

CoreTech™ Encoders - *Variety is beautiful*



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The SICK|STEGMANN CoreTech™ encoder line represents an unprecedented synthesis of custom-designed OPTO-ASIC technology with a modular mechanical concept. The result is astonishing. For the first time, customers now can choose from a large variety of incremental and absolute encoders with different mechanical interfaces, housing styles, resolutions, and new electronic features that are available within a standard lead-time of 48 hours.

For the first time incremental resolutions up to 8,192 lines are available in a 2" housing. SICK|STEGMANN is also the first manufacturer to offer absolute

encoders with up to 15-bit resolution in a 2" package.

In addition, CoreTech™ eliminates the cumbersome process of aligning the electrical position data to the mechanical encoder position. All absolute and incremental CoreTech™ encoders possess a new electronic **Zero Set Feature**. As a result the alignment of zero pulse and mechanical position becomes a software function, which is easy, fast, and convenient. This is a new and unique feature for incremental encoders worldwide, which reduces the costly and tedious manual alignment work to zero.

The CoreTech™ approach allows users for the first time to choose a specific model from over 10 million versions. Solid-, hub-, and hollow-shaft versions are available. Any line count from 1 to 8,192 for incremental and any step from 2 to 32,768 for absolute encoders can be realized. Small lot sizes are shipped within 48 hours after receipt of the order. As a result users are no longer limited to only a small number of preferred stock encoders. Now any model is available and keeping spare encoders on the shelf becomes obsolete for encoder users. This allows them to reduce inventory cost and simplify logistics at the same time.

CoreTech™ - Solution to a Paradox

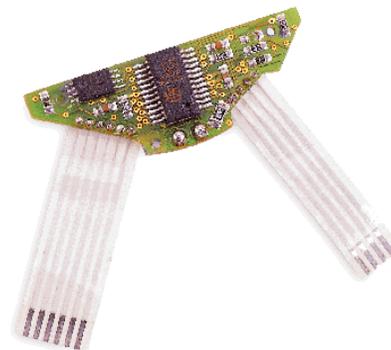
Whenever exact information about travel distance or angular position is required, machine builders and system integrators rely on incremental or absolute encoder feedback. Incremental encoders output a certain number of pulses per revolution, which allows calculating the travelling distance, speed, or angular movement. In contrast, absolute encoders output a specific position code for each angular position. The advantage of this system is that the current encoder position can be reproduced at any time, e.g. after power is lost.

Up to now the manufacturing process for incremental encoders was dominated by the creation of customer-specific line counts, each of which was realized by putting the required line count pattern on an individual code disk. This meant that for each line count between 1 and 8,192 a unique disk had to be created and kept in

stock by encoder manufacturers. Due to varying application requirements in automation and machine designs, a large number of line counts in combination with a variety of mechanical interfaces (shaft, sleeve, housing, connector) and electrical interfaces were required. However, state of the art technology for conventional encoders and the vast variety of electrical and mechanical variations also inevitably resulted in lead times of several weeks.

This created a problem for manufacturers, which eventually also affected users. Because encoder production was often made-to-order, long lead times and high cost were the result. Also, a number of designs have not even been realized due to the fact that a specific resolution was not available or too expensive, due to its uniqueness E.g. cost of tooling for a new code disk.

Today encoder users expect flexibility, almost immediate availability, reliability, easy installation, and above all useful and innovative new features at attractive prices.



In order to find a solution to this dilemma, SICK|STEGMANN has created the new CoreTech™ encoder generation. Core modules, which use an identical *Custom-designed High-Scale Hybrid OPTO-ASIC*, are the heart of all incremental and absolute CoreTech™ encoders.

These Core modules, in combination with a well-defined set of mechanical components, allow manufacturing and shipping of any resolution and electrical or mechanical interface within 48 hours.

CoreTech™ - The Heart of it all

The new CoreTech™ concept uses a minimum number of very sophisticated components to achieve maximum variety: A proprietary hybrid OPTO-ASIC, designed by Stegmann, and a small, unique disk with a barcode track.



Unlike conventional code disks with a continuous repetition of opaque and transparent fields, the very small CoreTech™ disk condenses absolute position information into one non-repeating circular barcode pattern. A second track with 1024 analog sine/cos cycles is used to enhance resolution and accuracy.

The pickup system itself is also very different from conventional encoder pickup systems. The sensitive area of the OPTO-ASIC consists of a

sophisticated sensor array, where individual sensors are selectively accessible. Instead of reading information in the usual parallel way across one specific disk location, the CoreTech™ sensor array reads complete serial data strings of the barcode information. At the same time a separate section of the ASIC sensor array reads the very precise sin/cos information, which is transformed into a high-resolution ARCTAN value within the hardwired ASIC. After synchronization of the two signal inputs, the desired resolution and accuracy for the position data is realized. Unlike other pseudo-random code based encoders, absolutely no angular movement is required to read the position information. The size of the sensor array and the bar code track are adjusted to each other. Thus the position readout is realized in a single glance. Due to the high integration level of the custom ASIC the complete operation is processed in real-time. Via firmware settings resolution and even the encoder type - incremental or absolute - can be selected for the CoreTech™ module via firmware set-up.



Consequent use of a differential sensing principle guarantees high noise immunity and signal quality. A long LED lifetime is ensured by means of an integrated current controller that adjusts for any potential aging and temperature drift. Reliability is greatly enhanced due to the immense reduction of electronic components. All major functions of CoreTech™ encoders are embedded into the custom ASIC. Additional integrated monitoring functions guarantee a high level of system safety.

This new technology for the first time also allows the implementation of an electronic zero pulse alignment for incremental encoders. Typically the zero pulse is a rectangular pulse of 90° or 180° electrical widths that is transmitted once per revolution. It is used as a reference related to a defined mechanical position. The zero pulse is mainly used during commissioning. Here it is attributed to the mechanical reference position of an axis in order to unambiguously find the reference position during the reset procedure, after power was shut down. Up to now alignment of the zero pulse was a costly and tedious process, because the encoder had to be detached and manually rotated, until the zero pulse was found.

With CoreTech™, the activation of the zero set feature via set line or push button assigns the zero pulse to the current encoder position (adjusted to the rising edge of the A channel). No mechanical detachment or rotation of the encoder is necessary. This saves important time for service personnel.

The basic element of all CoreTech™ encoders is always the core module. Because these modules are identical, they can be manufactured in high quantities, serving two important purposes. First, it contributes to a high and reproducible quality standard due to quantity production. Second, it allows competitive pricing due to the economy of scale. The only other components required to complete the encoder are the shaft, sleeve, housing, connector, and interface PCB.

CoreTech™ - A Wealth of Features

Incremental CoreTech™ Encoders

The product range for CoreTech™ comprises solid shaft as well as hollow shaft encoders for an incremental and an absolute encoder line. Three Capital letters **DRS** followed by a designator for the housing size specify the incremental line. **DRS 60** defines an incremental encoder in a metric 60 mm housing, **DRS 20** a 2" housing (HD20 style), and **DRS 25** a 2.5" housing (HD25 style). All incremental encoders, independent of package size, are available for any line count between 1 and 8192 lines including. They always include the zero set feature for the marker pulse.

For the first time even exotic line counts are now available without any price adder and within 48 hours! Also, line counts beyond 2,500 lines are now available in a 2" package without the disadvantages caused by multiplier boards. Even the 8,192 line count signal results from a direct read of the disk!

The width of the programmable marker pulse can also be selected to either be 90° or 180° electrically. The ASIC design guarantees that the synchronization of the marker with the rising edge of the A channel is better than 25 nanoseconds. In conventional encoders the marker width usually shrinks with increasing speed and the synchronization error increases. This is a typical result of the decreasing light seen by the conventional sensor as speed goes up. Due to the CoreTech™ design, these effects do not exist. In fact CoreTech™ encoders maintain their marker width and synchronization up to speeds of 10,000 rpm!

Engineers can also choose from a number of different output driver options that are available. At 5 Volt supply voltage, the rectangular output signals are transmitted via line driver according to the EIA 422 A standard. These drivers support an electrical bandwidth of up to 820kHz. They are also available for supply voltages from 10 to 32 Volts. In addition Push-Pull drivers are available.

All boards are designed in accordance with the CE requirements. They are short circuit proof, overvoltage proof, and reverse voltage protected. All incremental CoreTech™ encoders transmit two rectangular signals via channel A and B that possess a 90° phase shift and one rectangular zero pulse per revolution. For better noise immunity all output drivers are available with complement channels too.

Absolute CoreTech™ Encoders

The absolute line follows the concept of the incremental line. Three capital letters **ARS** followed by the size designator define the absolute products.

ARS 60 means an absolute encoder in a 60 mm housing, **ARS 20** means a 2" housing (HD20 style), **ARS 25** means a 2.5" housing (HD25 style).

All absolute CoreTech™ encoders offer any resolution from 2 to 32,768 steps per revolution. This means in addition to resolutions based on powers of 2, typically described by a resolution in bits (e.g. $8192 = 2^{13} = 13$ bit), all non-power of 2 resolutions are also available (e.g. 3, 7, 199, ...).

A variety of absolute code types are offered as a standard. Data transmission is either via Gray Code for SSI, or Gray, Binary or BCD for the parallel interface. (BCD counts to 7999 only)

The parallel transmission is realized via a push-pull driver that can be tri-state enabled, has short circuit and reverse voltage protection, and possesses integrated transient protection diodes. A parallel TTL board with 7407 driver is also available. All PCBs are designed in accordance with the CE requirements.



As with the incremental encoder line a zero set feature is offered as a standard feature. This feature enables users to adjust the encoder zero position electronically without manually moving the encoder shaft or the encoder housing. Additional features offered as an option for CoreTech™ absolute encoders with parallel interface are especially interesting for engineers. The dedicated **CW/CCW Line** is provided to adjust the counting direction to the clockwise or counter clockwise rotation of the shaft. A separate **Store Line** allows maintaining the current position value at the encoder output. This feature is especially helpful if no signal change is desired during a set-up, maintenance or shifting routine. With the **Enable Line** users can disable the output of encoder position data as required. This allows the user to parallel multiple encoders into common I/O points, therefore minimizing hardware requirements. Finally, a **Parity Line** option is offered for applications where a safety check for data accuracy of the transmitted position value is necessary.

Common CoreTech™ Features

All CoreTech™ encoders have rugged coated die-cast aluminum housings and

solid aluminum sleeves, which makes them resistant to harsh application environments. The standard material for the various shaft designs is stainless steel. All metric units possess an additional opening in the housing that allows access to a set button for the zero set feature.

In order to achieve superior environmental protection, through holes for mounting screws to the inside are avoided and different types of shaft seals are used.

As a response to the current trend towards hollow shaft encoder applications, hub and hollow shaft encoders with shaft ID's from 6mm to 15mm are offered too. Here the user benefit results from an elimination of expensive couplings and special mounting bells. In combination with the other CoreTech™ features a considerable amount of money, time and precious mounting space can be saved.

Of course all encoder versions are available with various cable or connector interfaces.

Every CoreTech™ unit that leaves the Stegmann factory undergoes a thorough performance test on a proprietary PC-based, automated test system. This way operator errors are excluded and highest quality levels are guaranteed. Individual test reports for each unit are stored and can be supplied to customers upon request.

CoreTech™ - A Win-Win Situation

Victor Hugo, a French politician and poet (creator of “The Hunchback of Notre Dame”) once stated that nothing is more successful than an idea for which the time has come. CoreTech® made by SICK|STEGMANN is more than an idea. It is a reality.

This fascinating encoder technology allows designers and engineers to create innovative designs with new options, in smaller packages with higher performance levels and additional features. Designs with unusual line counts, use of the new additional encoder signals, shorter component lead times for prototyping, and simplified set-up procedures will become a standard. Also, encoder shaft speeds of up to 10,000 rpm in combination with a frequency bandwidth of up to 820kHz now allow engineers to avoid costly and space-eating speed reduction measures (e.g. gears or pulleys and belts) in many incremental feedback applications.

Buyers now can choose from over 10 million different versions that are available within 48 hours without going

through the hassle of tooling charges and long lead-times. They can reduce inventory levels and the number of suppliers for different resolutions and incremental or absolute feedback solutions. With CoreTech™, SICK|STEGMANN becomes an important partner for their stock reduction program while improving component availability.

Distributors also can free up cash and improve the service to their customers. By cooperating with SICK|STEGMANN, even the strangest line counts are available. Customer requirements for short lead times and line count variety can now be met with reduced inventory. Within 48 hours SICK|STEGMANN can send any unit directly from the factory to the end user.

Finally, users will not only benefit from the availability of a wide variety of encoders, but also appreciate the increased performance characteristics of machines that take advantage of the innovative CoreTech™ features.

No doubt, CoreTech™ is a win-win situation for everybody.

For additional information contact SICK|STEGMANN, 7496 Webster Street, Dayton, OH 45414; 800.811.9110; www.stegmann.com; sales@stegmann.com.