TH6x Optical Seam Tracker

www.binzel-abicor.com
The only way to meet increasing production requirements while continuing to work efficiently and remain competitive is to use state-of-the-art systems that will impact the bottom line.

New developments and perfectly coordinated system solutions like the optical seam tracking sensor TH6D with the comprehensive ABICOR BINZEL Robotic Systems product range contribute to improving automated processes of all kinds.

**Universal, Precise & Dependable**

The optical seam tracking sensor TH6D is an innovative system solution for reliable real-time joint tracking to ensure quality welds and reduced rework. TH6D sports a very robust design to ensure smooth operation – even very close to the process – thanks to the integrated light filter.

The high-performance signal evaluation ensures reliable seam guiding, particularly on reflective surfaces like aluminum, stainless steel, and diamond plate.
Advantages that speak for themselves:

**Universal**
- Suitable for all standard seam shapes
- Suitable for all standard surfaces, particularly reflective and high-gloss ones such as aluminium or stainless steel
- Interfaces to well-known robot controls available

**Precise**
- Exact identification of the seam and sensor to seam alignment thanks to the use of the three-line laser
- Above-average process reliability even with demanding seam tracking
- Highly stable measurement data recording and corrections in real time

**Dependable**
- Spatter protection with integrated air flushing of the protective glass and air cooling of the sensor
- Water-proof housing
- Optical filter to prevent falsified measuring results
- Resistant to electrical field faults

Particularly suitable for reflective surfaces such as aluminium and stainless steel.
External supplementary lamp for the grayscale camera at TH6i
**TH6i Seam Tracker for Zero Gap Joints**

**The Functional Principle**

**How does optical seam tracking for zero gap detection work?**

**Application:** TH6i optical seam tracking sensors are used for non-contact recording and measuring joint edges 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.

**Functional principle:** Three measuring lines are generated and projected onto the weld piece. These laser lines create a diffused reflection, which is in the viewing area of the camera lens, and is recorded by the CMOS sensor. This allows for laser triangulation to determine the working distance, position and inclination of the weld joints.

The TH6i is equipped with an additional greyscale camera to detect butt joints. For this ‘zero gap’ seam tracking, the component is illuminated with a green light to decrease the brightness at the edges. The greyscale camera detects the illuminated surface with the visible contrast line and recognizes the course of the butt joint.

**Evaluation:** The current seam position, information about the gap, and edge offset at the joint and the position of the welding tool relative to the component surface are recorded as measured values and transmitted to the sensor process computer. This relays the values to the robot control and guides the positioning of the robot arm across the weld joint.

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**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:

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:

1. Measuring lines
2. Measuring object (component)
3. Green Light
4. Camera lens of the greyscale camera and visual contrast line

**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
The optical seam tracking sensor TH6D is used for the contact free recording and measurement of components as well as the precise positioning and tracking of the tool – in real time.

How it works: A light pattern of three parallel laser lines are projected onto the component surface via laser triangulation. At the same time, the seam shape at the joint is scanned by a digital camera. The laser lines are interrupted at the joint due to the inclined projection of approx. 20° and marks the seam point on the joint line.

Evaluation: Current seam position, gap information, edge offset at the joint, and position of the welding tool relative to the component surface are measured and recorded before being transmitted to the TH6D process computer. The processor then forwards the values to the robot control and thus influences the robot’s tracking of the seam onto the tool.

The functional principle
Schematic diagram of laser triangulation (= optical distance measurement) using the optical seam tracking sensor TH6x:

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

Seam shape examples
The contact free scanning of the component allows the sensor to be used for almost all seam shapes.

- Open edge
- Overlapping seam
- Tailored bank
- TB-area
- Y-seam
- Y-area
- HY-seam
- U-seam
- HU-seam
- M-depth
The optical seam tracking sensor TH6x is available in two different versions - the TH6D and TH6i.

TH6D comes in three versions, the GF, CF, and KF, which differ in resolution and measuring range and are suited both for thin-sheet and thick-sheet applications.

TH6D-GF is the lone TH6x model designed for both thin and thick-sheet applications. The TH6D-CF is a fine resolution device designed to find smaller seams in thin-sheet applications, while the TH6D-KF is for larger joints and is ideally used for welding processes that incorporate beveling, multi-pass welding, and thick plate material.

The TH6i comes with all the features of the TH6D and additionally allows for the seam tracking of zero gap welding seams thanks to the greyscale camera feature.

In combination with the sensor mount, the sensor is available for both over-arm CAT mounts, through-arm iCAT and iSTM robot mounts, and for the welding torches in the ROBO WH, ABIROB® A, and ABIROB® W series.

Reflective surfaces like aluminum and diamond plate are capably tracked by the TH6x optical seam tracker.
In Detail
Connection Sketch & Technical Data

Schematic diagram of the data flow:

Technical data

General
Measuring lines: 3
Measuring rate: 60 – 240 Hz
Operating temperature: 10°C to 45°C
Working Distance: 150 mm

TH6D-GF
Resolution (WxH): 0.03 x 0.07 mm
Field of View: 35 mm x 60 mm
Dimensions (LxHxW): 70 x 121 x 40 mm

TH6D-CF
Resolution (WxH): 0.03 x 0.07 mm
Field of View: 16 mm x 24 mm
Dimensions (LxHxW): 70 x 121 x 40 mm

TH6D-KF
Resolution (WxH): 0.10 x 0.30 mm
Field of View: 44 mm x 80 mm
Dimensions (LxHxW): 70 x 121 x 40 mm

TH6i
Resolution (WxH): 0.035 x 0.095 mm
Field of View: 15 mm x 24 mm
Dimensions (LxHxW): 70 x 40 x 191 mm
Greyscale camera: Detects butt joints from 0.02 mm gap

Greyscale camera: Detects butt joints from 0.02 mm gap

Optical seam tracking sensor TH6x
TH6x process computer

Initializing, setting system parameters and visualizing the current measuring data
Readjusting the TCP where the part deviates from the actual position

The measuring ranges

X-axis (tracking direction)
Coordinate origin
Measuring range height "H"
Lateral measuring range
## Interfaces and Conditions

<table>
<thead>
<tr>
<th>Robot</th>
<th>TH6D / TH6i</th>
<th>Interface</th>
<th>Hardware</th>
<th>Software (each of these modules are required)</th>
<th>Data connection sensor – robot</th>
<th>Calibration with</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABB</td>
<td></td>
<td>Ethernet</td>
<td>- Controller IRC5</td>
<td>- Robot system-software 5.15 (or higher) - „Optical Tracking Arc 660-1“ - Arc (633.1)</td>
<td>Ethernet</td>
<td>Calibration plate (514.5062.1)</td>
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<tr>
<td></td>
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<td>Serial</td>
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<td></td>
<td>Seriell RS-232</td>
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<tr>
<td>Fanuc</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 (RSF1) - User Socket Messaging (R64B)</td>
<td>Ethernet</td>
<td>10-point-measuring (Optional: Calibration plate (837.0882.1))</td>
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<tr>
<td>KUKA</td>
<td></td>
<td>Ethernet</td>
<td>KR C2 edition 05 - Network card 3Com 3C905CX-TX-M or ethernet 100Mbit PCI</td>
<td>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 (514.5062.1)</td>
</tr>
<tr>
<td></td>
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<td>Serial</td>
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<td>Reis</td>
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<td>Serial</td>
<td>IPC with RS422 Interface refit</td>
<td>- RoboStar V - Software-version 20.0 or higher (proprietary protocol)</td>
<td>Seriell RS-422</td>
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<tr>
<td>Yaskawa</td>
<td></td>
<td>D/A Interface</td>
<td>- Controller DX100 - General Controller with sensor board - XO102-card</td>
<td>Robot system-software DS2.05.00A (--)00</td>
<td>D/A Signale</td>
<td>Golden Seam reference path</td>
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<td></td>
<td>Ethernet</td>
<td>Controller DX100</td>
<td>Moto EyeLT software DS51.60.00A-27</td>
<td>Ethernet</td>
<td>Calibration plate (837.0882.1)</td>
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<td>Controller DX200</td>
<td>- System software version DN.1.83.00A-27</td>
<td>- Moto EyeLT software for scansonnic-sensor from Yaskawa Europe (Nr.: 178247)</td>
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<td></td>
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<tr>
<td>Universally applicable</td>
<td></td>
<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>
<td>D/A Interface</td>
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<tr>
<td></td>
<td></td>
<td>Universal XML Interface (TCP/IP)</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>
<td>SPS/PLC</td>
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</tbody>
</table>
Support
Sensor holders for ABICOR BINZEL Robot Mounts

All from one hand! As a systems provider, ABICOR BINZEL also has welding and cutting torches, flanges and sensor holders to match the respective job and system.

We also boast a variety of TH6D sensor holders for attaching to different ABICOR BINZEL flange-torch combinations.

Both hollow wrist robots and over-arm 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 designed 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 ideal mounting supports to the TH6 seam tracking sensors.

The above drawings show three examples of combinations. Information on other holders is available on request. Please contact your ABICOR BINZEL Key Accounts Manager or Sales Manager for more information.
## TH6x Packages
### For FANUC and Yaskawa Ethernet Packages

<table>
<thead>
<tr>
<th>Cable Length</th>
<th>TH6D-CF</th>
<th>TH6D-GF</th>
<th>TH6D-KF</th>
<th>TH6i-CF</th>
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<tbody>
<tr>
<td>10 m</td>
<td>514.5001</td>
<td>514.5142</td>
<td>514.5016</td>
<td>514.5066</td>
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<tr>
<td>15 m</td>
<td>514.5006</td>
<td>514.5143</td>
<td>514.5021</td>
<td>514.5067</td>
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<tr>
<td>25 m</td>
<td>514.5011</td>
<td>514.5144</td>
<td>514.5026</td>
<td>514.5068</td>
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</table>

### TH6x Sensor Package:
- Sensor Head (TH6D / TH6i)
- Protective unit including 10 cover glasses
- Processing unit with TH6D / TH6i software
- TH6x View (GUI Interface)
- Power Supply (24V-3, 2A)
- Power Supply (24V for processing unit)
- Patch cable CAT 6a Red 5 meters
- Patch cable CAT 6a Red 10 meters
- Sensor cable set TH6x: Power and Data (10/15/25 meter)
- Operating Manual
- Calibration unit (Optional Part Number 514.0237)

### FANUC Robot Requirements (Ethernet Data Link Sensor):
- Hardware: Controller R-30iA; R-J3iC; or R-30iB
- Software: Universal Sensor Interface (R691); User Socker Messaging (R648); Operation System Arc Tool

### Yaskawa Robot Requirements (Ethernet Data Link Sensor):
- Hardware: Controller DX100; DX200
- Software: Robot System Software; DS1,61.00A-27 (Note: Port 5020 has to be addressed in Robot Settings)
### ABB and KUKA Ethernet Packages

<table>
<thead>
<tr>
<th>Cable Length</th>
<th>TH6D-CF</th>
<th>TH6D-GF</th>
<th>TH6D-KF</th>
<th>TH6i-CF</th>
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<tr>
<td>10 m</td>
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- Patch cable CAT 6a Red 10 meters
- Sensor cable set TH6x: Power and Data (10/15/25 meter)
- Operating Manual
- Calibration unit (Optional Part Number 514.0237)

### ABB Robot Requirements (Ethernet Data Link Sensor):

**Hardware:** Controller IRC5
**Software:** Robot System Software 5.15; Optional “Optical Tracking Arc 660-1”

### KUKA Robot Requirements (Ethernet Data Link Sensor):

**Hardware (KR C4):** Standard Ethernet Port
**Hardware (KR C2 Edition 05):** Network card 3Com 3C905CX-TX-M or Ethernet 100Mbit PCI required

**Software:** 5.4, 5.5 or 5.6 Software Module; SeamTech Tracking (including RSI interface); XML protocol; InLine Standard Form
## TH6x Packages:
### Digital / Analog Complete System

<table>
<thead>
<tr>
<th>Cable Length</th>
<th>TH6D-CF</th>
<th>TH6D-GF</th>
<th>TH6D-KF</th>
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- Sensor Head (TH6D / TH6i)
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- Patch cable CAT 6a Red 5 meters
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- Operating Manual

### Controller Requirements (D/A-Interface WAGO):

Hardware: Analog input for measurements Side (Y) and Height (Z) in range of +/- 10 V / 4-20mA
# TH6x Seam Tracking Sensor: Spare Parts and Accessories

<table>
<thead>
<tr>
<th>Part Type</th>
<th>Description</th>
<th>Part Number</th>
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<tr>
<td><strong>Power Cables</strong></td>
<td>TH6x Power cable sensor [10 m]</td>
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<td>TH6x Power cable sensor [25 m]</td>
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<td>TH6x Power cable sensor [35 m]</td>
<td>514.5104</td>
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<td>TH6x Power cable sensor [50 m]</td>
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<td><strong>Ethernet Cables</strong></td>
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<td>TH6x Ethernet cable sensor [15 m]</td>
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<td>TH6x Patch cable CAT 6A red [2 m]</td>
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<td>TH6x Patch cable CAT 6A red [5 m]</td>
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<td>TH6x Patch cable CAT 6A red [10 m]</td>
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<td><strong>Cable Processor</strong></td>
<td>TH6x Power cable processor</td>
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<td><strong>Extension Cables (Ethernet &amp; Power)</strong></td>
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<td>TH6x extension cable Ethernet sensor [5 m]</td>
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<td>TH6x extension cable Ethernet sensor [8 m]</td>
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<td>Calibration plate (ABB or KUKA)</td>
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<td>Point for calibration plate (ABB or KUKA)</td>
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<td></td>
<td>Crossline for calibration plate (ABB or KUKA)</td>
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<td>Calibration unit (FANUC or Yaskawa)</td>
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<td>Interface digital/analog (WAGO)</td>
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<td><strong>Sensor Heads</strong></td>
<td>TH6D Sensor head 150-CF</td>
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<td>TH6D Sensor head 150-GF</td>
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<td>TH6D Sensor head 150-KF</td>
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<td>TH6i Sensor head 150-CF</td>
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<td>Kevlar protection for side mounted holder</td>
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<td>Kevlar protection for bottom mounted holder</td>
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