

# MV.EYE MI1

## Inspection System for Microfluidic Structures

Testing large surfaces with micrometer precision

ok

100% inspection in production cycle

Testing of microscopic ducts & structures

Detection of defects



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## High-speed inline inspection of large-scale microstructures

The MV.EYE MI1 inspection system represents an inline-capable vision solution for the automated inspection of large-area and microstructured components. For this purpose, the MABRI.VISION experts rely on the application of a high-speed microscope, which displays surface structures at speeds of up to 40mm/s. Thanks to optimized line illumination, precise, repeatable and high-contrast inspection results are achieved.

Whether in the field of injection molding, microelectronics or cell technology - even minor changes in process parameters can cause disruptions in the microstructure. A parallelized image processing algorithm reliably detects these shape deviations, impurities, particles or occlusions.

A high-speed camera system scans the entire surface of the test specimens with a resolution of  $0.75\mu\text{m}$ . Due to a fast processing, cycle times of less than 30s can be achieved, depending on the surface size. For shorter cycles MABRI.VISION offers a fully automated parallelization of the inspection process. The MV.EYE MI1 inspection system is designed for use in clean rooms and is equipped with an ISO class 5 ventilation unit.

Innovation is our passion: we rely on the use of AI and neural networks for efficient inspection processes. Our MV.IMAGING Software is smart as well as modular. Experience a future-oriented way of quality assurance in your production with the MV.EYE MI1 inspection system.

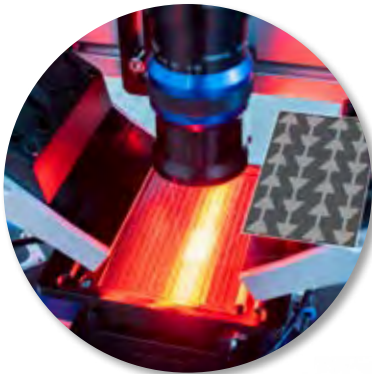
“With our MV.EYE MI1 inspection system, large surface objects can be inspected at high speed on a microscopic scale. Establish a 100% inspection in your quality control by using a MABRI.VISION highspped microscope.”

Dr. Ulrich Marx | CEO



# The inspection system for automated production processes

The MVEYE MI1 inspection system is designed for fast and optical inline inspection in the process cycle. Our automation platform offers the possibility to scale the inspection process according to your needs.



## Large-area and high-resolution inspection

The MABRI.VISION MVEYE MI1 inspection system is not only suitable for inspecting large and microstructured surfaces at high speed, but also offers precise results at high resolution. A high-speed microscope is used for this purpose, which displays the surface structures in high contrast thanks to optimized line illumination.



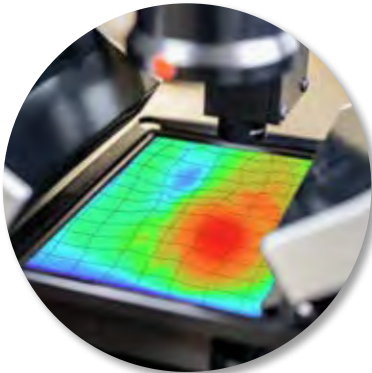
## Smart software for Structural testing

The MV.IMAGING software used in the system is capable of processing large amounts of data at high speed and performing a variety of different types of inspections. You can choose from a broad repertoire of standard modules. Our experts will be happy to extend the software with additional modules for your application.



## Inspection processes for Clean room environments

The MVEYE MI1 inspection system is designed for use in a fully automated production environment in a clean room of class 7. The integrated air filter creates class 5 conditions within the system. Large input fields with touch operation can also be operated with gloves.



## Precise focus tracking

By using a smart focus system, the MVEYE MI1 inspection solution enables focus tracking during the process. Thanks to a surface sensor, even the smallest changes in surface height are detected and precisely tracked while scanning. This allows reliable results to be delivered even for complex inspection parts.

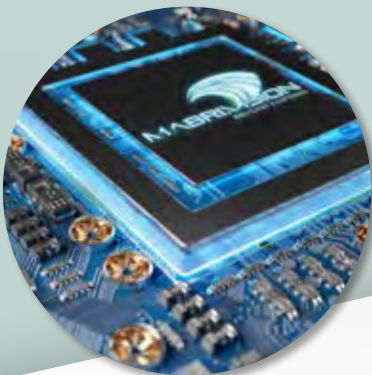


## Fast and light-intense

Through the use of TDI technology (Time Delay and Integration), the light output is increased 256 times. This means that the surface can be scanned much faster with bright illumination.

## Efficient use of AI and neural networks

MABRI.VISION relies on the use of neural networks to make inspection processes efficient and to create larger parameter spaces. Thus, anomalies are detected more reliably than with classical image processing. This is especially of advantage for unpredictable structures, where not all future production features can be anticipated.





# Camera technology, imaging and TDI

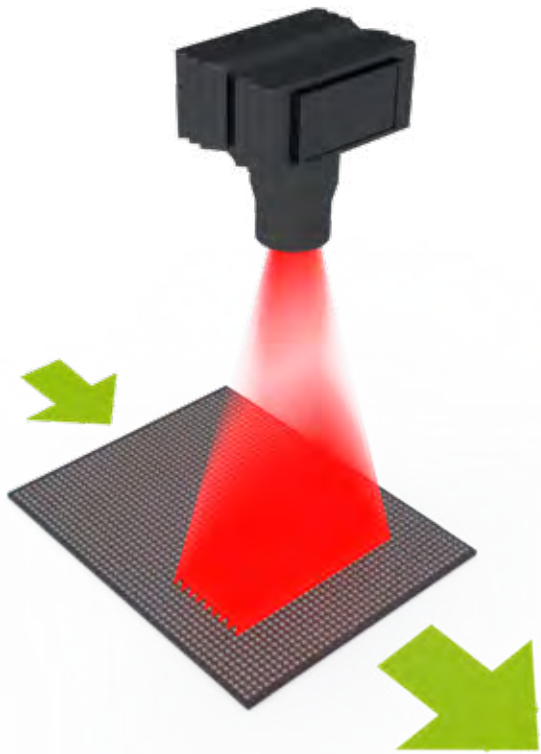
For inspection tasks with particularly fast line frequencies and a limited time period for illuminating the test specimens, MABRI.VISION uses TDI line scan cameras. The time-delay integration technology achieves higher sensitivity through successive detection stages. In contrast to conventional line scan cameras, each image line is not scanned only once, but passes through all TDI stages, successively building up the intensity of the inspection results. This allows inspections to be performed at high speed, with reduced illumination and improved depth of field.

Defects are detected with high precision via a parallelized image processing algorithm. The high-speed camera system integrated in the inspection system achieves a resolution of 0.75 µm with a line width of 17,824 pixels. The component surface is scanned with a line width of 13.37 mm. Fast processing allows cycle times of less than 30 s to be achieved, depending on the components' size.



TDI stands for „Time Delay and Integration“. When using TDI line scan cameras, the line-by-line displacement of the image sensor is synchronized with the imaging movement on the sensor, allowing object points to be integrated for longer. This in turn leads to increased sensitivity.

## Bright and low-noise images with TDI-Technology



Operation of a TDI camera



256-times luminous efficacy thanks to TDI technology

## TDI cameras specifications

Camera	Line width	Lines	Line frequency	Pixel size (µm x µm)
TDI-8K-H125	8.912	128	125kHz	7.0 x 7.0
TDI-8K-H250	8.912	128	250kHz	7.0 x 7.0
TDI-12K-H200	12.824	256	200kHz	5.0 x 5.0
TDI-18K-H142	17.824	256	142 kHz	3.5 x 3.5

Scan frequency

up to 250 kHz

Line width

up to 17 mm

Luminous efficiency

x 256



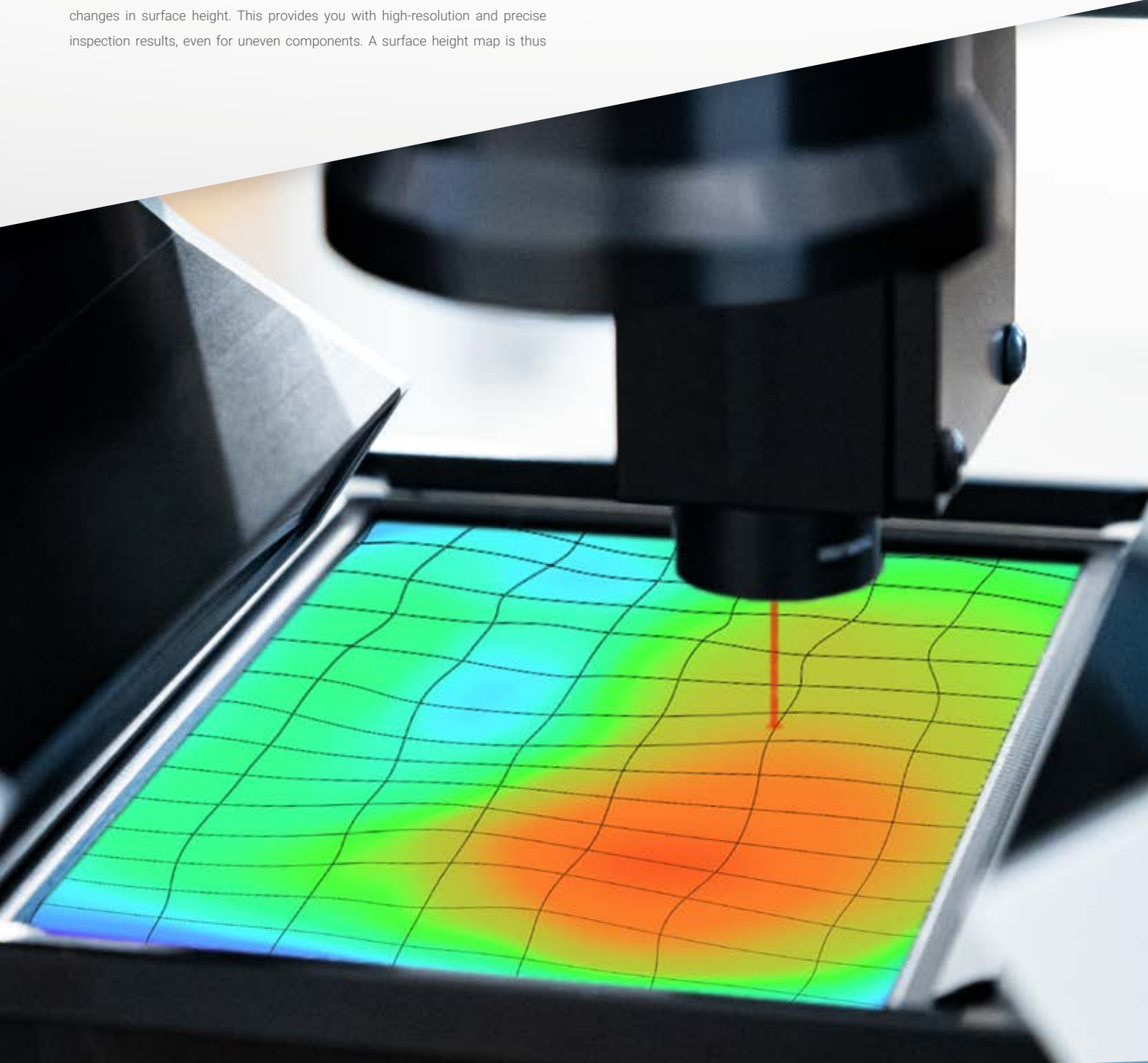
# z-focus tracking

The MABRI.VISION z-focus live control enables a tracking of the z-focus in the inspection process. A surface sensor travels ahead of the camera system to determine the topography of the component and detects even the smallest changes in surface height. This provides you with high-resolution and precise inspection results, even for uneven components. A surface height map is thus

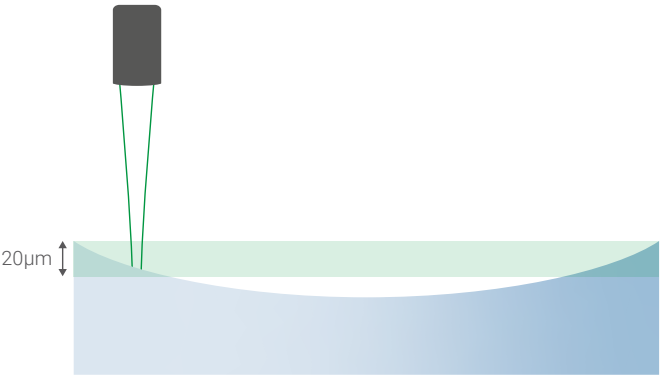
generated for each acquisition sequence and the camera is traced in parallel with the data acquisition. As a result, the system always achieves the optimum distance between the camera and the surface.



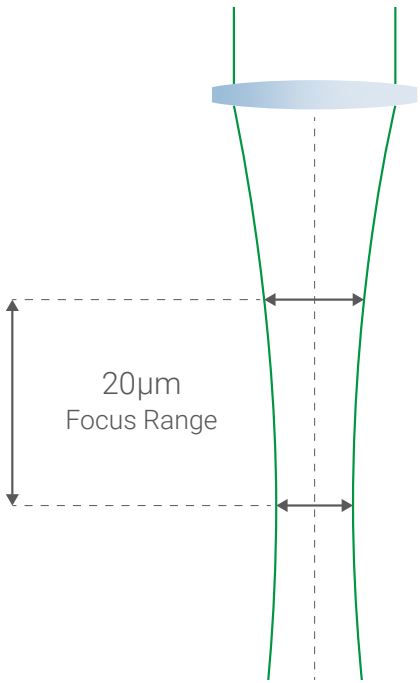
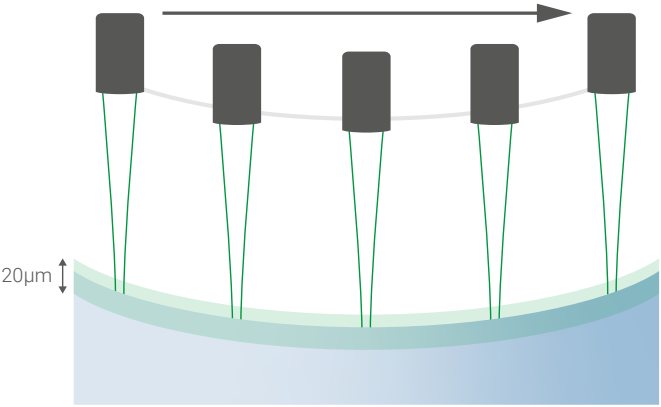
Rayleigh length is the distance along the optical axis that a light beam needs until its cross-sectional area doubles, starting from the beam waist or focus. The radius of the beam there is larger by a factor of  $\sqrt{2}$  compared to the beam waist/focus.



## Without z-tracking



## With z-tracking



## Special features

The processing and transmission of the surface formations in High speed results in live readjustment of the z-axis. As a result, even curved surfaces can be inspected with the appropriate distance ratio.

## Advantages

- Assurance of measurement quality
- Easy changeover to other inspection samples
- Surface always in focus area
- Highly accurate and in production cycle

Sensor Z measuring range

2,7 mm

Scan frequency

40 Hz

Surface area detection

< 1 µm





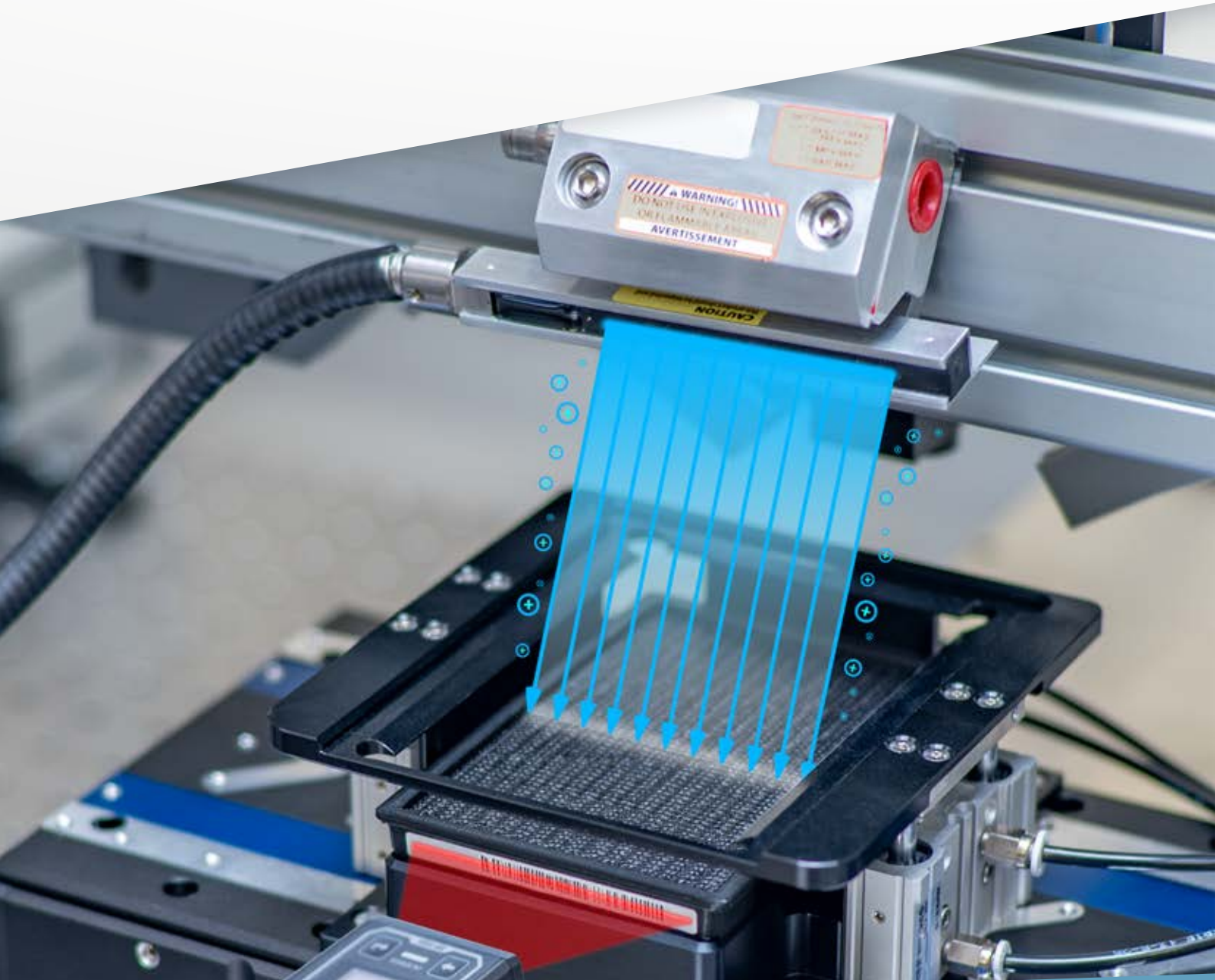
# Operation in clean rooms

The MV.EYE MI1 inspection system is designed for automated operation in the clean room and is equipped with a filter unit. It therefore meets the requirements of cleanroom ISO Class 5. The MABRI.VISION team of experts combines numerous experiences from the medical and pharmaceutical industries with innovative and progressive ideas and develops high-performance solutions for your inspection processes in the clean room. The inspection system ensures your process reliability through a high degree of automation. The surfaces of

the system can be easily cleaned and the interface for operation and evaluation can be operated with gloves. Our software MV.IMAGING supports you with user management, documentation of every change, ChangeLogs, AuditTrail and recipe and databases for your process validation.



Cleanroom classes define demands on cleanliness for the operation of controlled environments on an international level. ISO standards (DIN EN ISO 14644) determine the degree of air cleanliness by measuring airborne particles per m3. ISO clean rooms are divided into 9 classes. Class 1, with the lowest particle concentration per m3 represents the purest class.



Guideline

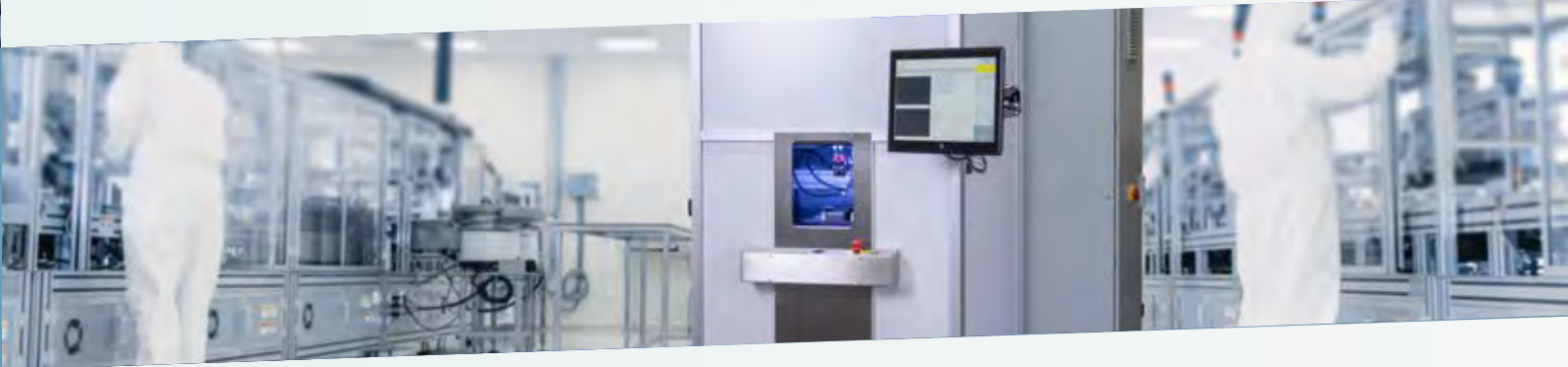
Particle filter

Clean room class

GMP

< 0,1 µm

ISO 5





# High speed inspection of large area structures

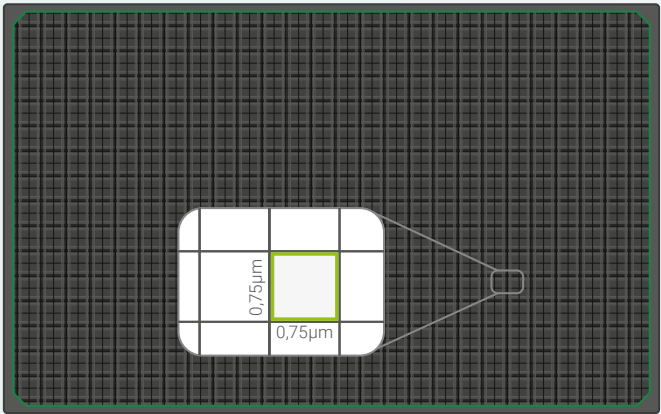
With the MV.EYE MI1 inspection system, surfaces of microstructured components can be inspected completely and at high speed. A large measuring range with a scanning area of 300 x 300 mm enables a wide spectrum of inspection applications, from hard disk components to biological specimens. The specimens are scanned at cycle time neutral speed with a resolution of 0.75 µm. MABRI.

VISION also uses neural networks for inspection. The image data is evaluated in parallel with the inspection process. Thus, the inspection result is available almost immediately after the scanning process.

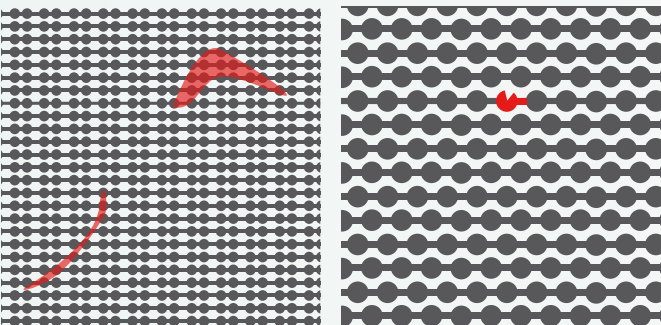


Artificial intelligence recognizes a wide variety of feature characteristics via correlation. By using neural networks, anomalies can be detected more reliably, which proves to be particularly advantageous in the case of volatile structures.

## Highest resolution



## Inspection of macro and micro defects



## Special features

The use of the MV.EYE MI1 high-speed microscope enables large-area objects to be scanned in the shortest possible time. Surface structures are scanned at speeds of up to 40 mm/s and displayed with high contrast thanks to optimized line illumination. Despite the high scanning speeds, a high light yield is achieved through the use of innovative TDI camera technology. The high degree of automation of the inspection procedure enables repeatable and inline inspection processes.

## Advantages

- High measuring volume, adjustable according to your inspection requirements
- Combination of a large scanning area of 300 x 300 mm with a Z-measuring range of up to 120 mm
- Manual determination of resolution possible
- Inspection of up to 750mm2 area per second
- Inspection of repetitive structures

Image Size

120 MP

Scan area

300 x 300 mm

Resolution

< 0,75 µm





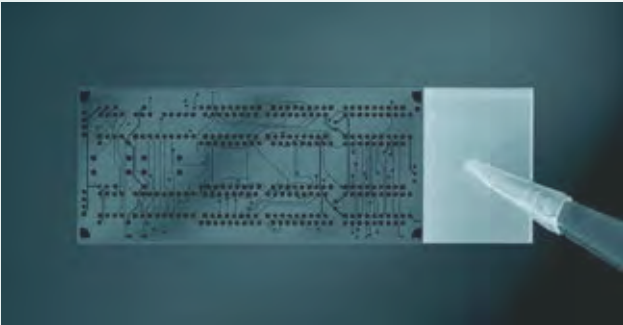
# Applications

The application areas of high-speed microscopy are mainly in medical technology, biotechnology and microelectronics. Our systems are suitable for the inspection of any large surface in the micrometer range. These include, for example, surfaces and profiles of fuel cell pressure depots, wafer inspection, analysis of cell culture vessels, the inspection of processors, circuit boards and electronic structures

and the evaluation of microstructures for diagnostic purposes (lab-on-a-chip). Other areas of application include testing of display panels, printed circuit boards (PCBs), microstructured functional surfaces and adhesive dots/adhesive depots.



High-speed microscope technology can be used in a wide variety of industries. We can only offer a small selection of possible usage scenarios here. In individual cases, a feasibility study is always carried out by our engineers to find the right solution for your requirements. This includes e.g. also a possible combination with other technologies.

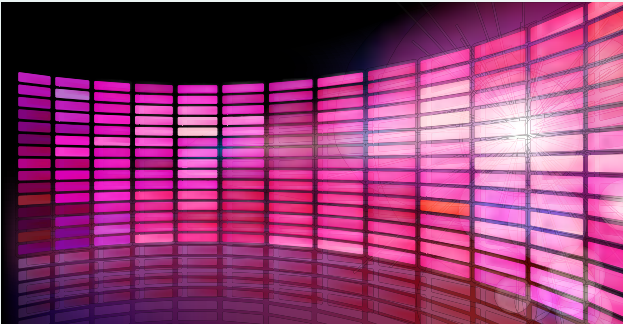


## Lab-on-a-Chip

- Detection of micro and macro defects on injection molded microfluids and microstructures
- High-speed analysis of slides and cell culture vessels

## Precision parts

- High-speed inspection of entire carriers in UV-LiGA production
- Offline and inline capable
- Flexible specimen thickness thanks to Z-focus tracking



## Fine-Metal-Masks for OLED production

- Detection of contamination and defects on FMM's
- FMM's can be inspected between cleaning and use

## SMD stencils

- Microscopic inspection with real-time evaluation
- Analysis of pad geometry and size
- Detection of contamination and defects





# Modular design

The modular design of the MVEYE MI1 inspection system allows you to meet the most diverse requirements of modern inspection processes. The MABRI.VISION expert team faces the challenges of your test objects and creates adaptable solutions. Through a combination of advanced optics, presence, position and defects can be detected. The inspection system can be extended by a robot connection and follows the fundamental idea of automation in all steps. There are no limits to the variety of structured surfaces.

## Inspections



Inspect the complete surface of your specimens at cycle time-neutral speeds. The MVEYE MI1 inspection system detects presence, micro and macro defects and determines position parameters. Due to the large scanning area and the high resolution, the inspection system is used in various areas, such as the inspection of electronic components, fuel cell parts or in the microscopy of biological specimens.

## Optics



MABRI.VISION relies on the use of different optics to provide the best solution for your application. Whether matrix or TDI line scan camera: our high performance optics enable the inspection of finest structures and provide precise results in high resolution despite fast inspection speeds. Thanks to innovative camera technology, a large light yield is generated even at high velocities.

## Automation

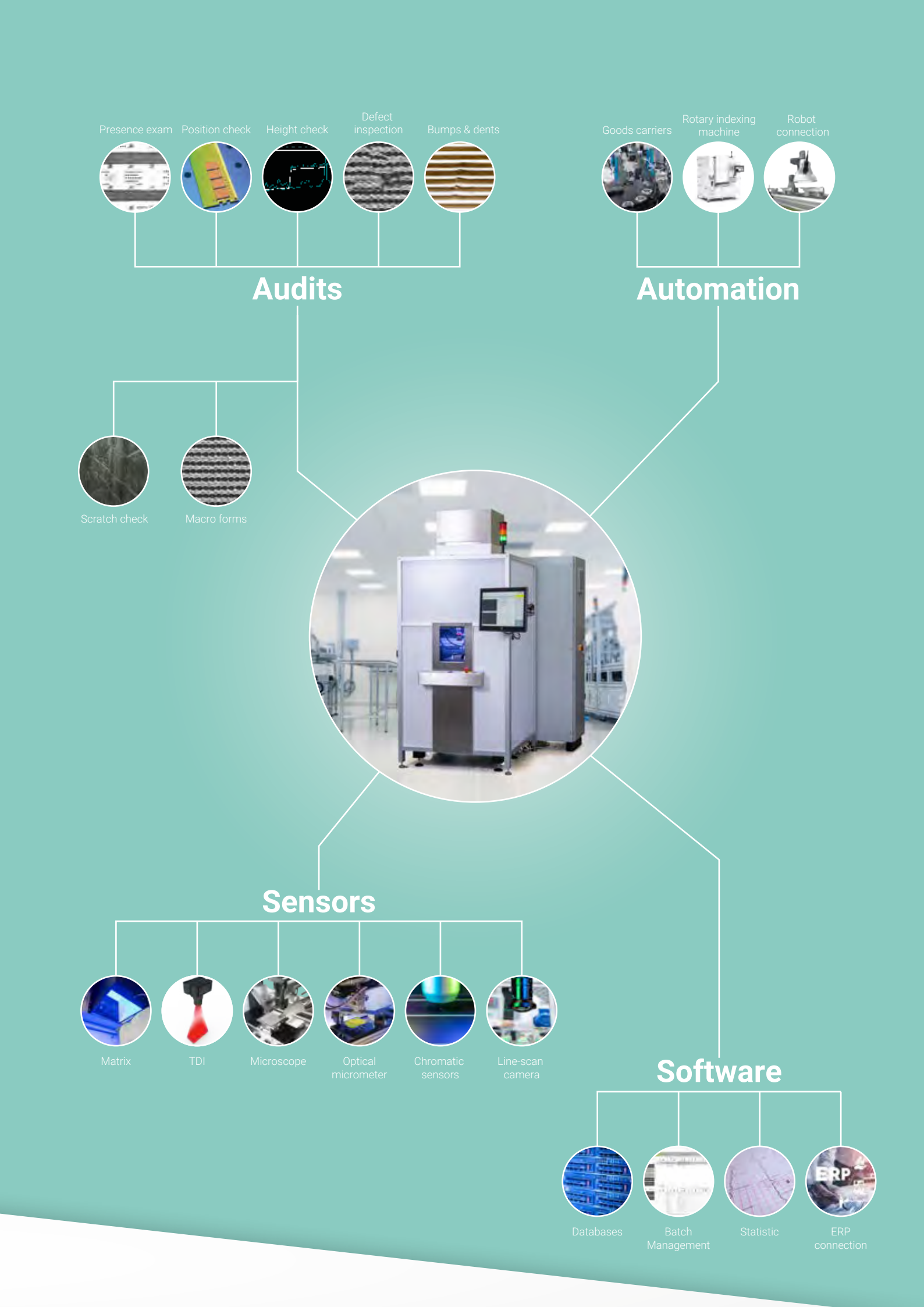


Modern production and research environments place high demands on complementary equipment and systems. The MVEYE MI1 inspection system meets these requirements through efficient automation while supporting the design of lean processes. Take advantage of stand-alone solutions and the possibility of a connection to robot and goods carrier systems.

## Software



The MABRI.VISION software MV.IMAGING also follows a modular structure. Choose from a broad repertoire of standard modules and extend the software with suitable functions for your inspection process. Especially in medical technology, our software supports you with comprehensive documentation of changes, AuditTrail and recipe databases for your process validation. All common interfaces are available for seamless integration into your inspection environment.



# Software

The operation in industrial productions set a number of requirements for the software in inspection systems. MABRI.VISION provides you with a smart software solution in the MVEYE MI1 inspection system, which can be adapted to the needs of your particular inspection thanks to its modular structure. From interfaces and visualization to user management and databases - our team of experts will support you with individual consulting and realization.

Through numerous projects in different industries, our software is tailored to industrial needs. The software platform offers you a wide range of visualization options. This way you keep an overview of production processes and quality assurance through insightful evaluations. The MABRI.VISION software follows an efficient programming even for complex inspection tasks in order to provide evaluations in time with your production.

## Modular

The MABRI.VISION software is also designed in a modular way. In addition to a large number of standard modules, we are happy to extend the software with suitable modules for your application. All common interfaces are available for a seamless integration into your production process.

## Parallel Processing

The MVEYE MI1 high-speed microscope is designed for the inspection of repetitive structures. To achieve maximum scanning and processing speed, processing is performed in parallel with data acquisition. You will get the quality inspection results immediately after the inspection process.

## Databases

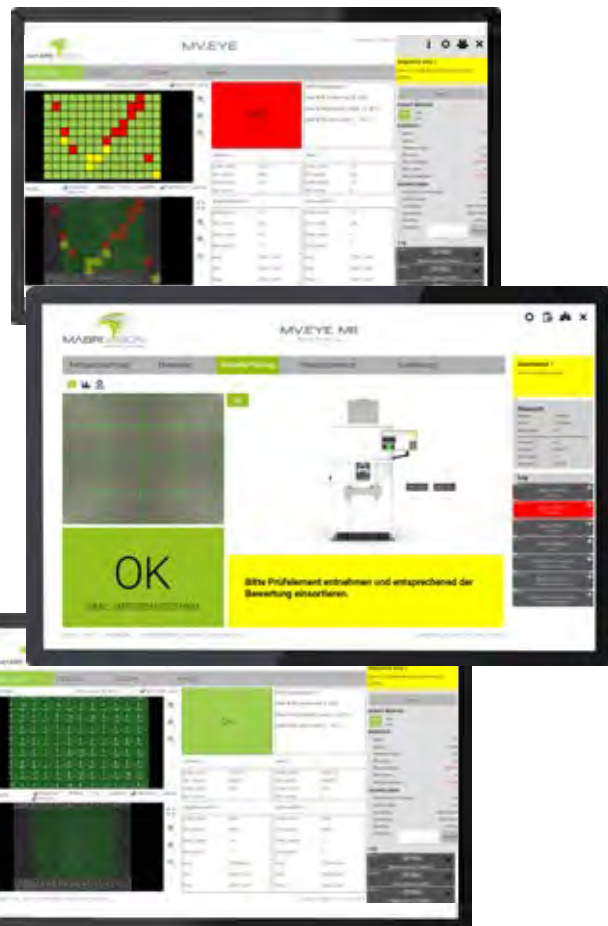
The MV.IMAGING software supports your quality assurance by using databases for production orders and recipes. The database interface is oriented to the specific requirements of your inspections and evaluations. All data can be exported as structured inspection reports in .csv, .xls or .pdf format.

## Statistics / Evaluation

Our software platform offers a wide range of different visualization options. You maintain an overview of production processes and quality assurance through informative statistics. Our software experts are familiar with the specific requirements of different industries and design the software with useful tools such as good part counters, defect and measurement image memory and prewarning limits for process support.

## Touch Interface

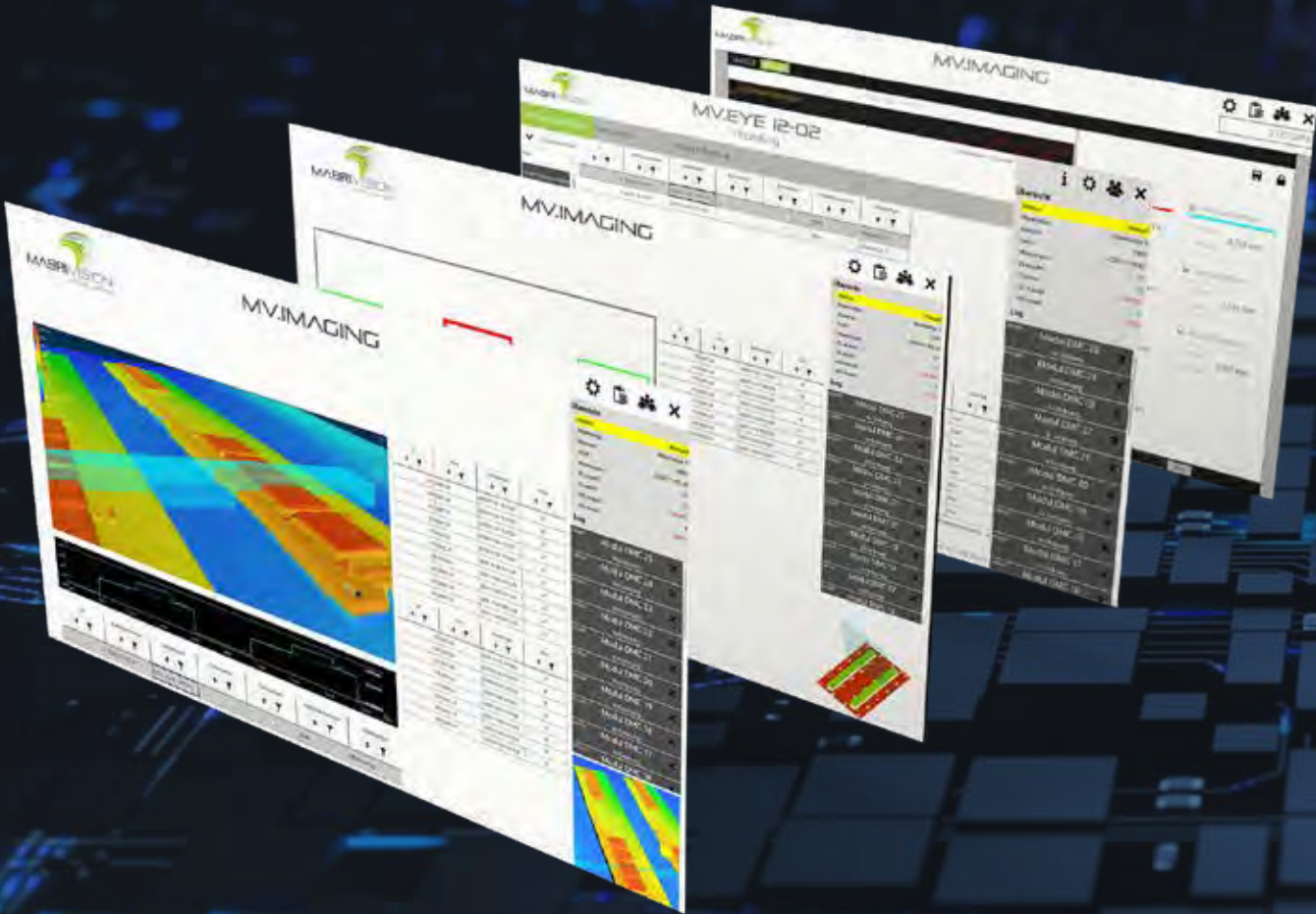
Experience increased efficiency in your quality assurance workflows through the intuitive touch-screen operation of the MVEYE MI1 inspection system. A large and well arranged control panel as well as a multitude of visualization and evaluation options enable an effortless application experience.





# Our software modules

The MABRI.VISION software platform MV.IMAGING is designed for maximum flexibility. Different modules covering the areas of interface, database and evaluations can be integrated as needed and adapted to the requirements of your inspections.



## Evaluation module

For complex components and inspection protocols, image processing must be evaluated and qualified in an elaborate way. We offer you tools to efficiently realize this qualification.

## Calibration Module

Test equipment monitoring is an important topic for each of our customers. We offer you the right solutions to carry out standard-compliant test equipment monitoring..

## Statistic

Our software experts have in-depth know-how in the sector of quality assurance and are familiar with the specific requirements of different industries, such as the production of medical technology. With the MV.IMAGING software, process support is enabled by key figures and tools such as good part counters, defect and measurement image memories and prewarning limits.

## Coordinate transformer

Software module for a clean switch between different coordinate systems.

## Data fusion

Die Datenfusion ermöglicht die Kombination von Prüfergebnissen aus unterschiedlichen Messsystemen.

## System diagnosis/ Monitoring

Automated sampling to verify error-free operation and detailed logging of all relevant processes and parameters.

## History graphs

Real-time overview of different measured variables. Threshold values as well as tolerances are displayed.

## Result database

MV.IMAGING software module for long-term storage of the results of your tests.

## Recipe database

The recipe database contains all relevant information for checking your production orders.

## Simulation mode

Once an inspection system is qualified, modifications have to be made with maximum caution. We offer you a customer-sided simulation mode with which you can test old measurement data before you authorize our machine for the production.

## Audit-Trail

We offer a comprehensive audit trail function, especially for medical technology and the pharmaceutical industry.

## Result visualization

Clear result visualization for the operator with different display options.

## Extended user management

Accurate user management enables clear definition of different levels of rights and user-dependent application behavior and group policies

## Batch reports

Completed production orders are clearly and automatically stored on your servers in the format you require.

## Interfaces

ProfiNet, ProfiBus, OPC UACameralink, GigE-Vision, USB3 Vision, CoaXPress, SMB-Share, SFTP, MSSQL, Various analog and digital I/O

## Change-Log

A change log module ensures the complete documentation of all parameter changes.



# Software in detail - Example of a manual system

1

touch friendly navigation bar

2

switching between different perspectives and visualization methods (measured values, time course, statistics, etc.)

3

main tab: result display (after selection), visualization of the step chain, plant status

4

pass / fail indicator

5

for manual operation: instructions to operator

6

settings & user management

7

indicator of machine status and current steps

8

info about current production order

9

good part/bad part counter

10

event log for user

11

timestamp and info about software version and user





# About MABRI.VISION

Quality assurance and quality management are essential for an efficient value creation process. For the implementation of a smart production process in the age of „Industry 4.0“, suitable inspection solutions are essential.

The smart networking of machines as well as modular and adaptive processes are only some of the components of a high-tech strategy. Under these circumstances, quality control is a challenge that the expert team at MABRI.VISION meets with new approaches. Following the motto „Innovative solutions - our passion“, we have specialized in the development and production of inspection systems and equipment.

Innovation is the foundation for continuous growth in modern industry. At MABRI.VISION we live this anew every day. The focus is always on the benefits and requirements of our customers.

Our measurement technology thrives on the combination of the most advanced technologies, is customer-oriented and can be integrated. Our systems contribute to lean and efficient production processes and support you in designing a future-oriented production. We are oriented towards your success - because this is how we can also outgrow ourselves.



Dr. Nicolai Brill

Dr. Ulrich Marx



## Design & Configuration

Benefit from fast and competent advice on the design and planning of inspection processes.



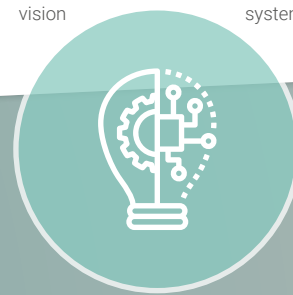
## Installation & Service

Professional installation, commissioning and training for uncomplicated integration and comprehensive support from our support team for questions concerning our systems.



## Process design & optics

Assessment of your requirements and development of a concept for the realization of your inspection process.



## Illumination & Programming

Reliable measurements and repeatability through perfectly designed illumination and guarantee of smooth operation of your inspection system by our software experts.



## Construction

The MABRI.VISION team of experts designs and realizes optical inspection systems for specific applications in your production. Our inspection systems are delivered turnkey. Project planning, design and layout, assembly and installation all come from a single source.

## Machine Vision

Taking your requirements into account, MABRI.VISION designs smart and powerful vision solutions for quality control in your production. We use the latest machine vision technologies as well as special solutions.

## Software

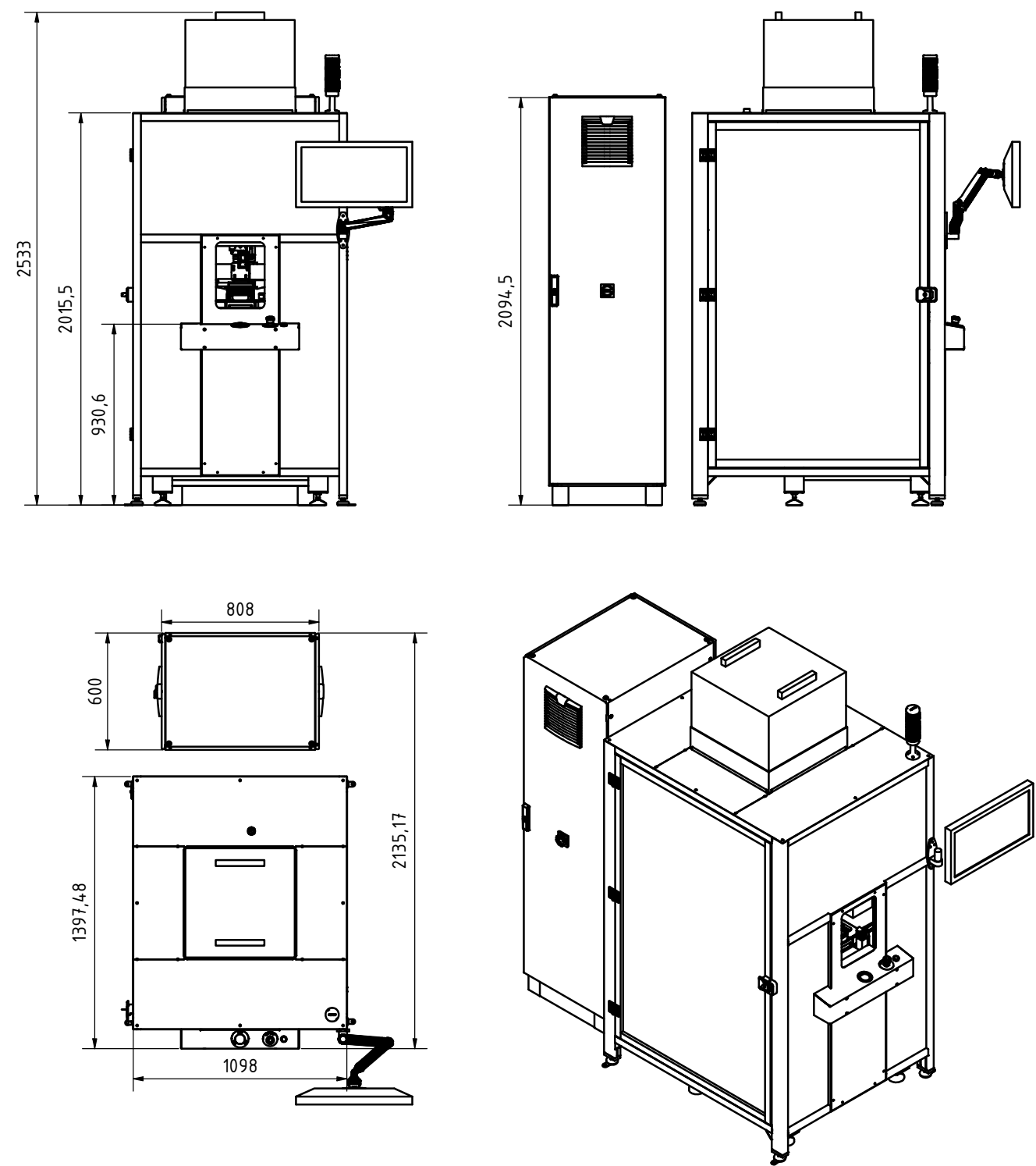
Our modern Vision Center software platform MV.IMAGING enables the uncompromising implementation of your requirements. You benefit from a wide range of visualization options, high-performance programming and the use of AI solutions.

## Electrical Assembly

MABRI.VISION offers the full spectrum: from circuit board design to final production and assembly of all switches, cables and distributors. We are also happy to support you in the maintenance and adaptation of your machine vision system.

# Specifications

## Dimensions



## Machine specifications

Voltage	230 V AC
Frequency	50 Hz
Power	<3,5 kW
Environmental requirements	Temperatur: + 15°C to + 35°C non-condensing non-corrosive Alteration max. +/- 3°C/d Relative moisture: <= 60% +/- max. 5%/d
Installation area	ca. 1.8 m²
Dimensions (L x W x H)	ca. 970 mm x 1832 mm x 2542 mm
Mass	ca. 600 kg
Noise level	55 dB (approx.)

## Inspection

Scanning speed	up to 40 mm/s
Scan width	12,5 mm
Scan length	up to 230 mm
Total measuring range	up to 500 x 230 mm²
Resolution	0,75 µm
Depth of field	10-30 µm depending on the required resolution
Measuring speed	~350 mm² / s

## Industry PC

CPU	CPU Intel Core i7
Hard disks	2 x 1 TB HDD im RAID 1
Operating System	Windows 10 Enterprise
Working memory	16 GB
Interfaces	ProfiNet, EtherNet
User panel	Visualisation of the inspection and statistics
Functions and modules	Recipes, databases, user management





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