



HEIDENHAIN

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HEIDENHAIN INDIA – You can count on us!

- + **Linear Encoders for Machining accuracy**
- + **Next generation Linear Encoders**
- + **Absolute Length Gauge-ACANTO**
- + **Next generation Angle Encoders**
- + **TNC 640 : New control for milling & turning**
- + **New TNC Features : Dynamic Efficiency & Dynamic Precision**
- + **Accuracy campaigns**
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HEIDENHAIN

Dear Readers,

Our nation has announced a resolve towards a manufacturing focus, and global experience has been that capital, technology and entrepreneurial energy will flow to countries that demonstrate qualitative competitiveness, without compromises and short cuts. In the manufacturing fraternity of India, there is an unmistakable air of expectant optimism. If the “**Make in India**” campaign is brought to its logical contours, aided by policy initiatives and structural support, it is sure to help the economy grow and will build the market for machine tools and other engineering products.

Even after half a century of existence, Indian machine tool manufacturing industry cater to only 33% of the local demand and they now have a huge opportunity to increase this share by a sincere upgradation process that will include investments in reliable technology. Indian machine builders would need to raise the quality bar to compete with the best in the world and “**Make in India**”, not only for the Indian market, but also for the rest of the world. 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 the world.

In any manufacturing economy, strong small and medium enterprises play a crucial supporting role as seen in the “MITTELSTAND” companies in Germany with a great focus on innovation and high technology. India’s MSMEs are known more for ‘low cost’ production with a lower focus on using high quality components and equipment. HEIDENHAIN, with an unassailable lead in research and development in areas of Machine tool metrology and control, continues to develop successful products that define global quality and reliability.

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 67% 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, Czechoslovakia and Taiwan, 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 make us unique.

HEIDENHAIN INDIA supports these outstanding products in terms of training, spares and service.

We invite you to our world of high end products that define accuracy, user-friendliness and long term reliability.

India is certainly poised to outlive the image of being a land of a “just enough”, “compromised” manufacturing philosophy and is aspiring to make equipment not only for local high end usage, but also for evolved markets. HEIDENHAIN is already in efficient partnership with the premium producers all over the world, including India.

Come, look at our uniqueness!

Come, let us make in India!



A.P. Jayanthram
Managing Director

Linear Encoders Improve the Machining Accuracy

The capability of a machine tool to cope with rapidly changing operating conditions is a decisive factor for its accuracy. A transition from roughing to finishing completely changes the mechanical and thermal load on the machine. Flexible machining of small manufacturing batches also results in rapid changes in the operating conditions. Particularly in small production runs, however, the profitable manufacturing of orders with narrow tolerances depends upon the accuracy of the first part. That's why the thermal accuracy of machine tools has become a prominent issue.

The feed drives are of particular importance in this context. High traversing speeds and accelerations put a heavy load on the feed drives, causing heat to be generated. Without suitable position measuring technology, this rise in temperature can lead to positioning errors of up to 100 μm within a few minutes.

Thermal stability of machine tools

Solutions for avoiding thermally induced dimensional deviations of work pieces have become more crucial than ever for the machine tool building industry. Active cooling, symmetrically designed machine structures and temperature measurement are common practice today. Thermal drift is primarily caused by feed axes on the basis of recirculating ball screws. The temperature distribution along the ball screw can rapidly change as a result of the feed rates and the moving forces. On machine tools without linear encoders, the resulting changes in length (typically: 100 $\mu\text{m}/\text{m}$ within 20 min.) can cause significant flaws in the work piece.

Position Measurement of Feed Drives

The position of an NC feed axis can be measured through the ball screw in combination with a rotary encoder, or through a linear encoder. If the slide position is determined from the pitch of the feed screw and a rotary encoder (Figure 2), then the ball screw must perform two tasks: As the drive system it must transfer large forces, but as the measuring device it is expected to provide highly accurate values and to reproduce the screw pitch. However, the position control loop only includes the rotary encoder. Because changes in the driving mechanics due to wear or temperature cannot be compensated, this is called semi-closed-loop operation.

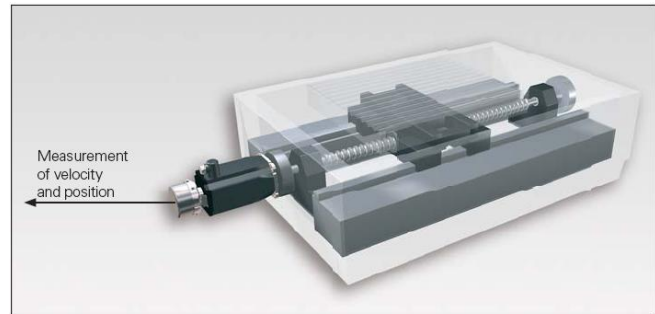


Figure 2 Position feedback control with a recirculating ball screw and a rotary encoder in semiclosed-loop mode

Positioning errors of the drives become unavoidable and can have a considerable influence on the quality of work pieces.

If a linear encoder is used for measurement of the slide position (Figure 3), the position control loop includes the complete feed mechanics. This is referred to as closed-loop operation. Play and inaccuracies in the transfer elements of the machine have no influence on position measurement. This means that the accuracy of measurement depends almost solely on the precision and location of the linear encoder.

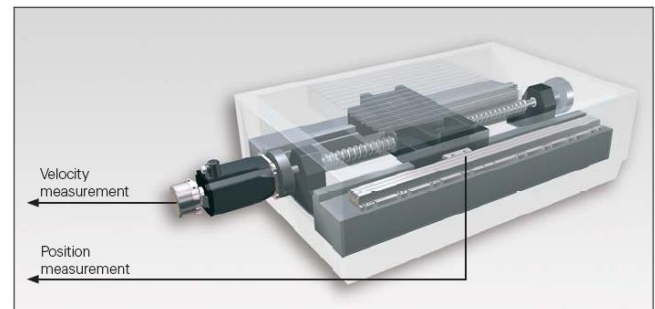


Figure 3 Position feedback control with a linear encoder in closed-loop mode

Summary

The successful fulfillment of manufacturing orders requires machine tools with high thermal stability. As a consequence, feed axes must achieve the required accuracy over the complete traverse range even with strongly varying speeds and machining forces.

Position errors may result if the slide position is only determined from the spindle pitch and a rotary encoder on the motor side. These errors can be completely eliminated by using linear encoders. Angle encoders used on rotary axes provide similar benefits since the mechanical drive components are also subject to thermal expansion.

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 sealed linear encoders of the LC 1x3 and LC 4x3 series have established themselves very successfully on the market. With the new LC 1x5 and LC 4x5 generation, HEIDENHAIN will complement its current product program. The development of the encoders was focused on the requirements for purely-serial absolute systems. 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 New LC 1x5 and LC 4x5 Linear Encoders over the current 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 (α), Siemens (DRIVE-CLiQ) and Mitsubishi (High Speed Interface up to 5 MHz).

LC xx5 Interfaces / Ordering designations		Accuracy grade 3 μ m	Accuracy grade 5 μ m
HEIDENHAIN	EnDat22	1 nm	10 nm
Fanuc	Fanuc05	1.25 nm (ai) 10 nm (a)	12.5 nm (ai) 50 nm (a)
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 μ m 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 will be 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.

Mechanical Compatibility with LC 1x3 LC 1x5

The LC 1x5 can be mounted to the same mating dimensions as the LC 1x3. However, since a new housing profile is used, the mounting aid for aligning the fixing element for the scanning unit of the LC 1x3 (ID 547 793-01) cannot be used.

LC 4x5

The LC 4x5 can be mounted to the same mating dimensions as the LC 4x3.

For more technical information please contact our Sales Department !

ACANTO AT 30xx – Absolute Length Gauge



The AT 30xx is the latest product in the length gauges product group and was developed for multipoint inspection apparatuses.

The compact dimensions of ACANTO and its measuring range of 30 mm are the basic characteristics resulting from this requirement. ACANTO provides the benefit of an optical encoder (high accuracy together with high resolution and linearity over the entire measuring length, temperature stability) and meets the requirement for an absolute interface.

It features an EnDat 2.2 interface so that in combination with the absolute measuring method, the values are immediately available upon start-up of the customer's complex system. There is no need to traverse reference marks. The absolute scanning method prevents the occurrence of counting errors.

Another benefit provided by ACANTO thanks to its EnDat 2.2 protocol is its diagnostic function when used in combination with the ND 2100 G GAGE-CHEK or MSE 1000 as subsequent electronics (pictures below). The online diagnostics ensure continuous manufacturing because the operator is always informed about the current status of the length gauge.



In order to meet the increasing demand for in-process measurement and applications in the automation industry, the ACANTO features a degree of protection of up to IP67, meaning it is protected against dust and temporary immersion in water.

New Generation of Angle Encoders with EnDat 2.2 Interface



The absolute angle encoders from HEIDENHAIN with integral bearings and hollow shafts have long been setting the standard for angular measurement in the range of a few angular seconds. Particularly on rotational axes, such as rotary tables and tilting axes on machine tools, they are the best solution for position and speed control. Now the existing RCN 200 and RCN 700/800 series have been completely revised. The angle encoders were improved with new scanning technology, evaluation electronics and changed mechanical design, and are now offered in the RCN 2000 and RCN 8000 series. In addition, a new series RCN 5000 is available with a hollow shaft diameter of 35 mm.

Advantages of the new absolute angle encoders:

The new scanning method permits a very high signal quality and at the same time even greater resistance to contamination. Thanks to the new scanning and evaluation electronics, it became possible to dramatically reduce the influence of the rotational speed on the generation of position values.

The new design of stator couplings feature even better behavior than the previous series in axial and radial deflection and torsional rigidity. Together with the new sealing design of the encoders, relatively large mounting tolerances are now permissible without restricting operating functions and accuracy.

The cable is connected with the new angle encoders by a quick disconnect, i.e. without need of a tool.

The EnDat interface makes extensive monitoring and diagnosis of an encoder possible without additional lines.

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 will be 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 smart elect function makes it easier, for example, to select cycles, and syntax color highlighting improves clarity for the editing of machining programs.

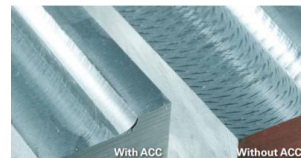
Come, take a look at the new TNC 640 at our stall 3A / D104 at the IMTEX!

Dynamic Efficiency: More chips in less time

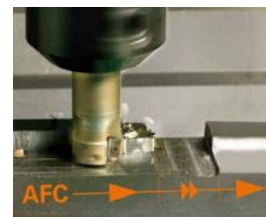
Heavy machining—roughing at high cutting power—is primarily about removing as much material as possible in the shortest time. The forces that result from the cutting process place an extreme load on the machine and tool. With **Dynamic Efficiency**, HEIDENHAIN offers innovative control functions that 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:

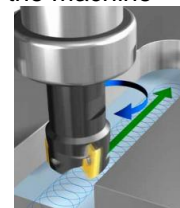
- Active Chatter Control (ACC): This option reduces chatter tendencies and permits greater infeeds



- 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 2014 too, like in the last years, HEIDENHAIN India continued 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 was 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 Gurgaon** 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 2015.

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 2015

TRAINING ON MEASURING SYSTEMS

MONTH	DATES
March	11-13
May	13-15
July	8-10
September	9-11
November	4-6

TRAINING ON TNC CONTROLS

MONTH	DATES
February	10-13
April	21-24
June	9-12
August	11-14
October	13-16
December	15-18

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