

high-end laser scanning

Digital Encoder Technology

SCANLAB's digital encoder technology extends the company's fully digital *iDRIVE*[®] solution platform by providing highest dynamic performance with close-to-XY-stage precision, as well as comprehensive position feedback and process monitoring. This enables applications that require both high precision and high throughput, a property mix unachievable with previous scan systems or other beam-positioning technologies.

Digital encoders are integrated into SCANLAB's *dynAXIS_{de}*[®] galvanometer scanners, *intelliSCAN_{de}*[®] scan systems and *varioSCAN_{de}* dynamic focusing units. Special care has been taken to ensure that use of digital encoders (even for a mid-size aperture of 14 mm) will enhance positioning precision without compromising dynamic performance or mechanical dimensions.

SCANLAB's first XY scan systems to feature digital encoders are the *intelliSCAN_{de}*[®] 14 and *intelliDRILL_{de}*[®] 20. Their *dynAXIS_{de}*[®] M galvanometer scanners equal or exceed the high dynamic performance of the industry-proven *dynAXIS*[®] M (with analog position detectors). They enable laser scanning with a positioning resolution of 19-20 bits, exceptionally low dither (electronic noise), best linearity and lowest drift. An SL2-100 interface facilitates comprehensive 20-bit control via SCANLAB's RTC[®]5 PC interface board or RTC[®]5 PC/104-Plus board. Line pitch can be precisely adjusted for scribing applications and to eliminate effects such as Moiré patterns.

Applications that require a small-spot-size laser focus precisely positionable within a large processing area (e.g. photovoltaic manufacturing or rapid prototyping) will typically use short-wavelength DPSS or single-mode IR lasers and large-aperture scan systems. The short-Rayleigh-length characteristic for such systems raises the need for high focus-positioning resolution in the third dimension, too. *varioSCAN_{de}* dynamic focusing units meet this requirement. Here, SCANLAB's digital encoder technology helps optimize precision, speed, resolution and linearity, while substantially reducing drift effects.

Additional SCANLAB digital-encoder-equipped scan systems with high-end capabilities will primarily include the *intelliSCAN_{de}*[®] 20, 25 and 30, as well as the *intelliDRILL_{de}*[®] 30.



intelliSCAN_{de}® 14

Compatibility

Integration of digital encoders does not appreciably change the outer dimensions of the dynAXIS® M galvanometer scanners. Therefore the housings of all intelliSCAN_{de}® scan heads are identical to those of the hurrySCAN® and intelliSCAN® series. For detailed dimensions, refer to the corresponding data sheets.

Moreover, intelliSCAN_{de}® scan heads are electrically fully compatible with hurrySCAN® and intelliSCAN® scan heads and can be ordered with a 20-bit SL2-100 interface or a 16-bit XY2-100 Enhanced interface. They are available with the same galvanometer mirrors and objectives with optimized mounts for all typical laser types and image fields.

Options

- A varioSCAN_{de} 20i can extend the intelliSCAN_{de}® 14 into a three-axis scan system.
- The intelliSCAN_{de}® 14 scan head is also available with water cooling.
- The intelliSCAN_{de}® 14 is also available without a housing as a scan module.
- For process monitoring, SCANLAB offers a camera adapter.

Preliminary specifications

(all angles are in optical degrees)

	intelliSCAN _{de} ® 14	hurrySCAN® II 14, intelliSCAN® 14
Dynamic Performance		
Dither (position noise, maximum amplitude)	< 5 µrad	< 22 µrad
Long-term drift over 8 hours (after warm-up)	< 0.1 mrad	< 0.6 mrad
Offset drift	< 15 µrad/K	< 30 µrad/K
Gain drift	< 8 ppm/K	< 80 ppm/K
Optical Performance		
Typical scan angle	±0.35 rad	
Gain error	< 5 mrad	
Zero offset	< 5 mrad	
Nonlinearity	< 0.5 mrad	< 3.5 mrad
Power Requirements		
	±15 V DC, max. 3 A each or 30 V DC, max. 3 A	
Interface		
	SL2-100 (20 bit), XY2-100 (Enhanced) (16 bit) or optical data transfer (16 bit)	
Positioning Resolution		
	19-20 bit ⁽¹⁾	up to 18 bit ^{(1), (2)}
Operating Temperature		
	25 °C ± 10 °C	

⁽¹⁾ resolutions above 16 bit only together with SL2-100 interface

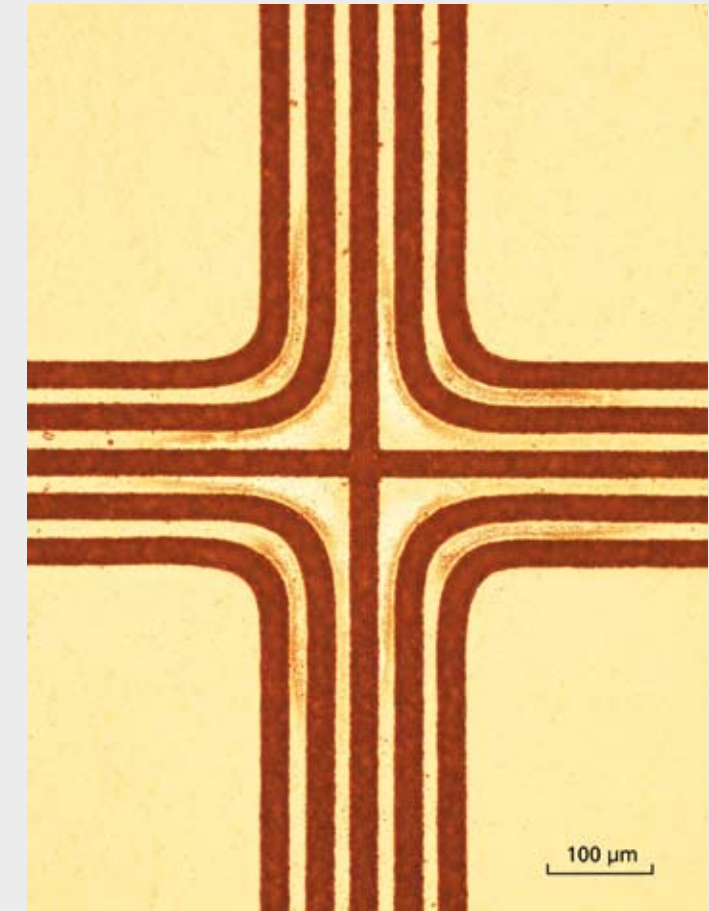
⁽²⁾ 16 bit for hurrySCAN® II 14

Preliminary dynamic specifications

Tuning	fast vector	sharp edge ⁽⁵⁾
Typical Speeds⁽³⁾		
Marking speed	1.5 m/s	2.0 m/s
Positioning speed	12.0 m/s	5.0 m/s
Dynamic Performance		
Tracking error	0.21 ms	0.15 ms
Writing speed^{(3), (4)}		
good quality	500 cps	600 cps
high quality	340 cps	420 cps

⁽³⁾ with F-Theta objective, f = 160 mm, ⁽⁴⁾ single-stroke characters of 1 mm height, ⁽⁵⁾ optimized for small corner radii

Example Processing Result



Structure parameters

approx. 40 µm line spacing
approx. 60 µm and 90 µm corner radii

System

intelliSCAN_{de}® 14
f = 170 mm objective

Process parameters

2 m/s marking speed
sharp edge tuning

Results

undisturbed corners (low tracking error)
excellent line straightness (low dither)



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