



Functions of the CNC PILOT 640

Comparison with the CNC PILOT 4290

www.heidenhain.com/cnc-controls

CNC PILOT 640

The control for lathes and turning-milling machines

The CNC PILOT 640 is always the right choice, allowing you to produce individual parts and series as well as simple and complex components with high efficiency, flexibility, and reliability. The CNC PILOT 640 offers a wide range of functions that cover not only the typical jobs of a conventional lathe but also automated manufacturing tasks. Programming directly on the control is fast and easy, even while other machining processes are in progress.

The CNC PILOT 640 provides intelligent support, including:

3D simulation

Gain a reliable assessment of the results prior to actual machining. The accurate, high-resolution 3D simulation of the CNC PILOT 640 lets you see whether, where, and why errors are to be expected and allows you to correct them before a single chip has fallen.

Touchscreen

Intuitively operate the CNC PILOT 640 with gestures commonly used on mobile devices. Simply select our 15.6-inch or

19-inch monitor with multi-touch functionality. A full ASCII keyboard with a number pad is also available for entering data.

smart.Turn

Create NC programs without needing to know G-codes. All of the required parameters are in user-friendly fillable forms illustrated with context-sensitive help graphics.

TURN PLUS

At the touch of a button, you can generate a work plan, machining strategy, tool selection, cutting data, and NC blocks for your machining operation. You just need to specify the geometry, material, and chucking equipment. The CNC PILOT 640 automatically generates the NC program.

Connected Machining

The responsibility for component quality and delivery date lies where the parts are machined: on the shop floor. That is why all information on machining has to come together here. And that is why you also need to have access to all relevant data from the shop floor and to apply your experience to the process chain. This is where the features of Connected Machining support you.

Send and receive e-mails on the control. Use the control to work directly with Windows applications, such as CAD programs. Forward status information in paperless format from the control. This is how you network your manufacturing process from the design to the shipped component with the shop floor as a command center in the company network.

Compatibility

You can also run existing NC programs from old HEIDENHAIN lathe controls on the CNC PILOT 640. With a convenient import filter, you can easily transfer older programs (e.g., from the CNC PILOT 4290) to the new control for continued use.

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Options are functions that are integrated in the control and that allow you to tailor the feature range of the CNC PILOT 640 to your actual requirements, including at a later time. Some options need to be adapted by the machine manufacturer.

The features and specifications described here apply to the following control and NC software versions:

CNC PILOT 640 with NC software versions

- 688946-08 (export license required)
- 688947-08 (export license not required)

This brochure supersedes all previous editions, which thereby become invalid. **Subject to change without notice.**

Main features of the CNC PILOT 640

Detailed simulation

The timely recognition of errors is extremely important in NC programming. With its graphic simulation feature, the CNC PILOT 640 supports you in checking the program for errors—with the real and exact dimensions of the contour and cutting edge, because the simulation works with the geometry values from the tool database.

Graphic simulation enables you to check the following already before machining:

- Approach and departure behavior
- The machining sequence
- The proportioning of cuts
- The finished contour

In the graphic simulation you can also display the tool cutting edge. You can view the cutting-edge radius, width, and position rendered true to scale. This helps you recognize machining details or collision risks in advance.

3D simulation

The accurate, high-resolution 3D simulation is particularly well suited for monitoring the machining results from turning, drilling, or milling processes prior to actual machining, or to monitor the workpiece on the control's screen. The 3D simulation visualizes milling and turning processes using different colors. This also applies to complex multi-channel operations. All workpieces are displayed, as are the tool movements of all slides. The rendered workpiece blank and finished part can be rotated on all axes, thus permitting visual inspection from any angle. With its intuitive gesture control, you can navigate and zoom into every programmed detail—of course even with C-axis contours on the cylindrical surface or face, and with Y-axis contours in the tilted plane. In this way, the 3D simulation enables you to detect even the smallest error before actual machining.

Of course, the CNC PILOT 640 is also available with the tried and tested line graphics, cutting-path graphics, and movement simulation (material-removal graphic) of the CNC PILOT 4290.

Your benefits:

Recognize critical tool movements

Identify unintended movement of the tool before machining

Minimize scrap

The detailed graphics let you recognize unwanted machining effects early on

Find necessary changes quickly

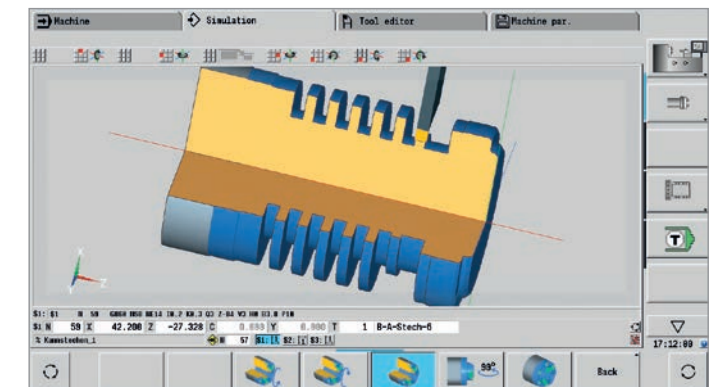
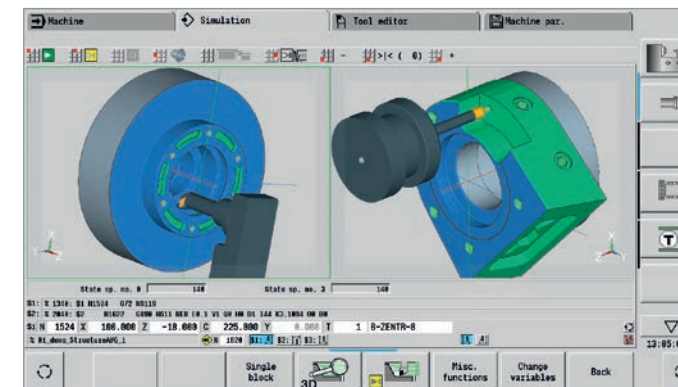
Recognize turning and milling operations at a glance

Complete simulation

Five-axis milling, turning, drilling, sinking, chamfering, and realistic thread depiction

Avoiding collisions

Realistic representation of the tool holder in the simulation



Main features of the CNC PILOT 640

State-of-the-art multi-touch operation and clear-cut display

The CNC PILOT 640 is equipped with a practical touchscreen designed for harsh shop conditions. It is splash-proof, scratch-resistant, and features an IP54 protection rating. The screen can be operated by means of gestures such as those commonly used on mobile devices.

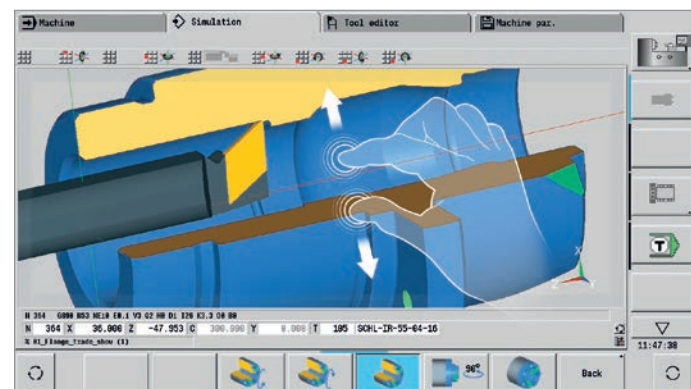
The CNC PILOT 640 is available with two screen formats. The 19-inch TFT color flat screen is particularly suitable for large or multi-channel machines that require a larger field of view.

The smaller screen in the 15.6-inch widescreen format is particularly suitable for compact machines. The widescreen format ensures a clear overview of the programs—particularly in programming mode.

The CNC PILOT 640 gives you a clear view of all the information you need for programming, operating, and checking the control and machine.

During program input, the required parameters are illustrated in help graphics. In the simulation, all movements of the tool are displayed in realistic detail. During program run, the CNC PILOT 640 shows you complete information on the tool position, speed, and load of the drives, as well as the current machine status.

The lathe controls from HEIDENHAIN were impressing users with their innovative 9-block menu guidance long before the advent of touchscreen operation. Here the numeric keypad serves both for the selection of functions and for data input. This makes fast one-handed operation possible. However, the user interface design based on this technique is also ideal for touch operation. This enhances a simple and effective operating technique with today's touchscreen technology. The familiar input via the ergonomically designed control panel is fully continued in the CNC PILOT 640. At the same time, you benefit from the same intelligent gesture control you've learned to use on your mobile devices.



Your benefits:

Effective operation

Through swiping (kinetic scrolling) in NC programs, tables, and lists

Intuitive operation

Through gesture control, e.g., in the 3D simulation

Easy to operate

Direct selection of operating elements, soft-key rows, and navigation in menus

Practical touchscreen

Designed for harsh shopfloor conditions: splash-proof, scratch-resistant, and an IP54 rating

| Symbol | Gesture |
|--------|-----------------|
| | Tap |
| | Double tap |
| | Long press |
| | Swipe |
| | Drag |
| | Two-finger drag |
| | Spread |
| | Pinch |

Programming

Effective, clearly organized and flexible

The smart.Turn principle

The working block—called a unit—plays a pivotal role in smart.Turn programs. A unit completely and unambiguously defines a single working step. The unit includes the tool call, the technology data, the cycle call, the approach and departure strategies, and global data such as the safety clearance. All of these parameters are displayed together in a clearly structured dialog box. The smart.Turn principle gives you the reassurance that the working block is defined correctly and completely. In the NC program, smart.Turn lists the unit's DIN PLUS commands. This gives you an overview of all of the working-block details at any time.

Clearly structured and easy-to-read—these are the characteristics of smart.Turn programs. smart.Turn uses section codes that clearly distinguish between the program head with setup information, the turret assignment, the workpiece blank and finished part description, and the actual machining operation.

Guided by the dialog, you enter the following data in this sequence:

- Program head
- Tool assignment in the turret
- Description of workpiece blank
- Description of finished part
- Individual machining steps

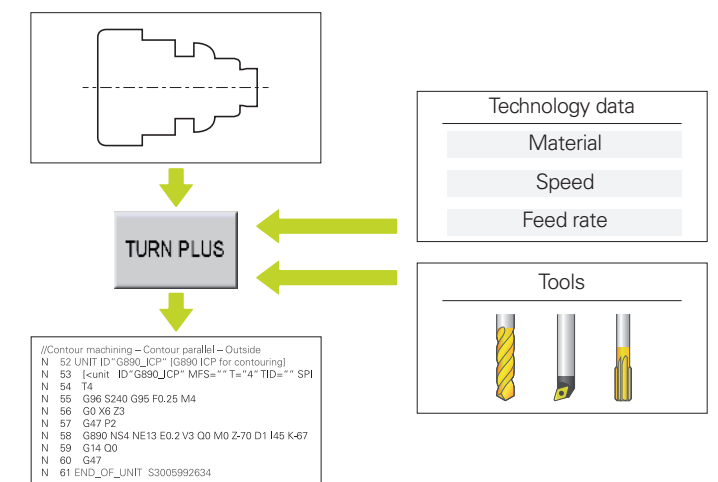
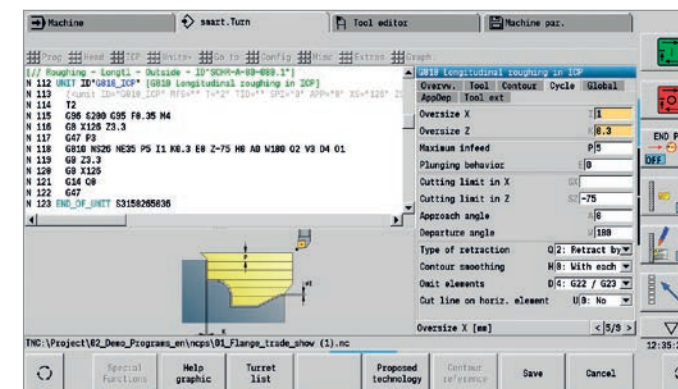
The smart.Turn method not only ensures that the program is easy to read; it also makes it possible to save all of the information required for producing the workpiece in the NC program.

TURN PLUS automatic program generation

With its powerful TURN PLUS automatic program generation, the control takes you on the fast lane from the drawing to the finished workpiece. After you have graphically entered the workpiece blank and finished contour, or imported it from a DXF file, simply select the material and fixtures. TURN PLUS does everything else automatically:

- Analysis of the contours
- Planning of the work strategy
- Selection of tool data and cutting data
- Generation of NC blocks

As a result, you receive a complete and thoroughly commented NC program in smart.Turn format.



Your benefits:

Better readability of NC programs

Well organized and user-friendly depiction. Program structure can be displayed in a tree view

User-friendly programming

Dialog-guided fillable-form input with help graphics

Collection of technology data

Automatic collection and input of technology data into the respective work block

Downward compatibility with existing NC programs

Compatible with predecessor controls through import filters for NC programs

Effective program creation with TURN PLUS

Up to 90% time savings in programming through analysis of the contours, planning of the working strategy and selection of the tool or cutting data

Setup

Tool measurement and workpiece measurement

Workpiece measurement

The CNC PILOT 640 features measuring cycles for checking the geometry of the machined workpieces.

For the measuring cycles, you simply insert a 3D touch probe from HEIDENHAIN into the turret in place of a tool. With a touch probe you can:

- Check whether all machining operations were conducted correctly
- Determine infeeds for finishing
- Detect and compensate for tool wear
- Inspect workpiece geometry and sort parts
- Log measured data
- Ascertain the machining trend

The HEIDENHAIN workpiece touch probe systems help to reduce costs on the shop floor and in serial production: The setup, measurement, and inspection functions can be executed automatically with the probing cycles of the CNC PILOT 640.

Tool measurement

Exact measurement of the tool dimensions is a decisive factor for ensuring a consistently high level of production quality. Tools can be measured for this purpose with a TT tool touch probe from HEIDENHAIN before or after a machining step.

Due to their rugged design and high protection rating, these tool touch probes can be installed directly within the machine tool's work envelope, thereby enabling tool measurement directly within the machine. You can thus determine the tool dimensions quickly, easily and, above all, very precisely. The TT tool touch probes from HEIDENHAIN are the ideal addition for improving the efficiency and quality of your production system.

Your benefits:

Easy calibration

Fully automatic calibration of the touch probe

Management of multiple touch probe data sets

Transparent and central management of touch probe data

Probe feed manipulation with override knob

Adjust the speed of probing without affecting accuracy

Risk reduction

Avoid collisions in automatic mode and in manual operation

Program run

Manufacturing complex parts productively

The CNC PILOT 640 provides a solution for any machining task and any machine configuration: it performs complex machining tasks with a C or Y axis. It also controls full-surface cutting on dual-spindle machines. On machines with a B-axis, machining in the tilted plane and even 5-axis simultaneous machining are possible.

In multi-channel machining, multiple slides simultaneously perform different machining steps. Several workpieces can also be machined at the same time, e.g., the front side on one part and the back on the other. These complex sequences require a perfect coordination of the individual processing steps.

A synchronization point analysis can be conducted beforehand in the simulation, which shows the time sequence of workpiece machining and the dependence of slides among each other. The CNC PILOT 640 calculates the productive, non-productive, and waiting times, as well as all tool changes and synchronization points. These are clearly displayed in a separate window.

Load Monitoring

The load monitor observes the machine's spindle and motor load while comparing them with the utilization values of a reference operation. You can set limit values for the measured load. If these values are exceeded, the CNC PILOT 640 can either stop the machining or continue with a replacement tool.

Advanced Dynamic Prediction (ADP)

ADP expands the previous pre-calculation of the maximum feed rate profile, providing optimized motion control for faultless surfaces and perfect contours, especially in milling operations. The control dynamically calculates the contour in advance and can therefore use an acceleration-limited motion control with smoothed jerk to adapt the axis velocity at contour transitions.

Simultaneous turning

Easy programming and time-saving machining of complex contours are possible directly on the machine and without a CAM system, with optimized production processes and fewer tool changes. Workpiece contours can be monitored relative to the tool and tool holder, while the tilt angle at the start and end points of the contour can be specified. The result: longer

tool life and prevention of visible transitions during the grinding of complex contours.

Trochoidal milling

The trochoidal milling function gives you prolonged tool life at higher feed rates and cutting depths, as well as lower machining times. This function can be used in all machining planes.

Component Monitoring

Through calculation of the mechanical loads on the spindle bearing during machining, you can avoid additional costs from unplanned machine downtime. You can thereby protect machine components from overloading without the need for additional sensors.

Your benefits:

Shorter machining times

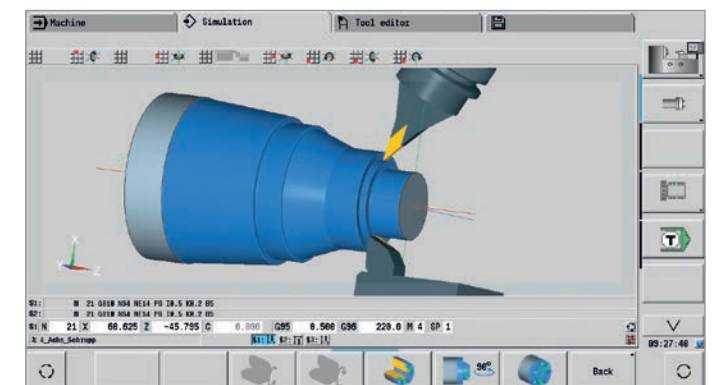
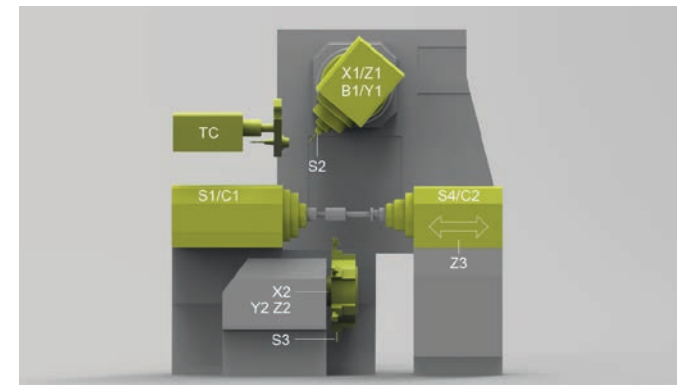
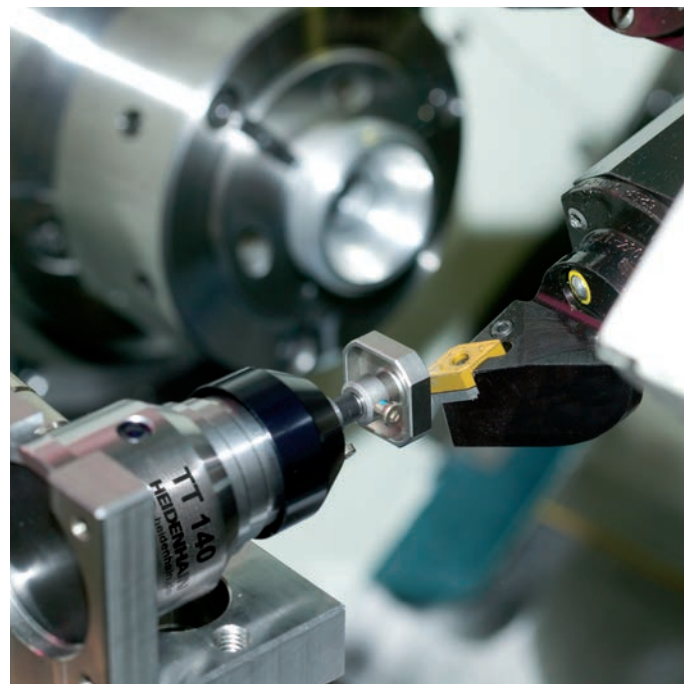
Through asynchronous multi-channel machining

Higher process reliability

Through spindle and axis supervision via Load Monitoring

Optimal surface definition

Through particularly smooth and precise tool movements thanks to ADP



Open for communication

Uniformly digital job management with Connected Machining

With Connected Machining, HEIDENHAIN controls support a thoroughly digital job management in production. Connected Machining offers a set of solutions that permit the exchange of information with all areas of the company that accompany production.

The **HEIDENHAIN DNC** software interface connects a control with resource planning and control console systems and to software for machine and production data collection systems. The CNC PILOT 640 provides comprehensive data as the basis for decisions in enterprise management via the DNC interface.

With **Remote Desktop Manager**, the machine operator can easily and safely use all data and information available in the company by directly accessing the company's PCs and servers. Of course, he can also send feedback to all process participants. Direct networking with the order processing department is particularly advantageous. By doing so, the machine operator can save time by directly processing job-related information, such as completion notifications, on MES/ERP portals made available for this purpose.

The PC software **StateMonitor** provides an easy-to-read overview of machine data in production. The machine's efficiency can be ascertained through the evaluation of important data such as current machine status, override settings, and the usage history. Based on the collected data, it indicates the available optimization potential and, if necessary, e-mails a notification if a machine is down or a malfunction occurs.

Extended Workspace enables the machine operator to work in parallel on the machine and on job management. He simply connects a second screen with the control via Ethernet and configures it as an additional screen. The control can then open PDFs, 3D data, DXF data, DXF files, or Remote Desktop Manager on a second screen.

connected + machining

Your benefits:

Windows-based applications right on your control

Operate PC systems or manage job orders

Increased competitiveness through optimized information flow

Gaps in information cost valuable time and resources. Optimize your data flow on the CNC PILOT 640

Using PC functions without reduction of machine performance

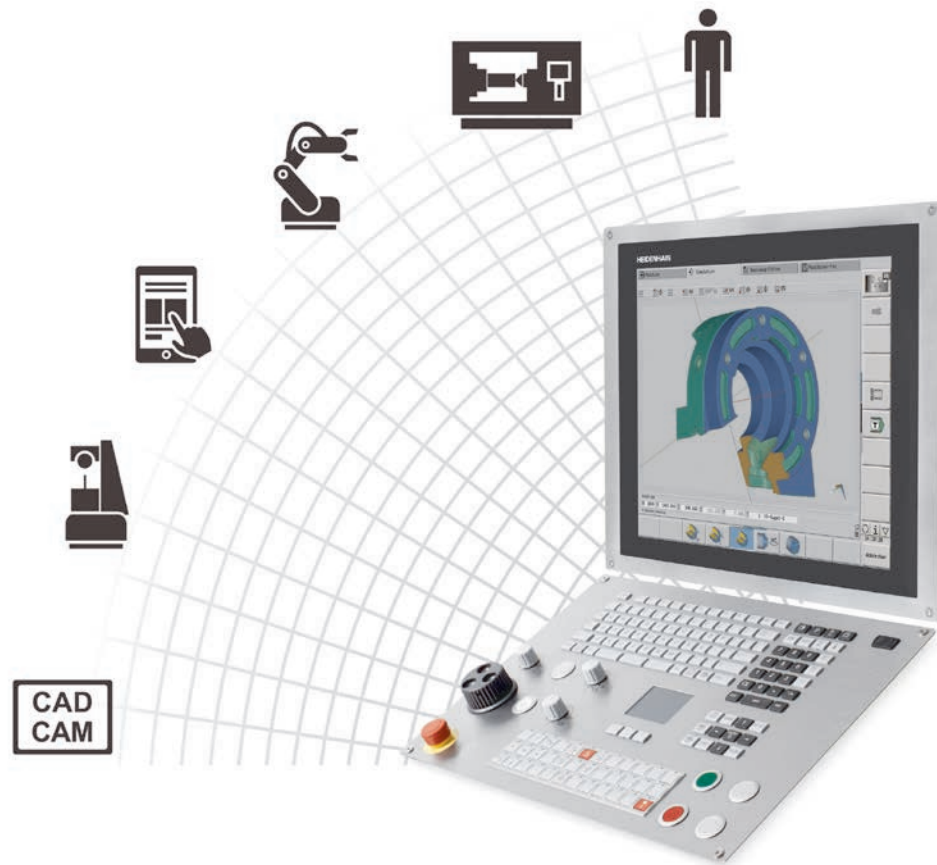
No negative effect on the control from remote access

Higher production efficiency

Continuous data exchange and coordinated processes enable economical production

Numerous functions provided as standard features

Even without options, you can use the CNC PILOT 640 to improve many processes on the shop floor



Comparison of functions of the CNC PILOT 640

New functions compared with the CNC PILOT 4290

| | Functions | Brief description |
|--------------------------------------|---|--|
| Touch operation | Quick and easy operation by fingertip | Practical touchscreens for: <ul style="list-style-type: none"> • Intuitive gesture control • Effective operation through swiping (kinetic scrolling) • Easy navigation in menus |
| Programming (general) | Import of MANUALplus cycle programs | Import and automatic conversion of DIN and cycle programs |
| | Programmable secondary axes U, V, and W | Simultaneous movement of NC and secondary axes in the NC program |
| | Eccentric machining and non-circular turning (G725, G726, G727) | Eccentric turning of out-of-round contours without any additional special mechanical provisions |
| | Face milling (G797) | Milling various figures as islands |
| | Helical slot milling (G798) | Milling of slots with any desired thread pitch |
| | Bore milling (G75) | Milling holes of any desired diameter |
| | Contour thread (G38) | Manufacturing threads without form tools |
| | Simultaneous turning with the B axis (G891, G895) | Roughing and finishing of complex contours in a single step |
| | Multiple plunging (G860) | Expansion of recessing: automatic distribution of recesses, taking the recessing width into account |
| | Trochoidal milling (G847, G848) | Efficiently machine pockets with different shapes (circle, rectangle, and polygon) and any slots |
| | Programmable misalignment compensation (G976) | Conical machining or compensation of mechanical offset |
| | Programmable fluctuating spindle speed (G924) | Reduction of resonance during shaft machining |
| | LIFTOFF with NC stop | Safe retraction without workpiece damage, even during thread cutting |
| | Names for milling, drilling, and boring contours | Designation of contour parts with freely definable names to use them in cycles |
| | Definition of milling patterns for free contours | Creating linear or circular patterns with any contours |
| Cycle extensions | Additional cycle functionality: <ul style="list-style-type: none"> • Aligning the proportioning of cuts to contour edges • Entering a dwell time in spindle revolutions | |
| Expanded subprogram interface | Transferring string parameters in subprograms and programming return values | |
| Expanded variable programming | String operations, e.g., for engraving dates and/or times | |
| Teach-in mode with blank form update | Machining workpieces step-by-step, thereby generating a program | |

| | Functions | Brief description |
|------------------------------------|------------------------------------|--|
| Programming with smart.Turn | UNIT programming | Structured programming with function blocks |
| | OEM UNIT and OEM menu | Integrating complete UNITS and menu trees of the machine tool builder into the editing interface |
| | NC program with tree view | Clear depiction of long and complex programs |
| Programming with TURN PLUS | Generating programs with TURN PLUS | Generating a complete program with functional blocks (UNITS) |
| | Interactive tool selection | Convenient selection and adjustment of tools during automatic program creation |
| | Operating-parameter dialog | Edit frequently used TURN PLUS parameters in an easy-to-read dialog box |
| Simulation | 3D simulation graphics | Display programmed contours as a 3D graphic before machining |
| | 3D holder graphic | Depicting the tool holder in the 3D machining simulation |
| | 3D simulation | 3D simulation for turning, boring, drilling, and milling operations: <ul style="list-style-type: none"> • Accurate, high-resolution view • Section view can be moved • Realistic depiction of threads • Start block can be specified • Genuine C-axis movements • Display mode for engraving • Color scheme based on machining operation (turning / milling) • Simultaneous depiction of multiple contour groups |
| Program-run graphics | Real-time graphical simulation | Graphical depiction of the current machining operation |
| Setup | Touch probe cycles | Touch probe cycles in setup mode: <ul style="list-style-type: none"> • Touch probe cycles for datum and tool measurement • Calibrating the TT tool touch probe |
| | LAC weighing cycle | Function G239: load ascertainment for LAC (Load Adapt. Control) load-dependent adjustment of control parameters (option 143) |
| Program run | Advanced Dynamic Prediction (ADP) | Optimized motion control for perfect surfaces and contours, particularly for milling operations |
| | Thread recutting | Repair and rework of threads |
| | Batch mode | Automatic execution of several different main programs, e.g., bar loader operation, loading by robots |
| | Five-axis machining | Milling for free-form surfaces |

| | Functions | Brief description |
|-----------------------------|---|---|
| Measuring | Probing cycles for tool measurement in manual operation | Calibrating tools with the TT tool touch probe |
| | Touch probe cycles in NC programs for workpiece measurement | Comprehensive touch probe cycles for: <ul style="list-style-type: none"> • Datum shift • Tool compensation • Additive correction • Logging |
| Tool management | Quick-change tool holder | Shortens setup and tool-change times |
| | Tool-holder database | Acquisition of geometric data on tools, e.g., for the 3D holder graphic |
| | Tool filter for tool selection or tool search | Comprehensive filter capabilities for fast searches in the tool table |
| | Tool-magazine management | Special functions for tool magazines: <ul style="list-style-type: none"> • Magazine pocket management for chain, manual, and circular tool magazines • Support of tool preselection • Tool change in mid-program startup • Loading and unloading during setup |
| | Tool-specific speed limitation | Assign a permissible maximum rotational speed for each tool |
| | Tool texts | Freely definable additional texts for each tool |
| Monitoring functions | Load Monitoring | Detect tool wear and breakage during machining |
| | Component Monitoring | Monitoring of machine components for overloading and wear |
| Connectivity | HEIDENHAIN-DNC | Interface for communication between NC and external PC applications |
| | Remote Desktop Manager | Display and remote operation of external computer units, e.g., a Windows PC |
| | HEIDENHAIN StateMonitor | Evaluation tool for all important data such as machine status, machine messages, etc. |
| | Support of handwheels with display | HR 550 FS and HR 520 (FS) |
| | State Reporting Interface (SRI) | Interface for convenient reporting of machine operating statuses for a higher-level MDA or PDA system |

| | Functions | Brief description |
|---|---|--|
| Improvements for machine manufacturers | Tool identification | Support of tool identification systems |
| | SQL tables | SQL tables defined by the machine manufacturer for expert programs or PLC functions |
| | Functional safety (FS) | Integrated functions in hardware and software that support the machine manufacturer in compliance with EN ISO 13849, "Safety of machinery — Safety-related parts of control systems" |
| | Gantry axes | Position and/or torque coupling of NC axes |
| | Integrated PLC software development environment | Convenient control-integrated development and diagnostic environment for the PLC user program |
| | PLC window | Display PLC window with Python |
| | Integrated TNCdiag motor diagnostics | Diagnostic possibilities of the entire drive train of the supply unit, inverter, and motors up to the connected encoders |
| | Modern computer hardware | Powerful processors on the NC and CC for compute-intensive functions |

| Improved functions compared with the CNC PILOT 4290 | | |
|--|--|--|
| Programming | ICP contour programming | Contour programming selectable in DIN or graphically (equally editable in both display modes) |
| | Recessing cycles with multiple planes | The desired plunging depth can be limited by an additional parameter |
| | Measuring spindle angular offset (G906) | Replaced by G905 |
| | Spindle parting control (G991, G992) | Replaced by G917 |
| Simulation | 2-D simulation | Color marking highlights the areas currently being machined by the tool |
| | Tool carrier depiction | Any tool carriers, e.g., turrets or B-axis heads, can be displayed in the 2-D graphic |
| Improvements for the machine tool builder | PLC and commissioning | Various tools for diagnosis and commissioning are available, e.g., TNCopt, ConfigDesign, PLCdesign |
| | Machine display (dashboard) | Display elements for datum shift, display of the current kinematics, FS status, etc. |
| | Editing of the machining sequence | Expanded capabilities for definition of the machining sequence in TURN PLUS |
| | Definition of multi-edges | Simple definition of tools with multiple edges in the tool editor |
| Differences in function | | |
| | Interpreter instead of compiler | Programs can now be started immediately. A previous compiler run is no longer necessary |
| | Realizing compensations | Tool and additive compensation values are realized in a movement immediately after a start. The CNC PILOT 4290 realized compensations gradually over the entire traverse distance |
| | Clamping fixture description | The clamping devices are described directly in the program. A clamping table is no longer required |
| | Tool life management | The sequence of exchange is defined in the NC program. The CNC PILOT 4290 defined the sequence in the turret table |
| | Variable programming with expanded functions | All variables are evaluated during run time. There is no need to distinguish between D and V variables. In addition, new functions are available for requesting states internal to the control |

Overview

| | CNC PILOT 640 NC SW 68894x-08 | CNC PILOT 4290 (in the latest software version) |
|--|---|---|
| Lathes and turning-milling machines | Max. 24 drives | Max. 10 drives |
| Program entry | | |
| • Teach-In mode | Option | – |
| • smart.Turn | ✓ | – |
| • DIN PLUS | ✓ | ✓ |
| • Interactive Contour Programming (ICP) | ✓ | ✓ |
| • DXF Import | Option | Option |
| • TURN PLUS | Option | Option |
| Machining time analysis | ✓ | ✓ |
| Tool and workpiece measurement | Option | Option |
| C-, Y-, and B-Axis Machining | Options | Options |
| 5-axis machining with X, Y, Z, B, C | Option | – |
| ADP for high surface quality | ✓ | – |
| Parallel axes (U, V, W) | ✓ | – |
| Counter Spindle | Option | Option |
| Multi-channel capability (up to three channels for asynchronous multi-slide machining) | Option | Option |
| Eccentric and non-circular turning | Option | Option |
| 3D simulation | ✓ | – |
| Load Monitoring | Option | Option |
| Advanced synchronization of axes and spindles | Option | – |
| Magazine management | ✓ | Limited |
| Tools and Technology | Option | Option |
| User administration | ✓ | – |
| Connected Machining | ✓ | – |
| Component Monitoring | Option | – |
| State Reporting | Option | – |

HEIDENHAIN

Mastering nanometer accuracy



HEIDENHAIN

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