
## compact design. modular usage. straightforward integration.

The fiberSYS is a 3D scan system for lasers in the 1kW power range. It is based on a low-drift xy scan module and a fast and precise z-axis. The fiberSYS offers a compact sealed housing with a direct fiber connection. This speeds up and facilitates the installation in laser processing machines.

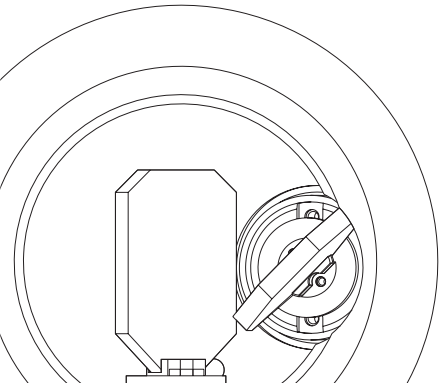
For multi-head systems, the narrow footprint of the fiberSYS allows for maximum overlap of the image fields, which benefits the user through increased productivity of the laser machine.

**Key features:**

- Modular, compact 3D scan system with integrated z-axis
- *SCAN*ahead control (optional vector tuning)
- Maximum image field overlap in multi-head systems
- Low-drift galvanometer scanner thanks to digital encoders
- Optimized for 1 kW single-mode laser
- Interface for process monitoring

**Typical applications:**

- Additive manufacturing
- Laser welding
- Electromobility
- 3D applications



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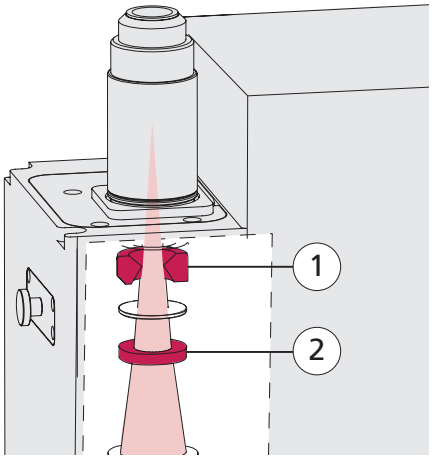
## Optimum Integratability

- Fully integrated beam guidance from the fiber adapter, including z-axis
- Efficient water cooling for galvanometer scanners, electronics and beam entrance aperture
- Flexible installation options: top, bottom, front face
- Sealed optics path in a dust- and splash-proof housing (IP 64 rating)
- Torsion-resistant main body ensures a high positional stability of the sub-modules relative to one another
- Replaceable protective window on the beam entrance side prevents contamination when changing the fiber
- Possibility to adapt for a range of lasers by replacing the aperture (1) and diverging lens (2). Thereby, the external dimensions and interfaces remain identical.



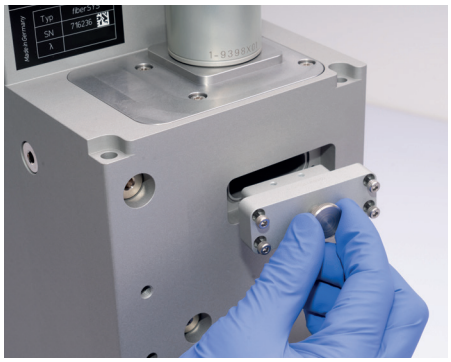

## Status and Process Monitoring

- Optomechanical interface for coaxial process monitoring
- High transmission over a wide range of wavelengths
- Can be individually adapted to sensor concept
- Record all key status variables in real time (i*DRIVE* technology)
- Scan mirror monitoring via contactless temperature sensors

**Optional additions:**

- Open Interface Extension (OIE): Synchronization of sensor and position data for spatially resolved measurements
- Beam splitter cube for simultaneous connection of different sensors, e.g. pyrometer, camera and/or OCT sensor


Direct fiber connection



Replaceable protective window

Process monitoring port with beam splitter cube

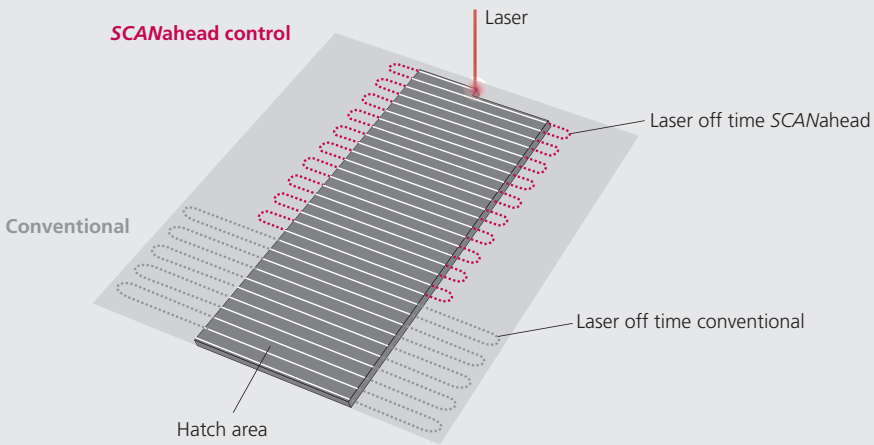
## *SCAN*ahead Control

With *SCAN*ahead control, the fiberSYS always reaches the set scan speed using the maximum acceleration. The dynamic potential of the galvos is fully utilized.

In additive manufacturing, two dimensional structures are typically realized by bidirectional hatching. A large part of the process time when using scan systems with conventional control is required for the turnaround times for acceleration and deceleration processes.

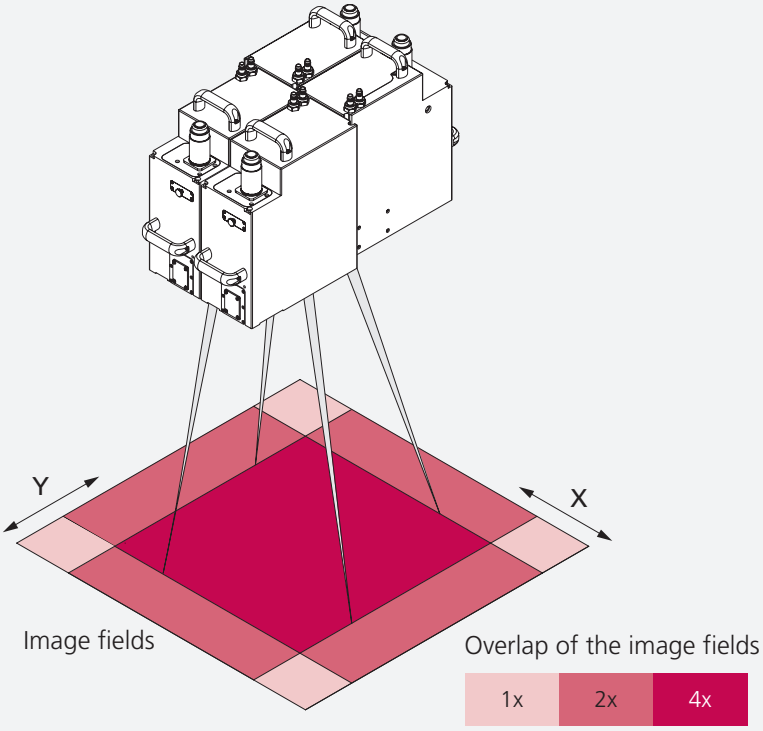
The fiberSYS with *SCAN*ahead control significantly reduce these turnaround times and therefore contribute to a significant increase in productivity.

**Example: Additive manufacturing**




More information in the *SCAN*ahead video:

## Expansion to a multi-head system: high productivity thanks to maximum image field overlap



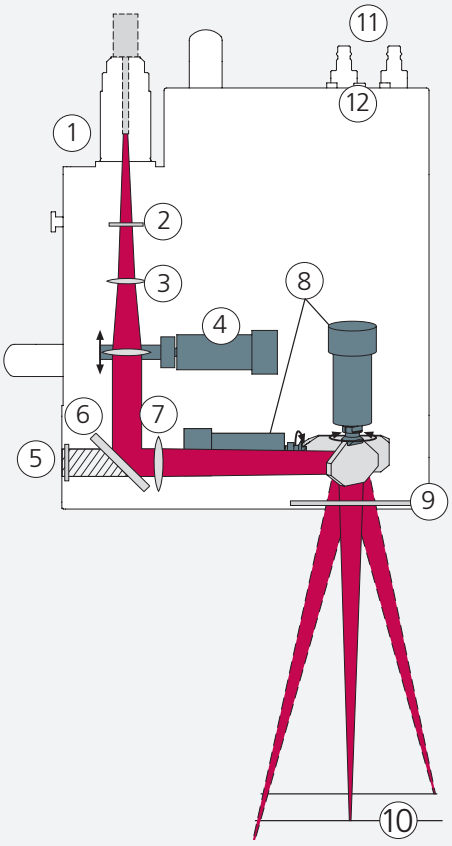

### Advantages

- Galvo-based z-axis allows for a slim design, which means 3D scan systems can be arranged in rows (in the x direction) close to one another
- Denser packing than standard systems (in the y direction) thanks to optimized arrangement of the galvanometers in the xy sub-module
- CalibrationLibrary software package (optional) provides support during scan field calibration

### Benefits for the user

- Shorter process times due to simultaneous processing of a component using multiple lasers
- Improved productivity thanks to parallel processes in a given process chamber
- Optimized duty cycle of the laser and 3D scan system due to flexible use of the available lasers throughout the entire construction area

### Operating principle

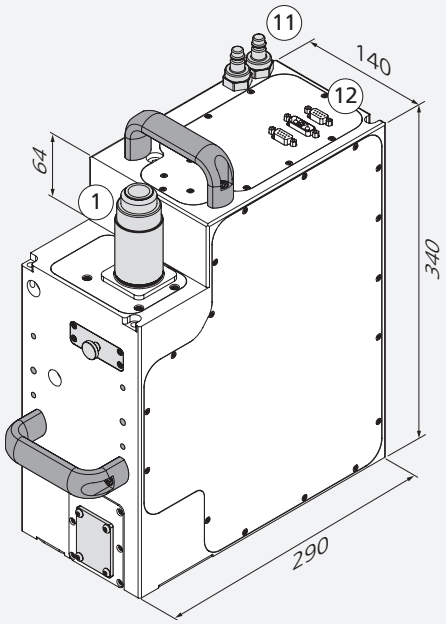



**Legend**

1 Fiber adapter
2 Replaceable protective window
3 Diverging lens
4 Galvanometer scanner collimation optics and z-axis
5 Connection for process monitoring with protective window
6 Tilted mirror
7 Pre-focus optics
8 Galvanometer scanner with digital encoders
9 Protective window
10 Focal plane
11 Cooling water connections
12 Electrical connections

### Dimensions

(in mm)



# fiberSYS – Preliminary specifications

(all angle specifications optical)

## Typical optical configurations [1]

| Image field size [mm²] | 450 x 450 | 550 x 550 | 650 x 650 |
|---|---|---|---|
| **100% overlap per image field [mm²] 2x2 scanner** | 308 x 323 | 408 x 423 | 508 x 523 |
| **Free working distance from lower edge of scan system [mm]** | 495 | 615 | 730 |
| **Rayleigh length [mm]** | 1.8 | 2.6 | 3.5 |
| **Average focus diameter in the image field [µm]** [2] | 55 | 65 | 75 |
| **Defocus diameter [µm]** | approx. 200 – 250 | approx. 200 – 250 | approx. 200 – 250 |

## Collimation

| | Config. 1 | Config. 2 |
|---|---|---|
| **Limiting NA (full angle)** | 160 mrad | 224 mrad |
| **Colimation focal length** | 190 mm | 135 mm |
| **Typ. beam divergence (full angle, 1/e²)** | 100 mrad | 140 mrad |
| **Fiber diameter** | 14 µm | 10 µm |

The laser in use determines the appropriate configuration. Further configurations on request.

## General specifications

| | |
|---|---|
| **Aperture** | 30 mm |
| **Wavelength** | 1060 – 1085 nm |
| **Max. laser power** | 1 kW |
| **Wavelength range for process monitoring** [3] | 800 – 870 nm and 1450 – 2000 nm |
| **Supply voltage (Requirements)** | 48 V DC max. 6 A |
| **Dimensions** LxWxH in mm [4] | 290 x 140 x 340 |
| **Interface** | SL2-100 |
| **Water cooling** | 3 l/min Δp < 4,5 bar Cooling water wetted material: Aluminium |
| **IP code** | IP 64 |
| **Weight** | approx. 20 kg |

## Precision & stability

| | |
|---|---|
| **Repeatability (RMS)** | < 0.4 µrad |
| **Position resolution** | 20 Bit |
| **Nonlinearity** [5] | < 0.5 mrad |
| **Dither** | < 1.6 µrad |
| **Temperature drift** | |
| Offset | < 25 µrad/K |
| Gain | < 8 ppm/K |
| **Long-term drift** | |
| 8-hr drift (after 30 min) [6] | |
| Offset | < 30 µrad |
| Gain | < 30 ppm |
| 24-hr drift (after 3 hrs) [6] | |
| Offset | < 30 µrad |
| Gain | < 30 ppm |

## Dynamics

| | |
|---|---|
| **Process speed** [7] | 17 m/s |
| **Acceleration** | 130.000 rad/s² |
| **Step response** [8] | |
| 1% full scale | 0.47 ms |
| 10% full scale | 1.54 ms |
| **Tracking error XY sub-module (standard tuning)** | 0 ms |
| **Tracking error Z-axis** | < 0.84 ms |

(1) Other configurations on request

(2) At z=0, $M^2$=1.05, typ. beam divergence

(3) Other wavelengths on request

(4) Dimensions without fiber adapter, handles and plug connections

(5) Related to 0.77 rad

(6) At constant ambient temperature and load

(7) For an image field of 550 × 550 mm²

(8) Adjusted to 1/1000 full scale

## Options

### Expansions for process monitoring

- Synchronization of sensor data with RTC data possible using Open Interface Extension (OIE)
- Additional monitoring port via beam splitter cube

### Tilted mirror (variants)

- HR mirror for the laser
- Dichroitic beam splitter for process monitoring

### Fiber adapters

- QBH/HLC-8
- QD/LLK-D

More information in the fiberSYS video:



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