

TECHNOLOGY FOR THE WELDER'S WORLD.

# TH6x Optical Seam Tracker

**ABICOR**  
**BINZEL**<sup>®</sup>  
ROBOTIC SYSTEMS



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# TH6x – The guide to perfect welding seams

## Universal, Precise & Dependable



### Top-level joining technology.

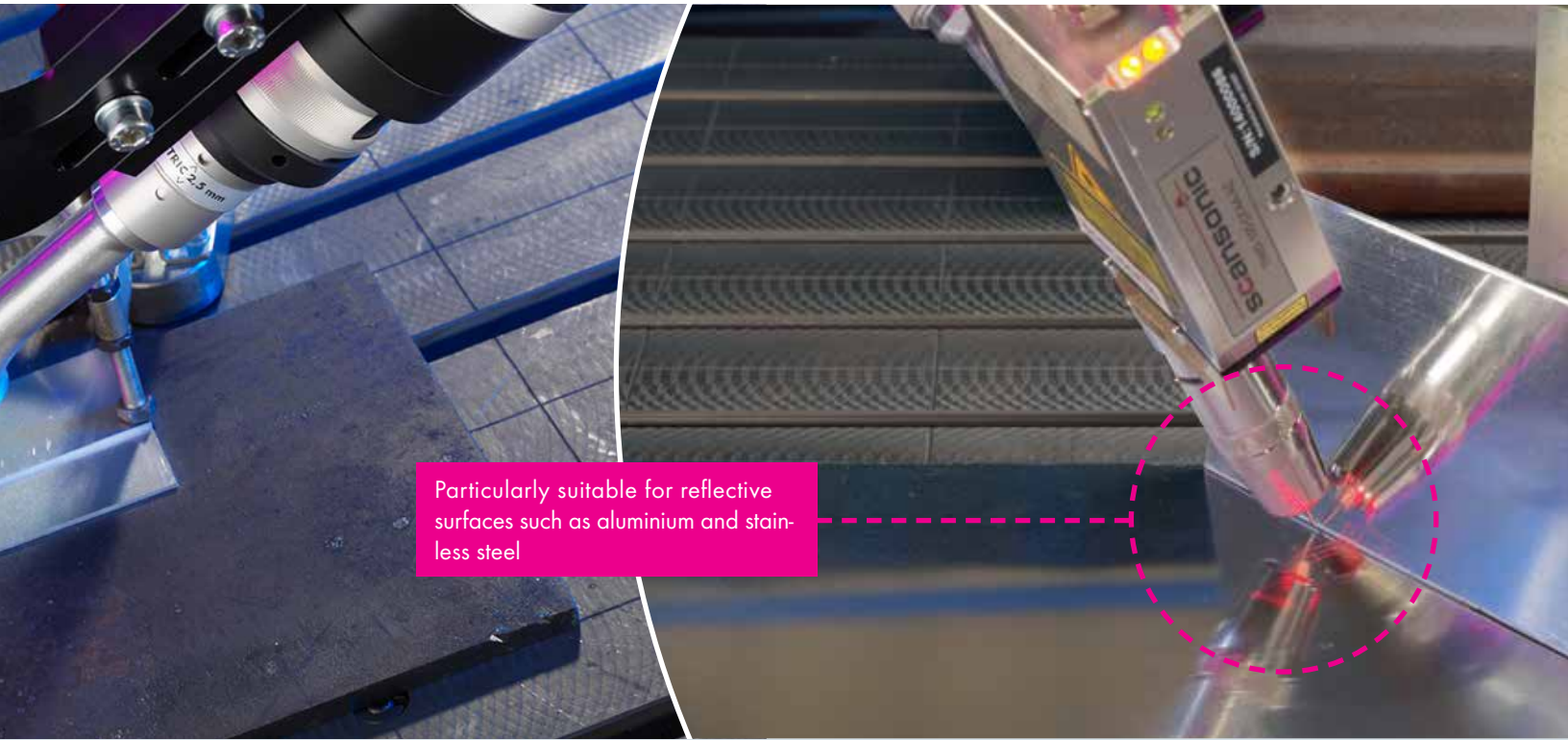
The only way to meet increasing production requirements while continuing to work efficiently and remain competitive is to use state-of-the-art systems that will impact the bottom line.

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.



Particularly suitable for reflective surfaces such as aluminium and stainless steel

## Advantages that speak for themselves:

### Universal

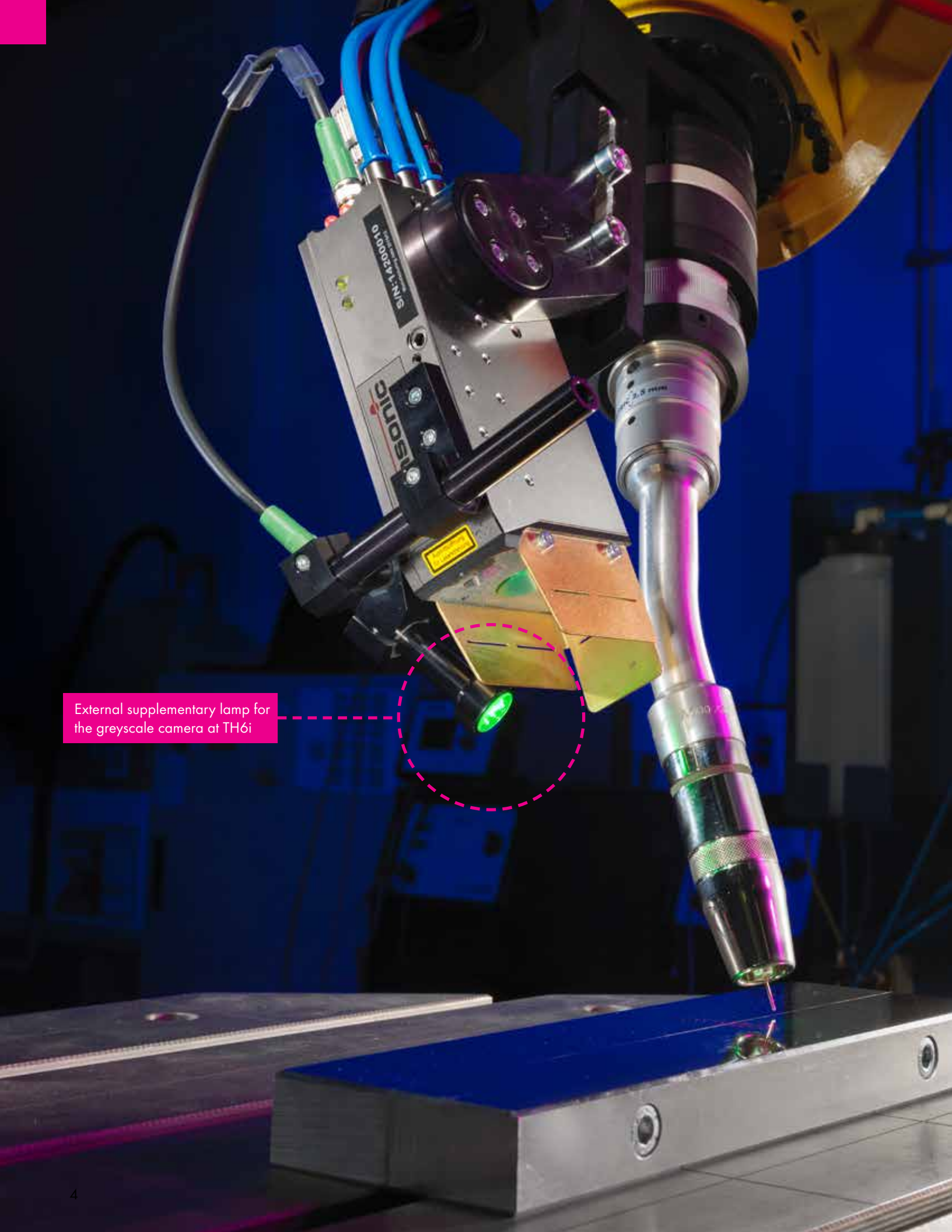
- Suitable for all standard seam shapes
- Suitable for all standard surfaces, particularly reflective and high-gloss ones such as aluminium or stainless steel
- Interfaces to well-known robot controls available

### 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



External supplementary lamp for the greyscale camera at TH6i

# TH6i Seam Tracker for Narrow 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.

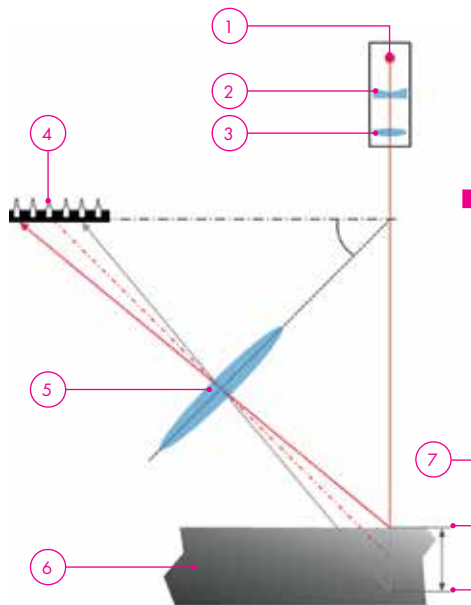
**Functional principle:** Three measuring lines are generated and projected onto the weld piece. These laser lines create a diffused reflection, which is in the viewing area of the camera lens, and is recorded by the CMOS sensor. This allows for laser triangulation to determine the working distance,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

The TH6i is equipped with an additional greyscale camera to detect butt joints. For this 'narrow 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.

### 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.  $20^\circ$  is projected onto the surface of the component:

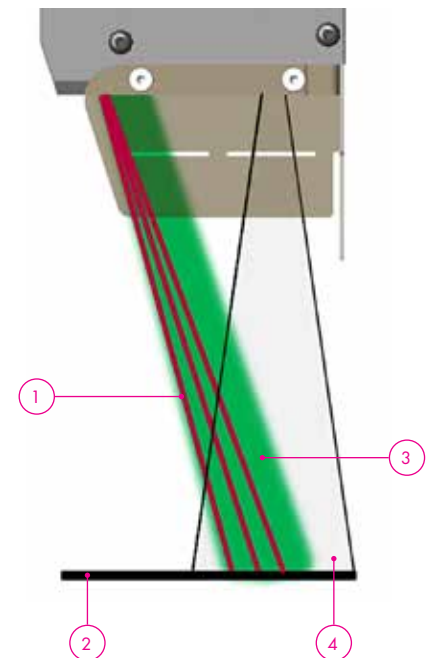


#### Legend:

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

# TH6D Seam Tracker for Common Joints

## The Functional Principle



**Application:** 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.

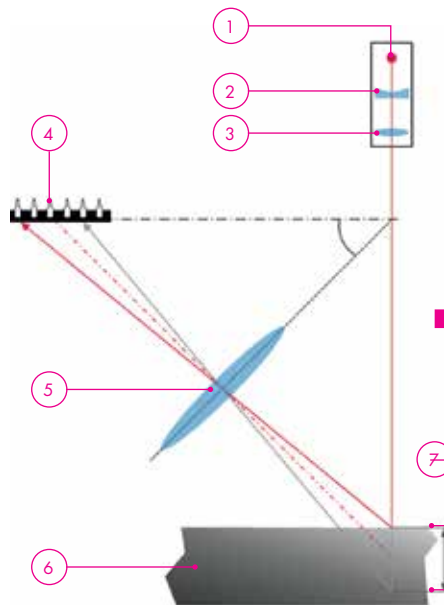
The laser lines are interrupted at the joint due to the inclined projection of approx. 20° and marks the seam point on the joint line.

**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

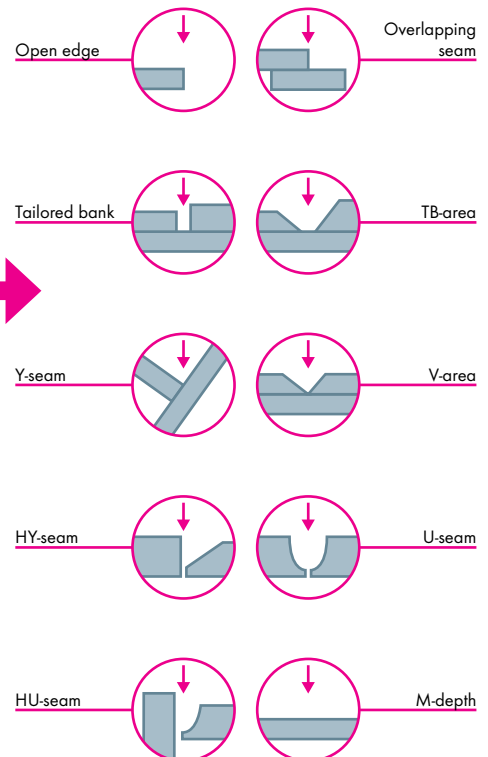
Schematic diagram of laser triangulation (= optical distance measurement) using the optical seam tracking sensor TH6x:



- 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

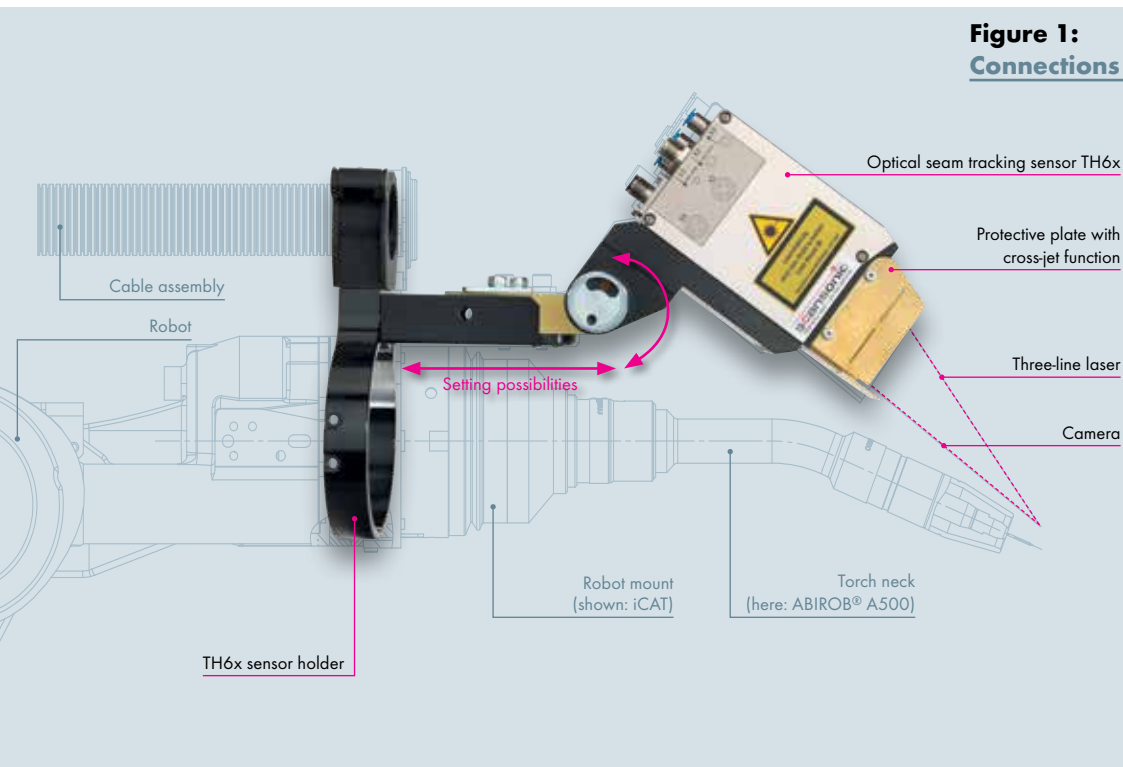
### Seam shape examples

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

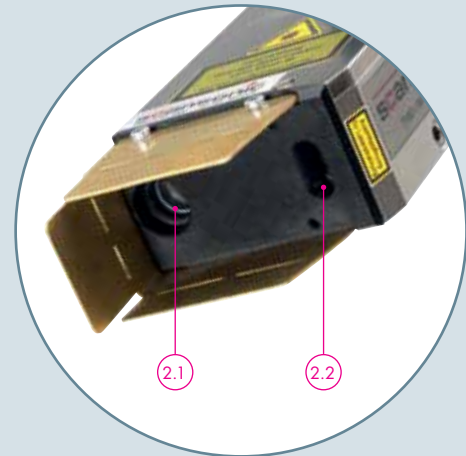
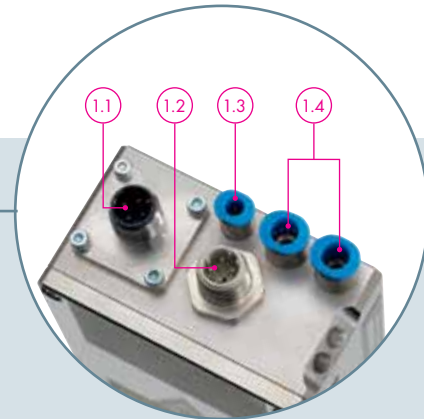


# Navigation

## TH6x System Overview



**Figure 1:**  
**Connections**



**Figure 2:**  
**TH6x detailed view**

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 narrow gap welding seams thanks to the greyscale camera feature.

Reflective surfaces like aluminum and diamond plate

are capably tracked by the TH6x optical seam tracker.

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.

**Figure 1:**  
**Connections**

- 1.1 Electrical power supply connection
- 1.2 Connection for process computer
- 1.3 Cross-jet
- 1.4 Air cooling

**Figure 2:**  
**TH6x detailed view (TH6D shown)**

- 2.1 Camera lens
- 2.2 Three-line laser

# In Detail

## Connection Sketch & Technical Data

Schematic diagram of the data flow:



Optical seam tracking sensor TH6x



TH6x process computer

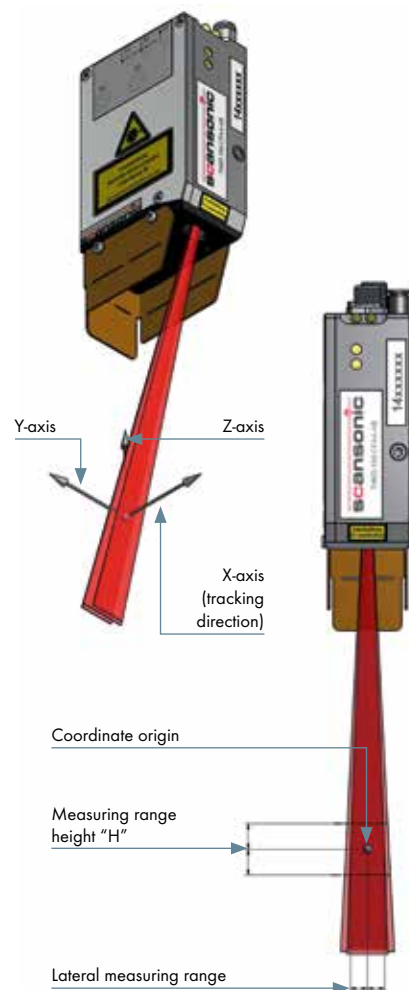


Initializing, setting system parameters and visualizing the current measuring data



Readjusting the TCP where the part deviates from the actual position

### The measuring ranges



### 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):	0.08 x 0.12 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

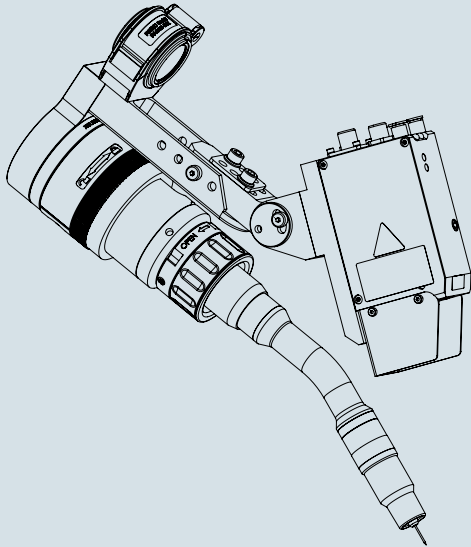


# Interfaces and Conditions

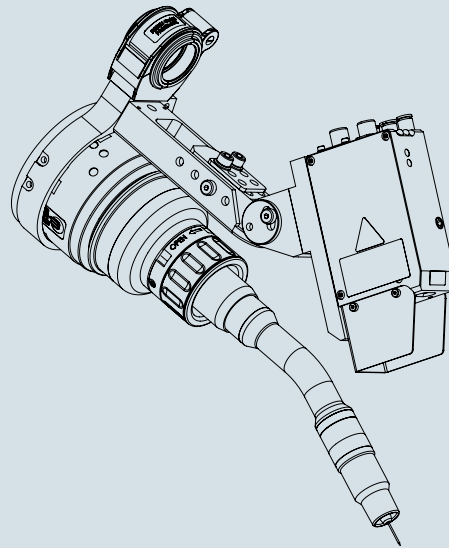
Robot	TH6D / TH6i	Interface	Robot requirements			Calibration with
			Hardware	Software (each of these modules are required)	Data connection sensor – robot	
ABB	●	Ethernet	- Controller iRC5	- Robot system-software 5.15 (or higher) - „Optical Tracking Arc 660-1“ - Arc (633-1)	Ethernet	Calibration plate (514.5062.1)
		Serial			Seriell RS-232	
Fanuc	●	Ethernet	- Controller R-J3iC - Controller R-30iA - Controller R-30iB - Ethernet Port #2 must remain free	- Operation System Fanuc „Arc Tool“ - Universal Sensor Interface (R691) - User Socket Messaging (R648)	Ethernet	10-point-measuring (Optional: Calibration plate (837.0882.1))
KUKA	●	Seam tech Interface	KR C2 edition 05 - Network card 3Com 3C905CX-TX-M or ethernet 100Mbit PCI	KUKA system-software (KSS) 5.4; 5.5 or 5.6 - SeamTech tracking (containing RSI Interface) - XML Protocol - InLine standard form	Ethernet	Calibration plate (514.5062.1)
				KUKA system-software (KSS) 5.4; 5.5 or 5.6 - SeamTech finding (containing RSI Interface) - XML Protocol - InLine standard form		
	●		KR C4 Standard ethernet port	KUKA system software 8.2.22 or higher (also 8.3) - KUKA.RobotSensorInterface 3.3.0 - KUKA.Ethernet KRL 2.2.2 - KUKA.SeamTech tracking 2.1.1		
				KUKA system software 8.2.22 or higher (also 8.3) - KUKA.RobotSensorInterface 3.3.0 - KUKA.Ethernet KRL 2.2.2 - KUKA.SeamTech Finding		
Reis	●	Serial	IPC with RS422 Interface refit	- RoboStar V - Software-version 20.0 or higher (proprietary protocol)	Seriell RS-422	Calibration plate (837.0882.1)
		Ethernet	Standard	Software-version 24 or higher	Ethernet	
Yaskawa	●	D/A Interface	- Controller DX100 - General Controller with sensor board - XO102-card	Robot system-software DS2.05.00A (-)00	D/A Signale	Golden Seam reference path
		Ethernet	Controller DX100  Controller DX200	Moto EyeLT software DS1.60.00A-27  - System software version DN.1.83.00A(-)00 and higher - Moto EyeLT software for scanasonic-sensor from Yaskawa Europe (Nr.: 178247)	Ethernet	Calibration plate (837.0882.1)
Universally applicable	●	D/A Interface	Analogue input for measurements - side (y) - height (z) in the range von $\pm 10 \text{ V} / 4 - 20 \text{ mA}$	SPS/PLC	D/A Interface	-
		Universal XML Interface (TCP/IP)	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			

# Support

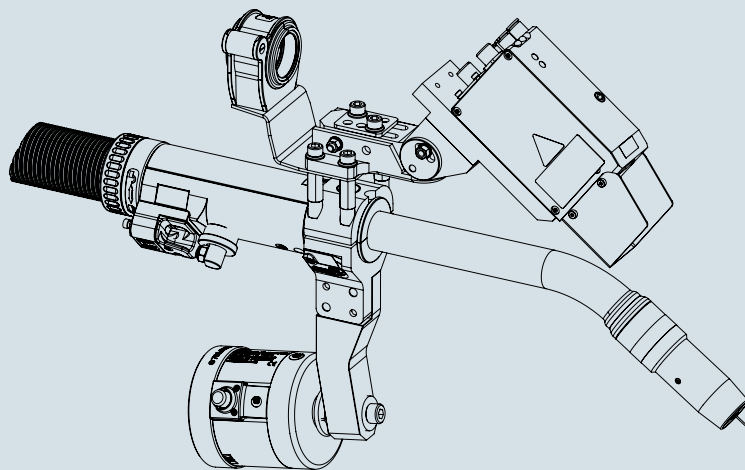
## Sensor holders for ABICOR BINZEL Robot Mounts



TH6x with support for iSTM



TH6x with support for iCAT



TH6x with support for CAT3 (over-arm cable assembly)

### 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

Cable Length	TH6D-CF	TH6D-GF	TH6D-KF	TH6i-CF
10 m	514.5001	514.5142	514.5016	514.5066
15 m	514.5006	514.5143	514.5021	514.5067
25 m	514.5011	514.5144	514.5026	514.5068

### 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 Socket 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

Cable Length	TH6D-CF	TH6D-GF	TH6D-KF	TH6i-CF
10 m	514.5001	514.5142	514.5016	514.5066
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25 m	514.5011	514.5144	514.5026	514.5068

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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

Cable Length	TH6D-CF	TH6D-GF	TH6D-KF	TH6i-CF
10 m	514.5005	514.5151	514.5020	514.5075
15 m	514.5010	514.5152	514.5025	514.5076
25 m	514.5015	514.5153	514.5030	514.5077

### 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

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

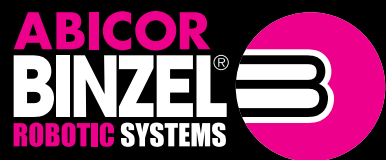
Hardware: Analog input for measurements Side (Y) and Height (Z) in range of +/- 10 V / 4-20mA

# TH6x Seam Tracking Sensor: Spare Parts and Accessories

Part Type	Description	Part Number
Power Cables	TH6x Power cable sensor [10 m]	514.5031
	TH6x Power cable sensor [15 m]	514.5032
	TH6x Power cable sensor [25 m]	514.5033
	TH6x Power cable sensor [35 m]	514.5104
	TH6x Power cable sensor [50 m]	514.5133
Ethernet Cables	TH6x Ethernet cable sensor [10 m]	514.5034
	TH6x Ethernet cable sensor [15 m]	514.5035
	TH6x Ethernet cable sensor [25 m]	514.5036
	TH6x Ethernet cable sensor [35 m]	514.5103
	TH6x Ethernet cable sensor [50 m]	514.5132
Patch Cables	TH6x Patch cable CAT 6A red [1 m]	514.5037
	TH6x Patch cable CAT 6A red [2 m]	514.5038
	TH6x Patch cable CAT 6A red [5 m]	514.5039
	TH6x Patch cable CAT 6A red [10 m]	514.5040
Cable Processor	TH6x Power cable processor	514.5041
Extension Cables (Ethernet & Power)	TH6x extension cable Ethernet sensor [2 m]	514.5102
	TH6x extension cable Ethernet sensor [5 m]	514.5134
	TH6x extension cable Ethernet sensor [8 m]	514.5135
	TH6x extension cable Ethernet sensor [10 m]	514.5136
	TH6x extension cable Ethernet sensor [20 m]	514.5137
	TH6x extension cable Power sensor [2 m]	514.5101
	TH6x extension cable Power sensor [5 m]	514.5124
	TH6x extension cable Power sensor [8 m]	514.5139
	TH6x extension cable Power sensor [10 m]	514.5140
	TH6x extension cable Power sensor [20 m]	514.5141
Machine Interface Accessories	Calibration unit complete [ABB & KUKA] (contains P/N 514.5051, 514.5049 and 514.5050)	514.5062
	Calibration plate [ABB or KUKA]	514.5051
	Point for calibration plate [ABB or KUKA]	514.5049
	Crossline for calibration plate [ABB or KUKA]	514.5050
	Calibration unit [FANUC or Yaskawa]	514.0237
	Interface digital/analog (WAGO)	514.5055
Sensor Heads	TH6D Sensor head 150-CF	514.5042
	TH6D Sensor head 150-GF	514.5154
	TH6D Sensor head 150-KF	514.5043
	TH6D Protective unit complete	514.5044
	TH6i Sensor head 150-CF	514.5082
	TH6i Protective unit	514.5084
Processing unit (EPC)	EPC Processing unit for TH6D-CF	514.5046
	EPC Processing unit for TH6D-GF	514.5155
	EPC Processing unit for TH6D-KF	514.5047
	EPC Processing unit for TH6i-CF	514.5083
Kevlar Protections for Sensor Heads	Kevlar protection for side mounted holder	514.5100
	Kevlar protection for bottom mounted holder	514.5099
Cover Glass	Cover Glass B16-L63, 3-H1 (Quantity: 25)	514.5045.25



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