EngRoTec Solutions

roller hemming technology

2017/18

EngRoTec-Solutions GmbH
Leading in Robotic Hemming

References

ABB Engineering

Adam Opel

ALLGAIER AUTOMOTIVE

Altinay Robot Teknolojileri

Autobox Technology (Shanghai)

AUTOMATE Technology (Shanghai)

AWL Techniek

Beycelik Gestamp

BMW Group

C.A.A.R. – Consulting Automotive Aerospace Railway

Carthago Reisemobilbau

Chropyňská strojírna

Porsche

DURA Automotive Body & Glass Systems

Emil Bucher

FFT Produktionssysteme

FIBRO-LÄPPLE Technology

Five Lakes Automation

Ford-Werke

Kuka Systems

Kunshan Noke Automotive Technical Machinery

LÄPPLE Automotive

Magna Cosma International

Magna Steyr

MINO Automation

Reißler-Technik

Salzgitter Automotive Engineering

Schuler Hangarter Maschinenbau

SD Automotive

ŠKODA AUTO

Suministros Industriales Servofluid

Tesla Motors

ThyssenKrupp System Engineering

TMS Turnkey Manufacturing Solutions

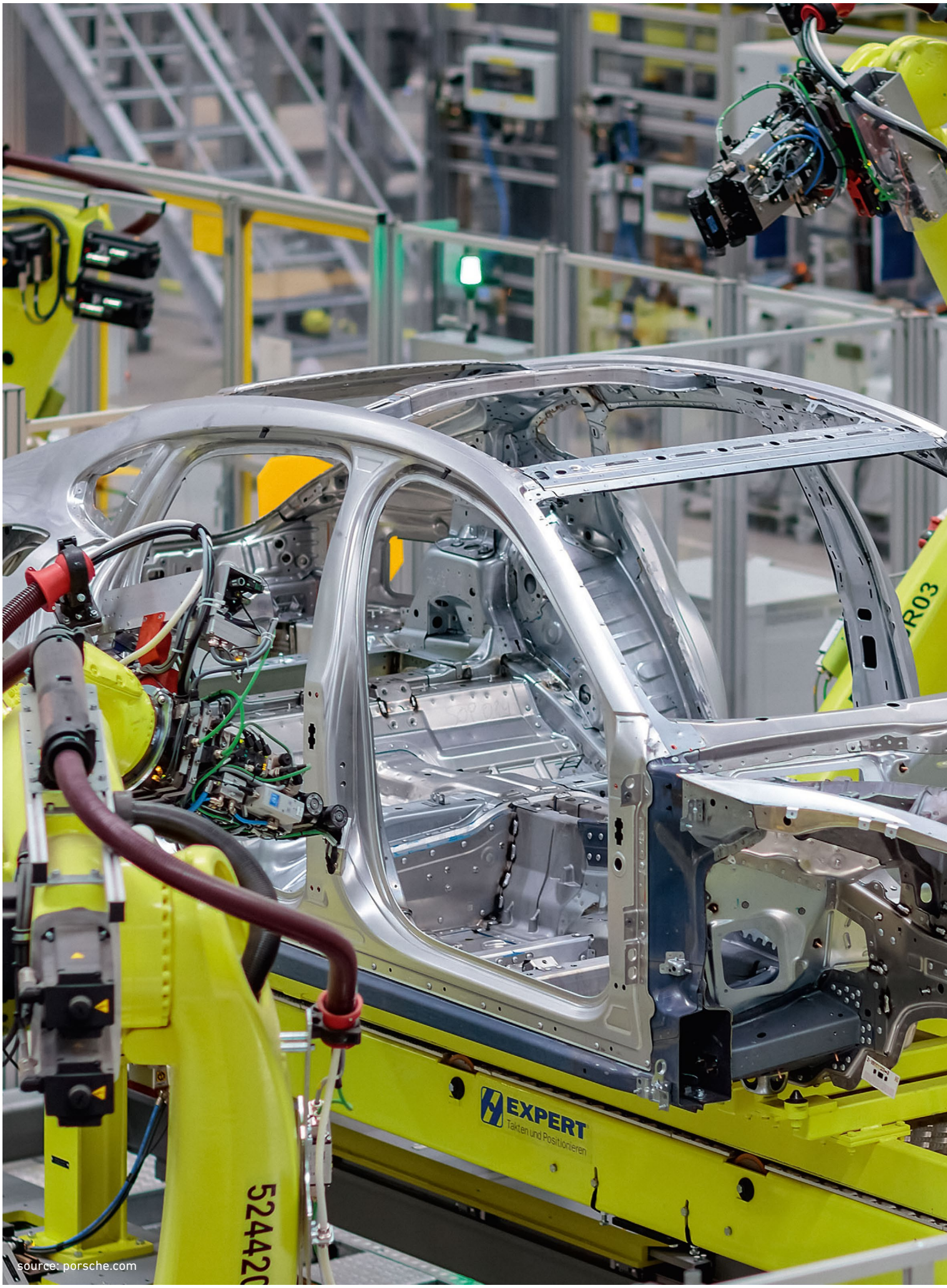
Valiant International

VDL Steelweld

voestalpine Polynorm

Volkswagen

Waldaschaff Automotive



source: porsche.com

innovation: hemming systems for door frames

Through new innovative material combinations, joining technologies have to meet new challenges. Conventional welding applications are replaced by hemming applications also within doorframes of a car body.

We played an important role in the development of our customers' product. We are the market leader with a system that solves the task simply and efficiently.

A double roller tool and a robot guidance system from AI◦ are put into effect. This combination avoids expensive investment in equipment for positioning completely. The integration of further models is done in software only.

Components	Description
FW 270	pneumatic roller hemming tool (see page 16)
AI◦ VISIONSCANNER2	laser triangulation sensor incl. software with the application ROBOTGUIDANCE (www.ai-engrotec.de)

roller hemming systems for doors & lids

Our hemming tools have been developed to meet the quality and planning requirements of modern door and lid systems. Combined with corresponding production fixtures, there are different possibilities in the installation of the system as well as realization of different cycle times. Our hemming systems guarantee an even hemming result with optimum adhesive distribution within the hemming geometry.

The tools are protected against overload. Optionally, they are attachable to a force control device to facilitate commissioning or as a process control system in mass production.

The use of high quality and high strength materials lead to an outstanding lifetime with a minimum of maintenance required.

Technical data	FW100 – hemming tool for closure panels
Weight	max. 12 kg (approx. 10 kg without force control device)
Pre-load	1,000 N by elastomer suspension > 1,000 N on request
Process forces	< 1,000 N rigid system 1,000 – 2,000 N spring-loaded system > 2,000 N on request
Features	• less wear out • protection against overload • compact and modular set-up • easy to use

Product overview – hemming tool without force control device

FW100

FW_100_00_VAR_01

hemming tool without force control device with:

2× standard roller,
1× pin for calibration short

FW_100_00_VAR_02

hemming tool without force control device with:

1× standard roller,
1× standard shaft,
1× pin for calibration short

FW_100_00_VAR_03

hemming tool without force control device with:

2× standard roller,
1× standard shaft,
1× pin for calibration long

FW_100_00_VAR_04

hemming tool without force control device with:

2× standard roll or shaft
(to be used for glass channel area at doors)

Product overview – hemming tool with force control device

FW100

FW_100_00_VAR_11

hemming tool with force control device and:

2× standard roller,
1× pin for calibration short

FW_100_00_VAR_12

hemming tool with force control device and:

1× standard roller,
1× standard shaft,
1× pin for calibration short

FW_100_00_VAR_13

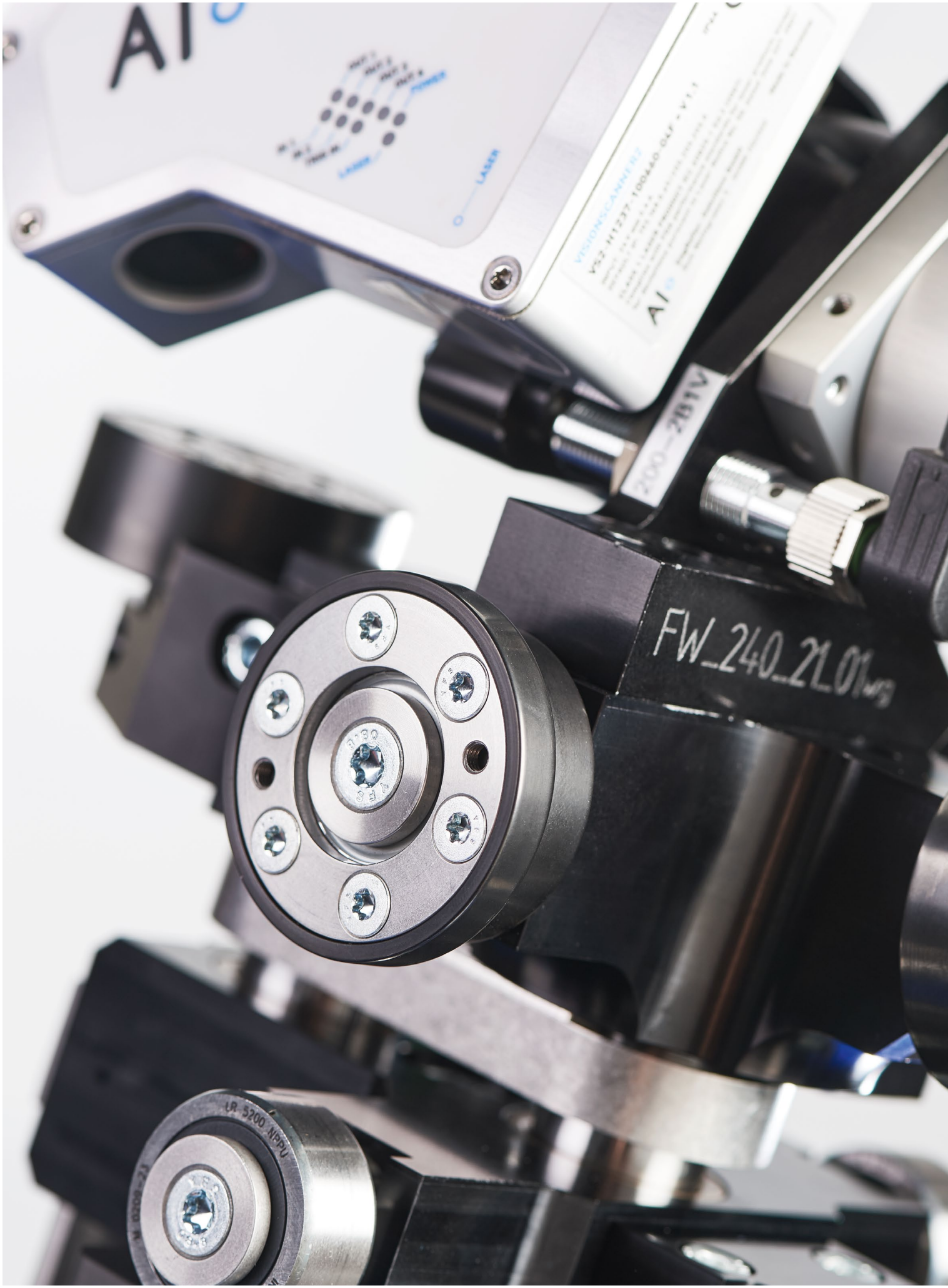
hemming tool with force control device and:

2× standard roller,
1× standard shaft,
1× pin for calibration long

FW_100_00_VAR_14

hemming tool with force control device and:

2× standard roller or shaft
(to be used for glass channel area at doors)


FW_240_21.01

systems for wheel house & door frames

The pneumatically supported tools of the FW 2XX series have been developed for hemming applications with a double roller system.

The tools carry multiple pairs of rollers on a special bearing system which guarantees a steady flow of hemming forces. The robot has a guiding function only.

A robot guidance system from AI◦ (www.ai-engrotec.de) complements the systems in order to compensate tolerances of automotive body panels. It can additionally be used for the control of the hemming result. A robot-guided surface protection with clamping technique is being used for hemming processes at the wheel house.

Furthermore, our hemming tool offers high flexibility in the possibility of a stationary set up in the production line. Different tasks can be realized by guidance of different parts at one tool on a stand.

Technical data	FW 200 – hemming tool for wheel houses
Weight	max. 25 kg
Interfaces	• central air supply • central power supply 24 V DC • connection to fieldbus with output of analogue values (IO Link) for Profibus DP, Profinet (Cu + LWL), Ethernet IP, DeviceNet
Features	• simple operation • simple optimization of quality (proportional valve) • compact set-up • easy to maintain • optionally equipped with hem inspection system AI◦ INLINE PROCESS INSPECTION

Product overview

FW200

FW_200_00_VAR_01

hemming tool with standard equipment for
3 hemming steps with
3× standard rollers

FW_200_00_VAR_02

hemming tool with standard equipment for
4 hemming steps with
4× standard rollers

FW_200_00_VAR_03

hemming tool fully equipped for
3 hemming steps with 3× standard rollers

and sensor measurement system, including:

1× smart sensor VISIONSCANNER2 incl. connection,
1× power supply cable and 1× LAN cable,
1× artefact,

with software

FW_200_00_VAR_04

hemming tool fully equipped for
4 hemming steps with 4× standard rollers,

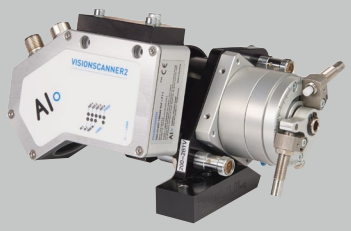
and sensor measurement system, including:

1× smart sensor VISIONSCANNER2 incl. connection,
1× power supply cable and 1× LAN cable,
1× artefact,

with software

FW_240_21_VAR_01

FW240



sensor measurement system
for robot guidance system AI◦ ROBOT GUIDANCE
and quality control AI◦ INLINE PROCESS
INSPECTION including:

1× smart sensor VISIONSCANNER2
incl. swivelling connection to roller hemming tool,
1× power supply cable and 1× LAN cable,
1× artefact,

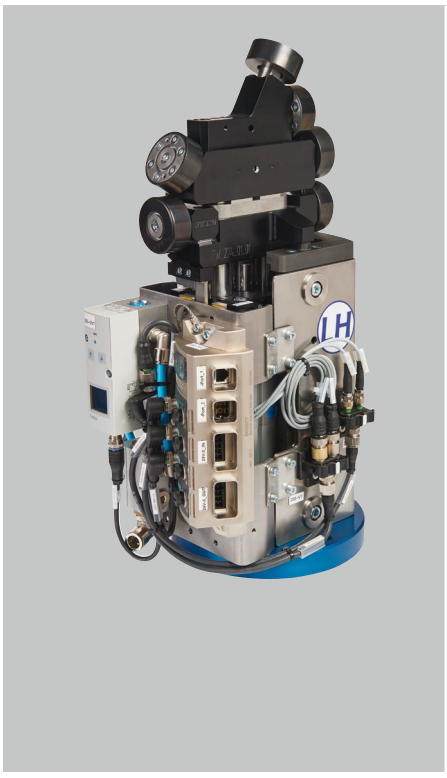
with software

Product overview – hemming tools for applications without hemming bed or stationary configuration

Technical data	FW 270 – hemming tool for door sills
Weight	max. 25 kg
Interfaces	• central air supply • central power supply 24 V DC • connection to fieldbus with output of analogue values (IO Link) for Profibus DP, Profinet (Cu + LWL), Ethernet IP, DeviceNet
Features	• simple operation • simple configuration of hemming force (proportional valve) • compact set-up • easy to maintain • optionally equipped with quality control system AI◦ INLINE PROCESS INSPECTION

FW_270_00_VAR_01

FW 270

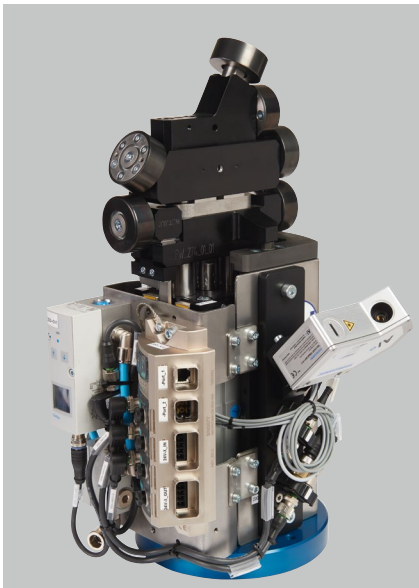


hemming tool with double roller technique for applications without hemming bed.

basic configuration for 3 hemming steps with 3 pairs of standard hemming rollers and control technology according to standard installation.

FW_270_00_VAR_02

FW 270

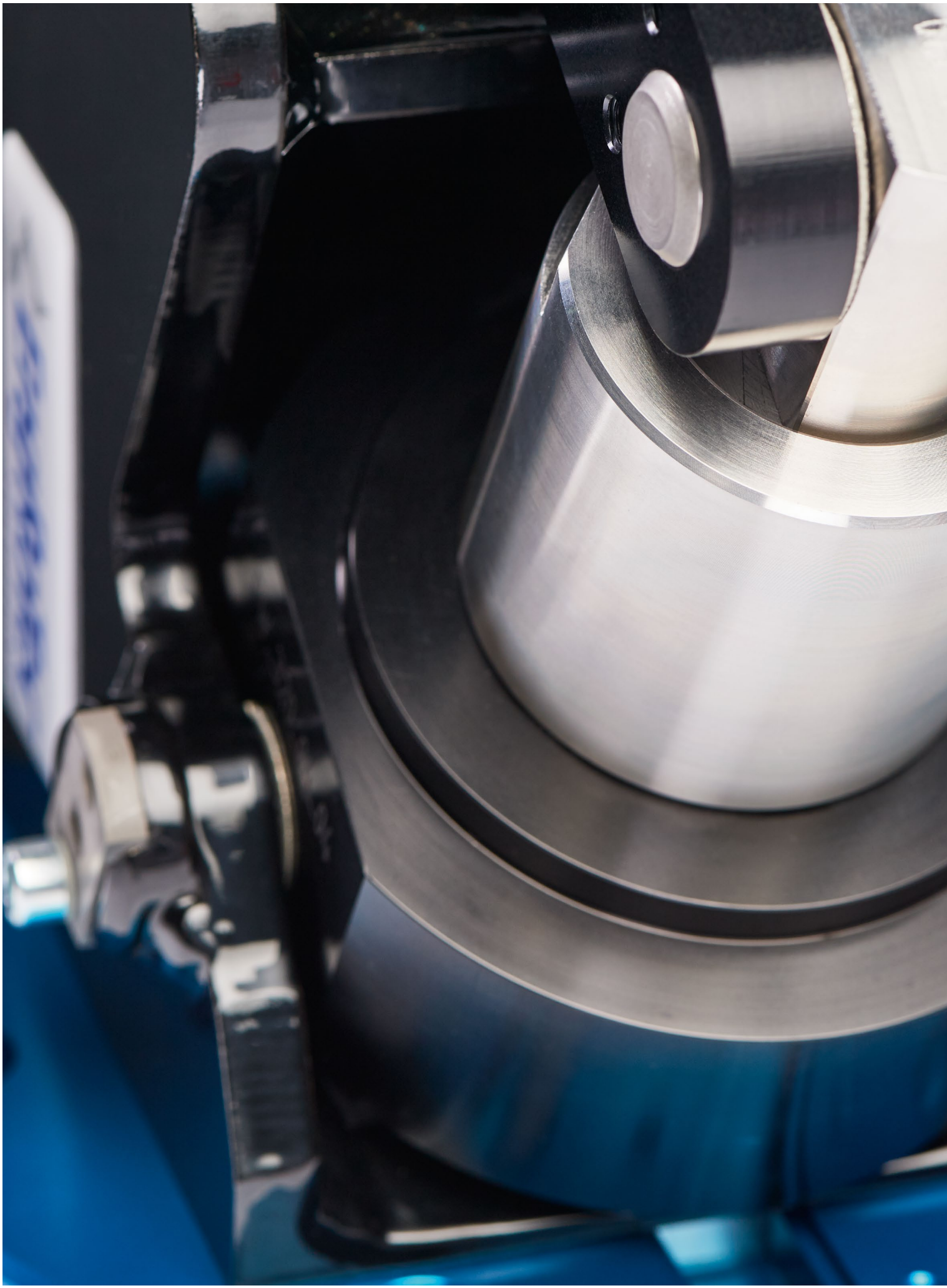


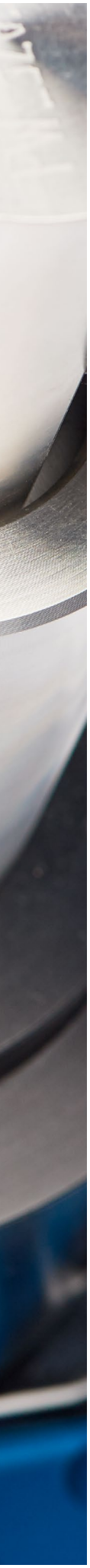
hemming tool with double roller technique for applications without hemming bed.

basic configuration for 3 hemming steps with 3 pairs of standard hemming rollers and control technology according to standard installation. additionally:

1x smart sensor VISIONSCANNER2 incl. bracket,
1x set of cables (Power, Ethernet)
1x reference artifact

incl. software





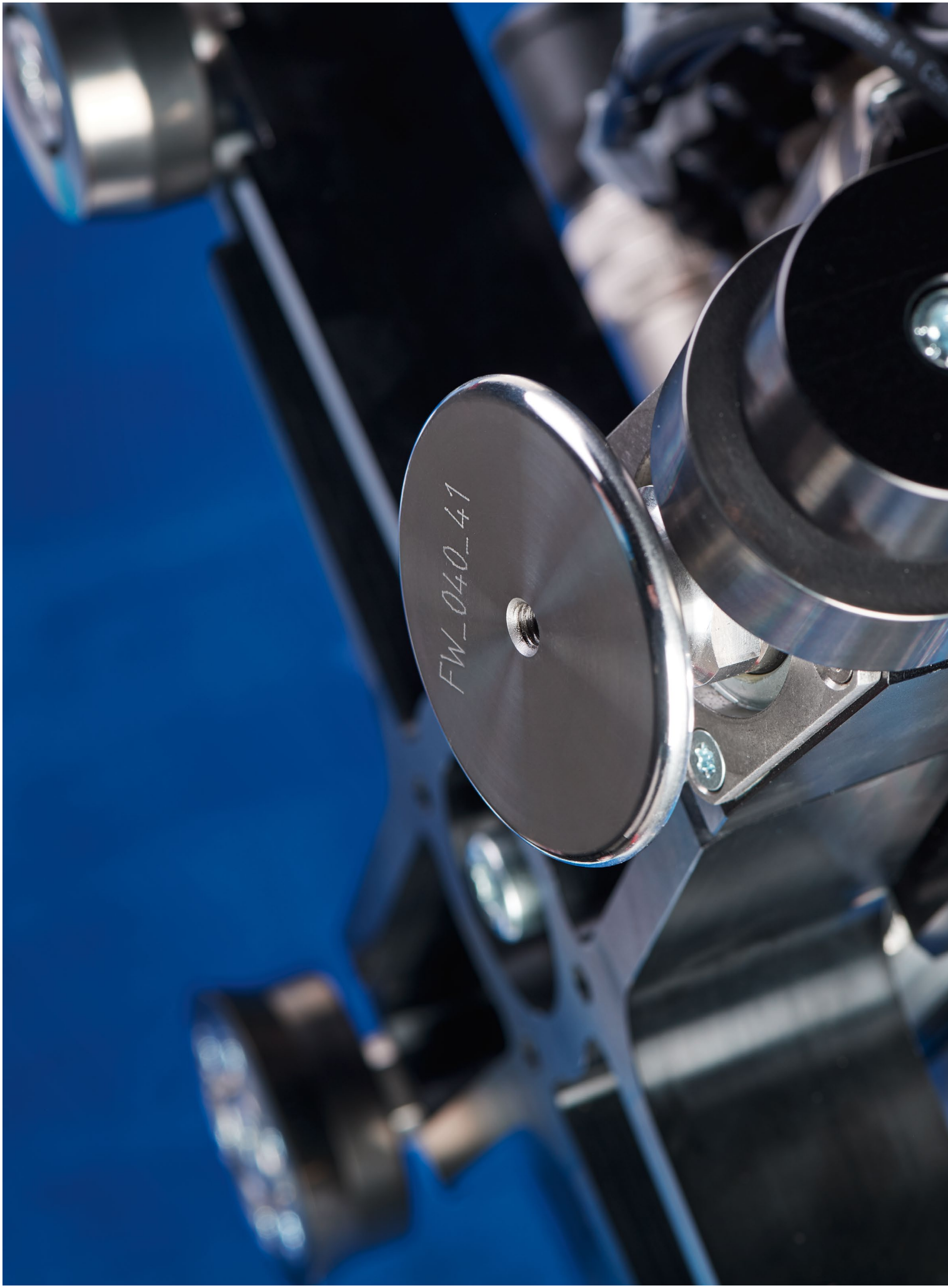
systems for limited access

Technical data	FW 300 – hemming tool for closure panels
Weight	max. 13 kg
Pre-load	1,000 N by elastomer suspension > 1,000 N on request
Process forces	< 1,000 N rigid system 1,000 – 2,000 N spring-loaded system > 2,000 N on request
Features	• less wear out • protection against overload • compact and modular set-up • programmer-friendly

FW_300_00_VAR_01

FW 300

hemming tool with roller carrier and
1× standard roller or shaft,
1× pin for calibration short


FW_040_41

systems for sun roof & panoramic roof

The tool FW 400 has been developed for the hemming of sun roof and panoramic roofs.

The flange – open 180° – is hemmed by using various, electrically driven pairs of rollers. Due to the innovative design of the tool and its compact dimensions and disturbance ranges, complex devices of conventional systems can be omitted. Quality optimization can be done by program changes only.

Optionally, the system can be complemented with a quality control by AI◦ (www.ai-engrotec.de).

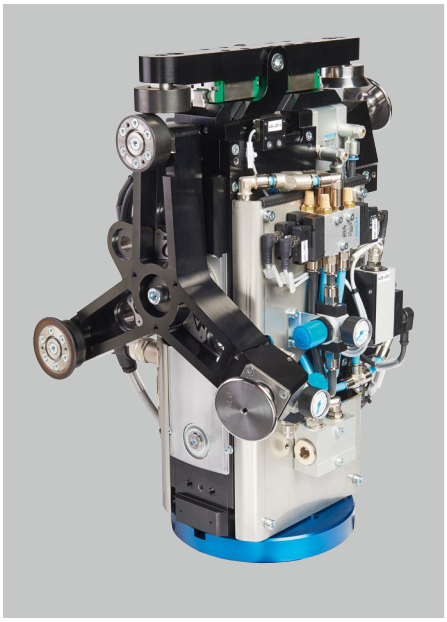
The tool can be mounted stationary, the robot leads the component. Thus, production for various models can be realized efficiently.

Technical data	FW 400 – hemming tool for sun roofs
Weight	max. 34 kg
Interfaces	• central air supply • central power supply 24 V DC • standard connection to fieldbus Profibus DP, Profinet (Cu + LWL), Ethernet IP, DeviceNet
Features	• simple operation • compact design • easy to maintain • high flexibility • optionally equipped with quality control system AI◦ INLINE PROCESS INSPECTION

Product overview

FW 400

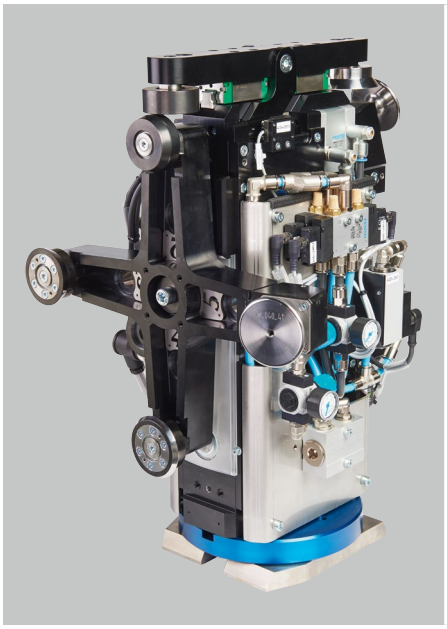
FW_400_00_VAR_01



hemming tool basic configuration

with roller carrier for
4× pairs of standard hemming rollers

FW_400_00_VAR_02

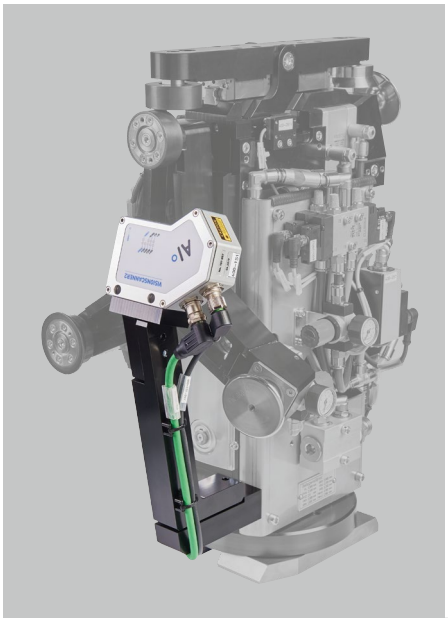


hemming tool basic configuration

with roller carrier for
5× pairs of standard hemming rollers

FW_480_01

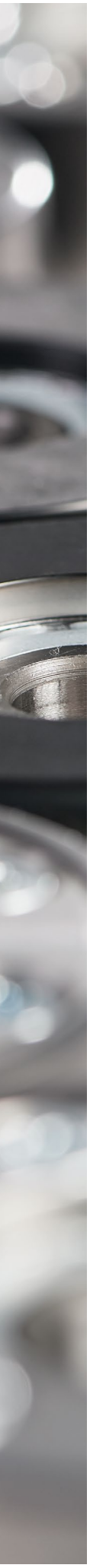
FW 480



tool extension for quality inspection consisting of

1× smart sensor AI◦ VISIONSCANNER2 incl. connection,
1× power supply cable and 1× LAN cable

article-no. 108398



spare & wear parts

On the following pages, you will find components and wear parts for our products.

	FW100	FW2xx	FW300	FW400
Rollers	p. 26 – 29	p. 26 – 29	p. 26 – 29	p. 30 – 31
Axles	p. 32	p. 32	p. 32	p. 32
Carriers	p. 33 – 34	p. 35	–	–
Calibration	p. 36 – 37	p. 36 – 37	p. 36 – 37	p. 36 – 37
Spare and wear parts	p. 37	p. 38	p. 39	p. 40 – 41

Rollers – FW 100, FW 200, FW 300

FW_040_01

FW_040_01

hemming roller
⌀ 50, cylindrical

article-no. 107066

FW_040_02

FW_040_02

hemming shaft
⌀ 20, cylindrical

article-no. 107271

FW_040_03

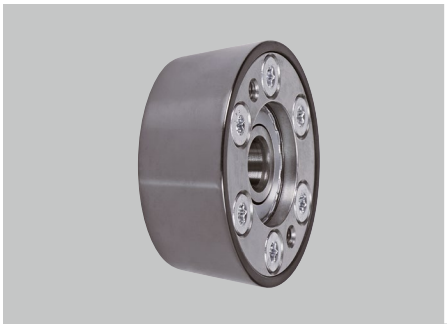
FW_040_03

hemming roller
⌀ 50, tapered 5°

article-no. 107064

FW_040_04

FW_040_04

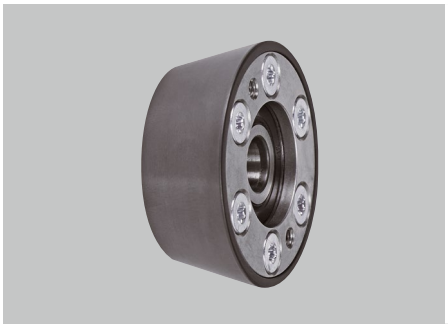


hemming roller
⌀ 50, tapered 10°

article-no. 107063

FW_040_05

FW_040_05



hemming roller
⌀ 50, tapered 15°

article-no. 107062

FW_040_06

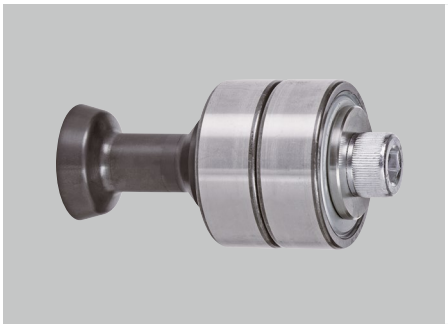
FW_040_06

hemming roller
⌀ 50, cylindrical stepped
for drop hemming

article-no. 107061

FW_040_13

FW_040_13

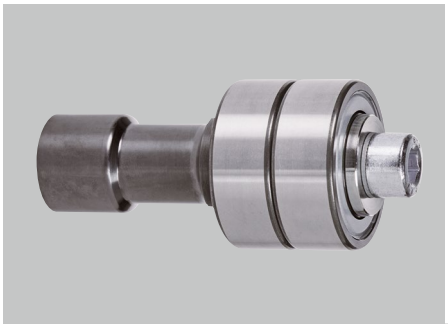


hemming shaft
⌀ 30, tapered stepped 15°,
for drop hemming

article-no. 107057

FW_040_17

FW_040_17



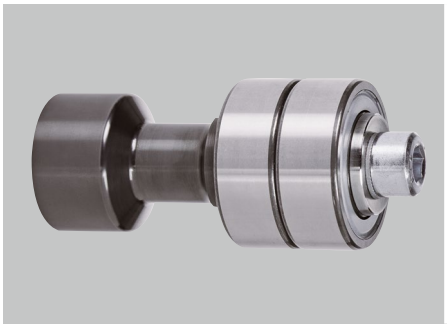
hemming shaft
⌀ 25, cylindrical stepped B = 20

article-no. 107056

Rollers – FW 100, FW 200, FW 300

FW_040_18

FW_040_18

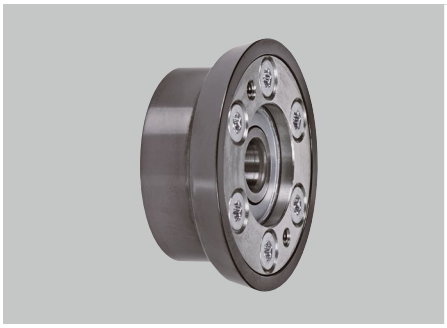


hemming shaft
⌀ 35, cylindrical stepped B = 20

article-no. 107055

FW_040_26

FW_040_26



hemming roller
⌀ 52, tapered stepped 15°,
for drop hemming

article-no. 107051

FW_040_27

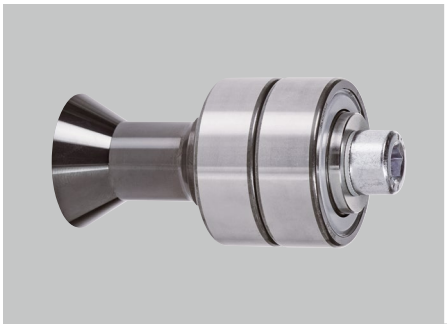
FW_040_27

hemming roller
⌀ 52, tapered stepped 10°,
for drop hemming

article-no. 107050

FW_040_29

FW_040_29

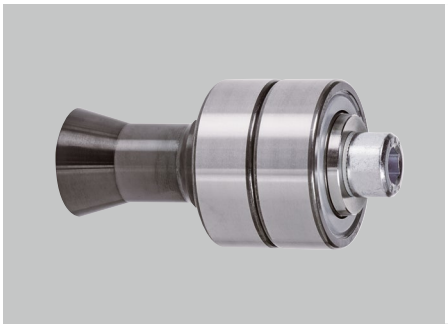


hemming shaft
⌀ 34, tapered 30°,
for drop hemming

article-no. 107049

FW_040_30

FW_040_30



hemming shaft
⌀ 28, tapered 15°,
for drop hemming

article-no. 107048

FW_040_xx

FW_040_xx

special hemming roller/shaft
according to customer request

to this, we will provide no guarantee regarding function and wear resistance; furthermore no corresponding stockpile is planned.

Rollers – FW 400

FW_040_01

FW_040_01

hemming roller
⌀ 50, cylindrical

article-no. 107066

FW_040_08

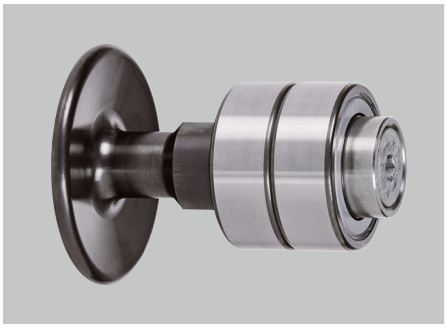
FW_040_08

hemming roller
⌀ 62,5, tapered stepped 40°,
for hemming of sun roof

article-no. 107060

FW_040_20

FW_040_20



hemming roller
⌀ 62, with undercut 10°,
for hemming of sun roof

article-no. 108197

FW_040_36

FW_040_36

hemming roller
⌀ 62,5, tapered stepped 35°,
for hemming of sun roof

article-no. 108198

FW_040_37

FW_040_37

hemming roller
⌀ 50, tapered 15° towards interior,
for hemming of sun roof

article-no. 100213

FW_040_38

FW_040_38

hemming roller
⌀ 56, tapered stepped 20°,
for hemming of sun roof

article-no. 100214

FW_040_39

FW_040_39

hemming roller
⌀ 60, tapered stepped 55°,
for hemming of sun roof

article-no. 100215

FW_040_41

FW_040_41

hemming roller
⌀ 60, tapered stepped 15°,
for hemming of sun roof

article-no. 108199

Axles

FW_030_VAR_01

FW_030_01

standard axle for front side assembly
including washer

FW_030_VAR_02

FW_030_02

standard axle for back side assembly
including washer

FW_030_VAR_03

FW_030_03

axle adapter for standard rollers
for assembly on hemming shaft carriers

Carrier – FW 100

FW_113_00

FW_113_00

extension tool base 100 mm

article-no. 106955

FW_113_15

FW_113_15

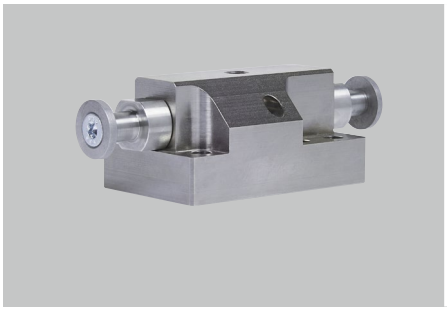
extension tool base 150 mm

article-no. 106953

Roller carriers – FW 100

FW_020_VAR_01

FW_020_VAR_01

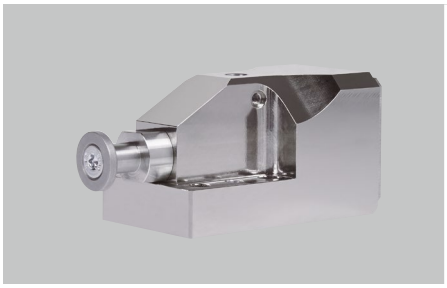


roller carrier with

2× axle for hemming roller and
1× pin for calibration

FW_020_VAR_02

FW_020_VAR_02

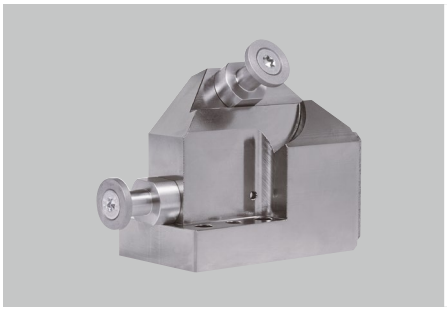


roller carrier with

1× axle for hemming roller,
1× axle for hemming shaft
1× pin for calibration

FW_020_VAR_03

FW_020_VAR_03

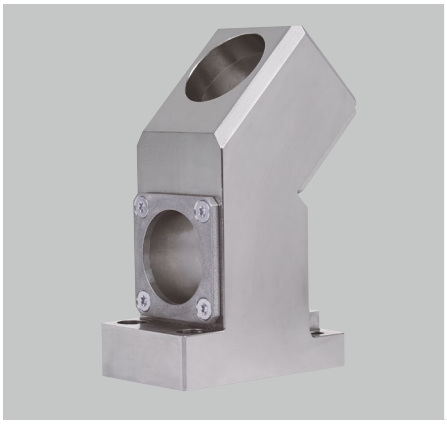


roller carrier with

1× axle for hemming roller
1× axle for hemming shaft or
1× flange axle for hemming roller,
1× axle for forehand roller
1× pin for calibration

FW_020_VAR_04

FW_020_VAR_04



roller carrier for hemming
at glass channel area at doors with

2× covers
1× pin for calibration
1× carrier for pin for calibration

Adapter – FW 100

BM_130_01_01

BM_130_01_01

for ISO robot connection D=125 mm
(for ex. Fanuc R-2000-series):

- reference circle – outer ⌀ 160 mm for
  6× threaded hole M10 with split 60° and
  1× precision bore 10H7
  cylindrical centre carrier D = 100f7
- reference circle – inner ⌀ 125 mm for
  6× through hole M10 with split 60° and
  1× precision bore 10H7
  cylindrical centre carrier D = 80H7

article-no. 108254

Carrier – FW 200

FW_221_11

FW_221_11

roller carrier for FW 200
4th hemming step

article-no. 106942

Calibration

FW_090_01_08

FW_090_01_08

pin for calibration short,
install at fixture or roller carrier
D = 8 mm

article-no. 106347

FW_090_01_0x

FW_090_01_0x

pin for calibration long,
to be fastened at front panel tool base
or used instead of hemming roller
M8 + M6 AG / M6 IG

article-no. 107350

FW_090_02_01

FW_090_02_01

socket for calibration,
install at fixture

article-no. 106350

FW_090_02_02

FW_090_02_02

sphere for calibration short,
install at roller carrier

article-no. 106351

FW_090_02_03

FW_090_02_03

sphere for calibration long,
install at front panel tool base

article-no. 106352

Spare & wear parts – FW 100

no	order no	descrpiption / supplier
1	**FB70040400A3**	elastomer spring 4040 CR EFFBE
2	**SOB202820**	plain bearing bush SANKYO
3	**9186-V3100**	force measurement / process value indicator incl. 5 m connecting cable BURSTER
4	**106366**	ring force sensor incl. socket FW_111_00_04
5	**3004 B-2Z-TVH**	angular contact ball bearings INA / FAG
6	**3200 B-2Z**	angular contact ball bearings INA / FAG

Spare & wear parts – FW 200

no	order no	descrpiption / supplier
1	**EAM4020**	end fittings with wiper ZITEC
2	**HW15** **L = 90 mm**	flat cage ZITEC
3	**M4020** **15x100Q10**	guide rail ZITEC
4	**V4020** **15x150Q10US**	guide rail ZITEC
5	**SOB253340**	plain bearing bush SANKYO
6	**ADNH 63x40-IPA-2N**	high-force cylinder FESTO
7	**Bi4U-M12-** **AP6X-H1141**	inductive sensor TURCK
8	**LR5200-2Z**	counter roller INA / FAG
9	**3802 B-2Z-TVH**	ball bearings INA / FAG
10	**DSM T-12-270-A-B**	swivelling cylinder FESTO
11	**BI8U-Q08-AP6X2-** **0,6-RS4/S1160**	position controlling TURCK
12	**CPE14-M1CH-5JS-1/8**	way valve FESTO
13	**CPE14-M1CH-** **5/3G-1/8**	way valve FESTO

Spare & wear parts – FW 300

no	order no	descrpiption / supplier
1	**SOBW 20**	thrust washer SANKYO
2	**MDZW 18**	thrust washer MISUMI
3	**PBG 151712 F**	plain bearing bush –
4	**SOB253325**	plain bearing bush SANKYO
5	**FB70040400A3**	elastomer spring 4040 CR EFFBE
6	**SOB202820**	plain bearing bush SANKYO
7	**3004 B-2Z-TVH**	angular contact ball bearings INA / FAG

Spare & wear parts – FW 400

no	order no	descrpiption / supplier
1	**03184-20**	tapered bushing NORELEM
2	**SHFZ 20-30**	flange bushing MISUMI
3	**RS-48H10E-3C13B-CT 1AM**	rotary encoder TURCK
4	**LR-1/8-D-7-MICRO**	pressure control valve FESTO
5	**PEV-1/4-B-M12**	pressure switch FESTO
6	**23010-1025**	spring-bar coupling NORELEM
7	**TKVD 15 BS**	guide rail INA / SKF
8	**KWVE 15 BS**	guide carriage INA / SKF
9	**MPBZ 12-10**	plain bearing bush MISUMI
10	**CPE14-M1CH-5J-1/8**	magnetic valve FESTO

no	order no	descrpiption / supplier
11	**SME-8M-DS-24V-K-0.3-OE**	proximity switch FESTO
12	**ADN 50-15-A-P-A**	pneumatic cylinder FESTO
13	**ADN 40-15-I-P-A**	pneumatic cylinder FESTO
14	**6006**	radial bearing INA / SKF
15	**3000 B-2Z TVH**	angular ball bearing INA / SKF
16	**3006 B-2Z TVH**	angular ball bearing INA / SKF
17	**3202 B-2Z TVH**	angular ball bearing INA / SKF
18	**MIS234A3M9N075**	multiphase motor JVL
19	**FW_420_09_13**	multiphase motor, configurated for 4 hemming steps EngRoTec-Solutions
20	**FW_420_11_13**	multiphase motor, configurated for 5 hemming steps EngRoTec-Solutions
21	**10 AT3 / 351 GEN III**	cam belt HILGER & KERN

portrait

EngRoTec Group looks back on a successful development since it was founded in 2009. With over 250 experienced employees along with corresponding investments in most modern system and software technologies, EngRoTec presents itself as a professional, flexible and reliable partner for manufacturers and integrators. In 2010, EngRoTec-Solutions GmbH started the development of hemming systems with robot guidance. Until today, the company became the leading supplier of such systems.

Our hemming systems have a modular configuration, with a minimum of maintenance and wear, and are suitable for different hemming designs. They are characterized by the combination of hemming technology and vision systems in order to meet the requirements of modern and flexible equipment.

Production parts are standardized, interchangeable and available on request. The rollers get a special coating so that materials tending to an adhesive wear can be hemmed reliable for the process with longer tool life. Our tools have been developed for the worldwide use in rough production environment. All components have been tested in long-term studies and are fixed and tested with highest care before leaving our plant.

The service portfolio includes virtual validation, methods and commissioning on site at the customer's factory.

Innovation and flexibility are part of our self-conception. As an independent system partner for robot guided hemming systems we supply most of the European automotive manufacturers as well as their suppliers in their worldwide plants.

EngRoTec Solutions

service

Germany

Order service

- inquiries
- orders
- commercial support

Technical support

- technical product support
- telephone support for commissioning
- internet hotline service

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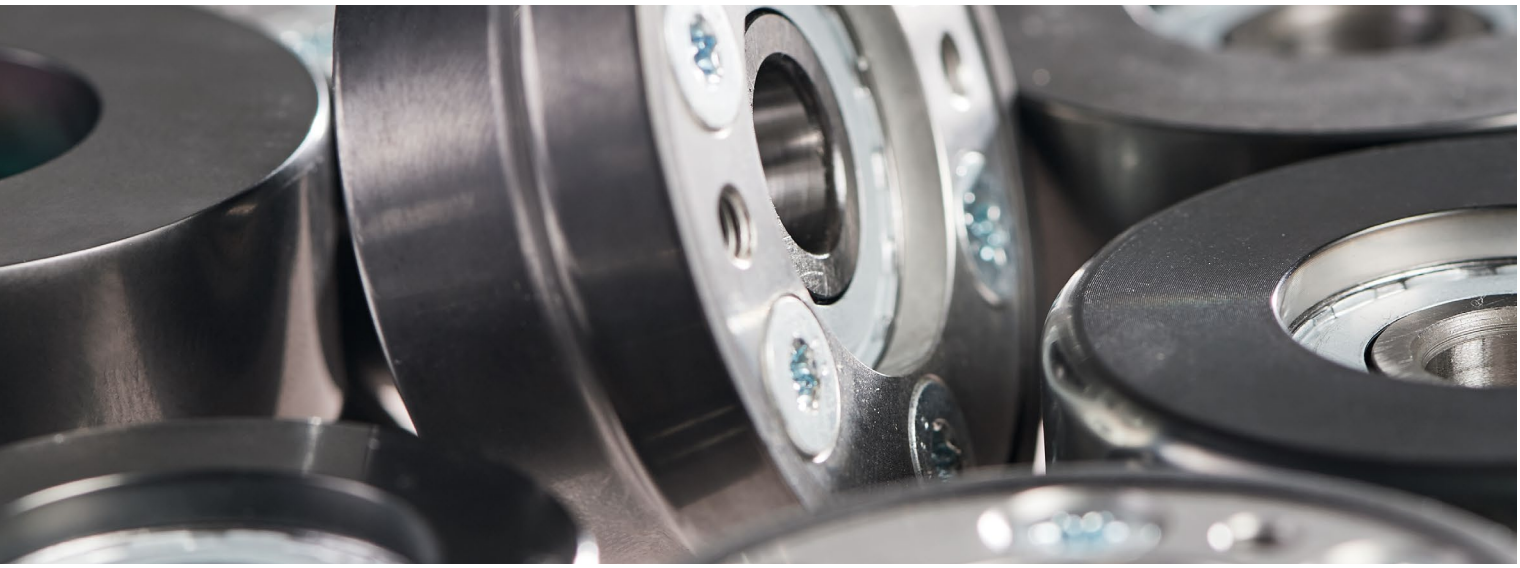


interfaces & notes

Useful notes for the design of a roller hemming application

A roller hemming tool is only one part of a complex overall system. To achieve the objectives regarding production quality and stability as well as longevity and further process specifications you have to take into account further conditions also being very important.

The following listing will help you to evaluate these conditions:

- **Did you evaluate the component in a positive way regarding the possibility of roller hemming?**
- **Are the requirements of the roller hemming assembly fulfilled regarding part location, part fixation and the repeatability of these both factors?**
- **Does the process planning comply with a stable and secure roller hemming process within the process time being available?**
- **Is the robot or the chosen drive unit suitable for the given task?**

Furthermore, it is important that the roller hemming tool will be used in the way that hemming can be generated with highest quality, maximum efficiency and high product stability.

If you need help while answering these questions or general support, please do not hesitate to contact us! We will be pleased to give you support.

Use of EngRoTec-Solutions hemming systems

Hereafter, you will find the most important notes for the intended use of our roller hemming tools, the tool FW-100 for doors & flaps as example.

We kindly ask you to take these specifications into account and are pleased to give you further information.

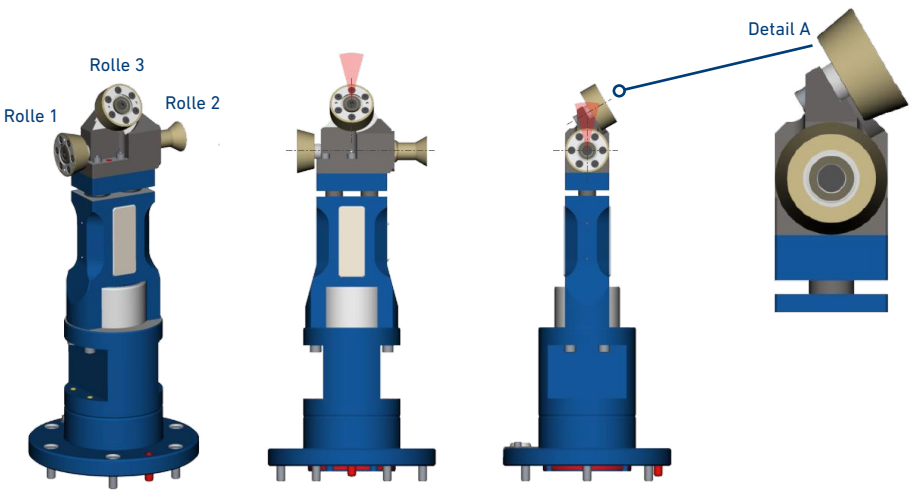
In case of special applications please contact us, we look forward to develop together suitable solutions for your tasks.

Notes for intended use of FW 100

If you correspond to the following aspects, the roller hemming tool will be used “within the intended application”:

- **Maximum permitted roller hemming force in loading direction = 2,000 N**
- **Maximum angle of load transmission, rotating around the roller rotating axis (red area) = ±15°**
- **Maximum touching speed = 50 mm/sec at tangential starting**
- **No pulling operation is allowed**
- **No use of cone hemming roller on position 3, if the mounting direction corresponds to detail A.**
- **Extension of the tools basis of max. 150 mm**

Please bear in mind that we cannot provide any guarantee for the hemming process or hemming tool if you don't comply to these conditions or even only partially.



Definition of interfaces between EngRoTec and customer

Interface	Scope of EngRoTec-Solutions Depending on the requirements of the production plant - until:
Mechanical	• connection flange of the roller hemming tool or • tool-side of tool-change-system or • robot flange at the quick-change adapter
Pneumatical	• tool-side of a tool-change-system or • pneumatical main supply (distribution block)
Electrical	• input plug of first field bus module for fieldbus and/or power supply • input plug of optical-fibre-converter for fieldbus-supply or • input plug of push-pull/M12-converter or • tool-side of a docking system
Regarding line control system and process control /robot program	**Stationary hemming task:** delivering of the pure movement program of the roller hemming operation, starting from the home position till re-arriving of the home position. **Moreover, this contains the following items:** • annotations to the necessary robot interlocks • annotations to the necessary process sequences (e.g. clamping units) • annotations to the control of the roller hemming tool **The following items are excluded in particular:** • any type of communication to the line or plant control system (e.g. interlocks, area scans or -releases, ready signals etc.) • any signals for actuating the fixture • any tasks which are part of the part handling or the tool changing • any down-hold movements, if included **Dynamic hemming process:** delivering of the movement program, starting from the pick-up of the production part until its deposit after the hemming process; beginning from the home-position till re-arriving of the home-position. **Moreover, this contains the following items:** • annotations to the necessary robot interlocks • annotations to the necessary process sequences (e.g. clamping units) • annotations to the control of the roller hemming tool **The following items are excluded in particular:** any type of communication to the line or plant control system (e.g. interlocks, area scans or -releases, ready signals etc.) • any signals for actuating the gripper • any tasks which are part of further processes (e.g. respot welding in the gripper) or the tool changing

Annotations to the interfaces to each fieldbus-system

Interface	Regarding the hemming tools FW 2xx and FW 400
Field bus connection (if necessary)	**The following field bus systems can be connected by default:** • Profibus DP • ProfiNet (Cu) • ProfiNet (LWL) • Ethernet/IP • DeviceNet **The following fieldbus systems can be connected on request/ against surcharge** • Interbus (Cu) • Interbus (LWL 500 kBaud) **The following fieldbus systems cannot be connected if the hemming tools needs an analogue value processing (model series FW 2xx):** • Interbus (LWL 2MBaud)

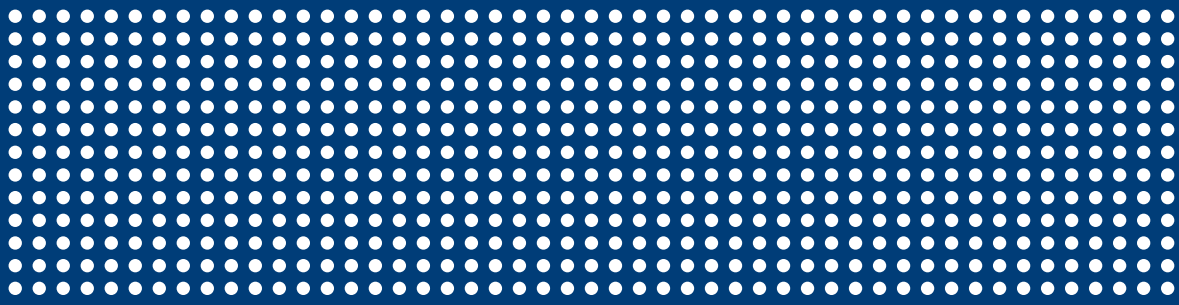
General annotations to the use of the roller hemming tools

Roller hemming process	
Cycle time	• EngRoTec will only accept the responsibility for the compliance with the given cycle time if EngRoTec is also permitted to influence the planning process or is responsible for this process respectively. • Further, EngRoTec will accept the responsibility for the compliance with the given cycle time, if EngRoTec has agreed expressly to the process specifications beforehand. • EngRoTec reserves the right to refuse this responsibility during the project in individual, constituted cases.
Quality	• EngRoTec will only accept the responsibility for the compliance with the predetermined hemming quality, if EngRoTec is also permitted to influence the planning process or is responsible for this process respectively. • Further, EngRoTec will accept the responsibility for the compliance with the predetermined hemming quality, if EngRoTec has agreed expressly to the process specifications beforehand. • EngRoTec reserves the right to refuse this responsibility during the project in individual, constituted cases.

The following services are part of the purchase order of a roller hemming tool:

- Definition of the required hemming rollers (shape) depending on the production part.
- Definition of the interfaces in the production cell/line (connection to the robot hand as standard).
- Definition and clearance of the integration of the roller hemming tool regarding process control system

Further consultancy services can be ordered against defined hourly rates and work performance records.



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ROBOT-GUIDANCE

Robot Vision Systems

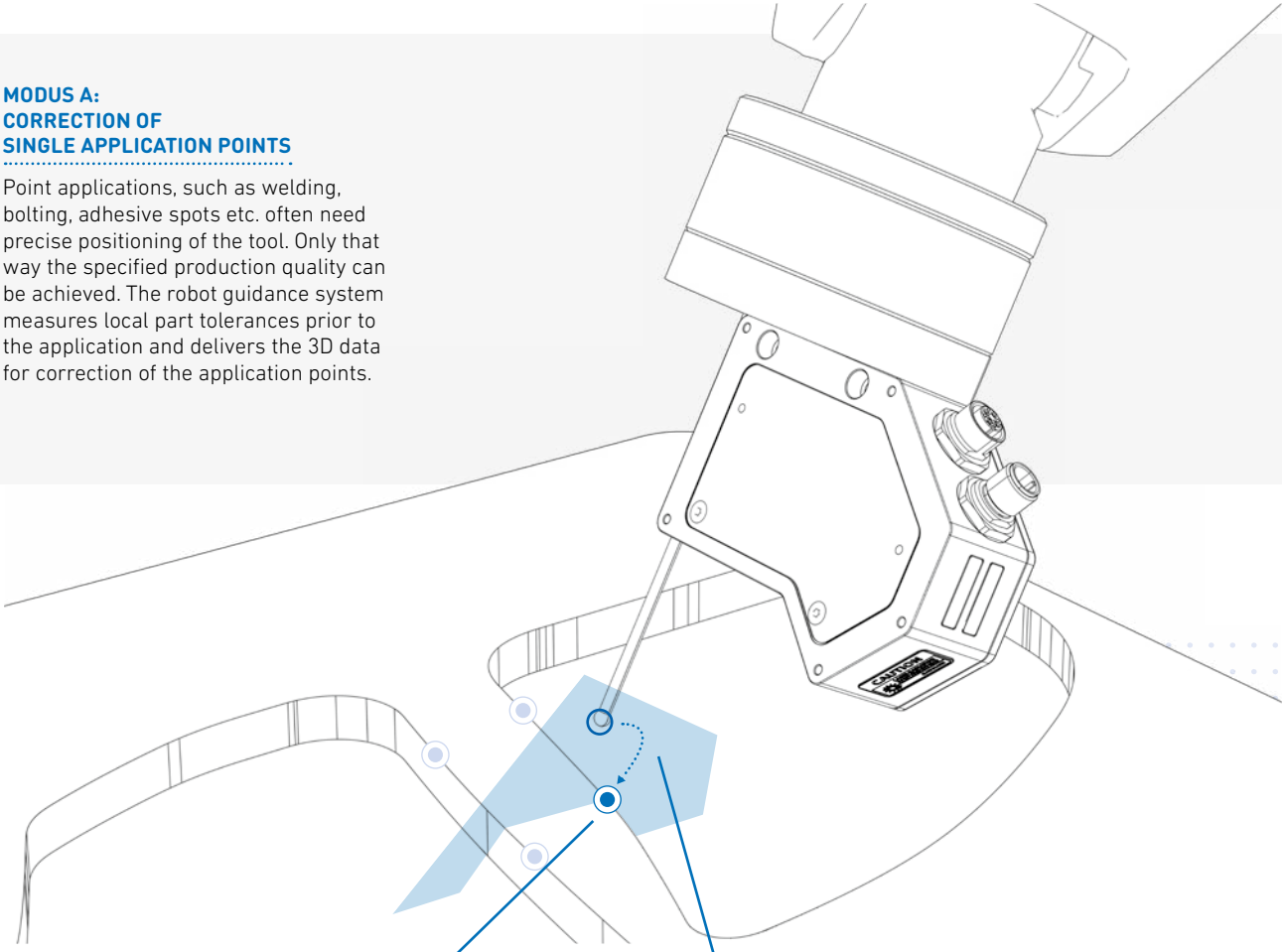
Simple by Design

EN

The ROBOT GUIDANCE SYSTEM can be operated in different modi. You can guide your tool independently per characteristic or adjust the complete position of the part. You will find the explanation for both modi on the following pages.

MODUS A: CORRECTION OF SINGLE APPLICATION POINTS

Point applications, such as welding, bolting, adhesive spots etc. often need precise positioning of the tool. Only that way the specified production quality can be achieved. The robot guidance system measures local part tolerances prior to the application and delivers the 3D data for correction of the application points.



1. MEASURING OF A "CORRECTION VECTOR" FOR EVERY APPLICATION POINT

Through the measurement with VISIONSCANNER2 deviations of the appliation points are acquired. The specification of the ideal application points through calibration or CAD data enables the system to determine the "correction vectors".

2. USAGE OF THE CORRECTION VECTOR FOR EACH POSITION OF THE APPLICATION

The determined correction vectors can be used as TCP- or FRAME-corrections.

MODUS A OFFERS TWO PROCESS SEQUENCES:

- measuring, measuring, ..., applying, applying, ...
- measuring, applying, measuring, applying, ...

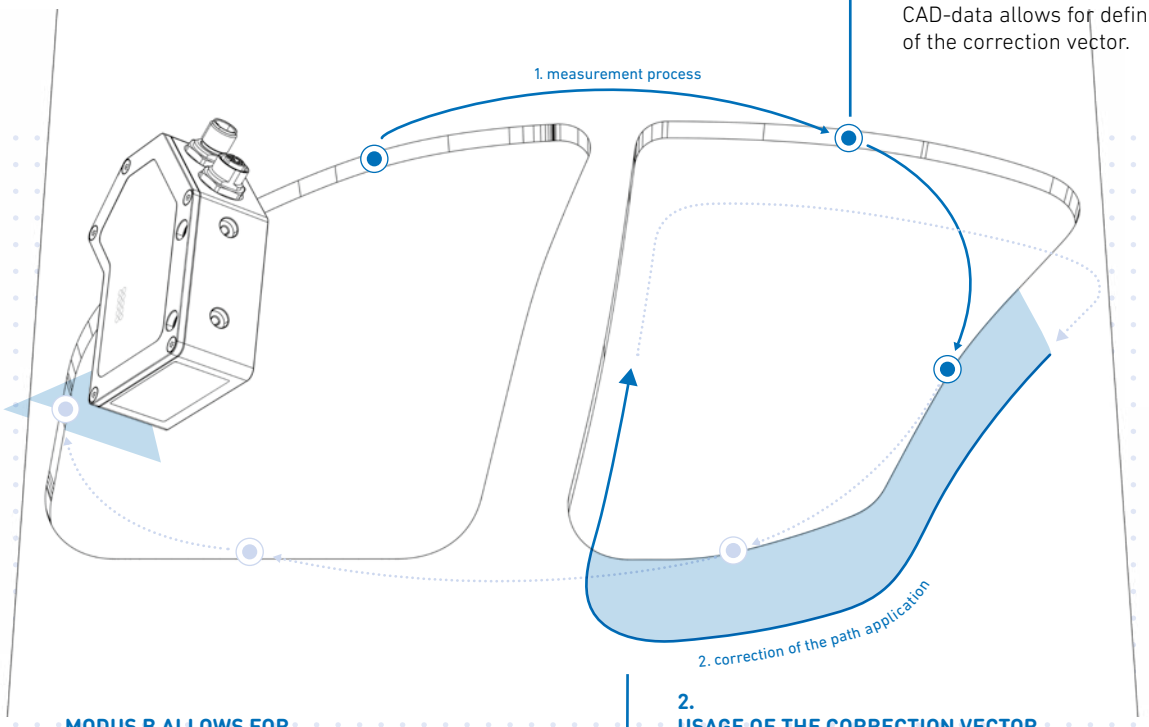
ROBOT-GUIDANCE

MODUS B:
CORRECTION OF THE COMPLETE APPLICATION PROGRAM

Path and handling application such as adhesive applications, welding or assembly processes need a precise positioning of path or part. Thus, the mandatory production quality can be achieved. The ROBOTGUIDANCE System measures the part at several features and delivers a 6D correction vector for the complete part.

1.
MEASURING OF THE CORRECTION VECTOR FOR THE COMPLETE PART

Global deviations in part position are detected through measuring of several features of the part. The default ideal part position through measurement or CAD-data allows for definition of the correction vector.



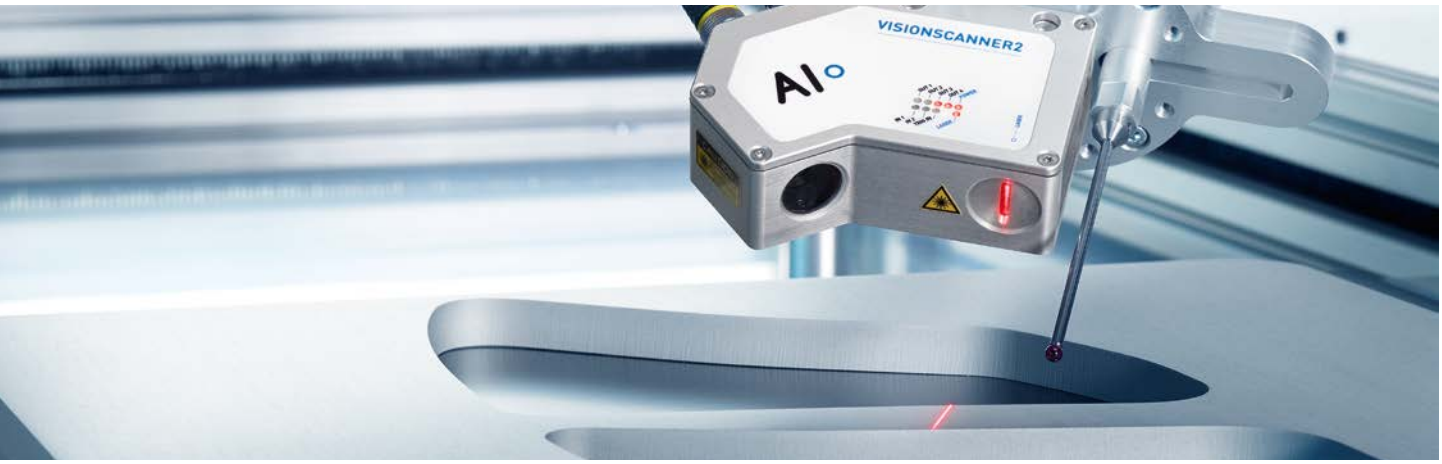
MODUS B ALLOWS FOR TWO PROCESS SEQUENCES AS WELL:

Measuring of all relevant positions
◦ after each other with one sensor
◦ at the same time with multiple sensors

2.
USAGE OF THE CORRECTION VECTOR FOR THE GLOBAL PART POSITION

The determined correction vector is used as FRAME correction data. Thereby the global application program is being shifted.

THE PROPERTIES ◦ ROBOTGUIDANCE ◦ AI



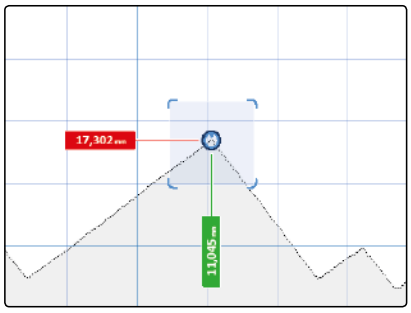
Positioning of your robot through AI◦ ROBOTGUIDANCE. We determine the pertaining correction for your robot to compensate tolerances in the part or system and guide your robot to the desired location.

- 3D local correction with one measurement. (2 translations, 1 rotation)
- 6D correction for the global part position through a combination of minimum 3 measurements. (3 translations, 3 rotations)
- Depending on the situation, sensors can be integrated into the production line in a stationary set up or can be attached to a robot.
- Delivery of a technology package for robot communication.
- Fast integration into the robot program through simple "Inline-Form-Commands".
- Short measuring time of 200 ms (example: 5 measuring points; 1.5 s time for robot moves: 5 × (0.2 s + 1.5 s) = 8.5 s additional process time)
- High accuracy: 0.2 mm (assumption: 0.1 mm robot and 0.1 measurement inaccuracy. Multiple measurement points do not decrease accuracy)
- Low maintenance: Sensors are easy to exchange. (please see "commissioning and maintenance")

AI◦ VISIONSCANNER2 is being delivered with multiple measuring tools. Thereby it solves most of your measuring tasks already.

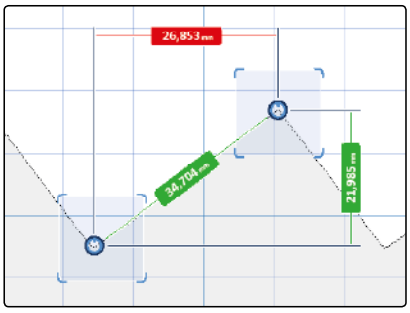
POSITION

E. g. increase the positioning accuracy of your production process.



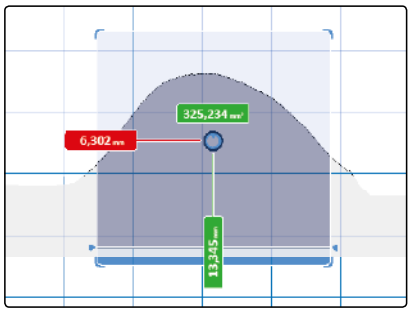
DISTANCE

100 % checks of important dimensions of your product.



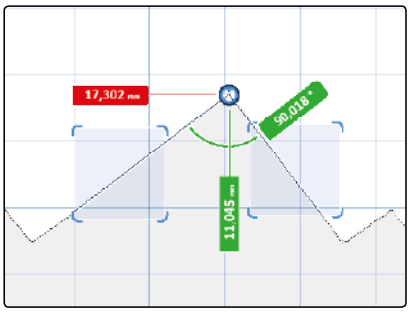
AREA

E. g. regulation of adhesive load during application.



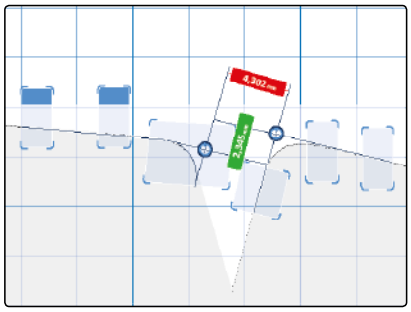
ANGLE

Secure e. g. the quality of your bending process.



GAP

Track e. g. the accuracy of assembling automotive closures into a car body.



YOUR TASK

We develop customized solutions for your needs.

CONFIGURE, VISUALIZE & CONTROL TASKS ◦ ROBOTGUIDANCE ◦ AI

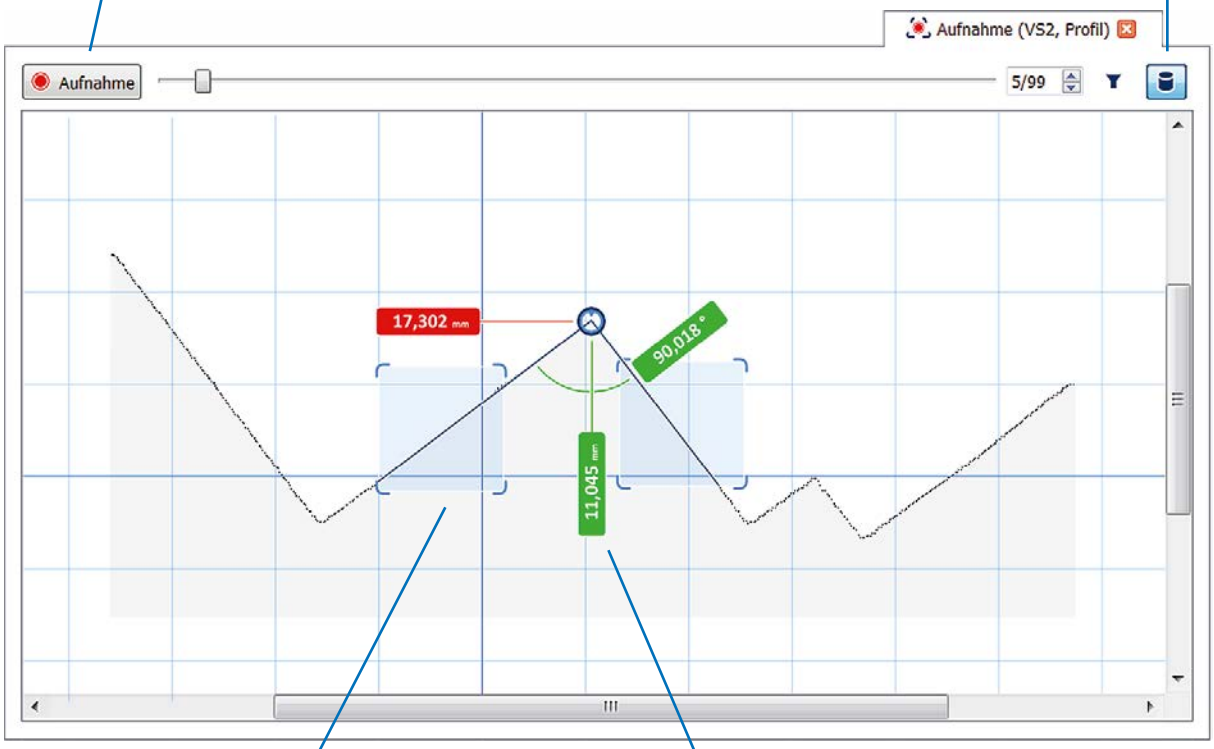
Put your measuring, control or robot guidance task in effect within shortest time. Therefore a fully integrated, graphical user interface is at your disposal. Programming skills are not required. Keep the system under control and use data from a previous period for analysis.

LIVE VIEW

Configure your measuring tasks online based on live data.

DATABASE OF DEFECT CHARACTERISTICS

Control and optimize your measuring tasks offline based on saved measuring data.



GRAPHICAL PARAMETER SETTING

Fast and precise system configuration through intuitive graphical setting of parameters.

MEASURING AND CONTROL DATA

The graphical visualization offers a simple overview over measuring and control data.

DIFFICULT OBJECT PROPERTIES & ENVIRONMENTAL CONDITIONS ◦ ROBOTGUIDANCE ◦ AI

AI◦ VISIONSCANNER2 uses multiple mechanisms to ensure a robust profile reading. Thereby it is perfectly applicable also to difficult measuring tasks in todays production environments.

1.
BANDPASS FILTER

Reduction of system errors incidence of extraneous light.

2.
ROBUST EXTRACTION OF LASER LINE

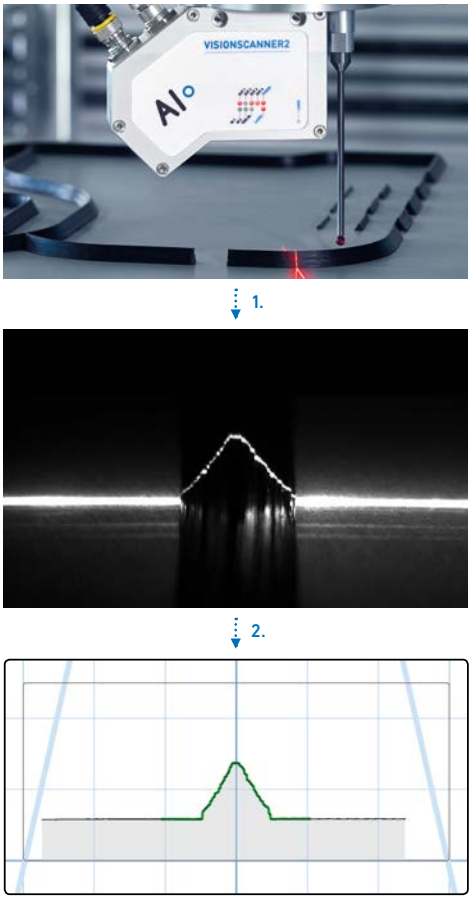
Automatic resolution of ambiguity by reflection or scattered light. Extraction of the laser line simultaneously between light and dark lines.

3.
PREPROCESSING OF PROFILES

Morphological filter for elimination of flaw.

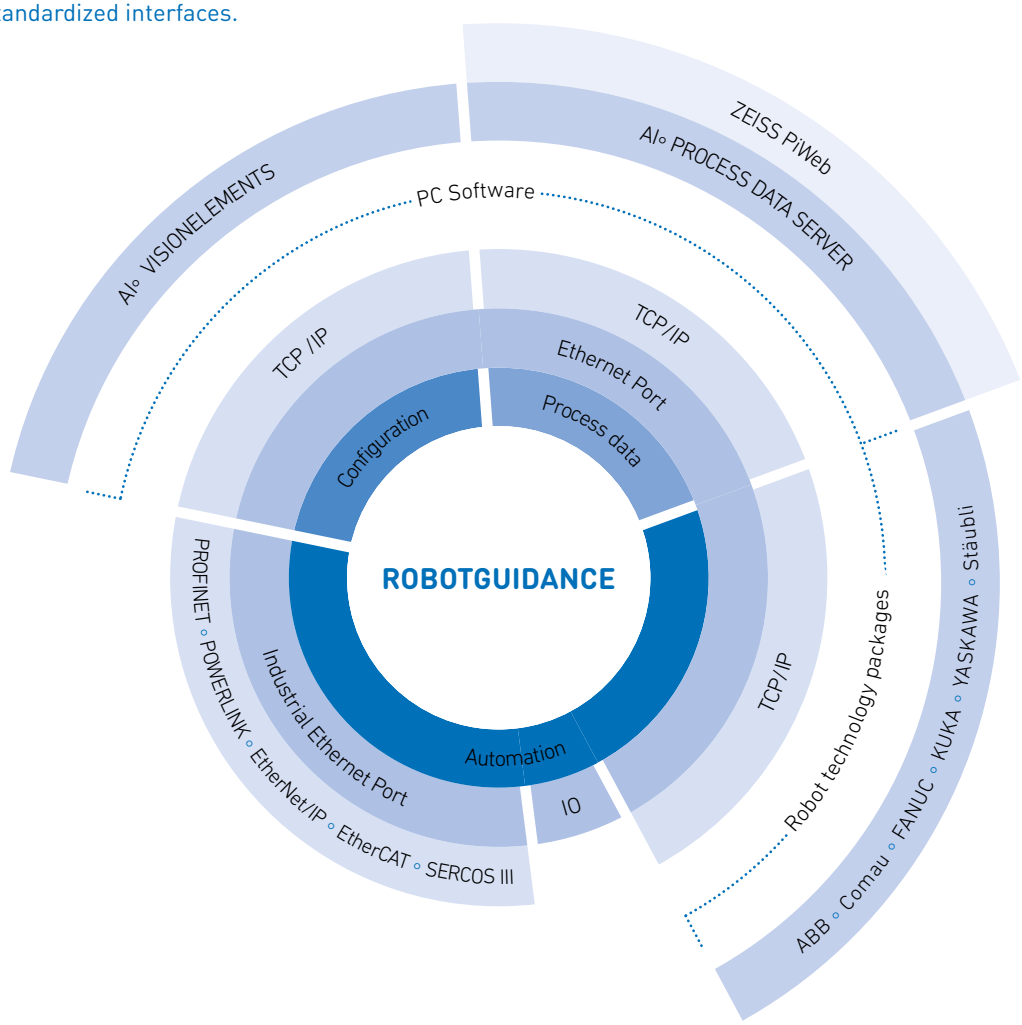
4.
DYNAMIC ADJUSTMENT OF LIGHT EXPOSURE

Verification of line intensity in a defined area of the measuring location. Adjustment to optimal illumination also for scanning processes.



THE INTERFACES ◦ ROBOTGUIDANCE ◦ AI

The strength of AI◦ VISIONSCANNER2 is its ability for integration. We offer multiple industrially standardized interfaces.

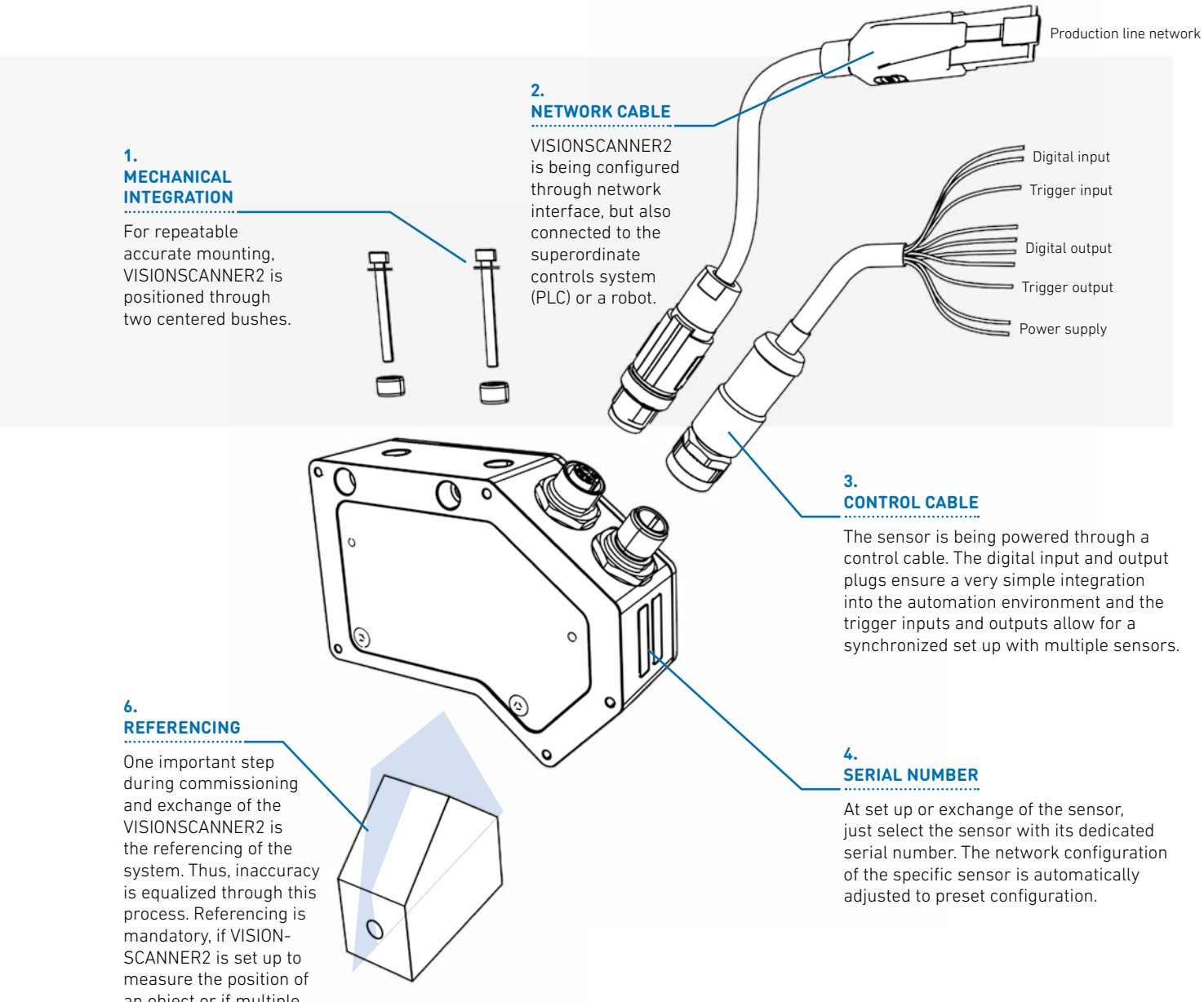


····· Software products or software options which need to be installed on a robot or PC.

AUTOMATION INTERFACE TCP/IP ◦ INTERFACE

Robot Manufacturer	Supported Controllers	Mandatory Options
KUKA	KRC2, KRC4, VKRC2, VKRC4	KUKA.Ethernet KRL XML
Stäubli	CS7, CS8, CS9	–
FANUC	RJ3iB, R30iA, R30iB	SKMG Socket Messaging, R648 User Socket Messaging
ABB	IRC5	PC-Interface Option 616-1
YASKAWA	DX200	MotoPlus
Comau	C5G	PDL2 Read/Write on TCP/IP

Within only few steps AI◦ VISIONSCANNER2 is fully integrated into the automation environment. Next to simple mechanical and electrical setting, the development has been carried out specifically in regards to network configuration and creation of measuring programs.



1.
MECHANICAL INTEGRATION

For repeatable accurate mounting, VISIONSCANNER2 is positioned through two centered bushes.

2.
NETWORK CABLE

VISIONSCANNER2 is being configured through network interface, but also connected to the superordinate controls system (PLC) or a robot.

3.
CONTROL CABLE

The sensor is being powered through a control cable. The digital input and output plugs ensure a very simple integration into the automation environment and the trigger inputs and outputs allow for a synchronized set up with multiple sensors.

4.
SERIAL NUMBER

At set up or exchange of the sensor, just select the sensor with its dedicated serial number. The network configuration of the specific sensor is automatically adjusted to preset configuration.

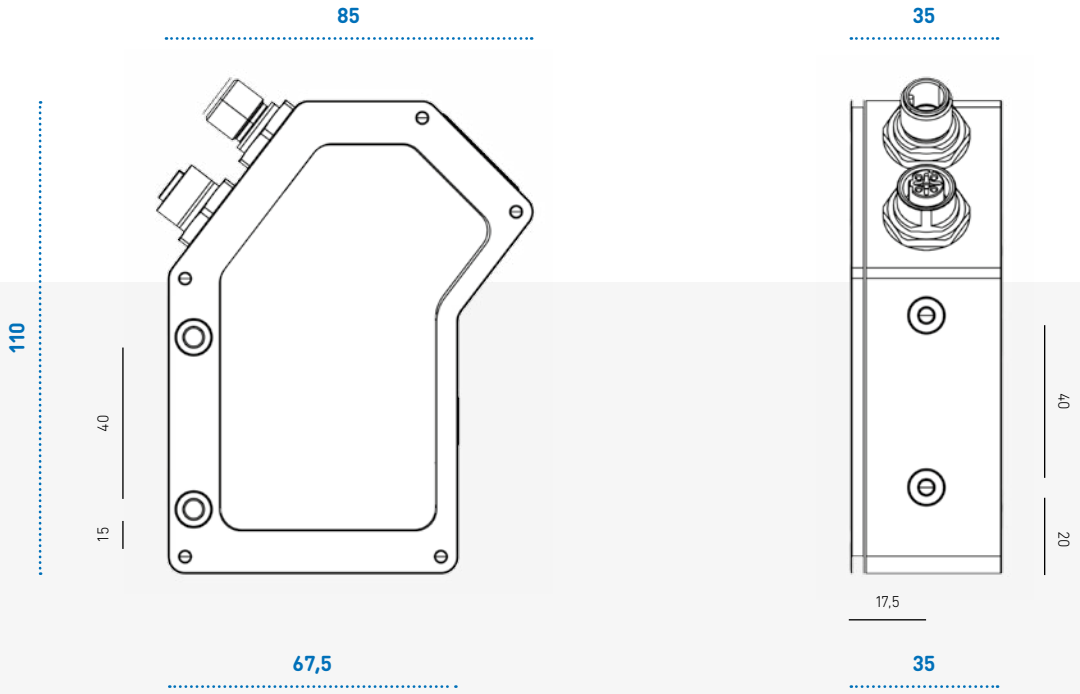
5.
CONFIGURATION

After mechanical and electrical commissioning of the automation environment, measurement tasks can be created. The integrated automation interface can be configured. Now, measuring tasks can be triggered by the superordinate system and measuring and control data can be drawn. Extended feature is the process data interface, which allows for control of the measuring process and specifically the quality of the product being measured.

6.
REFERENCING

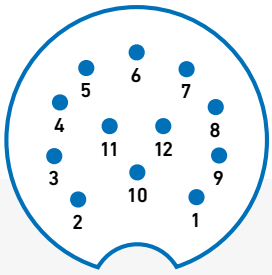
One important step during commissioning and exchange of the VISIONSCANNER2 is the referencing of the system. Thus, inaccuracy is equalized through this process. Referencing is mandatory, if VISION-SCANNER2 is set up to measure the position of an object or if multiple sensors are used for one coherent measuring system.

TECHNICAL DATA ◦ ROBOTGUIDANCE ◦ AI

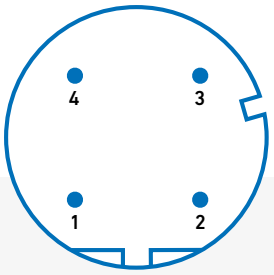


Sensor Technology	CMOS Sensor
Reading speed	up to 200 Hz
Measuring accuracy	± 0,2 % of measuring field, depending on feature and surface property
Laser	Laser Class 1 at 660 nm
Lifetime laser	40.000 h (independent from cycle of operation)
Interface	Fast Ethernet 10/100 Mbit, Half-/Fullduplex, Auto negotiation
Power supply	24 V DC, max. 400 mA

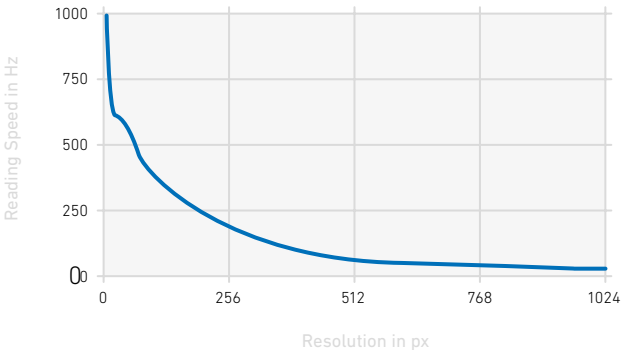
Size	110 x 85 x 35 mm
Weight	ca. 400 g
Protection class	IP 64
Housing	Aluminium, eloxated
Environmental conditions for warehousing	–20 up to 60 °C, humidity max. 90 %
Environmental conditions during operation	0 up to 55 °C, humidity max. 80 %
Registrations	CE, UL



Pin-No.	Signal	Comment	For 4 and 8 pin control cable different pin may apply		
1	OUT 2	Digital output 2	**8**	IN 1	Digital input 1
2	TRIG IN	Trigger input	**9**	+ 24 V DC	Power supply
3	OUT 1	Digital output 1	**10**	TRIG OUT	Trigger output
4	OUT 3	Digital output 3	**11**	+ 24 V DC	Power supply
5	IN 2	Digital input 2	**12**	+ 24 V DC	Power supply
6	OUT 4	Digital output 4			
7	GND, 0 V	Ground, 0 V power supply	**shield**		Pin 7 = ground connected



Pin-No.	Signal	Comment
1	Tx +	Output data Ethernet +
2	Rx +	Input data Ethernet +
3	Tx –	Output data Ethernet –
4	Rx –	Input data Ethernet –



Resolution in px	Reading Speed in Hz
1280 × 64	588
1280 × 128	336
1280 × 256	181
1280 × 512	93
1280 × 768	63
1280 × 1024	50

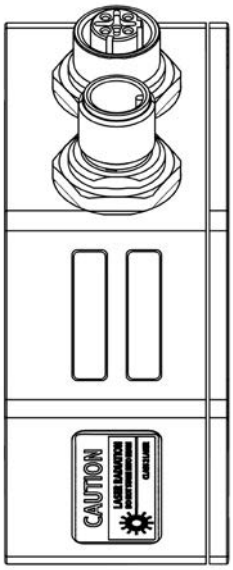
VS2-RFFAA-PPPWWW-SSE

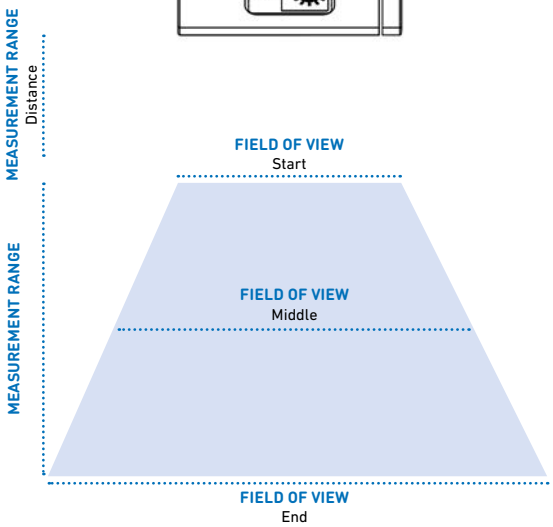
CAMERA LASER INTERFACE

CAMERA		Code	Value
R	Resolution	L	752 × 480 px
		H	1280 × 1024 px
		U	2592 × 1944 px
F	Focal Distance	08	8 mm
		12	12 mm
		16	16 mm
A	Angle of Triangulation	30	30°
		37	37,5°
		45	45°

LASER		Code	Value
P	Power	100	100 mW
W	Wavelength	660	660 nm

INTERFACE		Code	Value
S	Control Cable	04	4-pin
		08	8-pin
		12	12-pin
E	Ethernet Cable	F	Fast Ethernet
		I	Industrial Ethernet





MODELL		VS2-H08			VS2-H12			VS2-H16		
Angle of Triangulation		45°	37°	30°	45°	37°	30°	45°	37°	30°
MEASUREMENT RANGE Distance	mm	26	35	50	38	50	65	45	60	75
MEASUREMENT RANGE	mm	100	145	250	55	75	125	35	50	80
MEASUREMENT RANGE Resolution	mm / px	0,10	0,14	0,25	0,05	0,08	0,12	0,035	0,05	0,08
FIELD OF VIEW Start	mm	55	60	65	35	40	45	27	30	35
FIELD OF VIEW Middle	mm	88	110	158	48	58	78	32	38	50
FIELD OF VIEW End	mm	120	160	250	60	75	110	37	45	65
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VISIONSCANNER2
AI O
OUT 1
OUT 2
OUT 3
OUT 4
POWER
IN 1
IN 2
TRIG IN
LASER
LASER
No. 000 001
05.2016

THE ADVANTAGES ◦ ROBOTGUIDANCE ◦ AI

COMMUNICATIVE

Interface to robot or PLC through
Industrial Ethernet, TCP/IP or IO

ROBUST

Automatic adjustment of illumination
and reflexion compensation of the
laser line for extreme conditions

SMART

No PC needed during operation

SIMPLE

Graphic configuration
without programming skills

ALLROUNDER

Detection, measuring, verification
and control on one device

FUNCTIONAL

User and change management,
configuration and fault analysis using
PC software VISIONELEMENTS.

POWERFUL

Laser triangulation is possible
on almost any surface

SMALL BUT IMPRESSIVE

Suitable for industrial use, compact design

AUTOMATION INTERFACE

We know the challenges manufacturing companies have to handle complex production systems to enhance their own competitiveness. Our products offer the highest level of comfort and only need little specialist knowledge by using comfortable interfaces for various robots and control systems.

ADAPTIVE IMAGING

AI◦ stands out through optimal integration capability as well as highest user friendliness, specifically in regards to the requirements of todays complex production scenarios. The components can be integrated without special programming skills.

ARTIFICIAL INTELLIGENCE

Thanks to many years of experience in dealing with industrial robots in the automotive industry, we understand the requirements for quality and process optimization in production environments for various products. Therefore, we deliver sensors and pertaining intelligence in an integrated machine vision solution.

ALL INCLUSIVE

We offer various possibilities for our customers, from components to integrated solutions. AI◦ not only offers high value products, but also services and support for parameter setting and start up, training as well as software programming for your special requirements.

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EngRoTec-Solutions GmbH

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36088 Hünfeld

+49 (0) 6652 ◦ 79 39 48-0
info@ai-engrotec.de
www.ai-engrotec.de

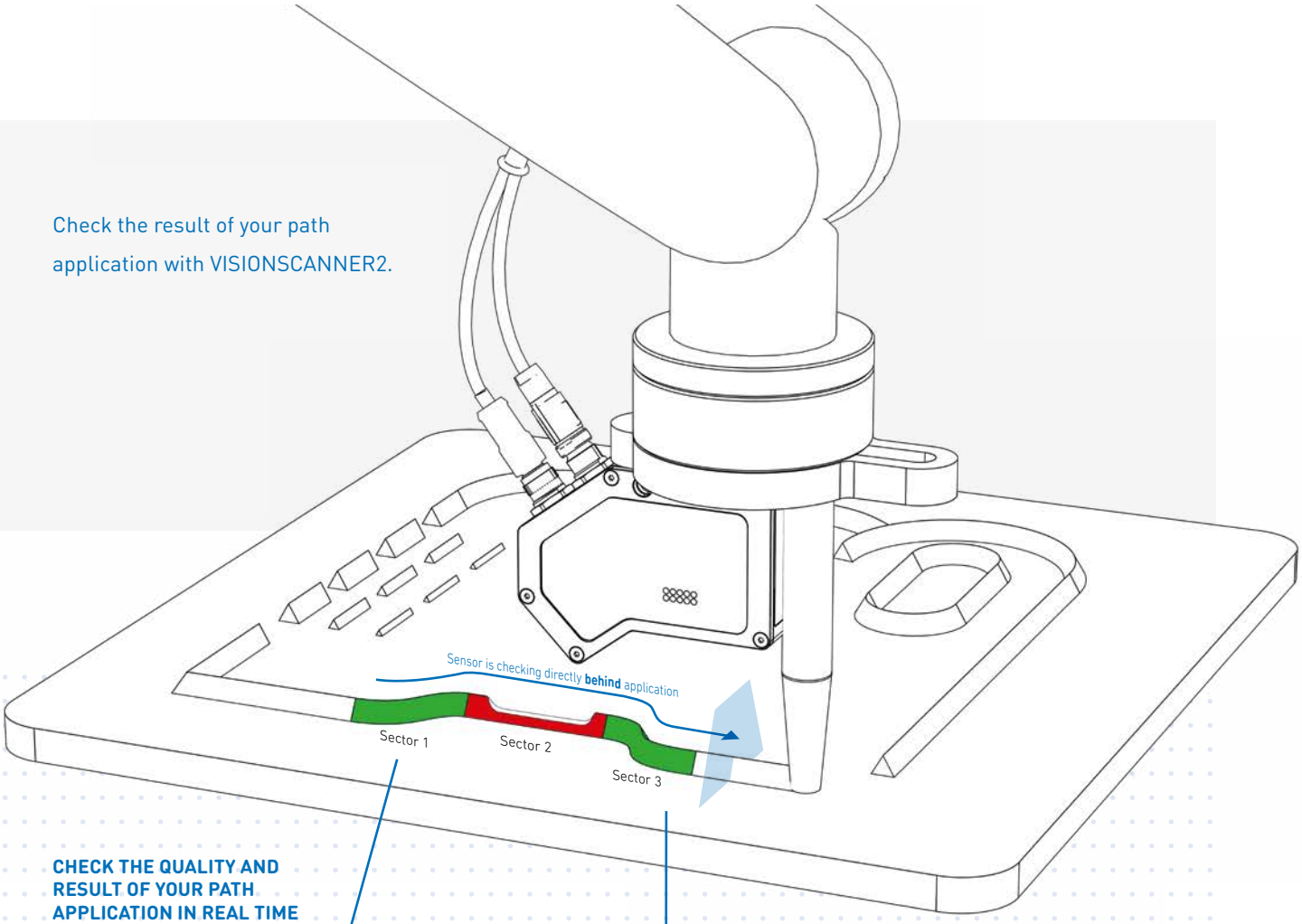
INLINE PROCESS INSPECTION

Robot Vision Systems

Simple by Design

EN

Check the result of your path application with VISIONSCANNER2.



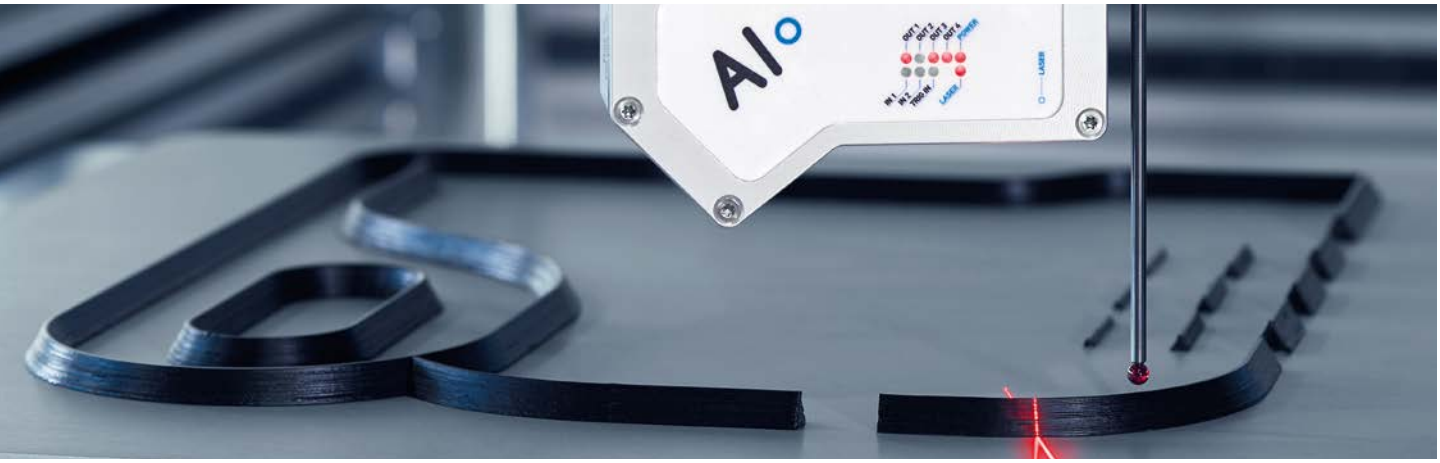
CHECK THE QUALITY AND RESULT OF YOUR PATH APPLICATION IN REAL TIME

Whether adhesive application or hemming edge: Check the result of your application with VISIONSCANNER2 in real time. Deviations are measured precisely.

SET INDIVIDUAL PARAMETERS FOR TOLERANCES AND VERIFICATION PER SECTOR

The path application can be divided in multiple sectors. Per sector different parameters for checking with pertaining tolerances and limits can be configured. Use the result per sector as criteria for decision making for the following processes (e.g. rework station).

INLINE PROCESS INSPECTION



Check your path application through assistance of INLINE PROCESS INSPECTION by AI◦. Whether adhesive bead, hemming seam or brazed joint, VISIONSCANNER2 is dependably checking the result of your path application real time.

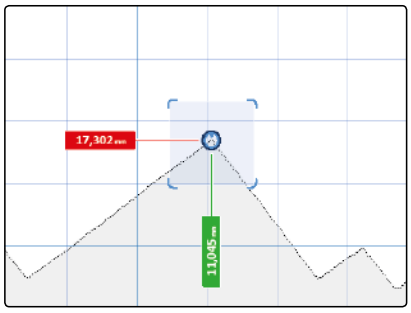
- Savings of cycle time through inline measuring.
- 100 % checking of your application results.
- Statistics with minimum, maximum and average per sector.
- Useful reports with interface to a data base (Zeiss PiWeb).
- Detection of waste or rework through feedback of overall result per part.
- High diversity for individual parameter setting per sector.
- Possibility for multiple checks simultaneously.
- Secure detection of start and end of application path.
- Small and large radii possible through adjustable sensor optics.

THE MEASUREMENTS ◦ INLINE PROCESS INSPECTION ◦ AI

AI◦ VISIONSCANNER2 is being delivered with multiple measuring tools. Thereby it solves most of your measuring tasks already.

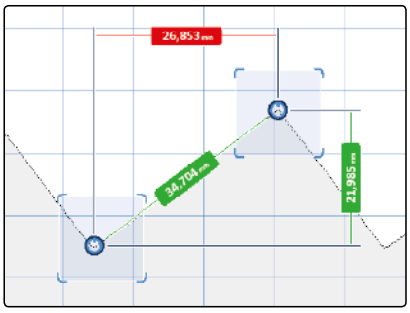
POSITION

E. g. increase the positioning accuracy of your production process.



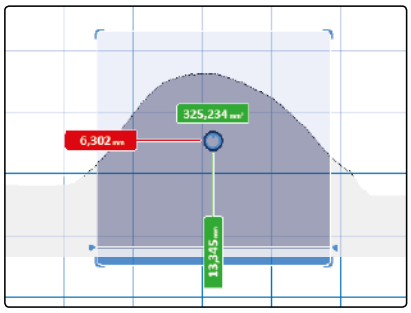
DISTANCE

100 % checks of important dimensions of your product.



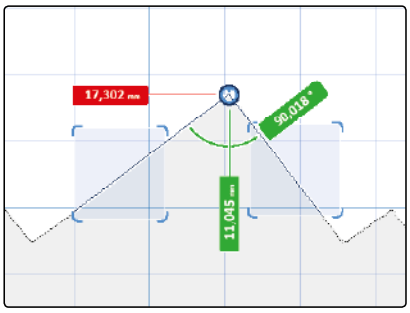
AREA

E. g. regulation of adhesive load during application.



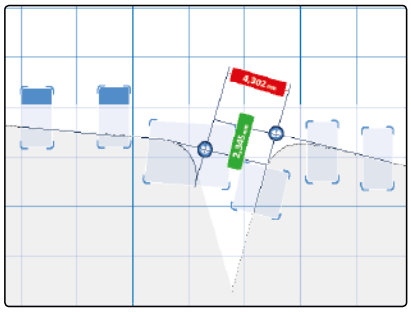
ANGLE

Secure e. g. the quality of your bending process.



GAP

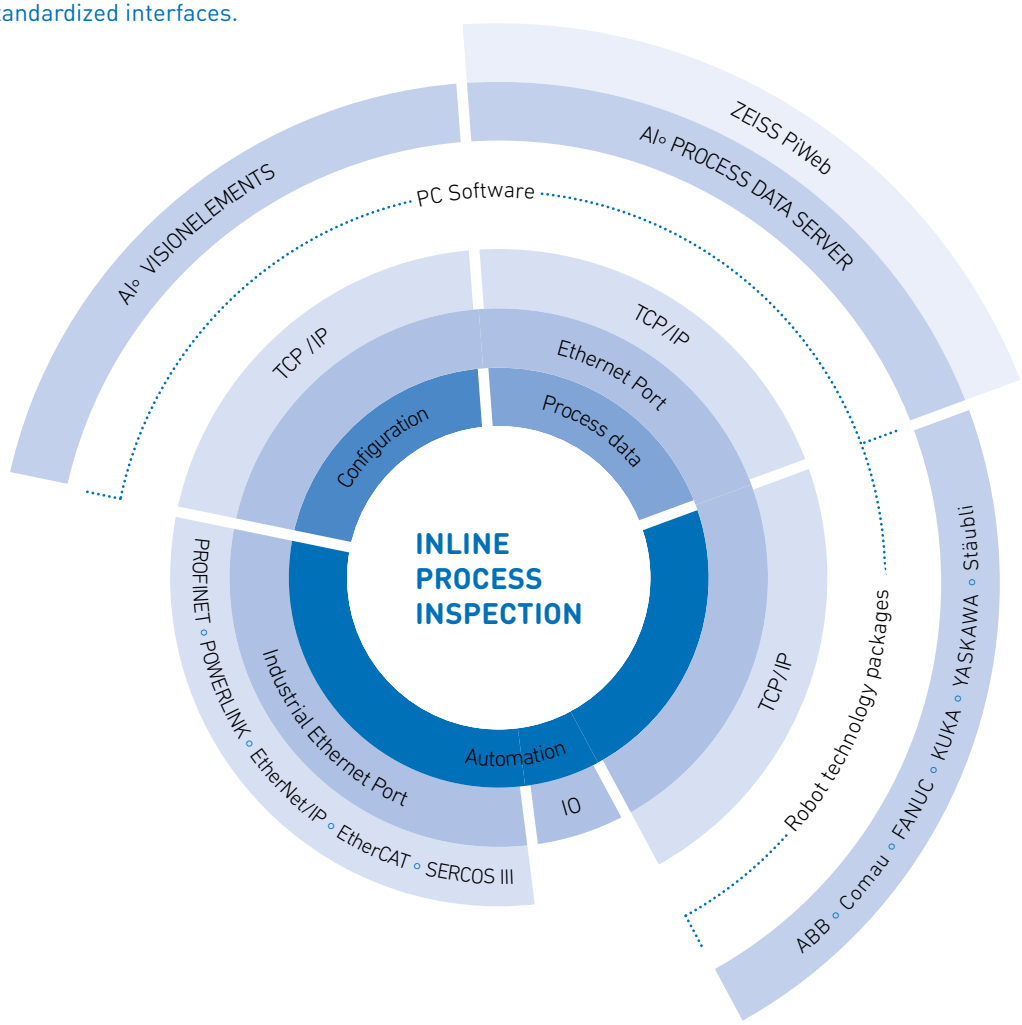
Track e. g. the accuracy of assembling automotive closures into a car body.



YOUR TASK

We develop customized solutions for your needs.

The strength of AI◦ VISIONSCANNER2 is its ability for integration. We offer multiple industrially standardized interfaces.



····· Software products or software options which need to be installed on a robot or PC.

AUTOMATION INTERFACE TCP/IP ◦ INTERFACE

Robot Manufacturer	Supported Controllers	Mandatory Options
KUKA	KRC2, KRC4, VKRC2, VKRC4	KUKA.Ethernet KRL XML
Stäubli	CS7, CS8, CS9	–
FANUC	RJ3iB, R30iA, R30iB	SKMG Socket Messaging, R648 User Socket Messaging
ABB	IRC5	PC-Interface Option 616-1
YASKAWA	DX200	MotoPlus
Comau	C5G	PDL2 Read/Write on TCP/IP

CONFIGURE, VISUALIZE & CONTROL TASKS ◦ INLINE PROCESS INSPECTION ◦ AI

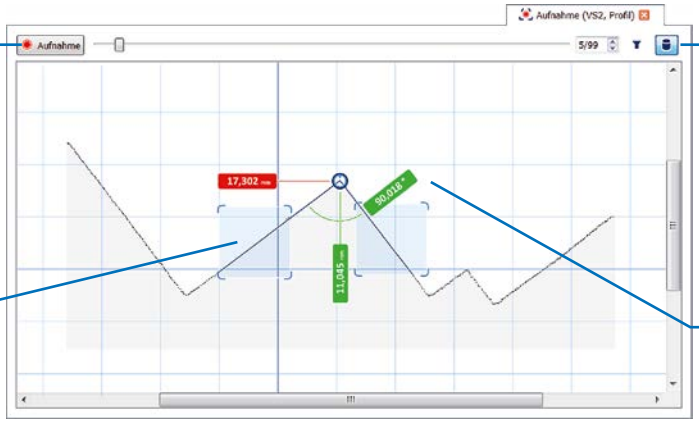
Put your measuring, control or robot guidance task in effect within shortest time. Therefore a fully integrated, graphical user interface is at your disposal. Programming skills are not required. Keep the system under control and use data from a previous period for analysis.

LIVE VIEW

Configure your measuring tasks online based on live data.

GRAPHICAL PARAMETER SETTING

Fast and precise system configuration through intuitive graphical setting of parameters.



DATABASE OF DEFECT CHARACTERISTICS

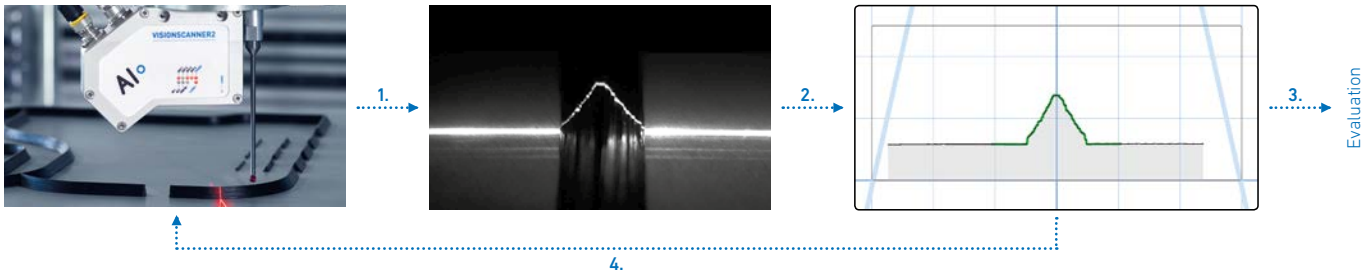
Control and optimize your measuring tasks offline based on saved measuring data.

MEASURING AND CONTROL DATA

The graphical visualization offers a simple overview over measuring and control data.

DIFFICULT OBJECT PROPERTIES & ENVIRONMENTAL CONDITIONS ◦ VISIONSCANNER2 ◦ AI

AI◦ VISIONSCANNER2 uses multiple mechanisms to ensure a robust profile reading. Thereby it is perfectly applicable even to difficult measuring tasks in todays production environments.



1. BANDPASS FILTER

Reduction of system errors incidence of extraneous light.

2. ROBUST EXTRACTION OF LASER LINE

Automatic resolution of ambiguity by reflection or scattered light. Extraction of the laser line simultaneously between light and dark lines.

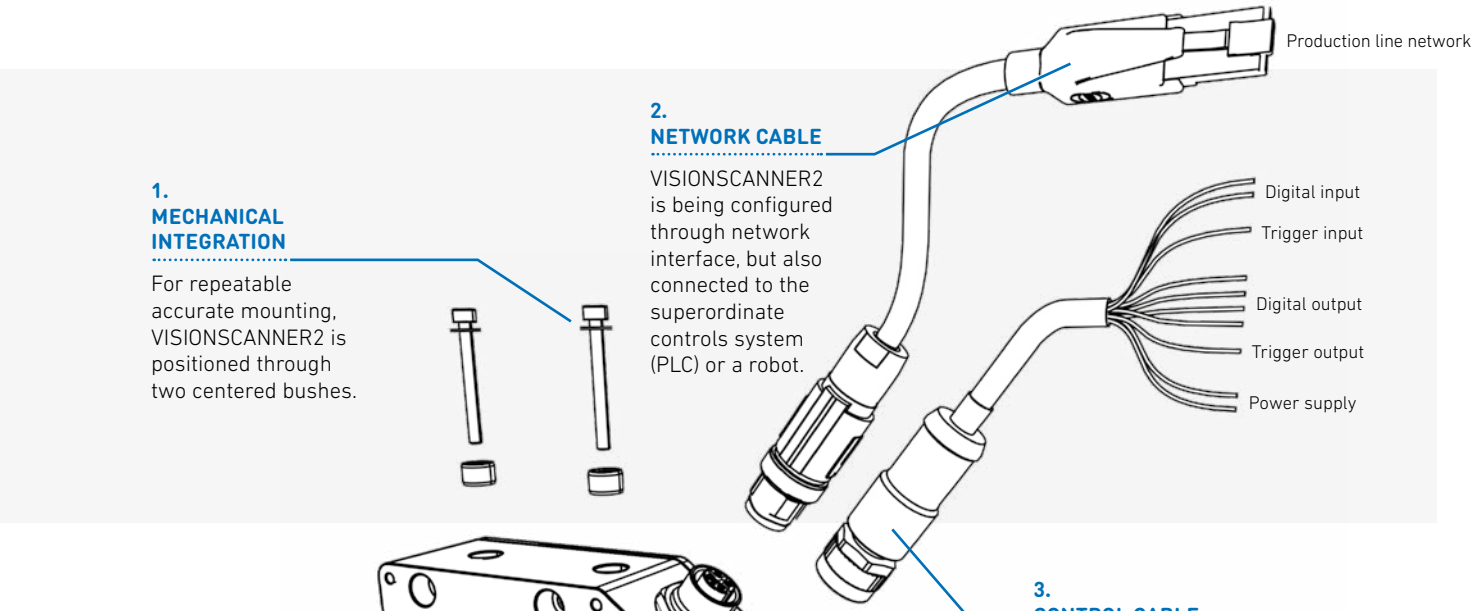
3. PREPROCESSING OF PROFILES

Morphological filter for elimination of noise.

4. DYNAMIC ADJUSTMENT OF LIGHT EXPOSURE

Verification of line intensity in a defined area of the measuring location. Adjustment to optimal illumination also for scanning processes.

Within only few steps AI◦ VISIONSCANNER2 is fully integrated into the automation environment. Next to simple mechanical and electrical setting, the development has been carried out specifically in regards to network configuration and creation of measuring programs.



1.
MECHANICAL INTEGRATION

For repeatable accurate mounting, VISIONSCANNER2 is positioned through two centered bushes.

2.
NETWORK CABLE

VISIONSCANNER2 is being configured through network interface, but also connected to the superordinate controls system (PLC) or a robot.

3.
CONTROL CABLE

The sensor is being powered through a control cable. The digital input and output plugs ensure a very simple integration into the automation environment and the trigger inputs and outputs allow for a synchronized set up with multiple sensors.

4.
SERIAL NUMBER

At set up or exchange of the sensor, just select the sensor with its dedicated serial number. The network configuration of the specific sensor is automatically adjusted to preset configuration.

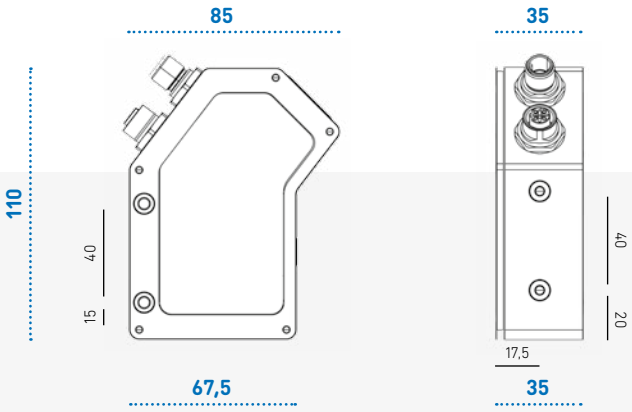
5.
CONFIGURATION

After mechanical and electrical commissioning of the automation environment, measurement tasks can be created. The integrated automation interface can be configured. Now, measuring tasks can be triggered by the superordinate system and measuring and control data can be drawn. Extended feature is the process data interface, which allows for control of the measuring process and specifically the quality of the product being measured.

6.
REFERENCING

One important step during commissioning and exchange of the VISIONSCANNER2 is the referencing of the system. Thus, inaccuracy is equalized through this process. Referencing is mandatory, if VISION-SCANNER2 is set up to measure the position of an object or if multiple sensors are used for one coherent measuring system.

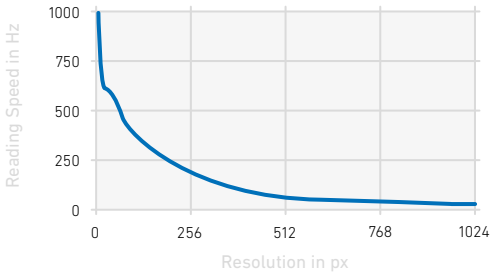
TECHNICAL DATA ◦ INLINE PROCESS INSPECTION ◦ AI



Sensor Technology	CMOS Sensor
Reading speed	up to 200 Hz
Measuring accuracy	± 0,2 % of measuring field, depending on feature and surface property
Laser	Laser Class 1 at 660 nm
Lifetime laser	40.000 h (independent from cycle of operation)
Interface	Fast Ethernet 10/100 Mbit, Half-/Fullduplex, Auto negotiation
Power supply	24 V DC, max. 400 mA

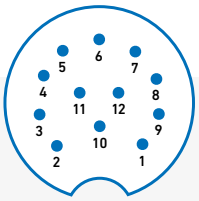
Size	110 x 85 x 35 mm
Weight	ca. 400 g
Protection class	IP 64
Housing	Aluminium, eloxated
Environmental conditions for warehousing	–20 up to 60 °C, humidity max. 90 %
Environmental conditions during operation	0 up to 55 °C, humidity max. 80 %
Registrations	CE, UL

READING SPEED ◦ TECHNICAL DATA

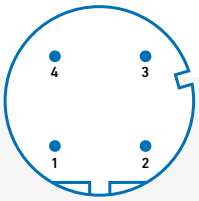


Resolution in px	Reading Speed in Hz
1280 × 64	588
1280 × 128	336
1280 × 256	181
1280 × 512	93
1280 × 768	63
1280 × 1024	50

CONNECTIONS ◦ TECHNICAL DATA



Pin-No.	Signal	Comment	For 4 and 8 pin control cable different pin may apply		
1	OUT 2	Digital output 2	**8**	IN 1	Digital input 1
2	TRIG IN	Trigger input	**9**	+ 24 V DC	Power supply
3	OUT 1	Digital output 1	**10**	TRIG OUT	Trigger output
4	OUT 3	Digital output 3	**11**	+ 24 V DC	Power supply
5	IN 2	Digital input 2	**12**	+ 24 V DC	Power supply
6	OUT 4	Digital output 4			
7	GND, 0 V	Ground, 0 V power supply	**shield**		Pin 7 = ground connected



Pin-No.	Signal	Comment
1	Tx +	Output data Ethernet +
2	Rx +	Input data Ethernet +
3	Tx –	Output data Ethernet –
4	Rx –	Input data Ethernet –

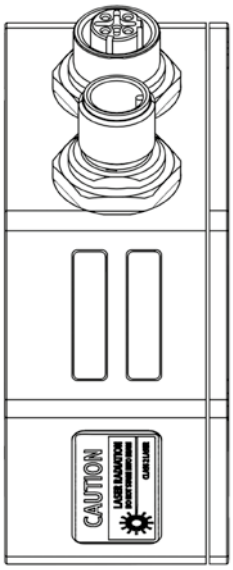
VS2-RFFAA-PPPWWW-SSE

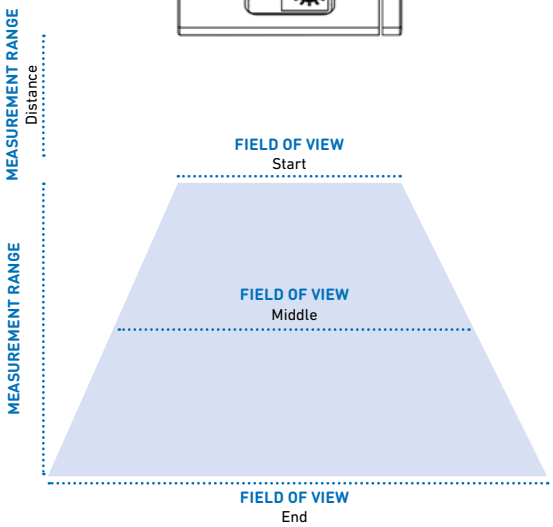
CAMERA LASER INTERFACE

CAMERA		Code	Value
R	Resolution	L	752 × 480 px
		H	1280 × 1024 px
		U	2592 × 1944 px
F	Focal Distance	08	8 mm
		12	12 mm
		16	16 mm
A	Angle of Triangulation	30	30°
		37	37,5°
		45	45°

LASER		Code	Value
P	Power	100	100 mW
W	Wavelength	660	660 nm

INTERFACE		Code	Value
S	Control Cable	04	4-pin
		08	8-pin
		12	12-pin
E	Ethernet Cable	F	Fast Ethernet
		I	Industrial Ethernet





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