Klartext

News from the World of HEIDENHAIN Controls

Volumetric Accuracy
of Machine Tools
for Five-Axis Machining

The World Champion
of Precision

Migration to the iTNC 530

Precision Starting from the First
Workpiece

Lathe Control

New Functions for the
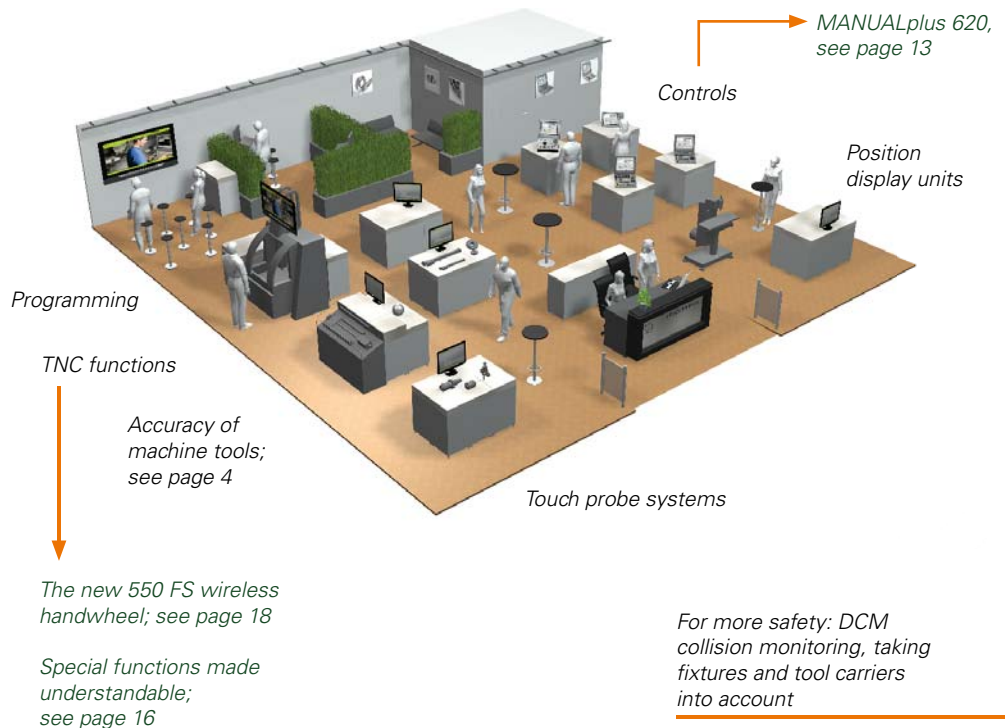MANUALplus 620

Editorial

Dear KLARTEXT Reader,

The Klartext staff was on the road quite a bit, finding interesting stories involving lots of practical experience. The topics this time include aerospace engineering and the efficient manufacture of complex surgical instruments. It will surely be exciting to see how the various companies and their employees combine their know-how with the functions of the TNC to produce the best results. The report about the optimum connection of CAD/CAM systems to the TNC control describes what effects new technologies have on current practices.

Read and enjoy, with best wishes from ...
The Klartext staff!

HEIDENHAIN at the AMB in Stuttgart, in Hall 4, Booth 4E12
International Exhibition for Metal Working, Sep. 28 to Oct. 2, 2010

MANUALplus 620, see page 13

Controls

Position display units

Programming

TNC functions

Accuracy of machine tools; see page 4

Touch probe systems

The new 550 FS wireless handwheel; see page 18

Special functions made understandable; see page 16

For more safety: DCM collision monitoring, taking fixtures and tool carriers into account

Contents

The central topic of the HEIDENHAIN booth is the active presentation of new user functions. Beside the **integrated, adaptive feed-rate control (AFC)**, **KinematicsOpt**, and **Dynamic Collision Monitoring (DCM)**, which takes fixtures and tool carriers into account, quite especially **trochoidal milling** is of benefit to the user. This new cycle enables you to manufacture closed and open slots and any desired contour slots quickly and efficiently.

Volumetric Accuracy of Machine Tools for Five-Axis Machining

The World Champion of Precision

Positioning accuracy depends on position measurement

TELSTAR, the official ball of the FIFA world championship, with a perfect surface – milled in three machining steps.

For numerous machining tasks, five-axis machining offers obvious economic advantages compared with standard three-axis machining. However, distinctly more complex feed movements must be taken into account in order to reduce the machining times and the number of rechucking operations. Depending on the axis arrangement and fixture situation, considerably longer traverse paths in the linear and rotary feed axes can result, even during the machining of small workpieces. Since the deviations between the ideal motion and the actual behavior of a feed axis usually increase as the traverse path becomes longer, machine tools for five-axis machining are presented with a special challenge: the manufacture of precise workpieces is only possible with a sufficiently high volumetric accuracy of the machine tool.

In contrast to the accuracy considerations of individual axes, the volumetric accuracy of a machine tool is determined based on measurement points distributed throughout the entire work envelope. Along with the positioning accuracy of the individual axes, this method also measures the effects of tilting movements, squareness errors and straightness deviations of the axes.

The measurement of the positions in the linear and rotary feed axes plays a definitive role here. If the axis positions are simply captured via rotary encoders on the motors, and are converted to the positions of the feed axes via gear reductions and the pitch of the ball screws, significant deviations between the control's machine model and the actual machine kinematics occur. These deviations result from thermal shifts in the ball screws and from transmission errors in the gears of the rotary axes, possibly leading to dramatic flaws on the workpiece, especially if produced with five-axis machining. The method of capturing the position via rotary encoders on the feed motors is also referred to as **semiclosed-loop operation**, since mechanical errors on the gear mechanisms cannot be compensated via the drives' control loops.

Closed-loop operation of the feed axes with linear and angle encoders from HEIDENHAIN make it possible: precise machining of the seams despite large changes to the cutter orientation.

A soccer ball as proof of the TNC's accuracy

The positioning accuracy and repeatability values of feed axes can be vastly improved with the **use of precise linear and angle encoders**. Since the axis positions are no longer measured on the motor, but rather directly on the linear and rotary axes of the machine, this is referred to as **closed-loop operation**. If the machine tool's mechanical components are of sufficiently high quality, accuracies in the micron range can be achieved even under varying operating conditions. This results in enormous **advantages for five-axis machining**. The compensation movements can be traversed exactly if the cutter orientation is changed, without machining the workpiece contour incorrectly.

The advantages of capturing the position via linear and angle encoders from HEIDENHAIN become obvious when the Telstar workpiece is considered. Telstar is the name of the first civilian communications satellite, which NASA launched into space in 1962. The official ball of the FIFA world championships in 1970 and 1974 was named for the satellite, and has 20 white hexagonal panels as well as twelve black pentagonal panels. This pattern is still in wide use today.

The HEIDENHAIN workpiece is similar to the classical form of the Telstar ball. The ball was produced in three machining steps from a workpiece blank shaped on a lathe: three-axis milling of the pentagons with vertical paths and inclined cutter, three-axis milling of the hexagons with horizontal paths and inclined cutter, and five-axis milling of the seams.

Perfect surface quality and details demonstrate the accuracy of the machine

A perfect optical appearance of the Telstar ball is only possible if the seams, pentagons and hexagons are milled with superb precision despite a machining time of over two hours. The inclined angles prescribed for the cutter in the NC program for the Telstar tool result in large motions of the rotary and linear axes, necessitating a high volumetric accuracy. Transmission errors and thermal effects in the mechanics of the feed drives limit the volumetric accuracy of the machine if it is operated

in semiclosed-loop mode. But if the feed axes are operated in closed-loop mode, the transmission errors of the drive mechanics are detected via the linear encoders on the linear axes and the angle encoders on the rotary axes, and can therefore be compensated by the control. The feed axes achieve a very high positioning accuracy and optimum repeatability over their entire traverse range. This makes precise machining of neighboring sections on the workpiece possible, even with large changes to the cutter orientation and substantial periods of time between the individual machining steps.

The potential for the volumetric accuracy of a machine becomes especially clear in the grooves that form the seams of the Telstar ball. With a cutter diameter of 25 mm and the slight groove depth of 0.15 mm, even errors of just ±10 µm or less would lead to obvious fluctuations in the groove width. The precision attainable when operating the feed axes in closed-loop mode is made very apparent at the intersections of the seams: despite the large changes to the cutter orientation in each of the seams, the intersections are hit exactly every time, thanks to the precision of the linear and angle encoders from HEIDENHAIN. +

Wind-Tunnel Models with the iTNC 530

Exact Down to the Last Detail –
# CNC Manufacturing for Aerospace Engineering

Highest levels of precision and the consistent avoidance of scrap are of the utmost priority for Deharde Maschinenbau Helmut Hoffmann GmbH, especially since aerospace engineering companies are among the clients of this machine tool specialist. For the production of wind-tunnel models, plant equipment and numerous other difficult parts, Deharde relies on machine tools equipped with HEIDENHAIN controls. The iTNC 530 is chosen not only for investments in new machines, such as the DMC 340U CNC milling center, but also when machines already in the shop are overhauled in order to extend their lifetime. One advantage of this is that all production employees at Deharde can operate all of the machine tools. Furthermore, this excludes the possibility of errors arising in the programs during transfer to other types of controls.

Deharde even ordered the DMC 340U five-axis giga milling center with four exchangeable pallets with a HEIDENHAIN control.

"The value added by us in each working step is enormously high, whereas the tolerances during production are extremely tight. That is why any deviations or scrap are extremely expensive," explains Klaus Gerken, Operations Manager at Deharde. If required, the company can guarantee tolerances of ±0.015 mm for contours, ±0.01° for angles, and ±0.02 mm for positions over a distance of 2500 mm. "The price for a day in the wind tunnel — where the air-flow properties and the forces acting on individual airplane parts are measured based on true-to-scale airplane models — is in the high five digits. That is why each of the delicate holes where the air flow is measured must be 100% correct. Also, the exchange of model parts, such as the various contour variants of jet engines or body fairings, or differently shaped parts for adjusting the flaps used during landing, must be possible without losing any time," is how Tobias Schwarz, Engineering Manager at Deharde, describes the extremely high demands placed on the finished parts. Numerical controls from HEIDENHAIN, with their high level of precision, make this extremely accurate manufacturing of parts possible.

One of numerous work steps: Working from specific customer demands to create the 3-D models.
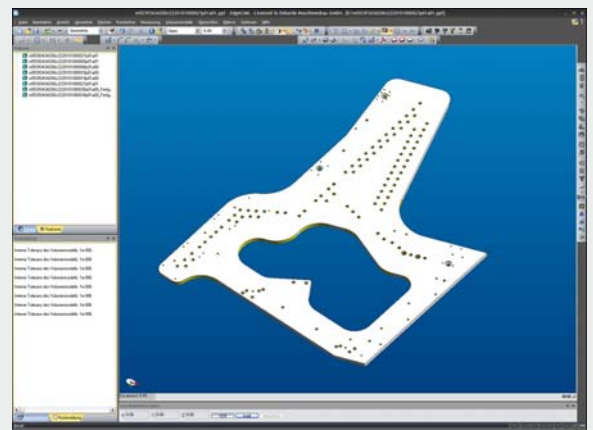
"A control from HEIDENHAIN ensures the greatest degree of flexibility for us, and therefore naturally for our customers as well."

Klaus Gerken,
Operations Manager at Deharde

Programming is based on CATIA V5 and Edgecam

But before the Deharde employees finally get to manufacture the workpieces on the nearly 20 CNC milling machines and six CNC lathes, numerous other work steps must have already been completed successfully. "Each project starts with an extensive exchange between the customer and our project leader, regardless of whether we're discussing the initial idea or if sketches have already been drawn up," says Tobias Schwarz. Working from the customer's specific requirements, the ten-man design time creates 3-D models using CATIA V5 and presents them to the customer for approval. In the next step, one of the five programmers uses CATIA V5 or Edgecam to write the CNC programs that will later be transmitted to the HEIDENHAIN controls on the machine tools. Deharde even has a special precautionary measure: for reasons of safety, the programs for "flying parts,"

Wind-tunnel models can consist of up to 800 parts, including the airplane wing shown here

i.e. those that will later be used in air or space travel, cannot be edited while at the machine. Any necessary changes can only be made by the production planning & programming employees.

For all other parts the production employees can correct the programs directly at the machine, and in some cases they even enter new program sections. "I find it especially helpful that entire machining cycles, such as for face milling, tilting or bore milling, are stored on the iTNC 530. These cycles are needed frequently, and I can enter them in just a couple seconds," reports Stephan Coquille, a production employee at Deharde. The iTNC 530 features a quick and convenient editor for programming while at the machine. One of the features is being able to structure a program through the entry of comments. The comments server as bookmarks, permitting rapid navigation within the program.

Impressive additional functions

In order to take the most advantage of the machine tool in terms of quality and machining time, Deharde uses the KinematicsOpt and the AFC (adaptive feed control) functions.

KinematicsOpt is a software option that is integrated directly in the iTNC 530. It eliminates deviations of rotary axes due to thermal influences, and compensates their drift. This way the operator can use KinematicsOpt to recalibrate his milling machine's rotary axes himself. The associated measuring process takes only a few minutes. "On average we calibrate some of our machines in this manner once a week. For parts with very tight tolerances we also use this function before each work step," comments Dietmar Warns, Machining Manager at Deharde. AFC (adaptive feed control) is also an optional function, but once it has been integrated, it is in effect for each work step.

AFC regulates the feed rate automatically, depending on the respective spindle power and the limit values defined by the operator. This can notably shorten the machining time, especially for castings, which have intrinsic and significant fluctuations in their dimensions and material strengths. The adaptive feed control ensures that the spindle power remains constant at the programmed level throughout the entire work step. For example, Deharde uses AFC for the machining of titanium and aluminum workpieces, reducing the roughing time by 5% across the board. "A very important advantage in
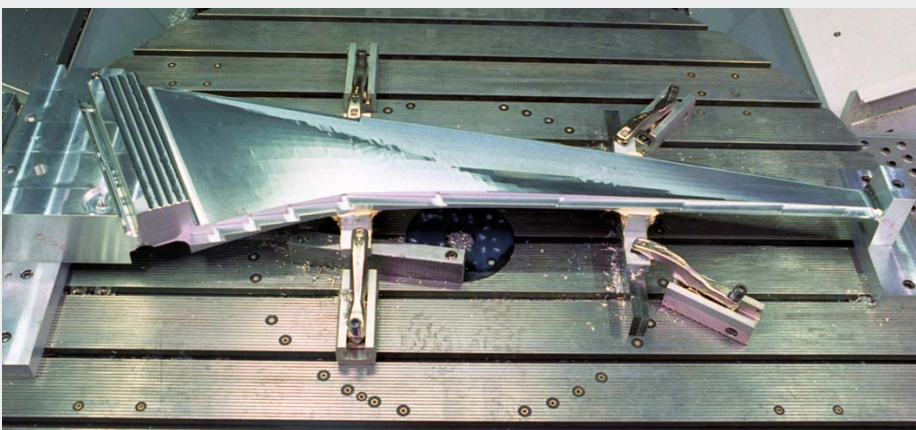
Every employee can work on every machine: HEIDENHAIN controls are used on practically all of them.

our opinion is that the machine automatically interrupts the program if the feed rate drops below the minimum defined value. This is usually a sign that the tool has become blunt. We can therefore avoid expensive damage to the workpiece and the machine arising from tool breakage," says Operations Manager Klaus Gerken.

All employees, all machines

Back in 2000, Deharde already made the strategic decision to equip almost all machine tools with controls from HEIDENHAIN. This ensured that all production employees can operate any of the machines, depending on the situation at any given moment. Since 2003, both Deharde's employees as well as external participants have been trained on HEIDENHAIN controls at the TTC in-house training center, which has been an official training partner of HEIDENHAIN since 2004.

Older machines, already in the company's machine park, are overhauled in order to extend their lifetime and are equipped with an iTNC 530. Deharde even ordered a HEIDENHAIN control for its newest investment, a DMC 340U five-axis giga milling center with four exchangeable pallets from Deckel Maho Gildemeister, who nor-

mally interfaces a control from a different company to this machine. "This ensures the greatest degree of flexibility for us, and therefore naturally for our customers as well," emphasizes Klaus Gerken. The control of the DMC 340U milling center uses a third party's measuring software,

which fully automatically measures the workpieces on the machine with a touch probe and generates measuring logs. "There were no problems in connecting the software to the iTNC 530 via standard interfaces," notes Thomas Oltmanns, Planning & Production Manager. As a next step, Deharde plans to configure the measuring program so that it can intervene in the CNC program and make corrections automatically. Deharde is aiming for highly-automated production with this milling center. +

> **"The machining cycles already stored on the iTNC 530 are especially helpful. These cycles are needed frequently, and can be entered in just a couple seconds."**
>
> Stephan Coquille, production employee at Deharde

Tobias Schwarz, Thomas Oltmanns, Stefan Coquille and Dietmar Warns (from left) of Deharde stand in front of the DMC 340U five-axis giga milling center

The results at a glance

By using the iTNC 530 control from HEIDENHAIN, Deharde Maschinenbau Helmut Hoffmann GmbH profits from the following advantages:

- Highest degree of production precision, with tolerances of ±0.015 mm for contours, ±0.01° for angles, and ±0.02 mm for positions over a distance of 2500 mm.

- Elimination of scrap, which would be very expensive due to the large amount of value added in each step.

- Fast and error-free transmission of the CNC programs to the machine tools via Ethernet.

- The optional KinematicsOpt function eliminates deviations of rotary axes due to thermal influences, and compensates their drift.

- The optional AFC (adaptive feed control) function regulates the feed rate automatically, depending on the respective spindle power and the limit values defined by the operator. For example, Deharde used it to reduce the machining time for roughing by 5%.

Deharde Maschinenbau Helmut Hoffmann GmbH

The machine tool specialist from Varel near Oldenburg, Germany, is a worldwide leader when it comes to models used in wind tunnels. In addition, the company, which has 150 employees, is a successful job shop for numerous industries, ranging from airplane and automobile production to marine technology, and even to the food processing industry, chemical companies and the tobacco industry. Today information technology (on the basis of CATIA V5) is involved in all production processes of the owner-operated company Certification according to DIN EN 9100 is nearing completion. The customers include well-known companies covering many industries, such as Airbus, Boeing, Premium Aerotec, Thyssen-Krupp, Daimler Benz, Nautor, Bahlsen and Dow Chemical.

➕ *www.deharde.de*

Technologie Transfer Center (TTC) – an official HEIDENHAIN training partner

The TTC was founded in 2003 in Varel near Oldenburg, Germany, and has been an official HEIDENHAIN training partner since 2004. The training center offers practice-based CNC courses, CAD courses and courses on control technology. In small groups of no more than four people, Deharde employees and external participants learn from trainers with comprehensive job experience.

"We started offering these courses because we noticed that the courses offered by machine manufacturers were mostly very theoretical in nature. Our participants can use the assortment of machines owned by Deharde to use their knowledge directly on the machine that they are supposed to use in their own company later," explains Karl Bernich, Course Manager of the TTC.

The four-day basic courses are split into theoretical and practical halves. The course contents are mostly identical to those that HEIDENHAIN itself offers in Traunreut. Already over 500 participants have attended courses offered by the TTC since 2003.

More information about the TTC courses is available on the Internet at

➕ *www.tectransfer.de*

Efficient Programming at the Machine

Migration to the iTNC:
Precision Starting from the First Workpiece

First-class instruments are essential for surgical operations, which is an important reason for producing surfaces and contours of exceptional quality. After all, nothing that could cause an infection should remain behind after an operation.

Task

The Swiss company Robert Ott AG follows the motto "Precision is not a coincidence," and has attained much experience in the highly automated manufacture of workpieces and assemblies for a wide variety of industries.

Robert Ott only recently set its sights on the new field of medicine technology. In addition to the current certification according to ISO 9001-2000, the certification according to the medical standard ISO 13485 serves to fulfill an important demand of these new customers. The company now successfully produces surgical instruments, which have especially intricate shapes and are used in complicated operations.

The company's intention was to implement these new goals quickly, meaning that a machine tool with a control that permits rapid and uncomplicated entry into this world had to be found. The task: the challenging shapes of the "new workpieces" require simultaneous machining in five axes. The machining programs are accordingly complex, and must be created quickly and efficiently, since the

*An efficient team —
a Fehlmann machining center
with a HEIDENHAIN iTNC 530.*

production lots are often only five to 100 units. The combination of these conditions makes an efficient production process very difficult.

In order to quickly start production of the new workpieces, it was hoped that the programs could be written directly at the machine. However, the controls used up till then were not suited for quick writing and optimizing of complex programs on the shop floor.

Solution

Mr. Ott found the appropriate solution right in his own neighborhood. The machine manufacturer Fehlmann, located in the same city, delivered a VERSA Picomax 825, which is only available with a HEIDENHAIN iTNC. KinematicsOpt helps maintain a consistently high level of precision when machining the workpieces. KinematicsOpt is a software option that is integrated directly in the iTNC 530. It eliminates deviations of rotary axes due to thermal influences, and compensates their drift. This way the operator can use KinematicsOpt to recalibrate his milling machine's rotary axes himself. The associated measuring process takes only a few minutes. A laser system measures the tools automatically, and plays an important role in ensuring the dimensional accuracy of the finished workpieces.

The goal of programming directly on the shop floor was quickly implemented with the new machine and its iTNC 530 control: The employees involved took a two-week course at Fehlmann to learn the conversational programming used with the HEIDENHAIN control. This new knowledge was then promptly put into

The Real World

What pleases Robin Suter and Lukas Dietiker about the user-friendliness of the control:

- The iTNC has a convenient editor with simple functions for copying, moving and structuring.

- The HEIDENHAIN cycles are indispensible. They permit rapid program creation for three-axis machining.

- Even complicated tasks, such as machining on an inclined plane, are made easy by the PLANE function.

- The iTNC's manual is easily understandable, and the functions being searched for are found quickly.

Complex workpieces are programmed directly on the machine.

practice. A short time later, the machining of complex contours with just a few setups was already a standard process. In the meantime Fehlmann has delivered a second machine, which already began production after just a couple of days.

Experiences

When asked about their new experiences, Robin Suter and Lukas Dietiker praised the vintage strengths of the iTNC: the editor presents them with a completely new level of convenience. The same applies to the functions for tilted machining — machine operators especially like to use the TNC's PLANE SPATIAL function for operations on inclined planes. The many practical HEIDENHAIN cycles are now also considered nearly indispensable. Only program sections involving very complex multi-axis operations are created with an external programming system. The conversational programming language directly on the machine handles all other aspects. This goes quickly and without complications, even if the workpiece drawing is not dimensioned correctly for NC.
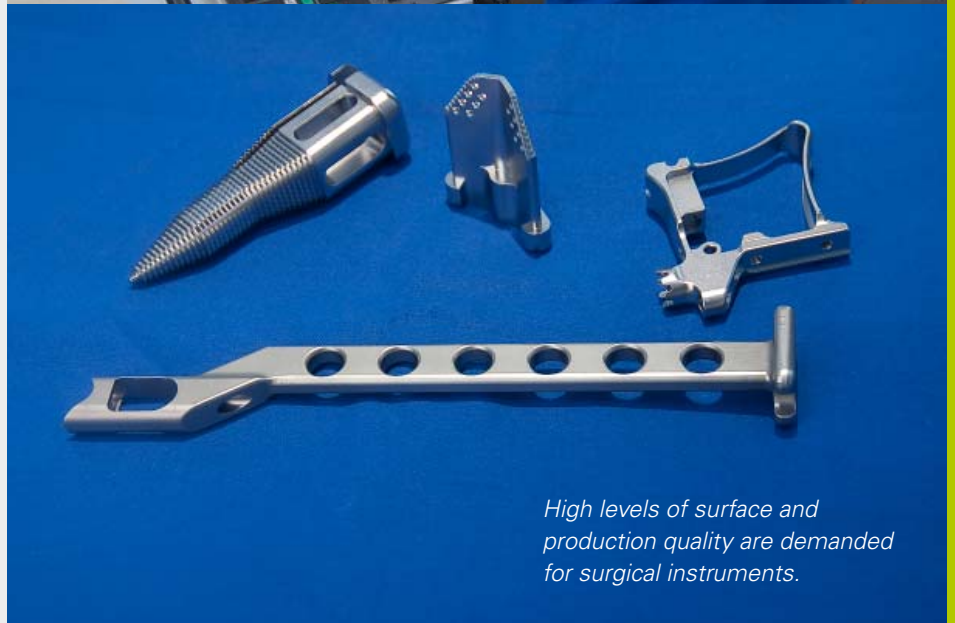
High levels of surface and production quality are demanded for surgical instruments.

*Managing Director Robert Ott
(right) talking with Robin Suter*

Robert Ott AG

*Robert Ott AG was founded in 1989,
and has grown to nearly 50 employees.
Its commitment to combine a high de-
gree of quality with cost-efficient pro-
duction is met by highly qualified em-
ployees and a modern assortment of
machines. The core competence is the
machining of ferrous and non-ferrous
metals, stainless steel, plastics and
graphite. Mechanical parts and assem-
blies are produced for a wide variety of
industries.*

+ *www.robertottag.ch*

Further development

The iTNC from HEIDENHAIN has learned
a lot in recent years, and can now do an
excellent job of holding its ground in high-
ly automated production. The connection
to CAD/CAM environments has become
common practice. Proven virtues, such as
programming on the shop floor, were not
forgotten, but of course continue to be
improved. That is what makes the iTNC so
valuable, particularly for a mid-size com-
pany like Robert Ott AG. Since its pow-
erful programming features are available
directly on the machine, the control from
HEIDENHAIN simplified the migration to
new products, and laid the groundwork
for being able to quickly react to change
requirements and to achieve new goals.

The success of the migration can also
be measured in terms of time and costs.
The efficient, dialog-guided programming
minimizes the amount of work before-
hand. Optimized machining strategies
and automated tool measurement ensure
a rapid and error-free machining process.
The regular use of KinematicsOpt helps
to maintain a high degree of precision for
workpieces over a long period of time.
The combination of these advantages
leads to an especially economic produc-
tion process.

Forecast

From Robert Ott's point of view, the transi-
tion to the iTNC was nearly perfect, and
helped the up-and-coming company es-
tablish a new range of products.

He would like to further automate the
production of medical instruments in the
future, and also create the machining
programs entirely with programming sys-
tems. The iTNC will also have no problems
here, and will produce the margins need-
ed for new company goals. +

*Discovered at Robert Ott:
The classic TNC 360 has been
used for a long time for "simple"
machining needs – now
HEIDENHAIN is also used for
sophisticated operations!*

The iTNC 530 for a Huge Machining Center

Test Run in Storm and Rough Seas—Fast Modeling with the iTNC

Imagine you're a ship owner and want to have somebody build you a ship. Everything seems OK with your future megaship on the drawing board. But how will it act once it's really on the water? And in a storm? Will it meet the specifications for consumption, loading capacity and speed? If you want to test your maritime challenges down to the very last decimal point, MARIN is the place for you.

MARIN, a marine institute in the Netherlands, is the definitive link between the maritime draft and the end product. Here plans for new ships are reproduced in wood or plastic—usually on a scale of 1:20—and then tested in a water basin. Weather and water conditions can be simulated in this basin. The results of these tests make it possible, for example, to correct the draft. What makes MARIN so special is that it manufactures its own test models.

"Our customer gives us the specifications and we manufacture the ship model from soft tropical abachi wood. It's easy to machine and gives optimum results," explains Giel Kaandorp, CAD/CAM engineer and department manager. "The test models are between 2 to 14 meters long and

up to 3 meters wide. To give you an indication, we can mill a really large ship model with all the bells and whistles—about 12 meters long—in about 16 to 20 hours."

A separate hall just for the machining center

The existing milling machine was no longer large enough for the impressive dimensions of these ship models. A five-axis high-speed machining center for workpieces of up to 25 m length, 2.75 m height and 5 m width was ordered from the German machine tool builder EEW and integrated in its own hall. The primary considerations in selecting the control were speed and computing time. MARIN proposed using the iTNC 530 control from HEIDENHAIN.

Gert van de Pol, CAD/CAM engineer says, "We let EEW mill a test model. We were careful to include all the challenges we had ever encountered in our model construction work. The iTNC 530 from HEIDENHAIN and the large milling machine from EEW proved to be an optimal combination for testing, and it continues to be optimal in our machining tasks. We've been working with the HEIDENHAIN control for half a year now and are completely satisfied."

A smooth hull in very little time

What sort of experiences have they had with the HEIDENHAIN control? Gert van de Pol says, "The iTNC 530 from HEIDENHAIN is very user-friendly—and this is an especially important aspect for us. The computing speed, too, has fully met our expectations. The specified measuring points are quickly processed. The control's machining strategies enable smooth movements and achieve smooth, high-definition surfaces." And smooth surfaces save time in the follow-up work like sanding, filling and painting. Then the test model is ready for the water. After all, all of the working steps have to be optimized within a mean production time of five to six weeks. The control's high processing speed is an essential factor for this.

What the iTNC can do for the quotation phase

There's another advantage as well. Giel Kaandorp says, "The iTNC 530 enables us to make very detailed quotations. The simulation program lets us calculate how much time a milling job later will actually require—which is extremely practical for quotations. We program the specs in the

Seaworthy and ship shape while still in "dry dock": A glance at the machining center

Gert van de Pol, CAD/CAM engineer, concentrates on applying the cutter with a hand-wheel ...

HEIDENHAIN control and then run the program in the Test Run mode. This simulation can even be run while the milling machine is working on another job. So we have an estimate already in the quotation phase that comes very close to the actual machining time. Before, we usually just had a gut estimate. Now, we can back up our quotations with hard facts. Our only investment is in programming the prospective job in advance."

MARIN – Maritiem Research Instituut Nederland

MARIN is one of the four largest technological institutes in the Netherlands. Since 1932, MARIN has operated as an independent and innovative service provider for the maritime industry. MARIN's core business is its unique combination if simulation and model testing.

Its customers are in the fields of ship building, shipping, offshore industry and government agencies. The most important customers are ship-building factories, shipping companies, engineering design offices and producers in the oil and gas industry. But also other marine institutes from all over the entire world find their way Ede and Wageningen. MARIN has the world's most modern model testing facilities and simulators to examine and optimize the dynamic behavior ships and oil platforms.

What makes MARIN unique is that all conditions can be tested in one place: shallow water, waves, swells, offshore conditions, but also cavitation—the destructive effect of vapor pockets on propellers.

... and is very satisfied with the high processing speed of the iTNC 530.

> **+ The new NC software 548 328-03 for the MANUALplus 620**

New Functions for the MANUALplus 620

A high degree of user-friendliness—that characterizes the contouring control for CNC and cycle lathes. The functions of and enhancements to the new software go even one step further.

Newly added to the simulation: a 3-D view of the work-piece blank and the finished part.

New cycle features

Recessing cycles: Flexible proportioning of cuts
Take advantage of the highly flexible proportioning of cuts: Now you can enter a maximum recessing depth (parameter ET) in the Cycle G860, Recessing.

Drilling and roughing cycles, now with an intermittent feed rate
Define your feed rate any way you want: Enter the feed duration and break duration separately when entering the feed rate. This helps to improve the chip flow and at the same time spares your tool.

ICP roughing cycles: Definition of starting point of workpiece blank
Freely selectable starting point: Now you can start the cutting process at any desired diameter of the contour and at any angle. Enter the starting point on the workpiece blank and, if desired, the approach and departure angles at which the tool approaches and departs the contour.

All cycles: M functions within a cycle
You want to call M functions from within a cycle? You can now do so directly in the cycle's input form. You no longer need to convert your cycle program to DIN in order, for example, to automatically perform a machine command after a tool change or end of cycle.

Parting cycle: Now with speed limitation
Enter a speed limitation of the spindle effective only for the parting cycle. The spindle is then no longer accelerated to maximum speed if the tool moves in the direction of the diameter X=0 during parting (at constant cutting speed).

Thread cycles: Handwheel superimposition
You can now perform minor corrections via the handwheel in the Teach-in and smart. Turn modes during thread cutting, since superimposed movement of the tool in X and Z directions with the handwheel is now possible during thread cutting.

Helical slot milling cycle: Helical slot milling with multiple starts
A new parameter presents itself: Program 1 to 99 gears/threads via parameter D.

Engraving cycles: Plunging feed rate and expanded character set
Define a reduced feed rate in order to protect your tools during delicate engraving. New features here are a separate factor for the feed rate, and an expanded character set for the engraving cycles.

Simple modification of programs with ICP and 3-D simulation

Use the new "Change element" soft key to navigate to any element and modify it. Multiple elements can now be changed in sequence, without having to call the editing mode each time.

If a contour section is shifted, then the entire contour now follows the shift of that

section. This is particularly useful when DXF contours are loaded and then have to be shifted to the "correct" diameter, or when C-axis milling contours need to be positioned to the front face or lateral surface.

Proceed as follows:

- Navigate to any contour element with "Change element".
- Remove it from the contour.

- Insert a new element in the gap just created.
- Connect the new element to the rest of the contour with the "Set target pos." soft key.

Newly added to the simulation: a 3-D view of the workpiece blank and the finished part. The workpieces can be depicted as solid-body models and can be rotated about the principle axes. A three-quarter section view is also possible.

Finding a startup block in the program sequence

Use the soft keys to find a start block for mid-program startup quicker via units, a tool change, subprogram or block number.

New soft keys for finding a startup block

Measurement of workpieces

A brand new feature, similar to the familiar measurement of tools, is the measurement of workpieces with the TS touch probes from HEIDENHAIN. A sample cycle for measurement of workpieces is available in the control. Machine tool builders can also offer measuring cycles matched to specific machine models.

Measurement of workpieces made very easy with the MANUALplus 620

Implementation of a new kinematics model

Use the "new kinematics model" developed for NCK-based controls as an alternative to the previous model. With the new kinematics model, Kinematics-Design can be used to create and modify kinematics for the control.

MANUALplus 620 for retrofitting

The new MC 320T main computer without HSCI interface supports purely analog drive control. In this case the axes are controlled exclusively through the analog nominal speed command interface.

Screen

Main computer

Machine operating panel

HSCI = HEIDENHAIN Serial Controller Interface, the serial interface for all control components

MANUALplus 620 control

Controller unit(s)

Touch probe systems

PLC inputs/outputs
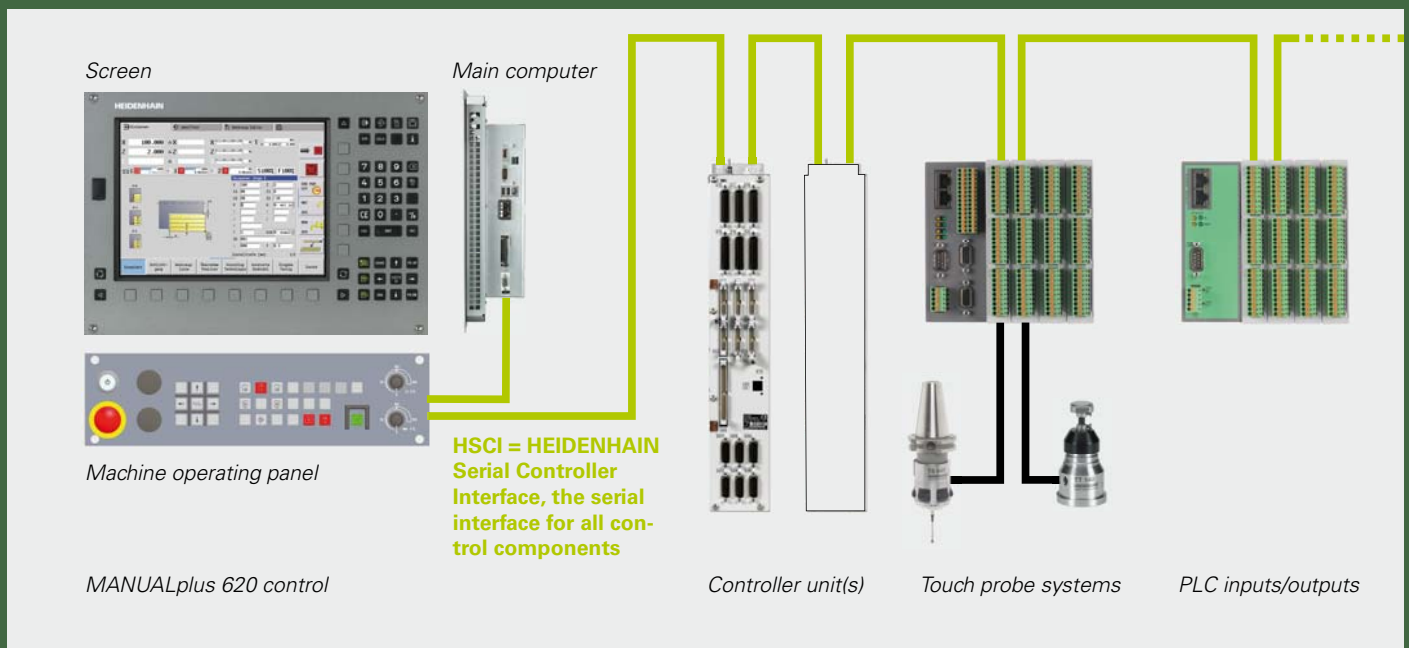
HSCI – All Control Components with a Uniform Digital Connection

For the MANUALplus 620, the main computer, controller unit and all other components now communicate with each other via the powerful HSCI interface. The uniform digital connection increases the performance of the entire system and guarantees very high accuracy and surface quality, even at rapid traverse speeds.

Both the machine tool builder and the end user profit from HSCI: the entire system becomes less susceptible to noise, is thoroughly diagnosable, and so ensures a high degree of availability.

New hardware design with many advantages

The main computer and controller unit are connected with each other via a real-time Ethernet cable. Data is exchanged via a protocol developed by HEIDENHAIN — the "HEIDENHAIN Se-

rial Controller Interface", abbreviated as HSCI. Together with the digital EnDat 2.2 encoder interface, there is a uniform digital connection from the main computer to the encoder.

The most important technical benefits:

- High noise immunity
- Extensive possibilities for diagnostics
- Simpler commissioning
- Simpler wiring

Have you seen this function?
iTNC 530: Special Functions—Clearly Explained

Convenient Selection of Files

You want to call an NC program with CALL PGM, but mistyped the path again? With software version 340 49x-06, calling the program is a piece of cake, thanks to the new selection window.
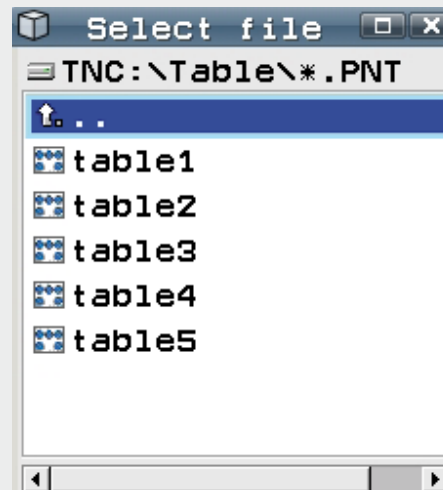
```
SELECTION
WINDOW
```

For which functions does the selection window appear?

The selection window appears when you call a subprogram (CALL PGM) that you want to integrate in your NC program. It also appears when selecting point tables (SEL PATTERN) or even datum tables.

```
1   SEL PATTERN "TNC:\Table\table1.pnt"
```

What is so new about the selection window?

You no longer need to manually enter the entire path of the subprogram you want to call. This had been the case if the NC program and subprogram were in two different folders. Typos slipped in very quickly. Naturally the iTNC 530 issued an error message if this happened.

```
Select file
TNC:\Table\*.PNT
   t. . .
   table1
   table2
   table3
   table4
   table5
```

How does the selection window appear?

You open the selection window via soft key. The selection window appears when you want to select the program or table after entering a PGM CALL. The selection window then appears as a pop-up window. In it you mark the file that you want to integrate into your NC program.

And the iTNC 530 accepts the file I selected?

Yes, the control then generates the path quickly and automatically, making typos impossible.

How can I maintain an overview with so many files in the directory?

You can keep track of the files if you sort them by file type. For example, you can have only point tables (.PNT files) or only plain-language programs (.H files) be shown. Rapid selection is then a breeze.
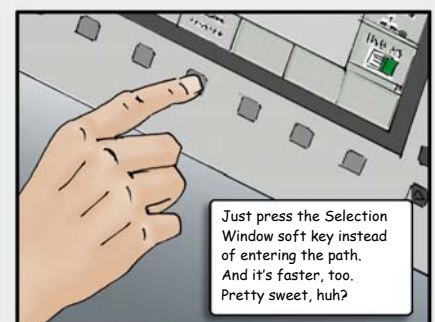
The new NC software 340 49x-06 for the iTNC 530

Practical: Individual point tables can be created in the smarT.NC operating mode—and are then simply integrated in the plain-language programming as .HP files.


Does this also work with smarT.NC?

You can even integrate .HP files in a plain-language program. These are point tables from the smarT.NC operating mode, containing the machining positions. You can very easily disable or hide any of these positions. This way you quickly create a separate point table in smarT.NC, even if you are working in a plain-language program. The disabled machining positions do not appear in the NC program, and the hidden positions are marked as hidden.

But can't more things be selected?

Yes, the new selection window is useful when working with the simple contour formula, for example, since the subcontours can be found more quickly in the selection window when you are combining them to form a contour.

The new and convenient selection window also appears in many other processes in the control. Simply try it out, and find where operating the iTNC 530 has become even easier. +
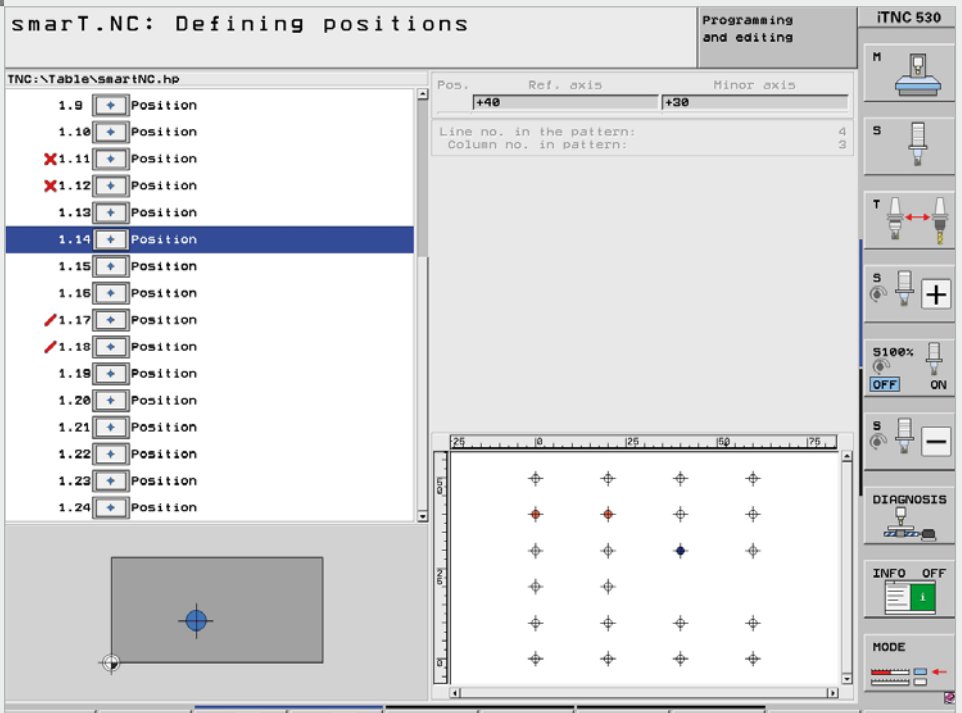
Even more improvements ...

Machine tool operators can enjoy many new and useful enhancements included in software version 340 49x-06:

- *Dynamic collision monitoring (the DCM software option) was enhanced with a toolholder wizard, which you can easily use to parameterize templates for tool carriers.*

- *There are also many improvements to KinematicsOpt (software option), including measuring the misalignment of an angular axis, or the new calibration cycle 460.*

- *Cycle 275 TROCHOIDAL SLOT is brand new. Use trochoidal milling for very efficient roughing of slots, followed by a finishing operation.*

- *Better overview: the 3-D line graphics can now also be displayed in full-screen mode to improve clarity of detail.*

The interactive Klartext e-magazine has comprehensive explanations describing all improvements.

+ *www.heidenhain.de/klartext*

And that's my surprise: the faster you program, the earlier you go on break. I'm outta here!

END

The New
HR 550 FS Wireless Handwheel

Where is the Remote Control?

Although it has long been a standard feature for television sets, it hasn't really caught on with machine tools: the wireless remote control. But it's not a question of comfort here. Rather, you are entirely concentrated on the action in the machine's working space when operating it with a handwheel. The new wireless handwheel from HEIDENHAIN does not restrict your movements in any manner.

The larger the machine is, the more helpful the new **HR 550 FS** handwheel is, since the operator can position himself very close to the tool and so keep an eye on the process at all times. The "FS" stands for Functional Safety, meaning that the handwheel corresponds to the valid requirements for safety. The **HR 550 FS** features the usual safety elements, such as an emergency stop button and permissive buttons, as well as **axis keys** in a different color and a **six-line screen** that displays important machine statuses, general information and the transmission field strength.

Enjoy the new degree of mobility permitted by the amply dimensioned transmission range. And what happens if you do move too far away? You are warned in time by a plainly noticeable vibration alarm.

The wireless handwheel features five **soft keys** for adaptation to your specific operating sequences. The screen displays the functions available for each respective step. In addition, the machine tool builder can freely assign specific functions to the six **function keys** featuring LED indicators. The symbols for the axis designations and the function keys can be exchanged.

You use the two **override potentiometers** to set the axis feed-rate and the spindle speed. On handwheels with mechanical **detent** (100 stops per handwheel revolution), you can also set the traverse path per stop. A variant without detent is also available.

You can use the new **HR 550 FS** wireless handwheel to control your tool responsively and precisely, that is, if you haven't misplaced it...

What is a handwheel for?

No CNC machine should be without a handwheel. It is simply indispensible for probing and for setting a datum. For setup, you can use the direction keys on the handwheel to move the machine axes manually or in incremental jog. With the handwheel superimposition function you use the handwheel to move the axes while the TNC is running a program.

The handwheel holder ensures that you'll find your handwheel again

The practical handwheel holder is not just a docking station for the handwheel: it also features an integrated charger for the batteries, so that your **HR 550 FS** is always ready for the next job.

The new HR 550 FS wireless handwheel from HEIDENHAIN

Emergency stop button

Soft keys

Axis keys

Function keys

Handwheel

Override potentiometer

Before you decide on a wireless handwheel, please check whether there is a wavelength free for the HR 550 FS, since some other wireless transmissions also use the 2.4 to 6 GHz range (WLAN, for example).

Training

Great interest at CAMTECH and HEIDENHAIN's Technology Day at the vocational training center in Remscheid.

Technology Day Sponsored by CAMTECH and HEIDENHAIN

Ever Heard of Associativity?

Imagine you are using a CAD system to create a model of a workpiece. A CAM system then uses this model to calculate the machining data, such as tool paths. A post processor subsequently creates a machining program from this. Then you discover that one of the component's features, such as a bore hole, has to be changed. If the CAM system automatically takes into account the change to the CAD model, and the machining data are adapted simultaneously, then one refers to this as associativity between the CAD model and the CAM system .... That was the simple version. This procedure saves time and helps to avoid errors.

In July the companies CAMTECH and HEIDENHAIN held a "Technology Day" in the vocational training center of the metal and electronics industry in Remscheid, Germany. Visitors were shown the practical effects of associativity on the CAD → CAM → TNC control process chain.

It was demonstrated that machining programs generated with Edgecam postprocessors from CAMTECH are very clearly structured and use the functions of the iTNC 530 in the best manner possible. For example, this automated program creation generates holes, circular and rectangular pockets, slots, etc., as HEIDENHAIN cycles in plain-language format. This means that the night shift machine operators have the chance of adapting the machining program without needing to wake the CAD specialists!

Especially interesting: the examples showed how the cycles of a HEIDENHAIN plain-language program changed immediately, i.e. associatively, as soon as the 3-D model was changed.

Other demonstration examples:

- *Programming of HEIDENHAIN measuring cycles directly in the CAM system, and the resulting fine adjustment of tools for fits*

- *Loading of 3-D CAD data, including thread, fit and tolerance information, from CAD systems like Autodesk Inventor, CATIA V5, Pro/E, SolidWorks, SolidEdge and others*

- *Changes to the 3-D CAD model*

- *Associative changing of the machining program in the production department*