HEIDENHAIN

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HEIDENHAIN INDIA –
You can count on us!

+ Manufacturing accuracy regardless of circumstances
+ Next generation Linear Encoders
+ Effective collision protection using TS 460 Touch Probes
+ TNC 640 : New control for milling & turning
+ New TNC Features : Dynamic Efficiency & Dynamic Precision
+ Accuracy campaigns
+ Training schedule

www.heidenhain.in

Dear Readers,

Machine Tool Market in India is poised for growth at a compounded annual growth Rate of 13% in the 2016-2020 period. Apart from the automotive and auto component industry that drives 40% machine tool consumption, there are more critical areas of die mold, aerospace and various 5 axes machining applications that feed machine tool consumption in India. In machine tool consumption, India holds the 10th rank in the world, though that is just about 6% of Chinese consumption and 21% of US consumption. When it comes to machine tool production, India's rank is 13 and produce just about 3% of China and 17% of machine tool production made by a tiny country like Taiwan. In spite of having around 1000 companies producing machine tools in India, when it comes to exports, our rank is a poor 34 and we export just half a percent of what the top exporter Germany exports. 93 % of machine tools produced by India are sold within the country. If we have to "make in India for the world" there is a huge opportunity to increase our share by a sincere upgradation process that will include investments in reliable technology. Indian machine builders would need to raise the quality bar by including world class elements without compromise, as some of the leaders are already doing.

When it comes to investing in high end technologies, fundamental research and product development, the 'low cost' mind set must change in favour of 'high reliability' in line with global standards. To create a more sophisticated manufacturing DNA, India should look at strategies adopted by manufacturing leaders like Germany, Japan, China, South Korea and Taiwan and start making for an aspiring India and a demanding world.

In any manufacturing economy, strong small and medium enterprises play a crucial supporting role as seen in the "MITTELSTAND" companies of Germany with a great focus on innovation and high technology, or the small and medium machine tool builders of Taiwan numbering about 1500, who are able to export 75% of their production to global markets.

HEIDENHAIN, with an unquestioned lead in research and development in areas of machine tool metrology and control, continues to develop successful products that define global quality and reliability in the fields of machine building, elevators, automation, semiconductor and electronic manufacturing etc, or wherever precision is to be produced.

We have a track record of over 120 years in the field of measuring technology and over fifteen years of leadership and competence on ABSOLUTE encoder technology. Over 600,000 absolute linear encoders were shipped to almost all important machine tool builders of the world, in the past 10 years. The machine building world has recognised that machines without closed loop feedback systems cannot remain accurate. We manufacture over a million rotary encoders every year, which go into a variety of applications including machine tools., motor manufacturing, packaging machines, robots, elevators etc, to name a few.

HEIDENHAIN's TNC controls come into Indian manufacturing domain, predominantly through the machine tool import channel. Whether it is real 5 axes machining, high speed milling, die mould machining or 3 + 2 axes machining of automotive parts, our TNC controls fitted on machine tools imported mainly from countries like Germany, Switzerland, France, Italy , Spain, Czech Republic and Taiwan, or made in India by a couple of top multinational machine tool makers from India, play a substantial role. The legendary user-friendliness of TNC controls, the top class graphics, combined turning and milling solutions, features like *Dynamic Efficiency* for efficient roughing and *Dynamic Precision* for exact finishing, makes us unique. HEIDENHAIN INDIA supports these outstanding products in terms of training, spares and service.

HEIDENHAIN INDIA has been operating here for almost a decade selling and servicing high quality products from Germany, adding efficiency to your supply chain, protecting your linear scales, rotary encoders and touch probes, commissioning and retrofitting CNC controls, training your operators and maintenance engineers and providing technical inputs on accuracy. We will continue to do this and be a relevant partner to both End users and Original Equipment Manufacturers.

A.P.Jayanthram
Managing Director

Manufacturing accuracy regardless of circumstances

Accuracy often suffers in small series production with constantly changing tasks and processing procedures. In many cases the reason for this are the permanently fluctuating and unforeseeable temperature changes in the machines and drives, which lead to the thermal expansion of the ball screw drives. Closed loop position measurement with HEIDENHAIN linear encoders eliminates these fluctuations in the drive train. It determines the exact position of the machine table at all times. This results in consistently accurate workpieces and strict adherence to tolerances.

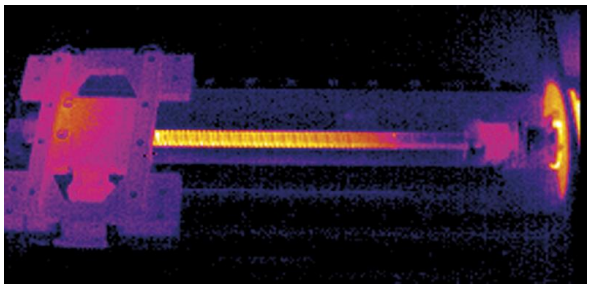
Flexible small series continue to demand a lot of even the most up-to-date enterprises if they are to run economically and accurately. If the actual machining is much faster than the setting up of the machines and plant, then delays have serious consequences.

No wonder that with all this organization and fine-toothed planning, the topic of accuracy is prominent in flexible small series production. In fact, modern machines usually do have an acceptable intrinsic accuracy. However, the devil is often in the details and in this case it is **thermal expansion due to internal heat sources** in the machine and therefore from the machining itself.

Thermal expansion has surprising effects

We all know that materials expand when heated. In the case of the linear axes it is mainly the ball screw drive which is affected. Due to the initial stress and associated friction between the ball screw and the nut, it heats up each time the machine table traverses during machining. The so-called fixed/floating bearings of the ball screw drive allow for the associated expansion so as to prevent damage to the bearing.

The expansion for a steel ball screw drive can be easily calculated taking the thermal expansion coefficient of steel of 10 µm per meter length and degree of temperature difference. In the case of a ball screw drive 1 m long, a rise in temperature of 1 °C causes a deviation of 10 µm. Since temperatures of 45 °C are quite common on the ball screw drive—an increase in temperature of 25 °C above the ideal temperature of 20 °C—it is easy to imagine the actual dimensions of the deviation.



Ball screw drive in action:
The ball screw reaches temperature upto 45 °C.

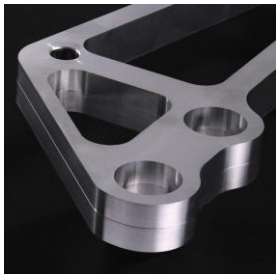
Scrap due to overheating

On Monday morning the machine is at its ideal temperature of 20 °C after a weekend of standing idle. Now setup and preparation begin for a small series production run of 40 parts. It involves machining of average difficulty without any particularly high traversing speeds for the machine table. The maximum feed is 3.5 m/min. Two holes 350 mm apart are to be drilled in the parts and the contour milled. The machining takes five and a half minutes, the tolerance for the distance between the holes is ±0.02 mm.

The subsequent quality control shows that of the 40 parts to be produced only the first 25 are within the specified tolerance. About 40 percent of the production is scrap—what a catastrophic result! What happened?

The ball screw drive heated up continuously during machining. After the 25th part the heat increase had reached the critical point when the thermal expansion of the ball screw drive causes the tolerance of ±0.02 mm to be exceeded. The deviation on the last part was even 70 µm.

You can clearly demonstrate this deviation with a simple trick: After machining of the 40th part, the first part is put back on the machine and the feed setting in Z direction is halved. The second holes made in this way in the finished part leave a clearly visible edge in the existing holes, likewise the second milling operation on the contour. This is the result of the 70 µm deviation due the thermal expansion of the ball screw drive.

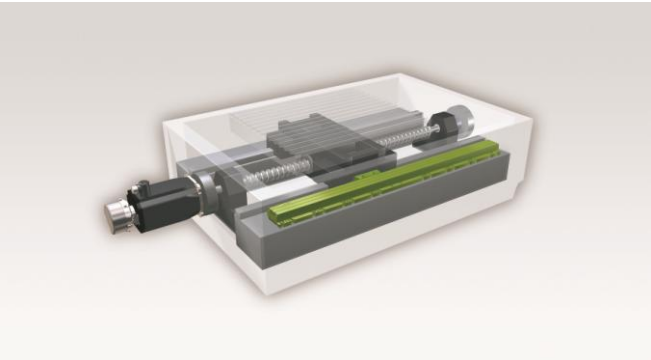


Clearly visible after the second machining:
The deviation of 70 µm due to the thermal expansion of the ball screw drive

Constant switching makes expansion unpredictable
However, the problem in small series production is not the linear expansion, which is easy enough to calculate. The problem is caused by the permanently changing requirements and conditions, which makes the temperature development unpredictable. For the first small series production on Monday morning is followed in the afternoon by a quick change of settings for the next machining run. But what are the temperature conditions in the machine now? Has everything cooled down again to 20 °C during the switchover or is there still residual heat in the ball screw drive?

Nobody knows, and with every subsequent small series production the conditions will become increasingly inestimable. There is no way that you can derive values for future machining runs. The same machining run could produce more or less rejects the next time round depending on the initial temperature of the ball screw drive at the start of machining and how the temperature develops.

Everything under control with precise position measurement
On the other hand, position measurement with a linear encoder is independent of the thermal expansion of the ball screw drive—and any other influences. This so-called closed loop control always determines the precise position of the machine table. The result is stable production with a constantly high level of workpiece quality



Unaffected by the temperature development on the ball screw drive: Closed loop position measurement with a linear encoder

A comparative machining run demonstrates the example described above. There is no scrap from a machine with closed loop control; all the parts are within the specified tolerance. A second machining run with the first part after machining of the 40th part with half the feed setting in Z direction leaves no visible edge.

Linear and angle encoders ensure high precision of the components to be manufactured even under strongly varying operating conditions of the machine tools.

Next generation Linear Encoders!

The new LC 1x5 and LC 4x5 generation, HEIDENHAIN are now successfully operating on machine tools across the world.
The new interfaces from Fanuc, Siemens and Mitsubishi can be realized on the basis of the LC xx5 series. In addition, the EnDat and Siemens encoders can be used in safety-related axes.

Advantages of the LC 1x5 and LC 4x5 Linear Encoders over the old LC 1x3 and LC 4x3

Support of new interfaces
The LC 1x5 and LC 4x5 series support EnDat 2.2 (up to 16 MHz) and the new interfaces from Fanuc (αi) , Siemens (DRIVE-CLiQ) and Mitsubishi (High Speed Interface up to 5 MHz).

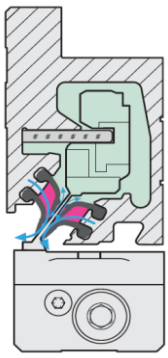
LC xx5 Interfaces / Ordering designations		Accuracy grade 3 µm	Accuracy grade 5 µm
HEIDENHAIN	EnDat22	1 nm	10 nm
Fanuc	Fanuc05	1.25 nm (αi) 10 nm (α)	12.5 nm (αi) 50 nm (α)
Siemens	DQ01	1 nm	10 nm
Mitsubishi	Mit02-04	1 nm	10 nm

Higher resolutions
The resolution of the LC 115 and LC 415 with an accuracy grade of 3 µm was increased from 5 nm to 1 nm. The resolutions of the encoders with Fanuc, Siemens or Mitsubishi interface were largely matched to those of the EnDat encoders

Functional safety for encoders with EnDat 2.2 or DRIVE-CLiQ interface

Functional-safety (FS) versions are available for the EnDat 2.2 (purely serial) interface and the DRIVE-CLiQ interface. This means that these encoders can be used as single-encoder systems in safety-related applications—such as in axes with linear motor. In addition to the safe processing of the position values, these encoders provide fault exclusions for the loosening of the mechanical coupling for various types of mounting.

Optimized sealing design—Doubled sealing lips on the LC 1x5
The LC 115 features an optimized sealing design with two successive pairs of sealing lips.
When compressed air is introduced into the scale housing, a very effective sealing air between the two pairs of sealing lips is the result. This optimally protects the interior of the encoder from contamination and provides better resistance against contamination and consequent failures.



Reduced height of the LC 4x5 scanning unit
The height of the LC 4x5 scanning unit was reduced to the dimensions of the LS 400 series. The mounting holes remain identical to those of the LC 483, so that the LC 415 can be mounted unaltered to existing geometries.

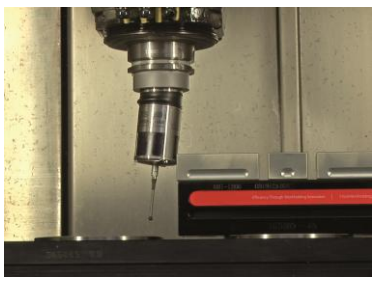
For more technical information please contact our Sales Department !

Effective Collision Protection for HEIDENHAIN Touch Probes

HEIDENHAIN TS 460 touch probe is protected during collisions. Machine operators have no need to fear damage and can measure their workpieces with an easy mind.
Nobody's perfect, meaning that mistakes sometimes happen—often completely without intention and unpredictably. With complex 5-axis machining, for example, an erroneous tilting motion can never be completely excluded. When measuring workpieces in the machine the touch probe is usually impaired in such cases and even the spindle may become damaged. This is when such misfortunes are not only annoying but also very costly—machine downtime, stoppages, costs for repair and other factors quickly accumulate to add up to considerable sums of money. It's here that machine operators are keen to benefit from the support of intelligent technology for avoiding such errors or for at least limiting their effects.

Simply using what is available
The HEIDENHAIN TS 460 touch probe for workpiece measurement demonstrates how simple such an intelligent solution often is. The system features a mechanical collision protection mounted between the touch probe and taper shank that compensates for smaller collisions and prevents larger ones. The protection makes use of what is already in place and available: The electronics of the touch probe and the readiness signal from the touch probe informing the control that it is activated.

With light collisions between the touch probe housing and the workpiece or fixture, the mechanical collision protection deforms to enable the touch probe to yield. Once the deflection reaches 1 mm, an integrated switch is actuated that then deactivates the readiness signal. This is the information that triggers the control to immediately stop the machine. Since the touch probe traverses a certain response path from activation of the switch until the machine stops, the collision protection permits a further 5 mm of deflection through which the touch probe is able to yield without any damage being caused !



TNC 640 – The new control for milling and turning applications!

HEIDENHAIN is now presenting the new and high-end TNC 640 control, based on NCK. (new NC Kernel).
The TNC 640 is suited for HSC and 5-axis machining on machines with up to 18 axes. It is the first milling-machine control by HEIDENHAIN offered with **optional turning functions.** With this control, HEIDENHAIN expands its selection of high performance controls into the complete-machining market, which had not been covered until now. It is now possible to perform turning operations on a milling machine fitted with a TNC 640. The turning operations can be programmed in plaintext, just like the familiar milling operations. Comprehensive turning cycles are available for frequently repeated operations, such as roughing, finishing, recessing and thread cutting. The synergy effects of the new NCK become apparent on the TNC 640. The field-proven lathe controls from HEIDENHAIN provided the software basis for the turning functions.

The TNC 640 is based on HSCI, the new and completely digital hardware platform. The new and ergonomic design of the 19” screen and the operating panel (see figure below) with stainless steel fronts provide the TNC 640 with a suitable appearance.

The user interface of the TNC 640 is more modern, making it even easier for the operator to find the various functions and status displays. The new smarts elect function makes it easier, for example, to select cycles, and syntax color highlighting improves clarity for the editing of machining programs.

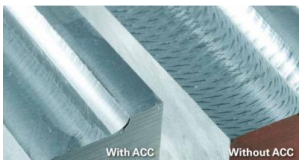
Contact us for more details and to learn about the exciting possibilities with TNC 640!

Dynamic Efficiency: More chips in less time

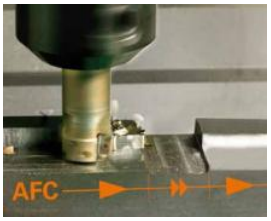
Heavy machining—roughing at high cutting power—is primarily about removing as much material as possible in the shortest time. The forces that result from the cutting process place an extreme load on the machine and tool. With **Dynamic Efficiency**, HEIDENHAIN offers innovative control functions that optimize the removal rate, maximize the tool life and minimize the load on the machine. Users can significantly increase the process reliability in heavy machining and roughing so that manufacturing as a whole becomes more efficient.

Dynamic Efficiency comprises three software functions:

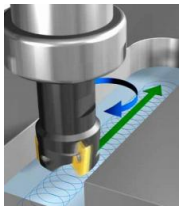
- Active Chatter Control (ACC): This option reduces chatter tendencies and permits greater infeeds



- Adaptive Feed Control (AFC): This option controls the feed rate depending on the machining situation



- Trochoidal milling: Cycle for the roughing of slots and pockets in a way that eases the load on the tool and the machine



Each function in itself provides advantages in the machining process. They can also be ideally combined to achieve decisive improvements.

- Reduced machining time thanks to higher material removal rates (ACC, AFC, trochoidal milling)
- Tool monitoring (AFC)
- Longer tool service life (ACC, trochoidal milling)

With **Dynamic Efficiency**, the manufacturing process becomes faster, easier on the machine and tool, and as a result, more efficient and economical.

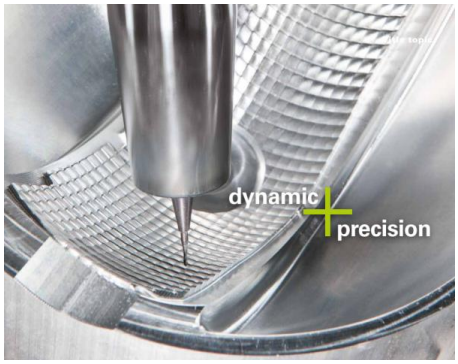
Dynamic Precision: Exact machining in the least amount of time

Under the concept of **Dynamic Precision**, HEIDENHAIN describes a group of functions for TNC controls that significantly improve the contouring accuracy of machine tools even at high feed rates and in complex contouring moves. The dynamic accuracy of a machine tool is determined by the feed-axis acceleration required in order to produce precise movement between the workpiece and tool. When feed axes are accelerated, machine components can be deformed by inertia forces or even begin to vibrate. With Dynamic Precision, the dynamic errors at the tool center point (TCP) that arise during machining are significantly reduced so that NC programs are run with better component accuracy and surface quality, and even noticeably faster.

The functions of **Dynamic Precision** are available as options for HSCI-based milling controls from HEIDENHAIN. They can be applied individually as well as in combinations.

- CTC – compensation of acceleration-dependent position errors at the tool center point (TCP), thereby increasing accuracy in acceleration phases
- AVD – active vibration damping for better surfaces
- PAC – position-dependent adaptation of controller parameters
- LAC – load-dependent adaptation of controller parameters enhances accuracy regardless of load and age
- MAC – motion-dependent adaptation of controller parameters

Through a significant reduction of error at the tool center point during the highly dynamic execution of NC programs, **Dynamic Precision** makes a valuable contribution to improving the performance of machine tools.
The users' demands for reduced scrap, faster machining times, increased workpiece accuracy, and avoidance of manual rework can be met very effectively with the **Dynamic Precision** functions.



Accuracy campaigns

During 2016 too, like in the last years, HEIDENHAIN India continues to conduct accuracy campaigns in partnership with the IMTMA as well as seminars at various Machine Tool OEMs and large machine tool users.

This accuracy campaign is to educate both builders and users of machine tools about the benefits of closed loop system on CNC machines and HEIDENHAIN's efforts in this area. The programmes were held at **Bangalore, Pune, Rajkot** and were very well received by the audience which consisted of well known companies from the machine tool fraternity.

The road shows will continue also throughout 2016 and 2017.

To find the next **HEIDENHAIN seminar in your area**, please contact us at **sales@heidenhain.in**

Training Schedule:

As you may be aware, HEIDENHAIN India is conducting these training courses at our state of the art Training Center located at Chennai with a mix of theoretical and practical classes since our inception in 2008. These courses focus on two major branches, measuring systems and controls systems. The course on measuring systems spans 3 days while controls spans 4 days.

This programme has been very popular in the past with participants from major OEMs and end-users who use our products. The reviews have been excellent and most companies repeat nominations. The participants are either from service / maintenance functions or machine users.

Registrations and course content are available online. Please visit **http://training.heidenhain.in** for more information!

The detailed schedule is given below. We look forward to your nominations!

TRAINING PROGRAMMES SCHEDULE FOR 2016 (2nd half)

TRAINING ON iTNC 530 CONTROL

MONTH	DATES
July	12-15
September	13-16
November	8-11

TRAINING ON MEASURING SYSTEMS

MONTH	DATES
August	10-12
October	5-7
December	7-9

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