intelli*SCAN* IV Series

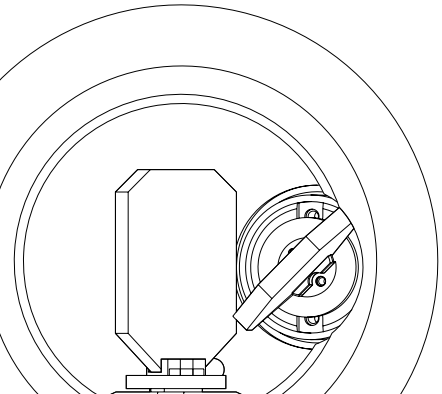
The intelli*SCAN* IV series belongs to a new generation of compact, high-performance scan heads developed by SCANLAB. It is designed for demanding laser applications and offers exceptional dynamics and precision. Its innovative control technology enables a significant increase in productivity. Thanks to its flexibility, the intelli*SCAN* IV series is suitable for a wide range of industrial applications.

Key Features

- Highest dynamic performance
- High long-term stability
- Maximum flexibility due to various tunings
- *SCAN*ahead tuning (optional)
- Comprehensive diagnostic and monitoring functions
- Innovative thermal management

Typical Applications

- Additive Manufacturing (3D Printing)
- Micro material processing
- Marking, welding, cutting



SCANLAB
innovators for industry

The Productive and Smart Scanning System

The intelli*SCAN* IV combines 35 years of SCANLAB expertise. It is a high-performance scanning system available in various aperture sizes, galvanometer technologies, and equipment configurations. It delivers maximum flexibility for a wide range of applications. Compared to the previous model, the dynamics have been increased by 20 %. At the same time, an innovative cooling concept ensures higher precision and stability. The design has been further refined for increased compactness. This makes the intelli*SCAN* IV ideal for processes with the highest demands regarding speed, accuracy and process reliability.

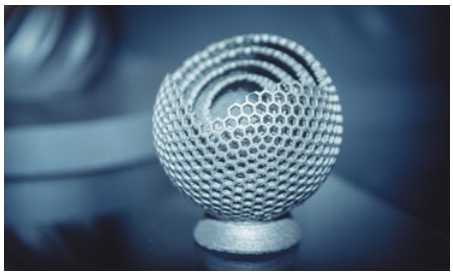
Tuning

The dynamic optimization of a scan system is referred to as tuning. It involves the fine adjustment of the controller to optimally align the system's motion dynamics to the desired scanning behavior.

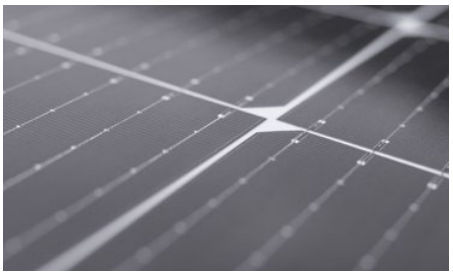
intelli*SCAN* IV systems can optionally equipped with the innovative *SCAN*ahead control technology. It optimizes the speed and precision of the scanning system. Compared to conventional control systems with tracking error, *SCAN*ahead offers various advantages to customers.

The intelli*SCAN* IV is also available with a conventional control system, e.g. vector tuning.

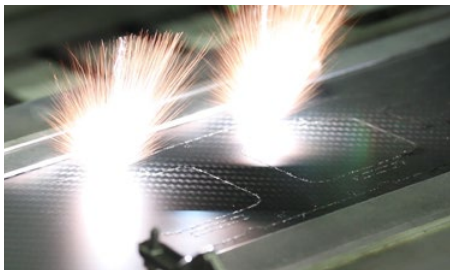
Typical Applications



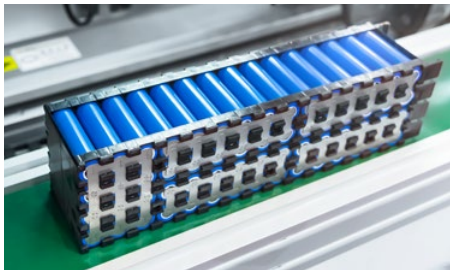
Additive Manufacturing
Additive manufacturing places the highest the highest demands in terms of dynamics, accuracy and repeatability. With *SCAN*ahead, processing time can be significantly reduced without changing any process parameter.



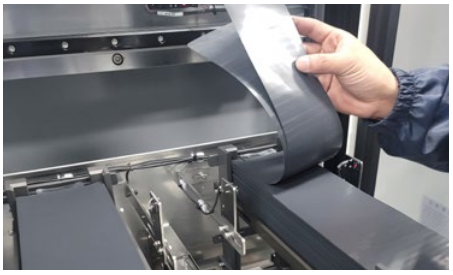
Photovoltaics
High accuracy and repeatability are crucial when structuring photovoltaic modules. The intelli*SCAN* IV, with its digital control system, ensures consistent results and stable production processes.



Tool and Mold Making
Deep engraving in tool and mold making requires maximum precision and long-term stability. The intelli*SCAN*$_{se}$ IV, with its digital encoders which offer very low non-linearity, meets these requirements. This enables precise engraving, even for complex geometries.



Battery Cell Welding
When welding individual battery cells into a pack, the contacts must be processed with high precision and speed. The 48 V technology of the intelli*SCAN* IV enhances system dynamics and performance.

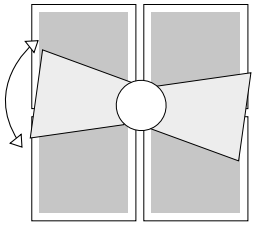


Battery Foil Cutting
In battery cell production, precise heat input is crucial during foil cutting to prevent distortion. The RTC6, in combination with the intelli*SCAN* IV, synchronizes scanner motion and laser emission with high accuracy. This allows stable and reproducible processes.

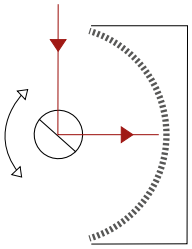
Versions and Equipment

Position Detection: Galvanometer Technology

The position detector (PD), also known as the angle encoder, is a key component of the galvanometer scanner and plays a crucial role in the precision of the entire scaning system. The standard version of the intelli*SCAN* IV uses an analog optical position detector based on the shadow-casting principle. This technology enables reliable position detection.



Analog position detector: Position detection by proportional shading of different photodiodes.



se-Encoder: Position detection by interferometric principle using a 'light pointer encoder' with reduced inertia of mirror at rotor end.

For applications with particularly high demands towards contour accuracy and long-term stability, the intelli*SCAN* IV can alternatively be equipped with digital dyn*AXIS*$_{se}$ galvanometers. These galvanometers use digital encoders with a 20-bit resolution, ensuring outstanding positioning accuracy and minimal drift.

Digital encoder technology offers various advantages:

- Maximum precision due to reduced position noise (dither)
- Excellent linearity and long-term stability
- High immunity to interference, ideal for demanding applications

The intelli*SCAN*$_{se}$ is especially suited for high-end applications that require not only high throughput but also the highest level of precision.

Aperture & Housings

The intelli*SCAN* IV is available in four aperture sizes: 10 mm, 14 mm, 20 mm and 30 mm. All models are certified according to IP66. Therefore, they offer reliable protection against and water. For more flexibility, the connections are also available either on the beam inlet or opposite to the beam outlet side. By default, all systems are equipped with a water cooling circuit.

The 14 mm, 20 mm and 30 mm apertures have mirror air cooling as standard to enable even higher laser powers.

- Compact, dust and water-protected housing (IP 66)
- Automatic detection for 20-bit (SL2-100) and 16-bit (XY2-100) interface
- Interlock connection for integration into a safety circuit

Sensors

In the standard configuration, all intelli*SCAN* IV systems are equipped with temperature sensors on the control board, the galvanometer and galvanometer holder. These sensors enable real-time analysis of the system status and allow immediate reactions if necessary.

For applications with particularly high laser powers, the systems with 20 mm and 30 mm apertures can also be equipped with contactless mirror temperature sensors. This enables even more precise process monitoring and supports an early detection of potential deviations.

These extended monitoring functions help to increase process and system reliability.

intelliSCAN IV High Power – up to 8kW Output

The intelli*SCAN* IV HP 30 is ideal for demanding laser processes that require maximum power and precision. The system is designed for up to 8 kW in the infrared range.

Hardware Extensions

vario*SCAN* II
Extension to a 3-axis scanning system

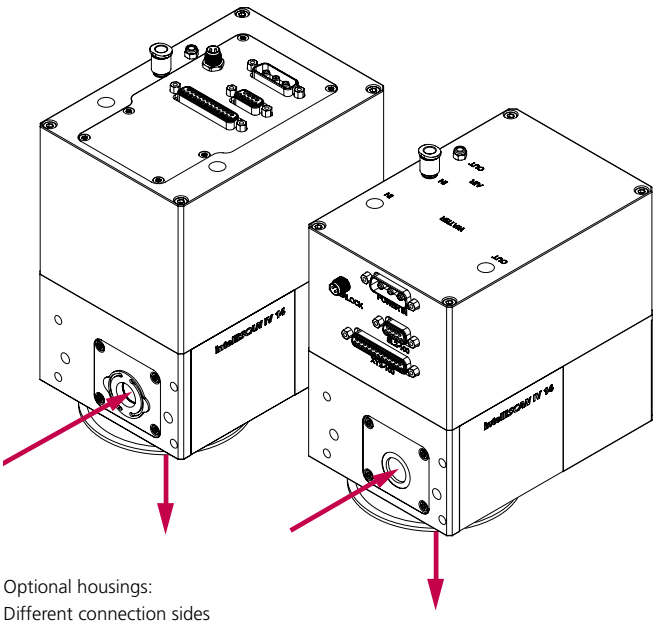
excelli*SHIFT*
Extension to a high-speed 3-axis scan system

Camera adapter
applicable for optical process monitoring

Recommended Control Boards

RTC6 (PCIe, Ethernet)

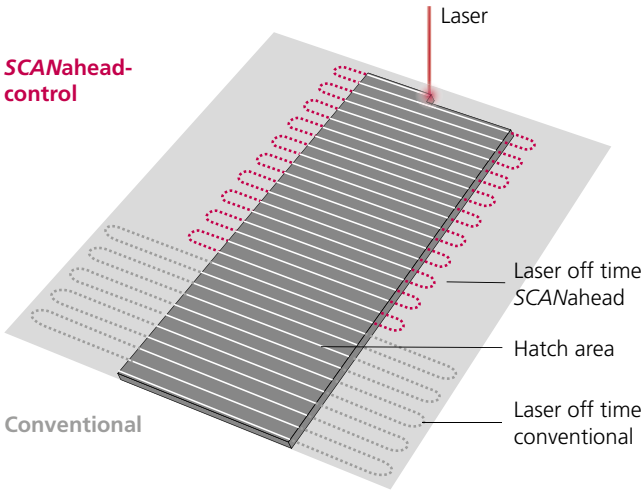
RTC6 EtherBox



Optional housings:
Different connection sides

*SCAN*ahead

Conventional control systems operate with a constant acceleration time, which results in a so-called tracking error. *SCAN*ahead changes this by utilizing the full dynamic potential of galvanometer scanners. It calculates a predictive target trajectory, enabling maximum acceleration (i.e., minimal acceleration time) and effectively eliminating tracking errors.



While many approaches to increasing productivity – particularly in additive manufacturing – focus on multi-head systems or higher laser power, *SCAN*ahead offers an efficient alternative. By significantly reducing turnaround times, especially in processes with frequent directional changes such as bidirectional hatching, *SCAN*ahead minimizes acceleration and deceleration phases, thereby boosting overall productivity.

Advantages

- Full utilization of scanner dynamics for higher acceleration and maximum throughput
- No tracking errors, even at processing high speeds
- Fast processing of circles without necking effect
- Automatic generation of laser and scanner delays (with RTC6)

Watch the video for more information about *SCAN*ahead.

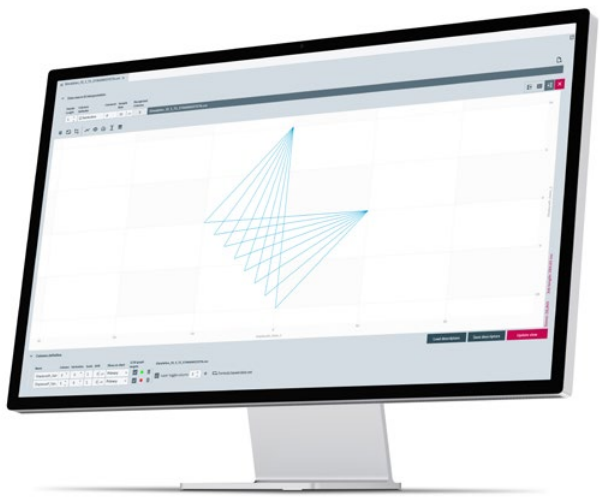
*SCAN*motionControl

*SCAN*motionControl is a software solution from SCANLAB designed for the precise control and optimization of laser processes. It enables accurate trajectory planning and synchronous control of laser power.

Calculations can be performed offline and without physical hardware, since the physical characteristics of the scan head are directly integrated into the software. This allows customers to develop their processing strategies more efficiently, significantly reducing the need for time-consuming test runs and accelerating process development.

Advantages

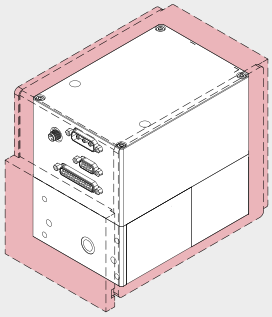
- Maximum precision and accurate laser control through advanced trajectory planning
- Shorter process times by fully leveraging scanner dynamics and laser power
- Integrated Spot Distance Control (SDC) functions for enhanced performance
- Intuitive job planning and simulation: ‘What you see is what you get’



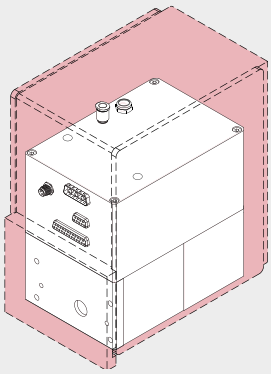
Watch the video for more information about *SCAN*motionControl

The intelli*SCAN* IV Series Compared to its Predecessor Models

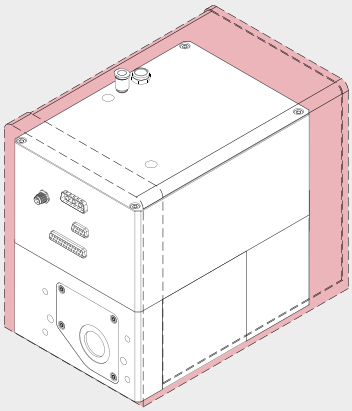
intelli*SCAN* IV 10



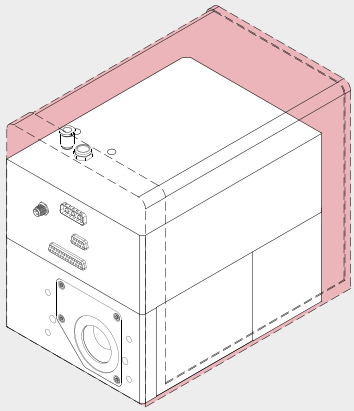
intelli*SCAN* IV 14



intelli*SCAN* IV 20



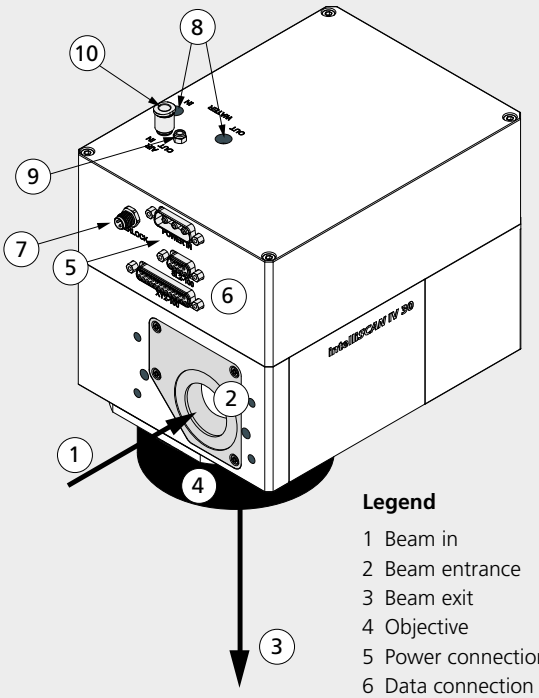
intelli*SCAN* IV 30
intelli*SCAN* IV HP 30
intelli*SCAN*$_{se}$ IV 30



	intelliSCAN (III) 10	intelliSCAN IV 10	intelliSCAN (III) 14	intelliSCAN IV 14	intelliSCAN (III) 20	intelliSCAN IV 20	intelliSCAN (III) 30	intelliSCAN IV 30
Height	147	135	156	141	180	165	180	144.5
Width	118	102	118	102	140	126	140	140
Depth	175	147	165	147	206.9	175.5	206.9	186

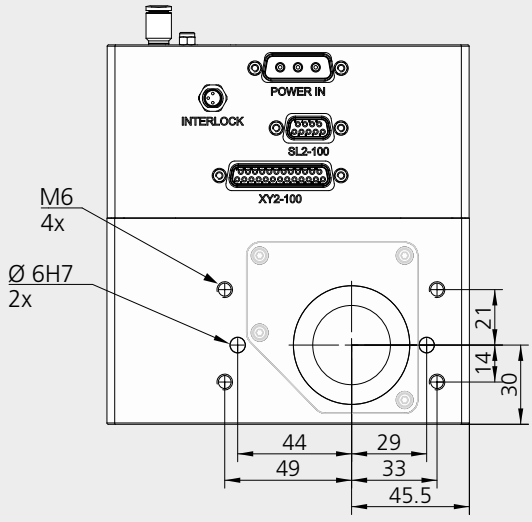
All dimensions in mm

intelli*SCAN* IV Connections



Legend

1 Beam in
2 Beam entrance
3 Beam exit
4 Objective
5 Power connection
6 Data connection
7 Interlock connection
8 Connections for cooling water
9 Connection for mirror air cooling
10 Air exit mirror cooling



All intelli*SCAN* IV systems have uniformly dimensioned mounting holes on the beam entry side. This allows the system to be easily integrated and seamlessly combined with various peripheral devices.

Specifications

(Preliminary)

Dynamics

	intelli*SCAN* IV 10		intelli*SCAN* IV 14		intelli*SCAN* IV 20		intelli*SCAN* IV 30 intelli*SCAN* IV 30 HP intelli*SCAN*$_{se}$ IV 30	
Tuning	*SCAN*ahead	Vector	*SCAN*ahead	Vector	*SCAN*ahead	Vector	*SCAN*ahead	Vector
Tracking error [ms]	0	0.08	0	0.12	0	0.21	0	0.32
Acceleration [rad/s^2]	600,000	n.a.	400,000	n.a.	180,000	n.a.	80,000	n.a.
Maximum speed								
[rad/s]	360	160	240	120	120	80	56	50
[m/s] [(1)]	57.6	25.6	38.4	19.2	19.2	12.8	9.0	8.0
Write speed								
Good writing quality [cps]	1310	880 [(2)]	1110	740	730	420	500	290
High writing quality [cps]	1200	710 [(2)]	930	500	630	300	420	200

[(1)] With F-Theta objective, f = 160 mm
[(2)] Tuning for higher CPS under development

Precision & Stability

		intelli*SCAN* IV	intelli*SCAN*$_{se}$ IV
Repeatability (RMS) [µrad]		< 2	< 0.4
Dither (RMS) [µrad]		< 5	< 1.6
Nonlinearity [µrad] [(3)]		< 0.7	< 0.5
Temperature drift [(4)(5)]	Offset [µrad/K]	< 10	< 10
	Gain [ppm/K]	< 10	< 5
Long-term drift [(4)(5)]			
8-h-drift (after 30 min warm-up)	Offset [µrad]	< 40	< 25
	Gain [ppm]	< 50	< 25
24-h-drift (after 3 h warm-up)	Offset [µrad]	< 50	< 20
	Gain [ppm]	< 50	< 25

[(3)] Related to 0.77 rad
[(4)] With water cooling
[(5)] At constant ambient temperature and load
(All angles are in optical degrees)

Further Specifications

Optical performance	
Typical scan angle [rad]	±0.35
Gain error [mrad]	< 5
Zero offset [mrad]	< 5
Power requirements (RMS)	48 V, 5 A
Interfaces	SL2-100 & XY2-100
Water cooling circuit material	Aluminium
Weight [kg]	
intelli*SCAN* IV 10	approx. 2.9
intelli*SCAN* IV 14	approx. 3.5
intelli*SCAN* IV 20	approx. 5.2
intelli*SCAN* IV 30	approx. 5.7

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