



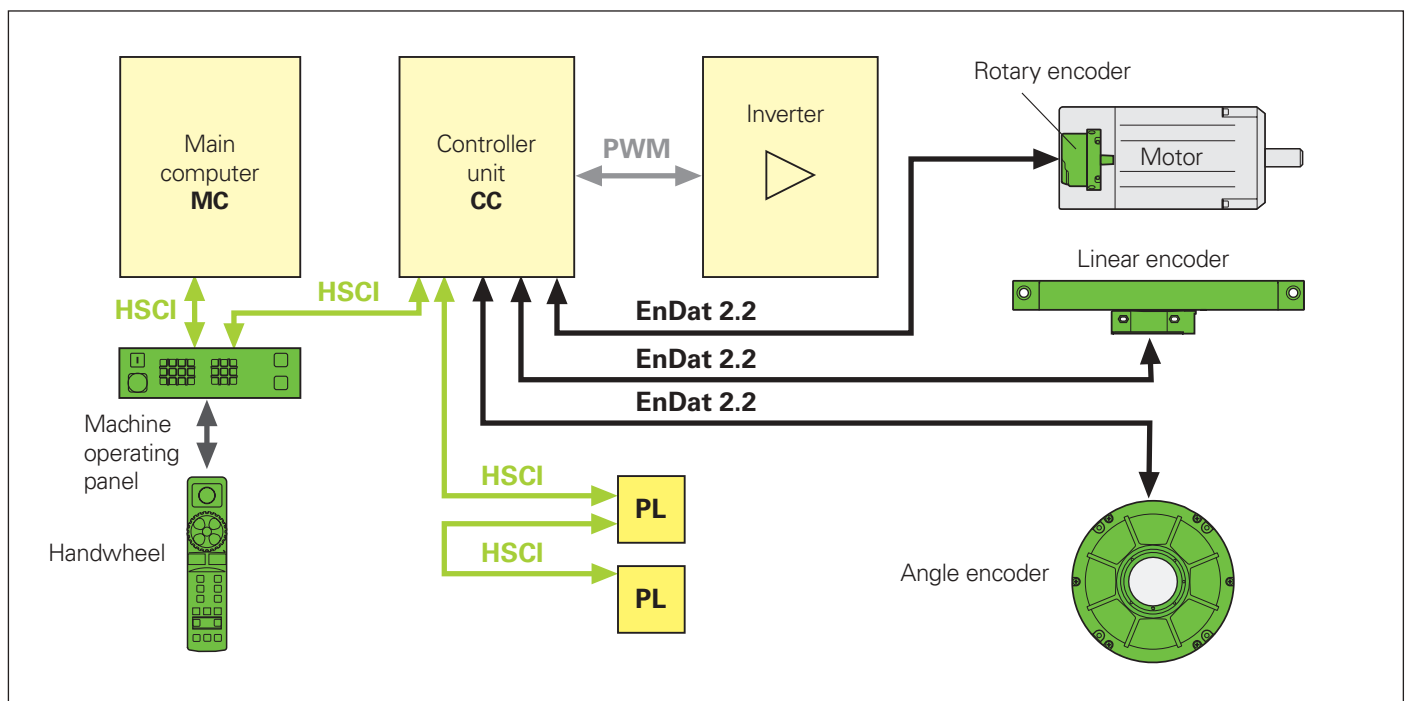
Technical Information

## Uniformly Digital – The New Hardware Design for Controls from HEIDENHAIN

For many years now, controls from HEIDENHAIN have been proving themselves in daily use in the workshop. Along with their suitability for the workshop, they are also characterized by the robust and reliable design of their hardware. At this year's EMO trade show in Hanover, HEIDENHAIN will present its vision for the controls of tomorrow.

Uniformly digital is more than just a buzzword. All components are connected to each other via purely digital interfaces: The control components are connected via HSCI (HEIDENHAIN Serial Controller Interface), the new real-time protocol from HEIDENHAIN for Fast Ethernet, and the encoders are connected via EnDat 2.2, the bidirectional interface from HEIDENHAIN.

The advantages for both the machine manufacturer and the end user are obvious: immune to noise, diagnosable, and high availability of the entire system. So we've got a green light for the uniformly digital control design from HEIDENHAIN. Products with the new uniformly digital control design should be available starting at the beginning of 2008.



# HSCI

## Serial Interface for Control Components (HEIDENHAIN Serial Controller Interface)

### The previous, proven hardware design:

The MC main computer and CC controller unit are contained in the electrical cabinet. The operating panel only includes the screen and keyboard. The components of the operating panel are connected to the MC main computer via separate cables.

### The new hardware design:

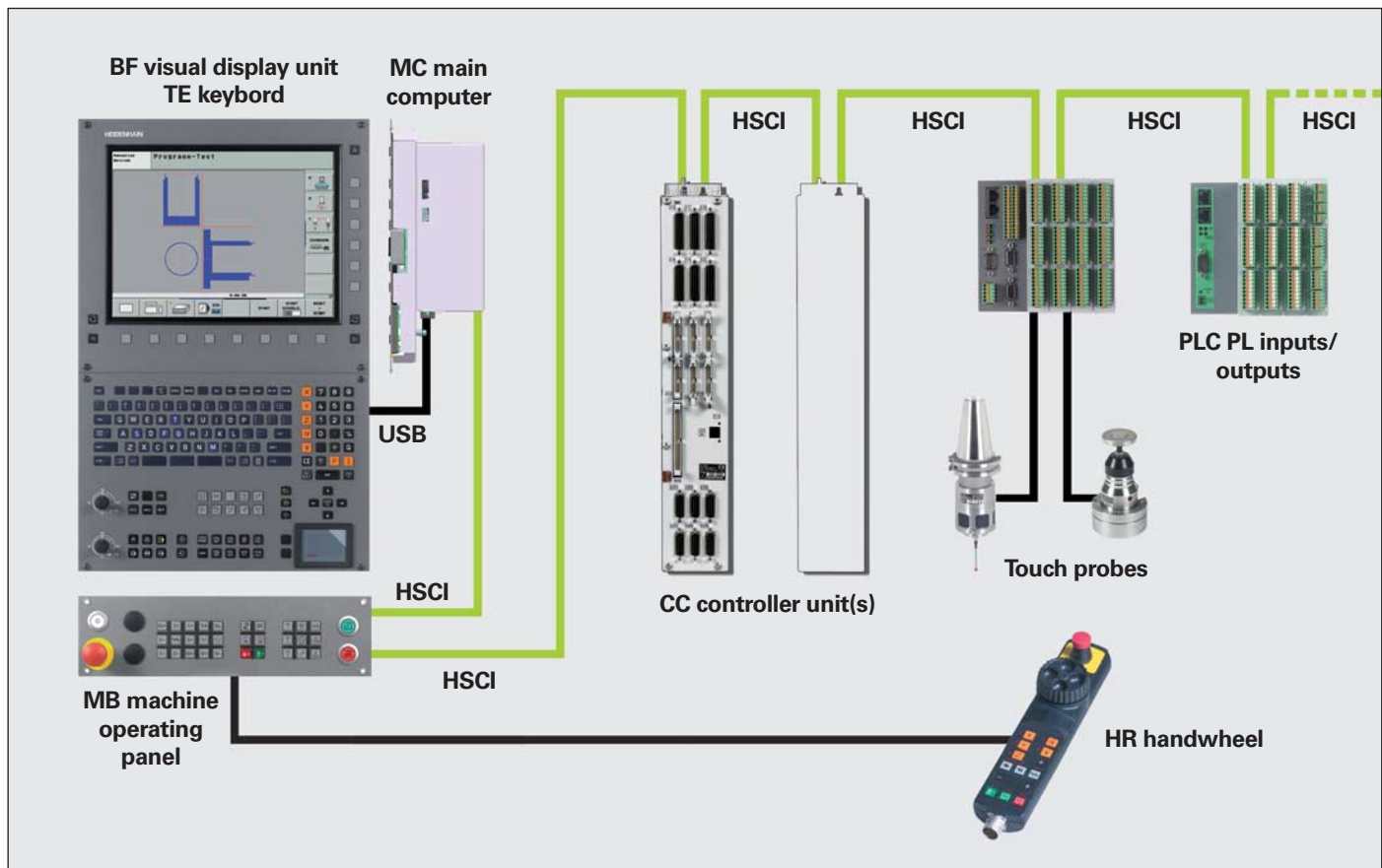
The MC and CC are connected via a real-time Ethernet cable, specifically a 100BaseT Ethernet Physical Layer device. The protocol was developed by HEIDENHAIN, and carries the designation HSCI. Together with the new, purely digital, EnDat 2.2 encoder interface, there is a **uniformly digital design** from the main computer to the encoder.

The **advantages** of this new design:

- Simpler cabling
- Simpler commissioning
- Extensive possibilities for diagnostics
- Improved noise immunity

Up to two CC controller units with up to 14 axes, as well as external input/output modules, can be connected to the **serial HSCI bus**. As a further expansion option, the control will offer integrated safety in accordance with IEC 61505 (SIL 2). The bus coupling requires the physical Ethernet interface as well as a module developed by HEIDENHAIN to make the brief cycle times possible for transmitting the nominal values. Thanks to the excellent synchronization of the HSCI, the transmission jitter is only several nanoseconds. Naturally, no collision occurs during data transmission.

These outstanding properties of the new, uniformly digital design from HEIDENHAIN guarantee not just very high accuracy and surface quality, but also rapid traverse speeds as well as high availability of the entire system.



**The hardware design of the future:** Uniformly digital connection of the various control components

# EnDat 2.2

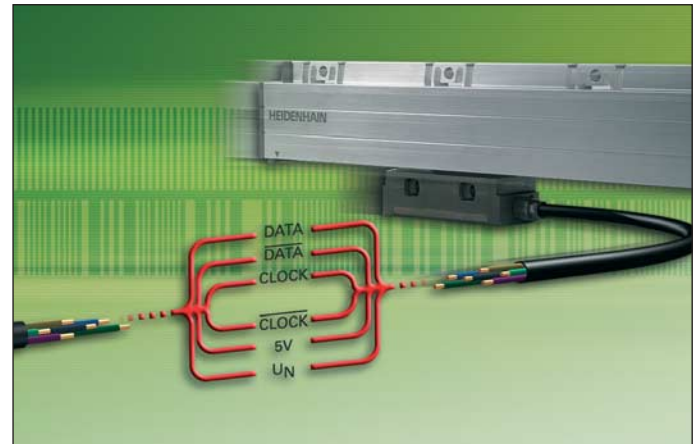
## Purely Serial Transmission of Encoder Data

In the same manner as HSCI for controls, **EnDat 2.2** offers a series of advantages for encoders:

- **Simpler and fewer cables required**

EnDat 2.2 encoders feature a high, internal resolution of the measuring signals. Therefore, unlike normally, additional incremental signals do not need to be transmitted. Thanks to the purely digital transmission, single-shielded cables with just a few wires suffice. This means that the connecting elements are also smaller. They can be put into place more easily, and the reduced cable diameters permit smaller bending radii. In addition to the position values, the EnDat 2.2 interface also transmits further information, such as the motor temperature. Separate lines are no longer required.

Having only a few lines...



- **Improved noise immunity**

The purely digital transmission of the position values is definitive in increasing the noise immunity. Electromagnetic influences on the connecting cable between the encoder and control no longer have an effect on the positioning accuracy.

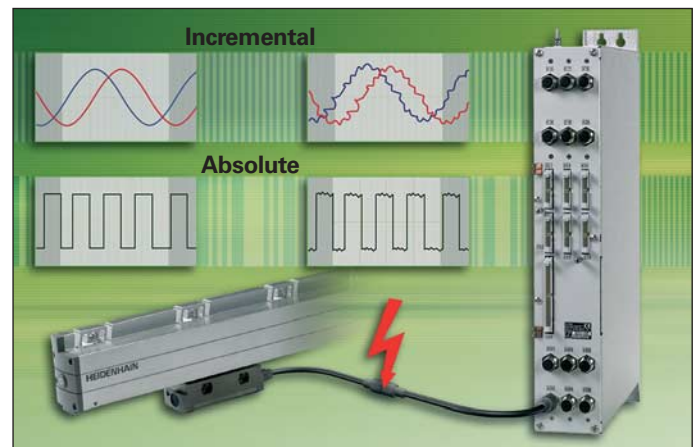


...makes simple cables and small connectors possible.

- **Simpler commissioning**

Encoders with EnDat interface have an electronic ID label—a significant requirement for simplified commissioning. All important information, such as encoder type (linear/angular, singleturn/multiturn, etc.), signal periods, position values per revolution, transmission format of position values, direction of rotation, maximum speed, accuracy dependent on shaft speeds, warnings and alarms, part number and serial number, is stored in the encoder itself and can be interrogated via the EnDat interface. In a freely definable memory area, the OEM can store his information, e.g. the “electronic ID label” of the motor in which the encoder is integrated, indicating the motor model, maximum current rating, etc.

High noise immunity through purely digital transmission



Simple commissioning, e.g. with an electronic ID label



• **Monitoring and diagnosis**

The EnDat interface makes extensive monitoring and diagnosis of an encoder possible without an additional line. They are significant requirements for the high availability of the entire system.

The **Diagnosis** feature provides cyclic information on encoder function and additional diagnostic values.

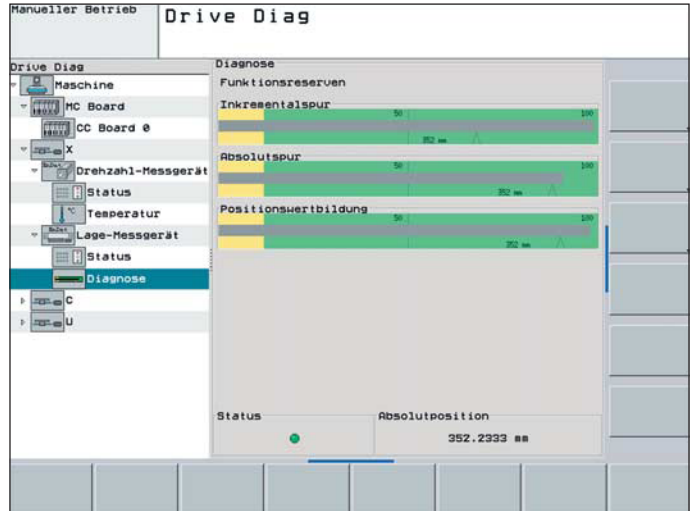
An **error message** becomes active if a malfunction of the encoder might result in incorrect position values. Errors include, for example,

- Illumination failed
- Signal amplitude too low
- Incorrect position value
- Power supply too high/low
- Excessive current consumption

A **warning** indicates that certain tolerance limits of the encoder have been reached or exceeded—such as shaft speed or the limit of light source intensity compensation through voltage regulation—without implying that the measured position values are incorrect. This function makes it possible to issue preventive warnings in order to minimize idle time.

**Encoders with EnDat 2.2 interface**

As a matter of course, HEIDENHAIN offers the appropriate encoders for various applications in practice-oriented versions, in order to bring this new control design to life, since the advantages of the **uniformly digital design** cannot be ignored. The encoders in the table will be added to the product program over time.



Absolute encoders		Resolution
<b>Linear encoders</b>	LC 183/LC 483	± 5 µm ± 3 µm
<b>Angle encoders</b>	RCN 226 RCN 228 RCN 729/RCN 829	26 bits 28 bits 29 bits
<b>Rotary encoders</b>	<b>Optical, singletum</b> ROC/ECN 425, ECN 1325, ECN 125 ROC/ECN 10xx/11xx <b>Optical, multitum</b> ROQ/EQN 437, EQN 1337 ROQ/EQN 10xx/11xx <b>Inductive, singletum</b> ECI 13xx ECI 11xx <b>Inductive, multitum</b> EQI 13xx EQI 11xx	25 bits 24 bits 37 bits 36 bits 19 bits 18 bits 31 bits 30 bits
Incremental encoders		Resolution
Encoders with 1-V <sub>PP</sub> output signals via EIB 192, EIB 392 (External Interface Box)		Integrated 14-bit interpolation



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