

Machine Tool Control



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Contouring controls for milling, drilling, boring machines and machining centers

The TNC contouring controls from HEIDENHAIN for milling, drilling, boring machines and machining centers cover the whole range of applications:

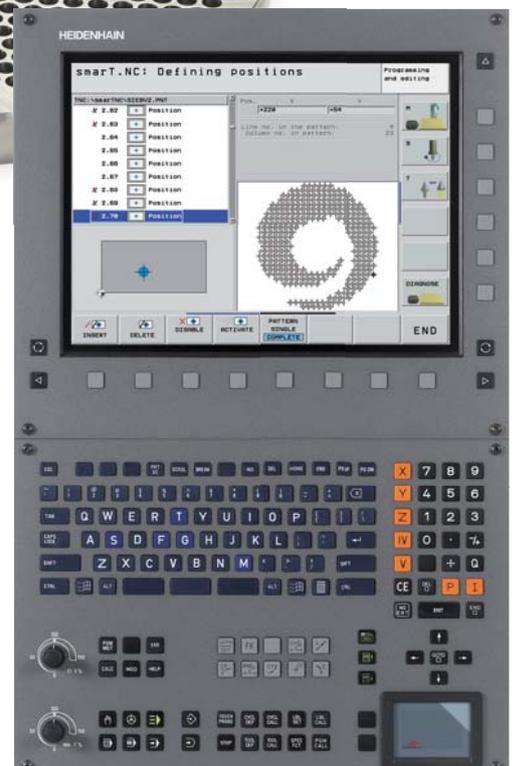
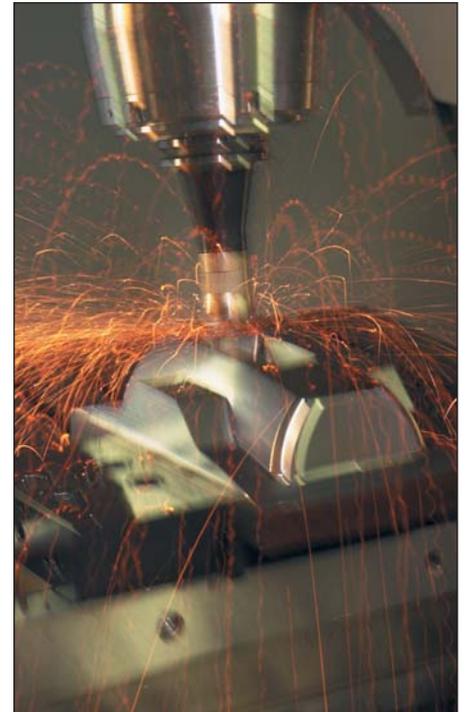
From the simple, compact TNC 320 3-axis control to the iTNC 530 (up to 13 axes plus spindle)—there's a HEIDENHAIN TNC control for nearly every application.

Besides these TNCs, HEIDENHAIN also supplies controls for other areas of application, such as lathes.

HEIDENHAIN TNCs are versatile, featuring both **shop-floor programming**, and **offline programming**, and are therefore ideal for **automated production**.

They handle simple milling tasks just as reliably as the iTNC 530, for example, can perform **high speed cutting**—with especially low-jerk path control—or **5-axis machining** with swivel head and rotary table.

TNC part programs have long lives because they are **upwardly compatible**. Programs from older TNCs can also run on the new models. When moving up to a more advanced TNC, the user merely builds on what he already knows.



Shop-floor programming

HEIDENHAIN controls are workshop oriented, which means that they were conceived to be **programmed** by the machinist **right at the machine**.

Thanks to its **conversational programming**, the user need not learn G codes or special programming languages. The control "speaks" with him with easily understandable questions and prompts.

Ease of use is also promoted by clear, **unambiguous key symbols** and names. Each key has only one function.

The **easy-to-read screen** displays plain-language information, dialog guidance, programming steps, graphics, and a soft-key row. All texts are available in **numerous languages**.



Frequently recurring machining sequences are saved as **fixed cycles**.

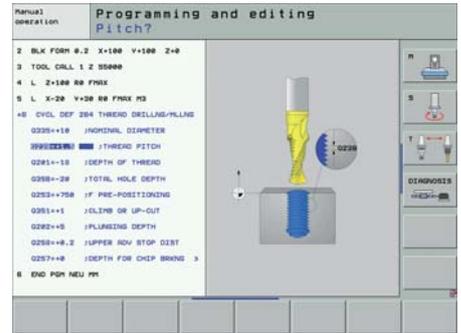
Graphic illustrations simplify programming and provide valuable aid for verifying the program during test runs.

The new **smarTNC** operating mode makes programming even easier. With the well-thought-out input forms, you can create your NC program even faster. Of course you'll be aided by help graphics. As always, HEIDENHAIN has placed great value on compatibility. At any time, you can switch from smarTNC to conversational and back. But not only can you write programs with smarTNC—you can test and run them as well.

HEIDENHAIN controls excel not only through their plain-language programming. You can also write programs in ISO 6983 (DIN 66025) or download and run them through the data interface.

DXF data processing (option)

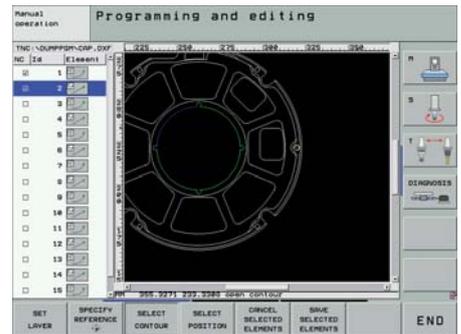
You can now open DXF files created in a CAD system directly on the iTNC 530 to extract contours and machining positions. Not only does this save time otherwise spent on programming and testing, but you can also be sure that the transferred data are exactly according to the designer's specifications.



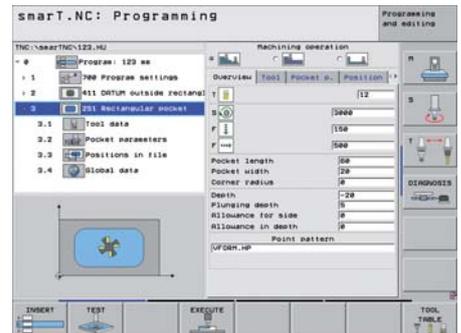
Conversational programming



Key symbols



DXF data, processing



smarTNC:
Programming made simpler

HEIDENHAIN Contouring Controls		Series	Page
For milling, drilling, boring machines and machining centers For simple milling, drilling and boring machines	Up to 11 axes plus spindle	iTNC 530	38
	3 axes + spindle	TNC 320	42
Accessories	Electronic handwheels Programming stations	HR	43
		iTNC/TNC 320	43

iTNC 530 Contouring Control

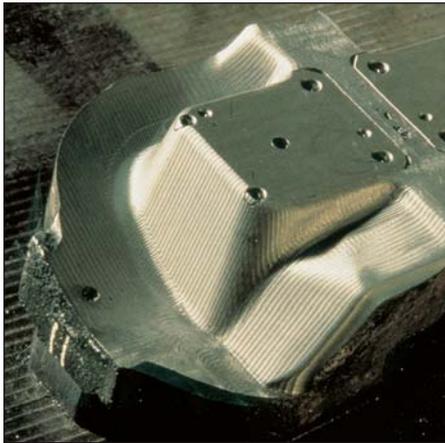
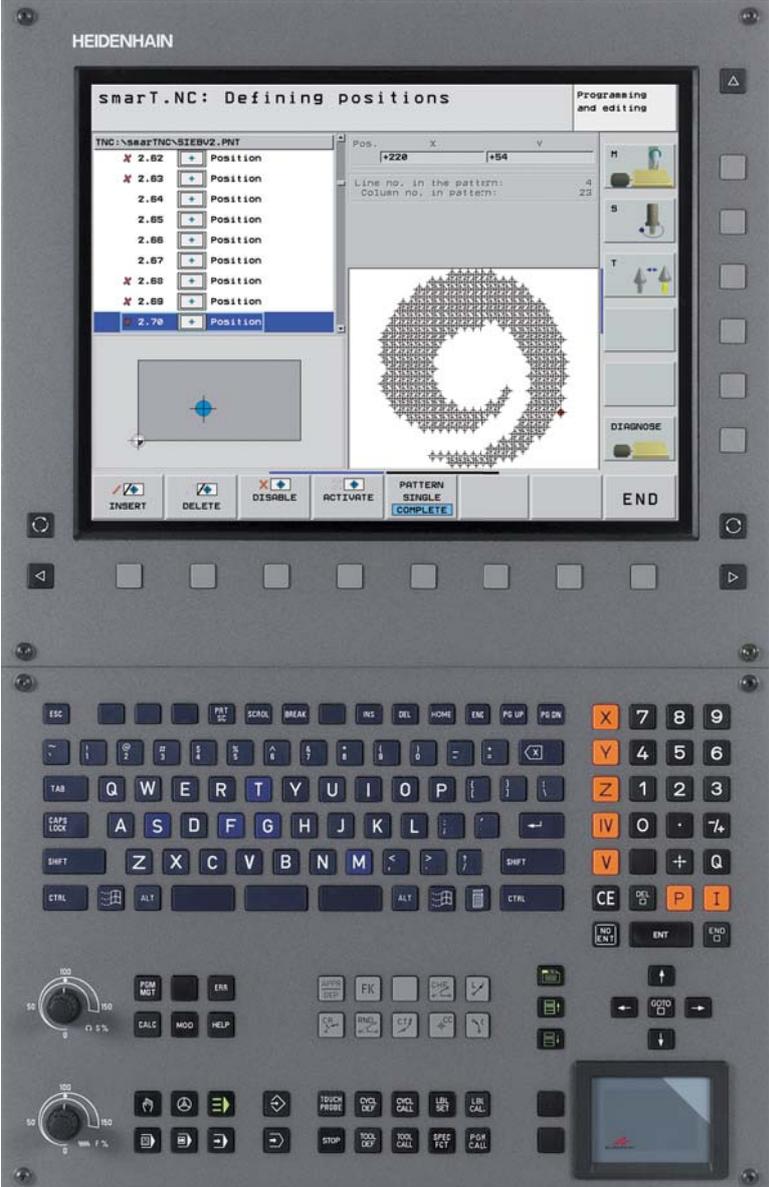
for milling, drilling, boring machines and machining centers

The iTNC 530 from HEIDENHAIN is a versatile, workshop-oriented contouring control for milling, drilling and boring machines as well as machining centers.

It features an integrated digital drive control with integrated inverter, which enables it to produce a highly accurate workpiece contour while machining at high velocity.

The iTNC 530 controls up to 13 axes and spindle. The block processing time is 0.5 ms. A hard disk serves as program memory medium.

The iTNC 530 hardware option with two processors additionally features the Windows XP operating system as a user interface, enabling the use of standard Windows applications.



High speed milling with the iTNC 530

The iTNC 530's special drive strategies enable very high machining speeds with the greatest possible contouring accuracy.

High contour accuracy at high feed rates

The control loop of the iTNC 530 is fast and it "looks ahead." Like all TNC contouring controls from HEIDENHAIN, the iTNC 530 features velocity feedforward control, which means that it can machine with a very small following error of only a few microns.

The integrated motor control has further improved contour accuracy, both through digital control technology and the additional acceleration feedforward capability. This also improves the machine's dynamic performance, with following error approaching zero. The benefit to you is dramatically improved geometrical accuracy, particularly when milling small radii at high speeds.

High speed spindle speeds

High surface-cutting speeds require accordingly high spindle speeds. The iTNC 530 can digitally control rotational speeds up to 40 000 min⁻¹.

Machining 2-D contours or 3-D surfaces at high feed rates

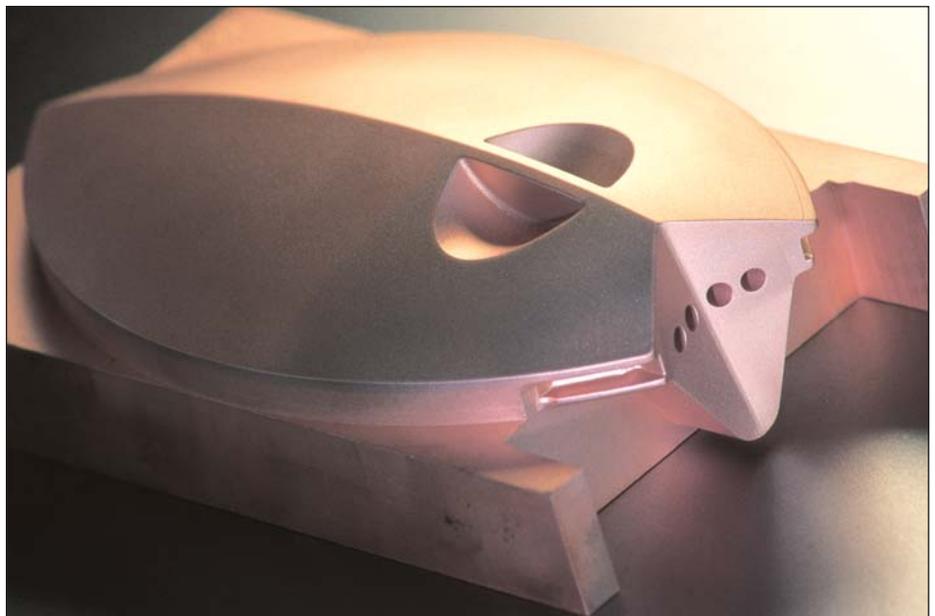
The iTNC 530 provides the following important features for machining contours:

- The iTNC's ability to limit and reduce jerk ensures smoother acceleration and optimum motion control—both during workpiece approach, on the contour, and at corners.
- When running long programs from the hard disk, the iTNC has a short block processing time of only 0.5 ms. This means that the iTNC can even mill contours made of 0.1 mm line segments at feed rates as high as 12 meters per minute.
- The iTNC looks ahead up to 1024 blocks into the part program to ensure a steady traversing speed even over a large number of very short contour elements.
- The iTNC can automatically smoothen discontinuous contour transitions—and you define the desired tolerance range. The iTNC mills smoother surfaces without risking dimensional tolerances.

Dynamic Collision Monitoring Option (DCM)

Since axis movements in 5-axis machining operations are very difficult to predict, and the traverse speeds of NC axes continue to increase, collision monitoring is a useful function for relieving the machine operator and avoiding damage to the machine.

The iTNC 530 cyclically monitors the working space of the machine for possible collisions with machine components. The machine manufacturer defines these machine components within the kinematics description as collision objects. The control outputs an error message in time before a collision with machine components can occur. The machine operator can then retract the axes.



Digital drive control

High surface definition, high contouring accuracy of the finished workpiece, and short machining times—these requirements can be met only with digital drive concepts. For **integrated drive control**, HEIDENHAIN offers the iTNC 530.

Either compact or modular inverters are available, depending on the type of machine.

The **compact inverters** contain the power stage for up to 2 axes, 3 axes, or 4 axes plus spindle with spindle power ratings up to 15 kW.

With **modular inverters**, various power modules are available for axes and spindles, and power supply units with 22 kW to 80 kW. The modular inverters are suitable for machines with up to 13 axes and a spindle with maximum power of 40 kW.

Feed motors of 1.5 Nm to 62.5 Nm and **spindle motors** of 5.5 kW to 40 kW are available for connection to HEIDENHAIN inverters.



iTNC 530
 with modular inverter
 and motors

TNC Contouring Control	iTNC 530
Axes	Up to 13 and spindle or 12 and 2 spindles
Interpolation	<ul style="list-style-type: none"> • Linear in max. 5 axes (with Tool Center Point Management) • Circular in max. 3 axes with tilted working plane • Spline interpolation in max. 5 axes • Helix • Cylinder surface¹⁾ • Rigid tapping¹⁾
Programming	HEIDENHAIN conversational, with smarT.NC and according to ISO
Programming support	TNCguide presents user information directly on the iTNC 530
DXF converter (option)	Download contours and machining positions from DXF files
Program memory	Hard disk with 25 GB minimum
Position data coordinates	Nominal positions in Cartesian or polar coordinates, dimensions absolute or incremental, in mm or inches; actual position capture
Input resolution and display step	To 0.1 µm or 0.0001°
Block processing time	0.5 ms (3-D straight line without radius compensation at 100% PLC utilization)
High speed cutting	Motion control with minimum jerk
FK free contour programming	HEIDENHAIN conversational with graphical support
Coordinate transformation	<ul style="list-style-type: none"> • Datum shift, rotation, mirroring, scaling (axis-specific) • Tilting the working plane, PLANE function (option)
Fixed cycles	For drilling and milling; data input with graphical support
Touch probe cycles	For tool measurement, workpiece alignment, workpiece measurement and workpiece presetting
Graphics	For programming and program verification
Cutting-data tables	Yes
Parallel operation	Program run and programming with graphics
Data interface	<ul style="list-style-type: none"> • Ethernet 100BaseT • USB 1.1 • RS-232-C/V.24 and RS-422/V.11 (max. 115200 baud)
Remote control and diagnosis	TeleService
Visual display unit	15-inch color flat-panel display (TFT)
Axis feedback control	<ul style="list-style-type: none"> • Feedforward control or following error • Integrated digital drive control with integrated inverter
Adaptive feed rate control option	AFC adjusts the contouring feed rate to the spindle power ¹⁾
DCM collision monitoring option	Dynamic monitoring of the working space for possible collisions with machine components ¹⁾
Integrated PLC	Approx. 16000 logic commands
Accessories	<ul style="list-style-type: none"> • Electronic handwheel • Triggering 3-D touch probes TS 220, TS 440 or TS 640 and TT 140
Dual-processor version option	With additional Windows XP operating system as user interface

¹⁾This feature must be implemented by the machine tool builder

TNC 320 Contouring Control

for simple milling, drilling and boring machines



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The TNC 320 is a compact workshop-oriented contouring control with TFT color flat-panel display and TNC control keys. The powerful main computer, the display unit and the TNC operating panel are all contained in one unit. A maximum of four (optionally 5) drives can be controlled via the analog speed command interface.

The user programs the control directly at the machine in HEIDENHAIN conversational format, with practice-oriented fixed cycles. Convenient graphical illustrations on the screen provide additional guidance during programming.



	TNC 320
Axes	3 closed-loop axes plus closed-loop spindle S
Options	4 closed-loop axes plus open-loop spindle S or (optionally with hardware expansion) 4 closed-loop axes plus servo-controlled spindle S or 5 closed-loop axes plus open-loop spindle S
Interpolation	<ul style="list-style-type: none"> • Linear in max. 4 axes • Circular in max. 2 axes • Helical, superimposition of circular and straight paths • Cylinder surface (option)
Programming	HEIDENHAIN conversational and ISO formats (via soft keys or via external USB keyboard)
Program memory	300 MB
Input resolution and display step	To 1 µm or 0.001°
Block processing time	6 ms
Display	TFT color flat panel display 15.1 inch (1 024 x 768 pixels)
Coordinate transformation	<ul style="list-style-type: none"> • Datum shift, rotation, mirror image, scaling factor (axis-specific) • Tilting the working plane (option)
Fixed cycles	Drilling, tapping, thread cutting, reaming, and boring, cycles for hole patterns (circular and linear), multipass milling of plane surfaces, roughing and finishing pockets, slots and studs
Touch probe cycles	For datum setting and workpiece alignment
Graphics	Programming graphics, verification graphics, graphical support for cycle programming
Parallel operation	With graphical support
Data interfaces	<ul style="list-style-type: none"> • Ethernet 100BaseT • USB 1.1 • RS-232-C/V.24
Integrated PLC	50 MB memory for PLC program 56 PLC inputs 31 PLC outputs (expandable by PL 510, max. 4) Symbolic operands
Accessories	<ul style="list-style-type: none"> • HR 410 electronic handwheel • TS 220, TS 440 or TS 640 workpiece touch probe



Accessories

Electronic Handwheels

With the electronic handwheel from HEIDENHAIN, you can use the feed drive to make very precise movements in the axis slides in proportion to the rotation of the handwheel. As an option, the handwheels are available with mechanical detent.

HR 410 and HR 420 portable handwheels

The axis keys and certain functional keys are integrated in the housing. It allows you to switch axes or setup the machine at any time—and regardless of where you happen to be standing. The HR 420 also features a display for the position value, the feed rate and spindle speed, the operating mode and other functions, as well as an override potentiometer for feed rate and spindle speed.



HR 420

HR 410

HR 130 and HR 150 panel-mounted handwheels

Panel-mounted handwheels from HEIDENHAIN can be integrated in the machine operating panel or be built-in at another location on the machine. Up to three HR 150 electronic handwheels can be connected through an adapter.



HR 130 for integration in the machine operating panel

The iTNC and TNC 320 programming stations enable you to program in plain language just as you do at the machine, but away from the noise and distractions of the shop floor.

Creating programs

Programming, testing and optimizing HEIDENHAIN conversational or ISO programs with the programming station substantially reduces machine idle times. You do not need to change your way of thinking. At the programming station you program on the same keyboard as at the machine. Of course you can also use the alternative smarT.NC operating mode on the iTNC programming station.

Training with the programming station

Because the programming stations are based on the respective control software, they are ideally suited for apprentice and advanced training.

TNC training in schools

Since they can be programmed in ISO as well as in plain language format, the programming stations can also be used in schools for TNC programming training.

