

Fraunhofer Institute for Applied Optics and Precision Engineering IOF

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## Underwater 3D sensor

### Accurate 3D scanning of large complex underwater structures





# Underwater 3D sensor

Accurate 3D scanning of large complex underwater structures

Underwater 3D sensor attached to remotely operated vehicle (ROV).

#### Applications

- Inspection of underwater structures, e.g., foundations, pipelines, cables, anchor chains
- Accurate 3D measurements of fine details, e.g., in cultural heritage documentation

#### **Measurement principle**

- Dense high-speed stereo 3D reconstruction using high-power aperiodic sinusoidal fringe pattern projection
- Online visual odometry by high-resolution color camera and inertial measurement unit
- Active movement compensation for continuous 3D measurements in motion

#### Features:

- Easy attachment to remotely operated vehicles (ROVs) by using 24 - 48 V power and single fiber optical cable for data
- Continuous measurements (3D scans and color images) with live streaming to operator
- In-situ parametric adaptation to scene requirements and measurement conditions
- Automatic, markerless scene reconstruction from thousands of scans using acquired odometry data from sensor
- On-site underwater system calibration using supplied marker board

#### System parameters

- Suited for deep-sea application up to 1000 m
- 3D measurement area: up to 0.9 m × 0.8 m
- 2D camera field of view: 1.7 m × 1.5 m
- Simultaneous 7-megapixel color texture acquisition
- Measurement distances: 1.0 m 2.5 m
- Movement-dependent measurement rates:
  ≤ 0.2 m/s: 12 Hz 3D @ 960 × 732 pixel
  ≤ 0.5 m/s: 25 Hz 3D @ 960 × 732 pixel
  ≤ 1.0 m/s: 60 Hz 3D @ 960 × 380 pixel
- 3D measurement uncertainty: 0.1 0.4 mm (depending on distance and water turbidity)
- Length deviation: ± 1 %
- Position error: < 1 mm</p>
- Sensor dimensions: ~ 1.2 m × 0.7 m × 0.5 m
- Sensor weight: ~65 kg



Underwater 3D sensor during calibration.



Contact

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