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TH6 / FH6 – Guiding the way to a perfect welding seam.

The in-process optical seam tracking with TH6 paves the way towards a perfect welding seam: Components and joints are recorded using a combination of laser lines and camera, allowing the course of the welding seam to be corrected in real time. Contact free and independent of both system and process, the method is suitable for all standard seam shapes and types of material. The FH6D offline seam finding sensor can also be used for less complex tasks.
The only way to do justice to increasing product requirements, continue to work efficiently and remain competitive is to use state-of-the-art production systems.

New developments and perfectly coordinated system solutions – like the optical seam tracking sensors TH6 as well as the optical seam finding sensors of the FH6 series and the comprehensive ABICOR BINZEL product range – contribute towards improving automated processes.

Universal, precise & insensitive ...

The optical seam tracking sensors TH6 and FH6 seam finding sensors are innovative system solutions for versatile applications in the field of automated welding. They have a very sturdy design and guarantee smooth operation even when very close to the process thanks to the integrated incident light filter.

The high-performance signal evaluation ensures reliable seam guiding or the search of the start and end point of the seam. Particularly on reflective surfaces.

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TH6 / FH6 – Guiding the way to a perfect welding seam.
Universal, precise and insensitive ...
Precise
- Exact identification of the seam and determination of the alignment of the sensor head to the seam thanks to the use of the three-line laser
- Above-average process reliability even with demanding seam tracking and corrections in real time
- High measuring data recording stability
- The TH6D / FH6D can detect any gap from width of 0.3 mm
- The TH6i is able to cognize any butt joint with a gap width of 0.02 mm

Universal
- Can be used for all usual seam shapes
- Ideal for thin-sheet and thick-sheet applications as well as butt-thrust detection
- Suitable for all standard surfaces, particularly reflective and high-gloss ones such as aluminium or stainless steel
- Interfaces to well-known robot controls available

Insensitive
- Splatter protection with integrated air flushing of the protective glass and air cooling of the sensor
- Splashwater-proof housing
- Optical filter to prevent falsified measuring results
- Resistant to faults caused by electric fields

Advantages that speak for themselves:
External supplementary lamp for the greyscale camera at TH6
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The Functional Principle of the TH6 series / FH6 series

How does optical seam tracking / seam finding work?

Application: TH6 optical seam tracking sensors are used for non-contact recording and measuring joint edge contours with height offset, gap, angle and butt joint detection (only with the TH6i) and for precise positioning and guiding of the tool – in real time. The FH6D offline seam finding sensor can also be used for less complex tasks.

Function principle: Three measuring lines are generated through a line generator and projected onto the component. The created diffuse reflection, which is in the viewing area of the camera lens, is recorded by the CMOS sensor. In this way, laser triangulation can be used to determine the working distance, position and inclination of the sheets that are to be joined.

The TH6i is equipped with an additional camera (greyscale camera) to detect butt joints. For this purpose, the component is illuminated with green light, which decreases the brightness at the edges. The greyscale camera detects the illuminated surface with the visible contrast line and in this way recognises the course of the butt joint.

Evaluation: The current seam position, information about the gap and edge offset at the joint as well as the position of the welding tool relative to the component surface are recorded as measured values and transmitted to the sensor process computer. This forwards the values to the robot control and thus influences the positioning of the tool.

Laser triangulation
Schematic diagram of the laser triangulation (= optical distance measuring) in which a light pattern consisting of three parallel laser lines at an angle of approx. 20° is projected onto the surface of the component:

Legend:
1. Laser diode
2. Collimator lens
3. Projection lens
4. Light detector
5. Lens (receiver lens)
6. Object to be measured (component)
7. Measurement 1 and measurement 2

Greyscale camera (only for TH6i)
Schematic diagram of the greyscale camera, which is used in combination with the green light to recognise butt joints, in that it detects a decrease in brightness (contrast) at the edge.

Legend:
1. Measuring lines
2. Measuring object (component)
3. Green Light
4. Camera lens of the greyscale camera and visual contrast line
The optical seam tracking sensor TH6D is available in three different versions. These differ in resolution and measuring range and can thus be used for thin-sheet and thick-sheet applications. The TH6D can reliably detect any gap from a width of 0.3 mm.

**Figure 1: Connections**
1.1 Connection for power supply
1.2 Connection for data process computer
1.3 Connection for cross-jet
1.4 Connection for air cooling

**Figure 2: TH6D detailed view**
2.1 CMOS-Sensor (Camera)
2.2 Three-line laser
The System Overview TH6i

In comparison with the TH6D, the TH6i seam tracking sensor has an additional installed greyscale camera system and along with the tried and tested functional properties of the TH6 appliances is therefore able to detect butt joints with a gap width of 0.02 mm. The TH6i is used mainly in the thin sheet area.

Figure 1: Connections
1.1 Connection for power supply
1.2 Connection for data process computer
1.3 Connection for cross-jet
1.4 Connection for air cooling
1.5 Connection for external supplementary lamp

Figure 2: TH6i detailed view
2.1 CMOS sensor (camera) and greyscale camera
2.2 Green LED (lighting for greyscale camera)
2.3 Three-line laser
(not ill. external supplementary lamp, see page 4)
The optical seam finding sensor FH6D is available in two different versions. These differ in resolution and measuring range and can thus be used for thin-sheet and thick-sheet applications. The FH6D can reliably detect any gap from a width of 0.3 mm.

**Figure 1:**
**Connections**
1.1 Connection for power supply
1.2 Connection for data process computer
1.3 Connection for cross-jet
1.4 Connection for air cooling

**Figure 2:**
**FH6D detailed view**
2.1 CMOS Sensor (Camera)
2.2 Three-line laser
Technical understanding: Connection Sketch and Technical Data

Schematic diagram of the data flow

Optical seam tracking sensors TH6D/FH6D and TH6i

TH6/FH6-process computer

Initialisation and system parameter setting and visualisation of the current measuring data

Re-adjustment of the TCP where the target deviates from the actual position

Technical data

General
- Measuring lines: 3
- Working distance: 150 mm
- Measuring rate: 60 Hz
- Operating temperature: 10 °C up to 45 °C

Dimensions
- TH6D/FH6D (B×H×T): 70×40×100 mm
- TH6i (B×H×T): 70×40×140 mm

TH6D/FH6D-CF – for thin-sheet applications
- Measuring range (W, H): 16 mm, 24 mm
- Resolution (W×H): 0.03 × 0.07 mm

TH6D GF – for thin-sheet + thick-sheet applications
- Measuring range (W, H): 35 mm, 60 mm
- Resolution (W×H): 0.06 × 0.10 mm

TH6D/FH6D-KF – for thick-sheet applications
- Measuring range (W, H): 40 mm, 80 mm
- Resolution (W×H): 0.08 × 0.12 mm

TH6i – for thin-sheet applications
- Measuring range (W, H): 16 mm, 24 mm
- Resolution (W×H): 0.03 × 0.07 mm
- Greyscale camera: Detection of butt joints from 0.02 mm gap

Coordinate origin
- Measuring range height "H"
- Lateral measuring range "W"
Support:
Examples for sensor holders

As a system provider, along with seam tracking sensors and seam finding sensors ABICOR BINZEL also has welding and cutting torches, flanges and sensor holders to match the respective job and system in its programme.

With regard to the respective starting situation there is a great variety of sensor holders available for attaching to extremely different ABICOR BINZEL flange-torch combinations. Both hollow wrist robots and robots with an external cable assembly can be equipped. Holders are also available for some torch-flange combinations from other manufacturers.

Through their construction, the specially developed holders enable exact setting of the sensor position. They have the required rigidity to fix the sensor head very precisely even with fast robot movements. This makes them the perfect addition to the TH6 seam tracking sensors.

The above drawings show three examples of combinations. Information on other holders is available on request.
## In Detail:
### Interfaces and Conditions

<table>
<thead>
<tr>
<th>Robot manufacturer</th>
<th>TH6D</th>
<th>FH6D</th>
<th>Interface</th>
<th>Hardware</th>
<th>Software (each of these modules are required)</th>
<th>Daten connection sensor – robot</th>
<th>Calibration with</th>
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<tr>
<td>ABB</td>
<td>•</td>
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<td>Ethernet</td>
<td>- Controller iRC5</td>
<td>- Robot system-software 5.1.5 (or higher) - „Optical Tracking Arc 660-1“ - Arc (633-1)</td>
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<td></td>
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<td>Seriell RS-232</td>
<td>[514.5062.1]</td>
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<tr>
<td>Fanuc</td>
<td>•</td>
<td>•</td>
<td>Ethernet</td>
<td>- Controller R-J3iC - Controller R-30iA - Controller R-30iB - Ethernet Port #2 must remain free</td>
<td>- Operation System Fanuc „Arc Tool“ - Universal Sensor Interface (R691) - User Socket Messaging (R648)</td>
<td>Ethernet</td>
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<td>(Optional: Calibration plate [837.0882.1])</td>
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<td>KR C2 edition 05 - Network card 3Com 3C905CK.TX-M or ethernet 100Mbit PCI</td>
<td>TH6 KUKA system-software (KSS) 5.4; 5.5 or 5.6 - SeamTech tracking (containing RSI Interface) - XML Protocol - Inline standard form</td>
<td>Ethernet</td>
<td>Calibration plate</td>
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<td>FH6D KUKA system-software (KSS) 5.4; 5.5 or 5.6 - SeamTech finding (containing RSI Interface) - XML Protocol - Inline standard form</td>
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<td>Seam tech Interface</td>
<td>KR C4 Standard ethernet port</td>
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<td>- RoboStar V - Software-version 20.0 or higher [proprietary protocol]</td>
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<td>Standard</td>
<td>Software-version 24 or higher</td>
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<td>Yaskawa</td>
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<td>D/A Interface</td>
<td>Controller DX100 - General Controller with sensor board - XO102-card</td>
<td>Robot system-software DS2.05.00A (-)100 - Moto EyeLT software DS1.60.00A-27 - System software version DN.1.83.00A(-)100 and higher - Moto EyeLT software for scansonic-sensor from Yaskawa Europe (Nr.: 179247)</td>
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<td>Golden Seam reference path</td>
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<td>D/A Interface</td>
<td>Analogue input for measurements - side [y] - height [z] in the range von ±10 V/4–20 mA</td>
<td>Protocol of XML communication is based on the principles of ISO-OSI reference model The lowest level is in Ethernet The XML communication lies on the level 5-7</td>
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<td>SPS/PLC</td>
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### Notes
- Ethernet Calibration plate [514.5062.1]
- Calibration plate [837.0882.1]
- Golden Seam reference path

### Terms
- **TH6D**: High-performance robot with a wide range of applications.
- **FH6D**: Advanced robot for high-precision applications.
- **KUKA**: Leader in industrial robots and robotic systems
- **ABB**: Known for its excellence in robotics and automation.
- **Fanuc**: Renowned for its quality and reliability in automation solutions.
- **Rais**: Specializes in automation and robotic systems.
- **Yaskawa**: Known for its high-precision robots and sensors.

### Protocol
- **TCP**: Transmission Control Protocol
- **IP**: Internet Protocol
- **XML**: Extensible Markup Language
- **D/A Interface**: Digital/Analog Interface
- **Universal XML Interface [TCP/IP]**: Universal XML interface over TCP/IP protocol

### Hardware and Software
- **Controller iRC5**: For ABB robots.
- **Controller R-J3iC**: For Fanuc robots.
- **Controller R-30iA**: For Fanuc robots.
- **Controller R-30iB**: For Fanuc robots.
- **Controller DX100**: For Yaskawa robots.
- **Controller SX100**: For Yaskawa robots.
- **Controller RX100**: For Yaskawa robots.
- **Controller KRL 2.2.2**: For KUKA robots.
- **Controller KRL 2.1.1**: For KUKA robots.
- **Controller KRL 2.1.1**: For KUKA robots.
- **Controller EyeLT**: For Yaskawa robots.
- **Controller EyeLT**: For Yaskawa robots.

### Calibration
- Calibration plate [514.5062.1]
- Calibration plate [837.0882.1]

### Application Areas
- **Robot system-software**: Software for controlling and programming robots.
- **System software**: Software for managing the robot system.
- **XML Protocol**: Protocol for exchanging data between systems.
- **SPS/PLC**: Stand-alone Programmable Logic Controllers.