



HEIDENHAIN



Functions of the CNC PILOT 640

Comparison with
CNC Pilot 4290

CNC PILOT 640

The control for lathes and turning-milling machines

The CNC PILOT 640 is always the right choice: with it, you can produce individual parts and series as well as simple and complex components. And you can do it with high efficiency, flexibility and process safety. The CNC PILOT 640 offers you a range of functions which covers the typical tasks of a conventional lathe as well as automated production. You can create the necessary programs conveniently and directly at the control, even during ongoing machining processes.

The CNC PILOT 640 supports you at this, e.g. with the following intelligent solutions:

3-D simulation

Before you actually begin machining, make sure you have a reliable evaluation of the expected result. With the high-resolution and finely detailed 3-D simulation of the CNC PILOT 640, you can see whether, where and why errors are to be expected and correct them before a single chip has fallen.

Touchscreen

Operate the CNC PILOT 640 intuitively through gestures such as those you use in mobile devices. It features TFT touch screens with 15.6" or 19". A full-fledged ASCII keyboard with numeric keypad is also available for the input of data.

smart.Turn

You can create NC programs even without having memorized G codes. All required parameters are included in clearly structured fillable forms and are illustrated by context-sensitive help graphics.

TURN PLUS

Create a work plan, work strategy, selection of tools, cutting data and NC blocks for your machining operations at the touch of a button. You only have to specify 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: in the workshop. 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 workshop 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 workshop as a command center in the company network.

Compatibility

Execute existing NC programs from old HEIDENHAIN lathe controls on the CNC PILOT 640 as well. With a convenient import filter, you can take older programs, e.g. from the CNC PILOT 4290, and simply transfer them to the new control for continued use.



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Options are functions integrated in the control with which you can adapt the feature range of the CNC PILOT 640, retroactively if necessary, to your actual requirements. Some options have to be adapted by the machine tool builder.

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

CNC PILOT 640 with NC software versions

688946-05

(export license required)

688947-05

(no export license 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 movements
- The machining sequence
- The proportioning of cuts
- The finished contour

In the graphic simulation you can also display the tool cutting edge. You see the cutting-edge radius, the cutting-edge width and the cutting-edge position with their actual dimensions. This helps to recognize machining details or collision risks in time.

3-D simulation

The high-resolution 3-D simulation is particularly well suited for accurately assessing the production result of turning, drilling or milling processes before actual machining. The 3-D simulation visualizes milling and turning processes using different colors. A freely rotational view about the axes permits optical inspection of the blank and finished part from all angles. 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 3-D 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

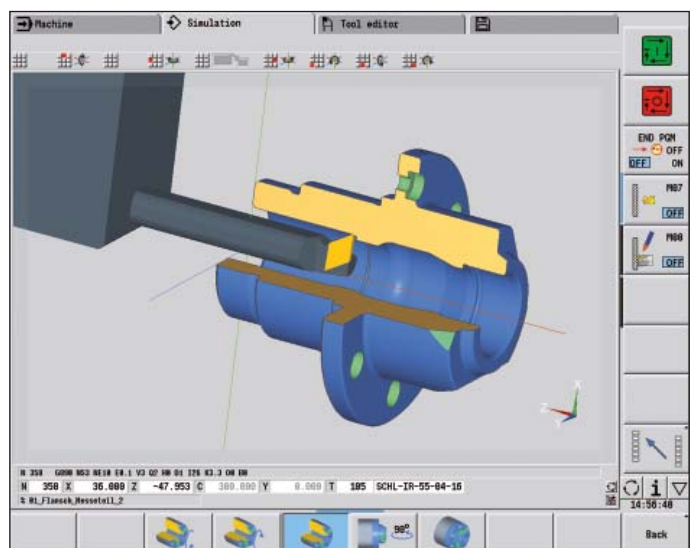
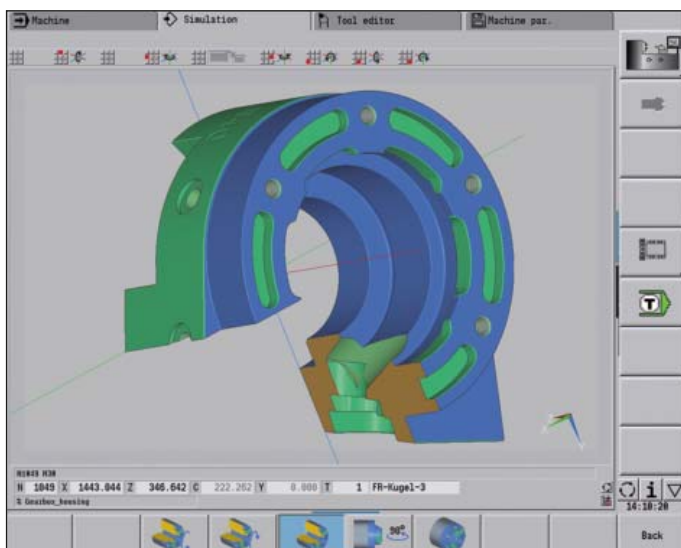
Recognize turning and milling operations at a glance

Complete simulation

5-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 multitouch operation and clear-cut display

The CNC PILOT 640 is equipped with a practical touch screen designed for harsh workshop conditions. It is splash-proof, scratch-resistant and certified for IP64 protection. The screen can be operated with gestures such as are commonly used on mobile devices.

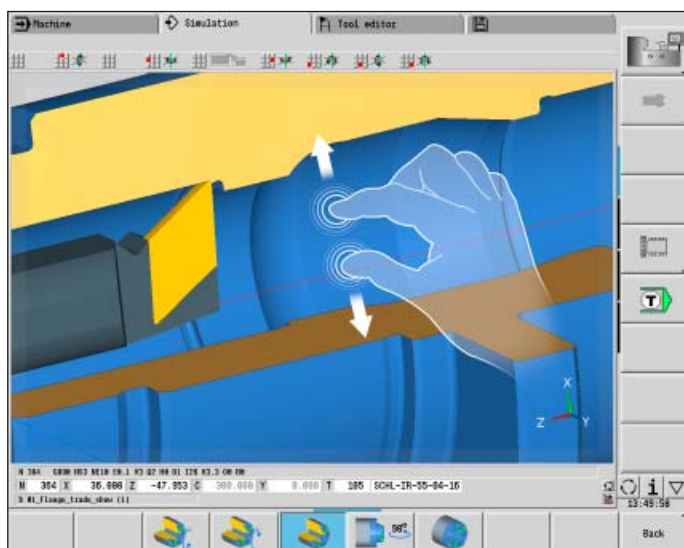
The CNC PILOT 640 is available with two screen formats. The 19" TFT color flat screen is particularly suitable for large or multi-channel machines that require a larger field of view.

The smaller screen in the 15.6" wide-screen format is particularly suitable for compact machines. The widescreen format guarantees a very clear view of the programs—especially in the programming mode.

The CNC PILOT 640 gives you a clear view of all the information you need to program, operate and check 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 a detailed and realistic manner. During the program run, the CNC PILOT 640 shows you all information on the tool position, speed and load of the drives as well as the current machine condition.

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 3-D simulation

Easy to operate

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

Practical touchscreen

Conceived for harsh workshop conditions. Splash-proof, scratch-resistant, with IP64 protection

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 the central role in smart.Turn programs. A unit describes a machining step completely and unambiguously. The unit includes the tool call, the technology data, the cycle call, the approach and departure strategies as well as global data, such as safety clearance, etc. All these parameters are summarized in one, 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 DIN PLUS commands of the unit. This gives you an overview of all 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.

Under dialog guidance, you enter in the following order:

- Program head
- Tool assignment in the turret
- Workpiece-blank definition
- Description of machined part
- Individual machining steps

The smart.Turn technique not only ensures that the program is easy to read, it also makes it possible to save all 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 brings 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 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

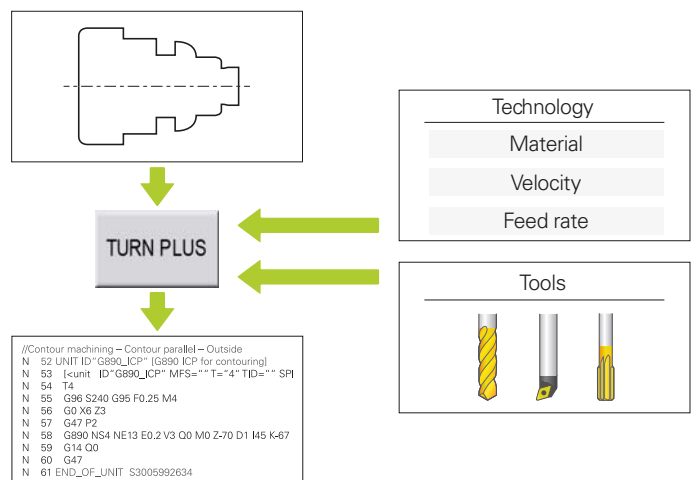
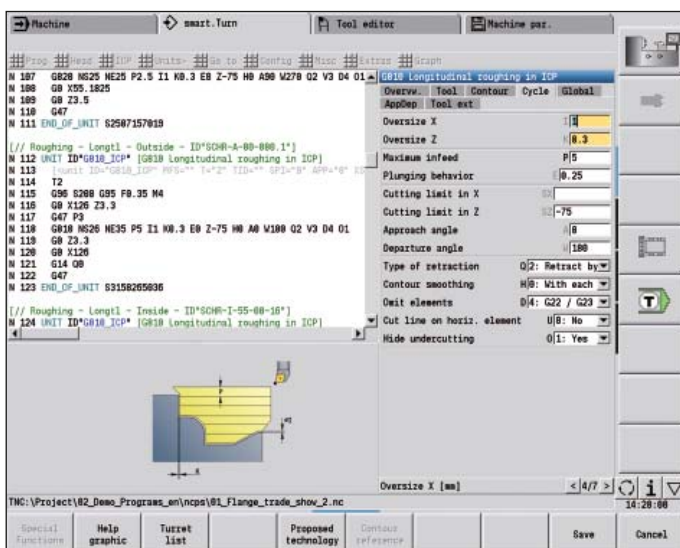
Automatic collection and input of technology data into the respective work block

Downward compatibility with existing NC programs

Compatible with predecessor controls through import filters for NC programs

Effective program creation with TURN PLUS

Up to 80% time savings in programming through analysis of the contours, planning of the working strategy and selection of the tool or cutting data



Setup

Tool calibration 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 3-D 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 tool wear,
- check workpiece geometry and sort parts,
- log measured data,
- ascertain the machining error trend.

The HEIDENHAIN workpiece touch probe systems help to reduce costs in the workshop 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 probe system from HEIDENHAIN before or after a machining step.

With their rugged design and high degree of protection, the tool touch probes can be installed directly within the machine tool's work envelope and make it possible to calibrate the tool right in the machine. This way you can determine the tool dimensions quickly, easily and, above all, very precisely. The TT tool touch probes are the ideal supplement to improve the efficiency and quality of your production.

Your benefits:

Simple calibration

Fully automatic calibration of the touch probe

Managing multiple touch probe data sets

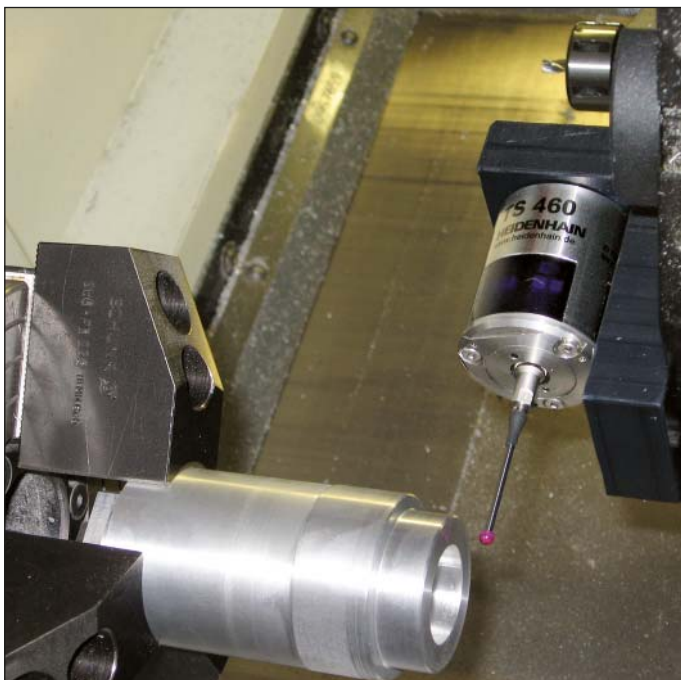
Transparent and central management of touch probe data

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



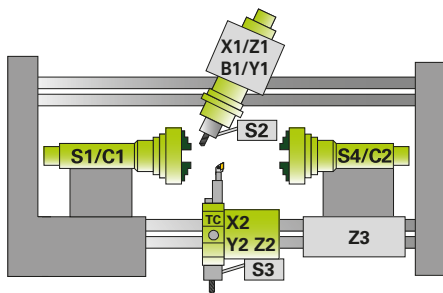
Program run

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.

Your benefits:

Shorter machining times

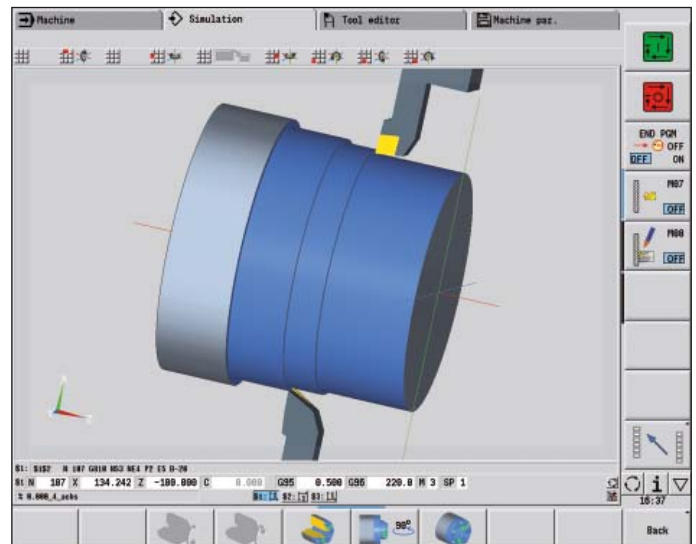
Through asynchronous multi-channel machining

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 order management with Connected Machining



With Connected Machining, HEIDENHAIN controls support a thoroughly digital order 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 the **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. This enables the machine operator to directly edit order-related information such as job-done messages on provided MES/ERP portals and thereby save time.

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 order 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, 3-D data, DXF data, DXF files or the Remote Desktop Manager on a second screen.

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 in the workshop



Comparison of functions of the CNC PILOT 640

New functions compared with the CNC PILOT 4290

	Functions	Short description
Touch operation	Quick and easy operation by fingertip	Practical touch screens for: <ul style="list-style-type: none"> • Intuitive gesture control • Effective operation through swiping (kinetic scrolling) • Simple 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	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
	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 time	
Teach-in mode with blank form update	Machining workpieces step-by-step, thereby generating a program	
Programming with smart.Tum	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 complex and long programs

	Functions	Short description
Programming with TURN PLUS	Generating programs for 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	3-D simulation graphics	Display programmed contours as a 3-D graphic before machining
	3-D holder graphic	Depicting the tool holder in the 3-D machining simulation
	3-D simulation	3-D simulation for turning, boring, drilling, and milling operations: <ul style="list-style-type: none"> • High-resolution, finely detailed view • Section view can be moved • Realistic depiction of thread • Start block can be specified • Genuine C-axis movements • Display mode for engraving • Machining-oriented coloring (turning/milling)
Setup	Touch probe cycles	Touch probe cycles in setup mode: <ul style="list-style-type: none"> • Touch probe cycles for datum and workpiece measurement • Calibrating the TT tool touch probe
Program run	ADP – Advanced Dynamic Prediction	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
	5-axis machining	Milling for free-form surfaces
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 compensation • Logging

	Functions	Short description
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 3-D 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
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 displays	HR 550 FS and HR 520 (FS)
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
	DriveDiag integrated drive 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

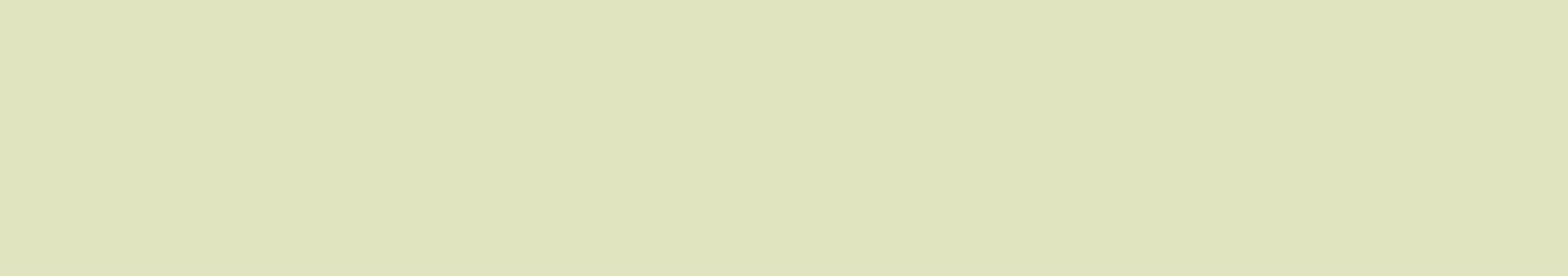
Improved functions compared with the CNC PILOT 4290		
Programming	ICP contour programming	Contour programming selectable in DIN or graphically (equally editable in both display modes)
	Recessing cycles with multiple planes	The desired plunging depth can be limited by an additional parameter
	Measuring 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 device 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

Scheduled functions

Function	Short description	Function scheduled for software version
LAC weighing cycle	"ASCERTAIN THE LOAD" cycle for Load Adaptive Control (LAC). Load-dependent adjustment of controller parameters (option 143)	68894x-06
3-axis simultaneous turning	Simultaneous turning with the B axis	68894x-06
Concurrent simulation	Current workpiece machining shown graphically in real time	68894x-06
Returning to the contour before the interruption point	Tool returns to contour at the interruption point	Later

Overview

	CNC PILOT 640 NC SW 68894x-05	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	–
Parallel axes (U, V, W)	●	–
Counter spindle	Option	Option
Multi-channel capability (up to 3 channels for asynchronous multi-slide machining)	Option	Option
Eccentric and non-circular turning	Option	Option
3-D simulation	●	–
Load monitoring	Option	Option
Advanced synchronization of axes and spindles	Option	–
Magazine management	●	limited
Tools and technology	Option	Option



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