

Latest metrology and position feedback solutions on show at SEMICON West 2007

Renishaw is highlighting its enhanced range of encoder solutions together with measurement and calibration systems at SEMICON West 2007, being held at the Moscone Center, San Francisco, USA from 16th to 20th July.

As described by the show organisers, SEMICON West is “the annual event for the global micro- and nanoelectronics industries, where over 40,000 people from around the world participate to see and showcase the latest trends and technologies shaping the future of semiconductors, nanoelectronics, MEMS, renewable energy technologies, and related micro- and nanoelectronics.” Joining more than 1,300 exhibitor companies representing over 40 countries, Renishaw will be located in booth 6177 in the North Hall.

The focus for this year’s booth will be the extensive range of position feedback (encoder) solutions, from robust, rotary magnetic solutions through to the ultra-high resolution laser-interferometer based variant, and the recently launched XL-80 measurement and calibration laser system.

The non-contact optical encoder range incorporates high accuracy linear and high precision angle encoders, including vacuum compatible models, and component, modular and packaged magnetic rotary encoders.

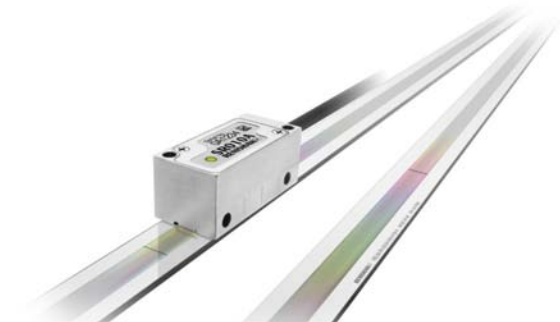


Renishaw’s RG2 (20 μm) and RG4 (40 μm) non-contact encoders offer reliable, high speed performance and are now available with resolution to 10 nm directly from the readhead. Resolution to 50 nm is now available directly from the robust 40 μm RGH41 readhead whilst the compact 20 μm RGH24 now offers digital resolutions to 10 nm. All Renishaw non-contact optical encoders exhibit zero mechanical hysteresis and excellent metrology. The patented filtering optics withstand a variety of contaminants such as dirt, dust and scratches ensuring customers’ machines run reliably with little or no maintenance.

The high accuracy SiGNUM™ encoder range has also evolved and now offers resolutions to 5 nm. SiGNUM™ encoders offer high speed, reliable, non-contact performance combined with advanced features including the *IN-TRAC*™ auto-phase optical reference mark and dynamic signal processing. The entire range gives high accuracy, repeatability and resolution, with 10 nm and 5 nm Si interfaces now available as standard. In addition, the new high resolution Si interfaces offer advanced noise filtering, ideal for applications that demand exceptionally smooth velocity control.

All SiGNUM™ encoder systems feature the bi-directionally repeatable *IN-TRAC*™ optical reference mark, which remains phased over the entire speed and temperature specification (over 12.5 m/s or 4,500 rev/min and up to 85 °C). Intelligent signal processing ensures excellent reliability and ultra-low cyclic error (± 30 nm), whilst the SiGNUM™ software enables optimum set-up and real-time system diagnostics via a PC’s USB port.

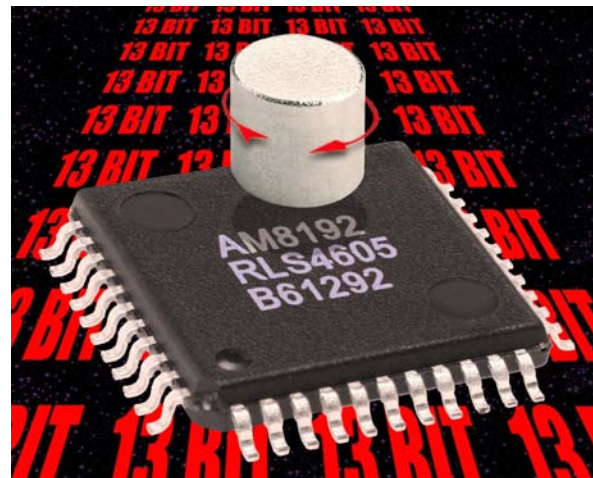
With accuracy better than $\pm 1 \mu\text{m}$ and resolution to 5 nm, the RELM high accuracy linear encoder system offers a level of performance previously available only from more delicate fine pitch encoder systems. The system comprises the SR readhead, Si interface and robust 20 μm RELM scale. Manufactured from stabilised Invar, RELM has a low coefficient of thermal expansion ($\approx 0.6 \mu\text{m}/\text{m}/^\circ\text{C}$, 0°C to 30°C), is available in a range of defined lengths up to 980 mm and is offered with a choice of *IN-TRAC*[™] reference mark positions and dual optical limits.



The RESM optical angle encoder comprises the SR readhead, Si interface and stainless steel RESM ring. The low profile ring, which has 20 μm graduations marked directly on the periphery, is available in a wide range of sizes ($\text{Ø}52 \text{ mm}$ to $\text{Ø}550 \text{ mm}$) and line counts, all of which feature a large internal diameter for flexible integration. Renishaw's patented taper mount minimises installation errors and simplifies integration, whilst RESM's low mass, low inertia design guarantees the highest system accuracy and dynamic performance. RESM suits the most demanding precision applications: a 5 nm system with a $\text{Ø}550 \text{ mm}$ ring offers accuracy to ± 0.38 arc second and resolution and repeatability to 0.004 arc second.

Recent SiGNUM[™] rotary developments include the Si-FN interface which provides FANUC serial communications direct from the encoder, the new DSi (Dual SiGNUM[™] interface) and the REXM ultra-high accuracy ring encoder. DSi combines two SiGNUM[™] SR readheads on a RESM ring for very high accuracy and outputs a customer located and angularly repeatable propoZ[™] index position, which is completely unaffected by bearing wander or power cycling. For ultimate precision, DSi combined with the ultra-high accuracy REXM ring can offer better than ± 1 arc second total installed accuracy.

The range of reliable, low-cost, high-speed, miniature magnetic rotary encoders already provides class-leading performance along with ruggedness and durability. Now, the addition of a 13-bit magnetic sensor provides 8,192-count positioning resolution and operating speeds to over 30,000 rev/min, with availability in chip, chip-on-board, and ready-to-mount packaged versions. The solid state, non-contact magnetic design, eliminates seals, bearings and moving parts for reliable rotary positioning. Especially suited to difficult design and environmental requirements, the friction-less magnetic sensors provide -40°C to 125°C operational temperature range and consistent, wear-free 0.3° positioning accuracy at high acceleration/deceleration rpm.



Standard models provide excellent shock and vibration resistance, while optional sealed models allow application in harsh environments and even immersion. Chip and chip-on-board models allow the sensors to be engineered and integrated into machinery and equipment designs. The ability to operate with a gap between the magnetic actuator and encoder chip meets design needs for isolation of moving elements. Low cost, compact size, multiple formats and design simplicity enables use in a wide range of industries.

In addition to the comprehensive range of non-contact position encoders, Renishaw also offers a laser interferometer based solution, the RLE. First launched in 2001, the RLE revolutionised interferometer system architecture, reducing a complex scientific instrument to a simple production tool. Comprising only three fundamental components - laser source which is connected by a 3 m umbilical to a detector head, and a target optic (either retroreflector or plane mirror depending on application requirements) - the system is simple to install and use.

Laser light is delivered directly to the measurement axis via fibre optics, eliminating the requirement for multiple beam splitters, benders and mounts, whilst simplifying alignment. The simple system architecture saves valuable real-estate around the motion system, and allows the laser source to be mounted remotely, which itself minimises the potential of thermal errors.

RLE systems are available in single or dual axis configurations with a choice of laser unit, detector head and target optic.



The available range of detector heads include options configured for plane mirror or retroreflector target optics (with a choice of beam output orientation), a differential interferometer configuration, a model with no internal interferometer - suitable for use with external optics for linear, angular and straightness measurements, or with the new vacuum compatible interferometer - and a new vacuum compatible model.

With laser frequency stability of ± 2 ppb (systems comprising the enhanced frequency stability RLU20 laser source), and resolutions to 38.6 picometres (when using plane mirror target optics and the optional RPI20 parallel interface), the RLE system is suitable for a wide range of applications within the semiconductor and electronics industries, particularly in applications requiring vacuum or other controlled environment conditions.

For non-vacuum applications, where environmental fluctuations in air temperature, air pressure and relative humidity influence the refractive index of air and therefore the wavelength of laser light travelling through it, the optional RCU10 quadrature compensation system enables positional accuracy to ± 1 ppm ($1 \mu\text{m}/\text{m}$) to be achieved over a broad range of environmental conditions.

Another of the laser interferometer product offerings from Renishaw on display at SEMICON is the recently launched XL-80 measurement and calibration system.

The new compact XL-80 laser system and XC-80 environmental compensator offer users a number of significant advantages over the previous ML10 and EC10 equivalents. With a combined weight of around 3 kg (including connecting cables, laser unit power supply and sensors), they weigh 70% less than the previous product offerings. The reduction in size of the laser unit and compensator has allowed a reduction in the size of auxiliary components such as tripod and stage, such that the whole system (less tripod) can now be packed into a much smaller, wheeled transport case, maximising system portability.

Operational advantages include a reduced pre-heat time of five to six minutes, a critical aspect for calibration service providers or those needing to perform multiple measurements on a single site, an increased linear measurement speed of 4 m/s with readings taken at 50 kHz, meaning the new system can record very detailed data about small, high frequency movements, and improved linear measurement accuracy of ± 0.5 ppm.



Other benefits include the intelligent power supply which auto-senses/auto-adjusts to the input voltage, USB connectivity, a signal gain switch which can increase linear range to 80 m (or increase signal strength at shorter ranges), and a series of LED system status lights.

Additionally, the new system is fully backwards compatible with existing ML10 system optics, allowing the thousands of current ML10 users to upgrade to the new system without jeopardising their existing investment in optics, procedures and staff training.

To maximise the benefits of the new XL-80 system, enhanced measurement software is also available. LaserXL™ software allows users to perform static and dynamic tests to determine a machine's linear, angular, flatness, straightness and squareness measurements. Standard report options within the software conform to a number of international machine performance checking standards. QuickViewXL™ is designed specifically to provide real-time information on the dynamic behaviour of your motion system. Recorded data can be viewed on screen or exported for further analysis into applications such as MathCAD, Mathematica and Excel.

A comprehensive, multi-lingual system manual is provided on CD with every XL-80 system, and systems are further supported by Renishaw's comprehensive warranty, which can be extended to five years for a small price premium.

This year's SEMICON West exposition provides Renishaw with a fantastic platform to showcase a diverse range of metrology and position feedback solutions for the semiconductor and electronics industries, and promises to provide visitors with an extensive schedule of technology developments, industry data and the opportunity to meet companies whose equipment is at the forefront of these industries.