular importance is having the correct control-loop optimization and function settings in the control. **TNCopt** conveniently helps you keep an overview and adhere to the correct sequence during the initial setup of all axes.

### Functions:

- Initial setup/optimization of the cascade control
- Compensation of peripheral machine influences (friction, hysteresis, etc.)
- System identification
- Dynamic Efficiency/Dynamic Precision
- Measuring functions (circular test, etc.)
- Automated Controller Tuning (ACT)



# Software

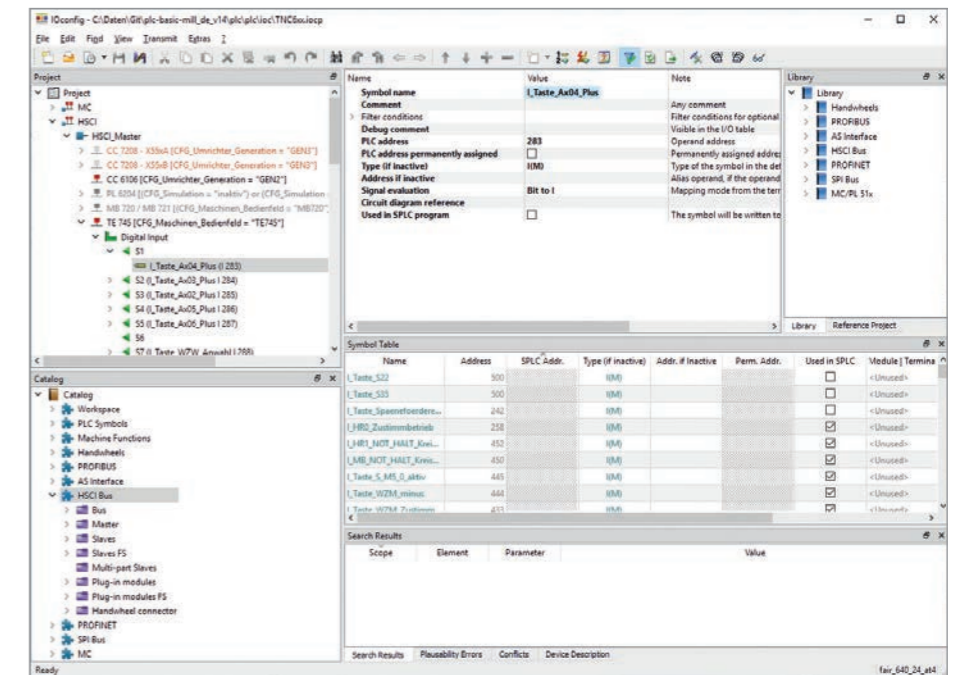
## IOconfig: configuration of I/O and HSCI components

Modern machine tools are becoming ever more complex and extensively equipped. For this reason, IOconfig allows you to configure all bus systems for HEIDENHAIN controls with all symbolic PLC operands. All required information is stored in a project file (.iopc).

### Functions:

- All information is included in one project file
- All device descriptions are contained in the project file
- Generation of symbol definition files for PLC and SPLC
- Comprehensive option handling for including optional elements in the project
- Simulation mode for direct overview of active and inactive elements
- Convenient operation thanks to modern user interface
- Easy exchange of modules
- Symbol table for straightforward management of PLC symbols
- Definition of PLC start addresses for all elements
- Catalog for device descriptions
- Library for frequently used elements and branches
- Reference project for transferring elements from other projects
- Embedded in PLCdesign as of PLCdesign 3.1

With IOconfig 3, new bus systems are supported by simply adding further bus plug-ins. IOconfig currently includes plug-ins for HSCI, SPI, PROFIBUS, PROFINET, and AS interface, as well as MC/PL51x and handwheels. The current device description files for HSCI devices and the HEIDENHAIN PROFIBUS PL are also included.



|  |                          |
|--|--------------------------|
| <b>TNCopt</b>  | Registration required    |
| <b>TNC 640 HSCI</b>  | NC SW 34059x-04 or later |
| <b>TNC 620 HSCI</b>  | NC SW 81760x-01 or later |
| <b>TNC 320</b>   | —                        |
| <b>Installation</b> by machine manufacturers or servicing providers                              |                          |
| <b>For more information</b> , see the <i>Information for the Machine Tool Builder</i> brochures. |                          |

|  |  |
|--|--|
| <b>IOconfig</b>  | Registration required                        |
| <b>TNC 640 HSCI</b>  | NC SW 34059x-01 or later                     |
| <b>TNC 620 HSCI</b>  | NC-SW 34056x-01/73495x-01/81760x-01 or later |
| <b>TNC 320</b>   | NC-SW 77185x-01 or later                     |
| <b>Installation</b> by machine manufacturers or servicing providers                              |  |
| <b>For more information</b> , see the <i>Information for the Machine Tool Builder</i> brochures. |  |

## Software

### TNCkeygen: enabling keys for software options

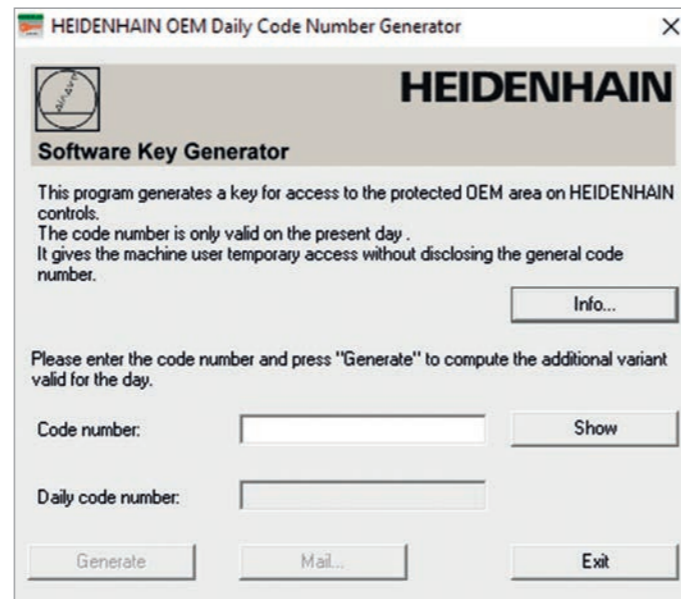
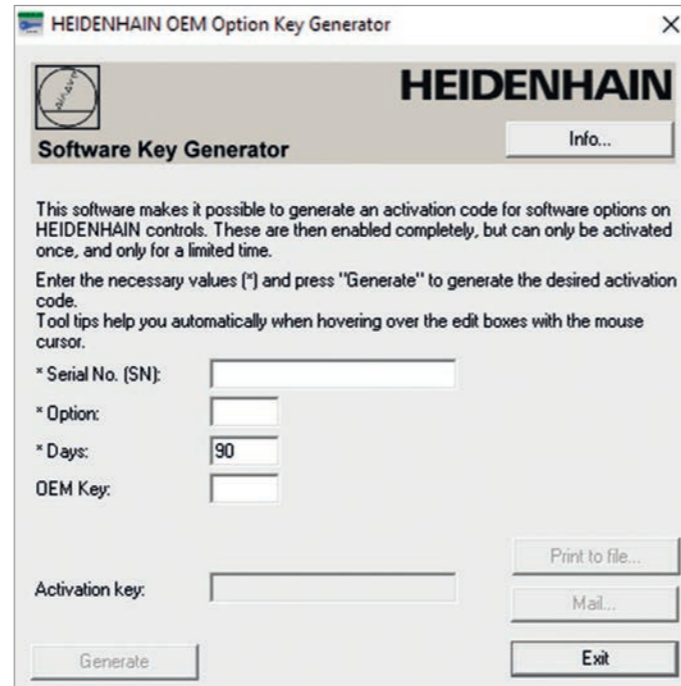
**TNCkeygen** is a collection of PC software tools for generating enabling keys for HEIDENHAIN controls for a limited period of time.

#### OEM key generator

The OEM key generator PC tool makes it possible to generate an enabling key for software options on HEIDENHAIN controls. The selected option is enabled for a limited time (10 to 90 days). It can only be enabled once. You can generate the desired enabling key by entering the SIK number, the option to be enabled, the duration, and a manufacturer-specific password. This allows the customer to test the available options at his own pace without being forced to buy them. After successful testing, the customer can purchase the desired option from HEIDENHAIN.

#### OEM daily key generator

This application generates an enabling key for the protected machine-manufacturer area on HEIDENHAIN controls. This key gives the user access on the same day the key is generated.



| Software Key Generator   | Registration required                        |
|--|--|
| TNC 640 HSCI   | NC SW 34059x-01 or later                     |
| TNC 620 HSCI   | NC SW 34056x-03/73498x-01/81760x-01 or later |
| TNC 320  | NC SW 34055x-05/771851-01 or later           |
| <b>Installation</b> by machine manufacturers   |  |
| <b>For more information</b> , see the <i>Information for the Machine Tool Builder</i> brochures. |  |

## Software

### BMXdesign

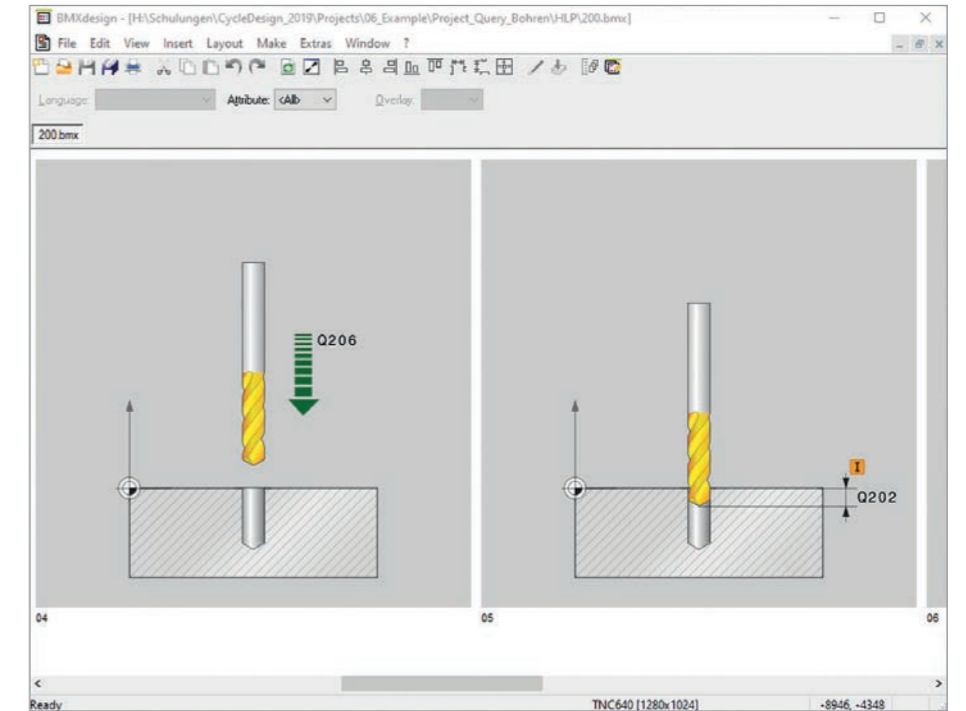
**BMXdesign** allows you to interactively create BMX project files and finished BMX files.

BMX files contain graphical and text elements that can be combined by the control into variants during program run. In this manner, help graphics or soft keys with language-sensitive texts or status-sensitive variants can be combined into just a single file.

BMX files are described in a BMX project file (\*.BPJ). BMXdesign generates the final BMX file from the BPJ file.

#### Available functions:

- Interactive creation of BMX project files (WYSIWYG)
- Display of BMX files as on the control
- Adding and editing text and graphic elements
- Positioning of text fields with the mouse
- Automatic alignment of fields
- Adding of variants
- Replacement of database IDs with plain-language texts from multi-lingual files
- Printout with page preview
- Generation of BMX files
- Export function as bitmap file (\*.BMP)
- Extracting graphic elements from BMX files
- Integration of PLCtext for managing BMX files
- Integration in PLCdesign



| BMXdesign  | Registration required                        |
|--|--|
| TNC 640 HSCI   | NC SW 34059x-01 or later                     |
| TNC 620 HSCI   | NC SW 34056x-01/73498x-01/81760x-01 or later |
| TNC 320  | NC SW 34055x-01/771851-01 or later           |
| <b>Installation</b> by machine manufacturers   |  |
| <b>For more information</b> , see the <i>Information for the Machine Tool Builder</i> brochures. |  |



# Software

## Programming station

### What's the purpose of a programming station?

As easy as it is to write a part program on a TNC at the machine while a different part is being machined, short reloading times or high machine utilization may hinder attentive programming work on the shop floor. The programming station lets you program the same way you would at the machine but away from all the noise and distractions.

### Creating programs

Creating, testing, and optimizing of HEIDENHAIN Klartext or ISO programs for the TNC on the programming station reduces machine idle times. And it's easy to get used to because every keystroke feels the same: the programming station's keyboard is just like the one on the machine.

### Testing programs created offline

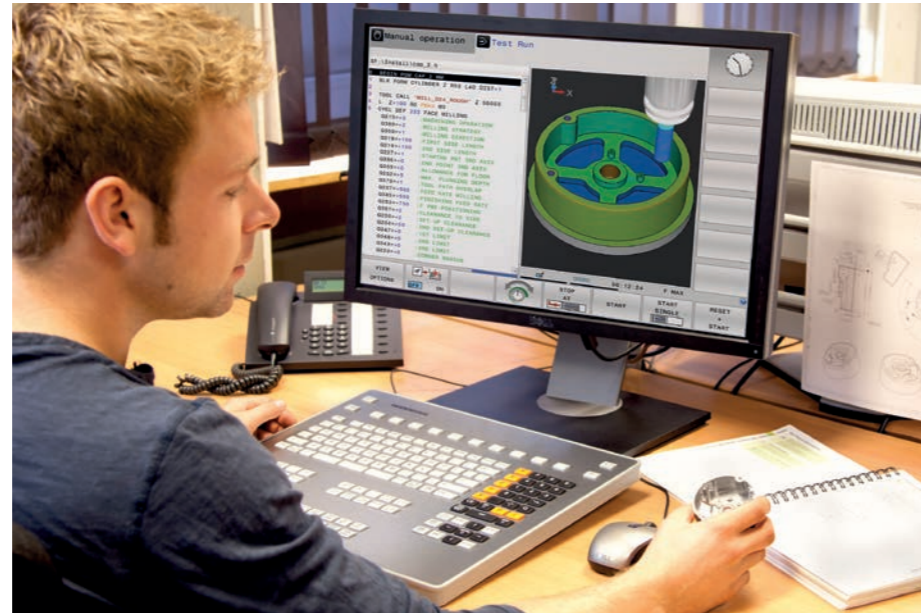
Naturally, you can also test programs written on a CAM system. The high-resolution program verification graphics help you easily spot contour damage and hidden details, even in complex 3D programs.

### Training with the TNC programming station

Since the programming station is based on the same software as the TNC, it is ideal for apprentice and advanced-level training. Programming is performed on the original keyboard unit. Even Test Run mode runs exactly as it would on the machine. This gives the trainee the confidence needed to operate a real machine. The programming station is also optimally suited for teaching TNC programming skills in schools, enabling programming in HEIDENHAIN Klartext and even ISO code.

### The workstation

The programming station software runs on a PC and differs only marginally from a real TNC on a machine. You can still work with a TNC operating panel, except that it now includes the soft keys normally built into the monitor. The TNC operating panel is connected to the USB port of your PC, allowing your PC to display the familiar TNC interface. Alternatively, you can also operate the programming station without a keyboard. In this case, operation is performed with a virtual keyboard displayed along with the TNC control panel. It gives you the TNC's most important dialog activation keys.



### Which programming stations are available?

Programming stations are available for all current TNC controls. A further version for operation with the VBox virtualization software is available as an option. The programming station DVDs include the programming station software, the necessary drivers, and the current User's Manuals in all available languages.

| Programming station                             | TNC 640       | TNC 620 / TNC 320 |
|---|---------------|-------------------|
| Demo version                                    | ID 1114029-xx | ID 1114030-xx     |
| With TNC operating panel                        | ID 1113967-02 |                   |
| With virtual keyboard                           |               |                   |
| Single station license                          | ID 1113924-03 |                   |
| Network license, 1 station                      | ID 1125955-03 |                   |
| Network license, 14 stations                    | ID 1113926-03 |                   |
| Network license, 20 stations                    | ID 1113928-03 |                   |
| Operating panel without software release module | ID 1113967-52 |                   |

**Installation** by the user

**For more information**, see the *Programming Station for TNC Controls* brochure.

# Software

## virtualTNC: control of virtual machines

The simulation of NC programs on the control has long been a part of HEIDENHAIN contouring controls. The **virtualTNC** solution makes it possible to use the TNC as a control component for machine simulation applications (virtual machines) on external computer systems.

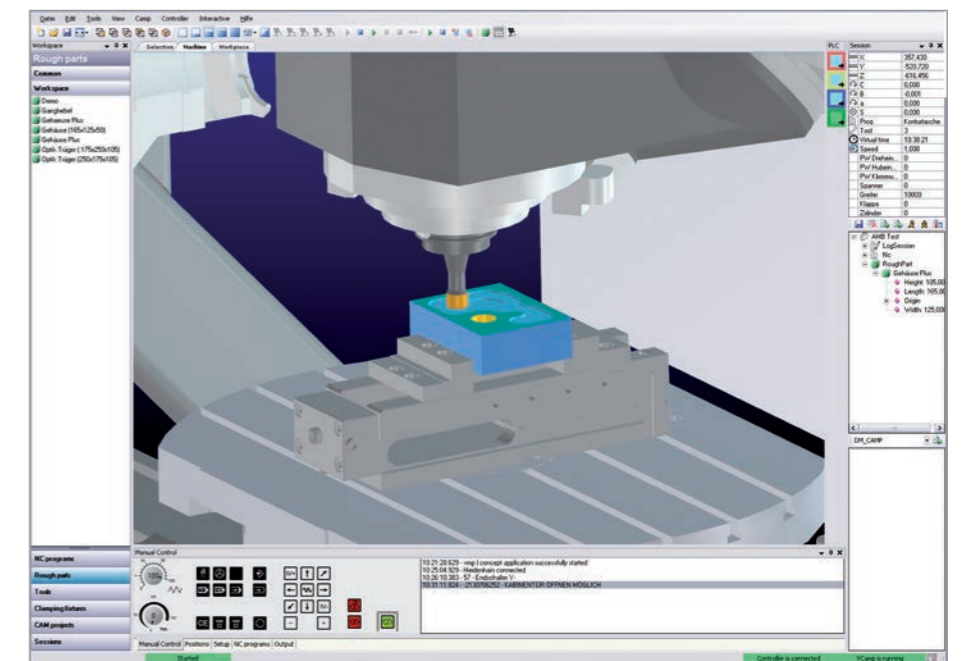
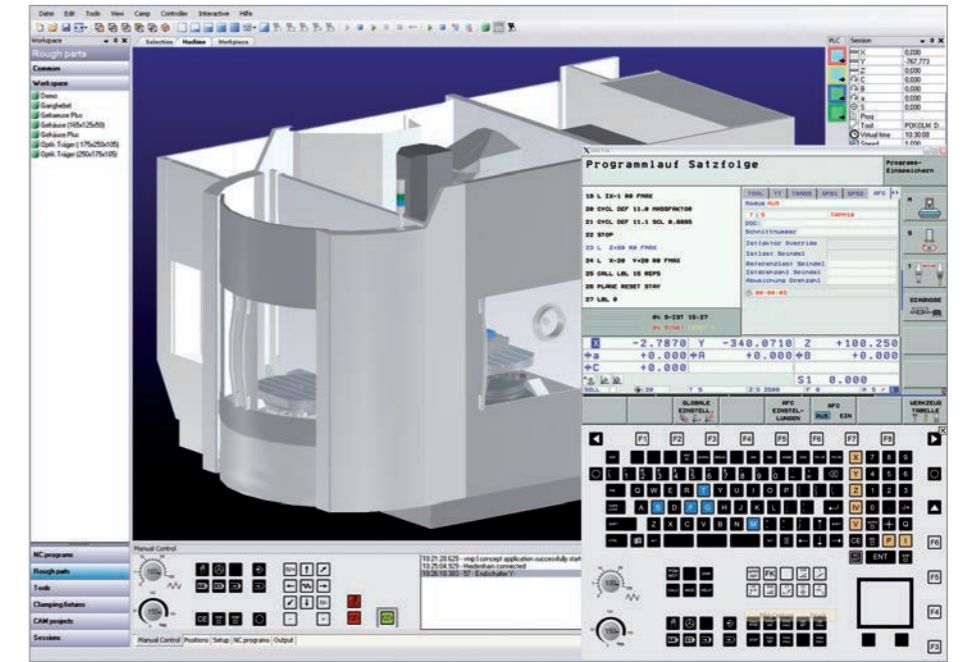
### How a virtual machine with virtualTNC works

Machine simulation applications (virtual machines) can fully simulate production units, allowing real-world production processes to be optimized in advance. The virtualTNC software can control the axes of a virtual machine as if it were a real system. Users program and operate the control just as they would an actual HEIDENHAIN TNC.

The virtualTNC solution is a programming station software application of the TNC that, thanks to a special interface, is able to ascertain the current axis positions of the running "virtual" control.

### Connecting virtualTNC over HEIDENHAIN DNC

Software manufacturers who wish to simulate a production system can connect their virtual machine to virtualTNC through HEIDENHAIN DNC. The **COM component** (AxisStreaming object) required for the programming and configuration of the interface to virtualTNC and its interface description are included in the **RemoTools SDK** development package and the relevant help system.



| The <b>virtualTNC</b> solution is available for a fee | <b>TNC 640 HSCI</b> |
|---|---------------------|
| Single station license                                | ID 1113933-03       |
| Network license, 1 station                            | ID 1122145-03       |
| Network license, 14 stations                          | ID 1113935-03       |
| Network license, 20 stations                          | ID 1113936-03       |

**Installation** by manufacturers of machine simulation applications

**For more information**, see the *HEIDENHAIN DNC* brochure.



## Hardware enhancements

### HR: electronic handwheels

You can move TNC-controlled machine axes by simply pressing the axis direction keys. A simpler and more sensitive method, however, is to use an electronic handwheel from HEIDENHAIN.

In this case, the feed motor moves the axis slide in direct relation to the handwheel's rotation. For delicate operations, you can incrementally set the distance travelled per handwheel revolution.

#### HR 130 panel-mounted handwheels

The panel-mounted handwheels from HEIDENHAIN can be integrated into the machine operating panel or mounted at another location on the machine.

#### HR 510, HR 520, and HR 550 portable handwheels

The HR 510, HR 520, and HR 550 portable handwheels are particularly helpful when you work near the machine's working space. The axis keys and certain function keys are built into the housing. This lets you set up the machine or switch between the axes you want to move from wherever you happen to be standing with the handwheel. The integrated display of the HR 520 and HR 550 handwheels keeps you immediately informed about the most important operating statuses. As a wireless handwheel, the HR 550 is ideal for use on large machines. When you aren't using the handwheel, you can simply place it in the HRA 551 FS holder (transceiver with built-in charger).



HR 550



HR 520



HR 510



HR 130

| Electronic handwheel        | With/without detent      | TNC 640 HSCI  | TNC 620 HSCI                  | TNC 320       |
|-----------------------------|--------------------------|---------------|-------------------------------|---------------|
|                             |                          | Minimum NC SW | Minimum NC SW                 | Minimum NC SW |
| HR 130                      | ID 540940-01/540940-03   | 34059x-01     | 34056x-01/73498x-01/81760x-01 | 34055x-01     |
| HR 510                      | ID 1120313-xx/1119971-xx | 34059x-01     | 34056x-01/73498x-01/81760x-01 | 34055x-01     |
| HR 510FS                    | ID 1119974-xx/1120311-xx | 34059x-02     | 34056x-02/73498x-02/81760x-01 | 34055x-06     |
| HR 520                      | ID 670303-xx/670302-xx   | 34059x-02     | 34056x-04/73498x-02/81760x-01 | 34055x-06     |
| HR 520FS                    | ID 670305-xx/670304-xx   | 34059x-02     | 34056x-04/73498x-02/81760x-01 | 34055x-06     |
| HR 550FS                    | ID 1183021-xx/1200495-xx | 34059x-02     | 34056x-04/73498x-02/81760x-01 | 34055x-06     |
| HRA 551 FS<br>for HR 550 FS | ID 1119052-xx            | 34059x-02     | 34056x-04/73498x-02/81760x-01 | 34055x-06     |

Installation by the machine manufacturer

For more information, see the *Information for the Machine Tool Builder* brochures.

## Hardware enhancements

### TS: workpiece touch probes

Workpiece touch probes from HEIDENHAIN help you reduce cost during shopfloor and serial production. Together with the TNC, touch probes can be used for manual or automatic setup, measuring, and inspection functions:

- Workpiece alignment
- Preset setting
- Workpiece measurement

The touch probes for workpiece measurement are inserted into the tool holder either manually or by a tool changer. Based on the machine, the touch probes can be equipped with various tool shanks. The stylus of a TS touch trigger probe is deflected upon contact with a workpiece surface. In that instant, the TS generates a triggering signal that, depending on the model, is transmitted to the control either by cable, radio transmission, or an infrared beam.

#### Cable-bound touch probes

For machines requiring manual tool changes, as well as for grinding machines and lathes:

**TS 260:** new generation; axial or radial cable connection

#### Wireless touch probes

With radio or infrared signal transmission for machines with an automatic tool changer:

**TS 460:** new-generation standard touch probe for radio and infrared transmission, with compact dimensions, energy-saving mode, optional collision protection, and thermal decoupling

**TS 740:** high probing accuracy and repeatability, low probing forces, and infrared transmission

#### Transceiver unit

Radio and infrared communication is established between the TS or TT touch probe and the SE transceiver.

**SE 660** for radio or infrared transmission (hybrid technology); for both the TS 460 and TT 460.

**SE 661** for radio or infrared transmission (hybrid technology); for both the TS 460 and TT 460; EnDat functionality for transmission of the switching state, diagnostic information, and additional data.

\*The SE 661 is only for the TNC 640 and TNC 620



TS 460



TS 260



SE 660/  
SE 661

| Workpiece touch probes |               | TNC 640 HSCI  | TNC 620 HSCI                   | TNC 320             |
|------------------------|---------------|---------------|--------------------------------|---------------------|
|                        |               | Minimum NC SW | Minimum NC SW                  | Minimum NC SW       |
| TS 260                 | ID 738283-xx  | 34059x-05     | 81760x-02                      | 771851-02           |
| TS 460                 | ID 1178530-xx | 34059x-05     | 81760x-02                      | 77185x-02           |
| TS 740                 | ID 573757-xx  | 34059x-01     | 34056x-03/73498x-01/ 81760x-01 | 340551-05/771851-01 |
| TS 642                 | ID 653217-xx  | 34059x-09     | 81760x-06                      | 77185x-06           |

Installation by the machine manufacturer

For more information, see the *Touch Probes for Machine Tools* brochure.



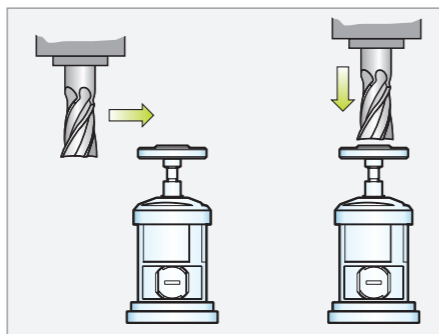
## Hardware enhancements

### TT: tool touch probes

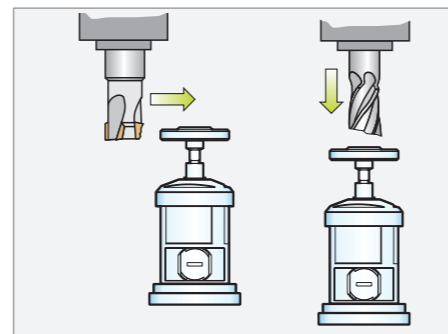
A key factor in obtaining consistently high production quality is, of course, the tool. This requires the exact measurement of tool dimensions and a cyclical inspection of the tool for wear, breakage, and tooth shape. For tool measurement, HEIDENHAIN offers the **TT triggering tool touch probes**.

These touch probes are installed directly within the machine's workspace, where they enable tool measurement either before machining or during interruptions.

The **TT tool touch probes** measure the tool length and radius. During probing of a rotating or stationary tool (e.g., for individual tooth measurement), the contact plate is deflected and a triggering signal is transmitted directly to the TNC. The **TT 160** uses cable-bound signal transmission, whereas the **TT 460** uses radio or infrared transmission. This makes the latter particularly well suited for use on rotary and tilting tables.



**TT tool touch probe**  
Tool length and radius measurement with stationary or rotating spindle



Tool wear measurement and tool breakage monitoring

| Tool touch probes           | TNC 640 HSCI<br>Minimum NC SW | TNC 620 HSCI<br>Minimum NC SW | TNC 320<br>Minimum NC SW |
|-----------------------------|-------------------------------|-------------------------------|--------------------------|
| <b>TT 160</b> ID 729763-xx  | 34059x-05                     | 81760x-02                     | 771851-02                |
| <b>TT 460</b> ID 1192582-xx | 34059x-05                     | 81760x-02                     | 77185x-02                |

Installation by the machine manufacturer

For more information, see the *Touch Probes for Machine Tools* brochure.

## Hardware enhancements

### ITC: additional operating station

The additional ITC (Industrial Thin Client) operating stations from HEIDENHAIN are convenient additional remote station solutions for operating the machine or machine units such as tool-changing stations. With a remote operating design tailored to the TNC, the ITC can be readily connected via a standard Ethernet connection with a 100 m (max.) cable.

The **ITC 755** is a compact additional operating station for control systems with a 15-inch or 19-inch main screen. In addition to having an ASCII keyboard and a touchscreen, it is also equipped with the most important function keys of the TNC. The ITC 755 adjusts its resolution automatically to fit the size of the main screen. The soft keys are operated on the touchscreen.

Together with the TE 73x or TE 74x keyboard unit, the **ITC 750** (15-inch screen) or **ITC 860** (19-inch touchscreen) each make up a full-fledged second operating station. Operation is identical to that of the TNC. The ITC 860 can also be used as a second-screen solution for an extended workspace.

#### Convenient plug-and-play technology

As soon as the TNC detects an ITC, the control provides it with an up-to-date operating system. After the ITC has booted, the main screen is mirrored one-to-one. Thanks to this plug-and-play capability, configuration by the machine manufacturer is not needed. With a standard configuration of the X116 Ethernet interface, the TNC automatically integrates the ITC into its system.

You can switch between the TNC and the ITC either by direct takeover or in accordance with a configurable handover principle. Both the booting and shutdown processes are fully controlled by the TNC for maximum operational reliability.



ITC 755



ITC 860



**ITC 860**  
As the "Extended Workspace"

| Additional operating station | TNC 640 HSCI<br>Minimum NC SW | TNC 620 HSCI<br>Minimum NC SW | TNC 320<br>Minimum NC SW |
|------------------------------|-------------------------------|-------------------------------|--------------------------|
| <b>ITC 755</b> ID 1039527-01 | 34059x-04                     | 81760x-01                     | –                        |
| <b>ITC 750</b> ID 1039544-01 | 34059x-04                     | 81760x-01                     | –                        |
| <b>ITC 860</b> ID 1174935-01 | 34059x-04<br>34059x-07 SP2    | –                             | –                        |

Installation by the machine manufacturer

For more information, see the *Information for the Machine Tool Builder* brochures.

## Hardware enhancements

### IPC: industrial PC

With the **IPC 6641** industrial PC, you can start and remotely operate Windows-based applications via the TNC's user interface, for example. The user interface is displayed on the control screen. Option 133 is required for this.

Since Windows runs on a separate computer, the control system remains unaffected by Windows. The IPC is connected to the NC main computer via Ethernet. A second screen is not needed, since the Windows applications are displayed on the TNC's screen via remote access.

In addition to the IPC 6641, a separately ordered hard disk is required for operation. The Windows 7, Windows 8, or Windows 10 operating systems can be installed on this empty data carrier.



IPC 6641

## Hardware enhancements

### VS 101: camera system for monitoring the working space

The **VS 101** camera system, in conjunction with Visual Setup Control (software option 136), enables you to monitor the working space of your machine. The sealed and highly rugged VS 101 camera system is designed to be installed inside the machine's working space. The protective housing features a closable cover and connections for sealing air to prevent damage to the camera optics. The VS 101 camera system can be connected directly to the control's main computer over a Gigabit Ethernet interface.

The lens cap and sealing air are controlled by the TNC's integrated PLC. This allows you to optimally adapt the VSC inspection procedure to your actual conditions.



VS 101

| Controls   | TNC 640 HSCI                                      | TNC 620 HSCI                     | TNC 320 |
|--|---|----------------------------------|---------|
| <b>Industrial PC</b>   | Prerequisite: Remote Desktop Manager (option 133) |                                  |         |
| <b>IPC 6641</b>  |   |                                  |         |
| With 8 GB of RAM   | ID 1039543-01                                     |                                  |         |
| With 16 GB of RAM  | ID 1039543-02                                     |                                  |         |
| <b>HDR IPC</b>   | ID 1074770-51                                     | Data medium for operating system |         |
| <b>Installation</b> by the machine manufacturer  |   |                                  |         |
| <b>For more information</b> , see the <i>Information for the Machine Tool Builder</i> brochures. |   |                                  |         |

| Camera system for monitoring the working space   | TNC 640 HSCI  | TNC 620 HSCI  | TNC 320       |
|--|---------------|---------------|---------------|
|  | Minimum NC SW | Minimum NC SW | Minimum NC SW |
| <b>VS 101</b>  | ID 1137063-01 | 340590-06     | –             |
| <b>Installation</b> by the machine manufacturer  |               |               |               |
| <b>For more information</b> , see the <i>Information for the Machine Tool Builder</i> brochures. |               |               |               |



# HEIDENHAIN

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