InstruNEXT

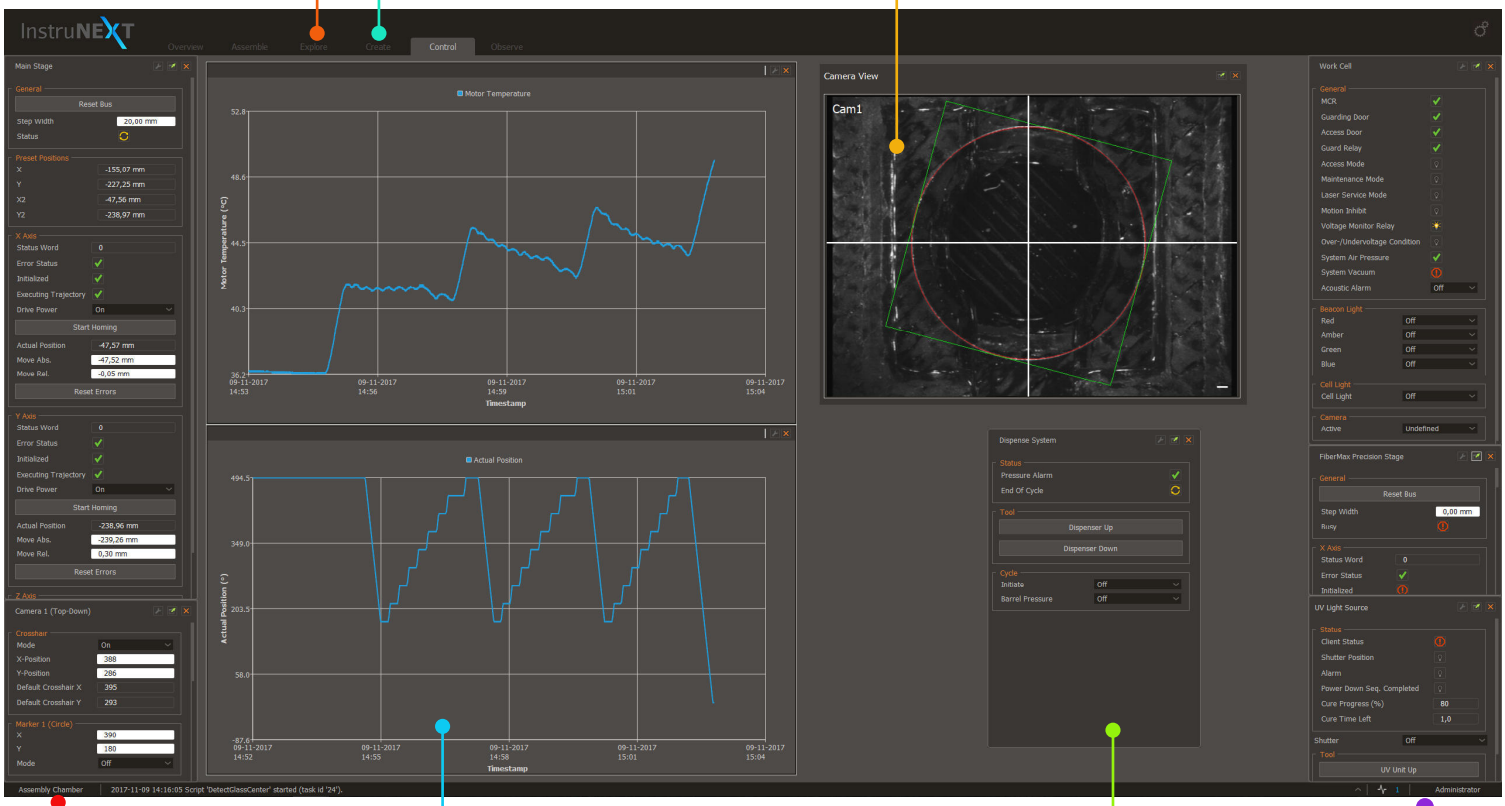
Introducing InstruNEXT Automation Center

Data analysis & Machine learning

Powerful script language

Machine vision

Custom instrument drivers



Data logging and visualization

User-defined device widgets

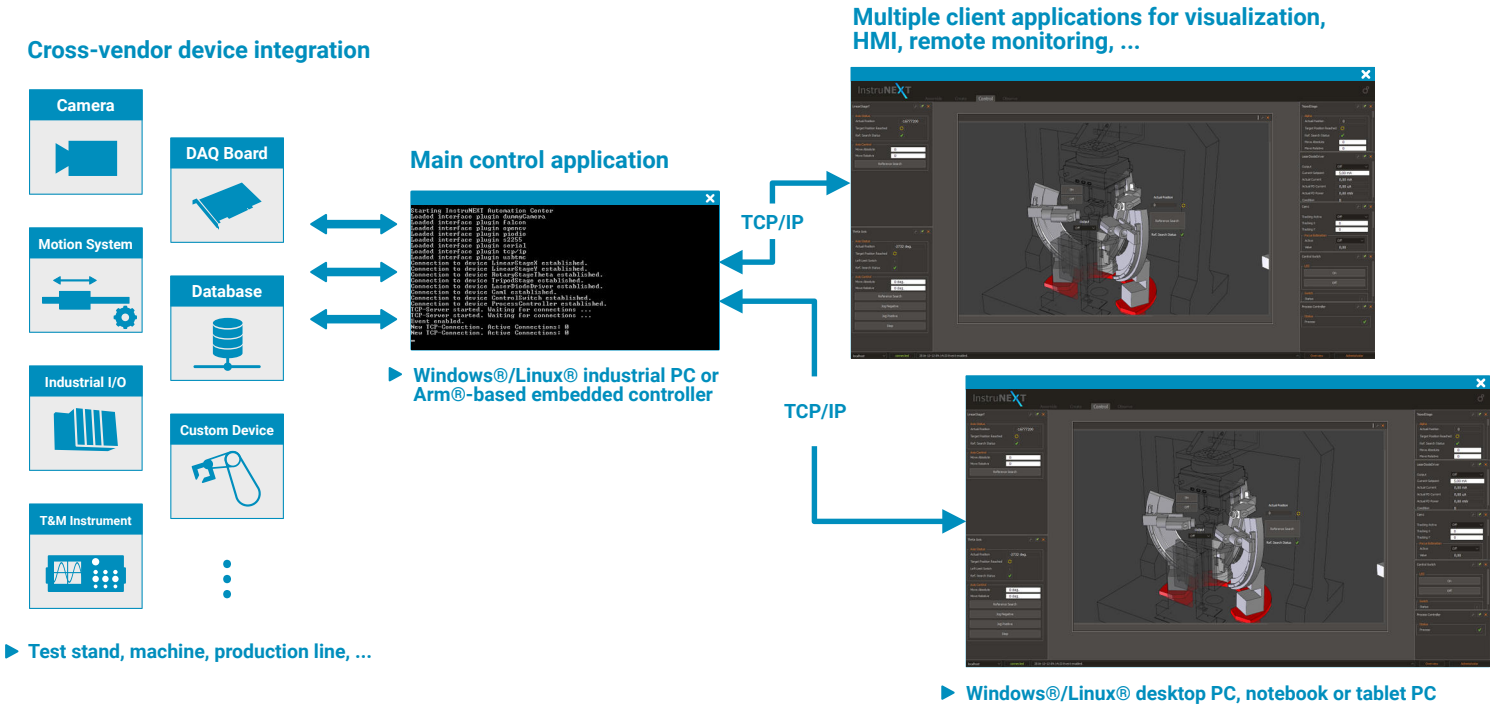
TCP/IP-based remote UI architecture

User management

InstruNEXT Automation Center is a versatile and user-friendly ready-to-use software for process control, monitoring and automation in production and R&D. Due to its flexibility it is an ideal solution for numerous applications like microassembly, packaging, characterization, testing, inspection and many more.

Increase productivity.
Reduce development effort.
Shorten time-to-market of your cutting-edge products.

Architecture & Device Integration



TCP/IP-based remote UI architecture

InstruNEXT Automation Center consists of a main control application as a server component and a remote UI application as a client component, which connects to the main application via network.

The main control application contains all the necessary control and automation logic, data analysis and machine vision functionality, etc. to run a process, a machine or a test stand and can operate completely independently e. g. on a standard or an industrial PC with Windows® or Linux® operating system or on an Arm®-based industrial controller or other Arm®-based embedded device.

It has a modular design and can be easily extended using plug-ins, which allow e. g. special device interfaces and communication protocols, database interfaces, or even completely customer-specific functionality to be added.

The UI application provides the user interface for visualization, control, configuration and development. It can be run on the same system as the main control application or on a remote computer and allows the user to switch between multiple server instances e. g. to establish centralized monitoring of multiple machines or test stands.

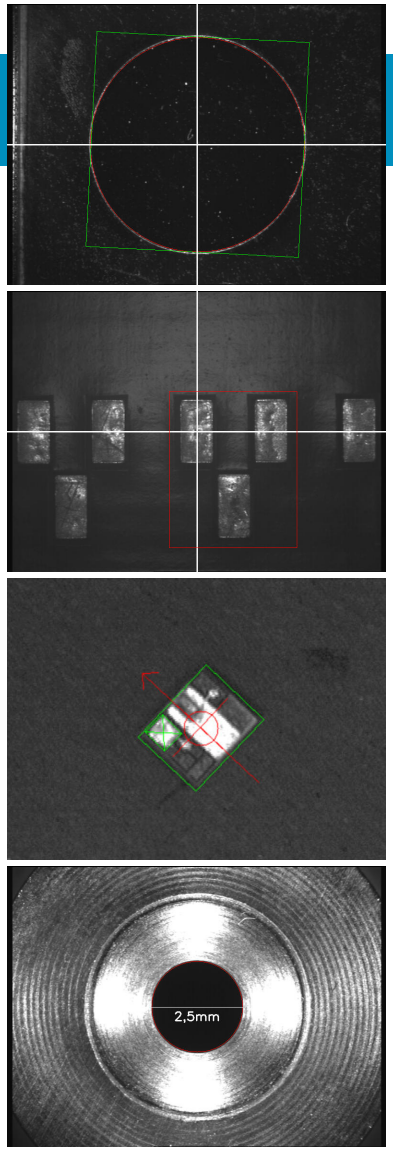
It is also possible to connect multiple instances of the UI application to one main control application, thus allowing simultaneous control and monitoring of a particular machine or test stand from multiple computers, e. g. from a panel-PC mounted directly at the machine and additionally from a remote monitoring station.

Cross-vendor device integration

Device communication interfaces and protocols, for common industrial components such as sensors, actuators, motion controllers, fieldbus devices, etc. as well as test & measurement equipment can be integrated in a modular way via plug-ins. The interfacing of hardware devices can be configured and parametrized in detail, down to individual device-specific commands at the protocol level. That way, even customer-specific devices or non-standard communication protocols can be described and implemented directly from the graphical user interface at run-time.

All device data can be accessed in control sequences or from clear and well-structured device-widgets in the graphical user interface.

Machine Vision & Machine Learning



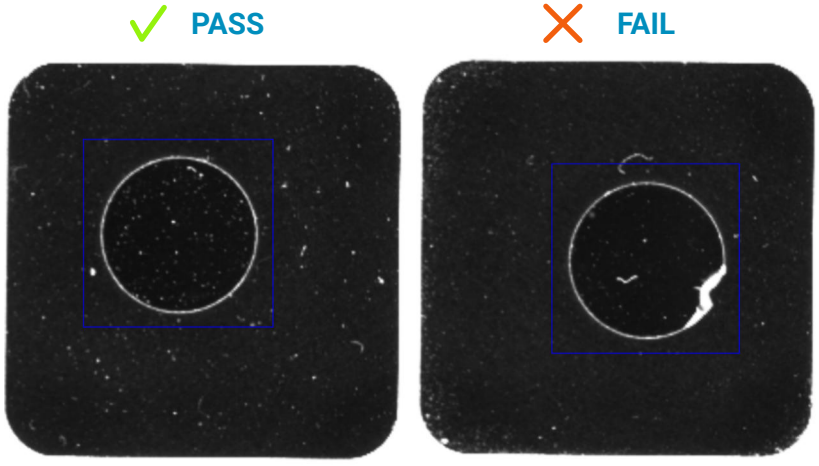
InstruNEXT Automation Center provides various built-in machine vision functions which can be combined and parametrized using the script language to realize tailored applications.

In addition to common computer vision functionality, like filtering, thresholding, morphological operations, edge detection, segmentation, template matching, etc., convolutional neural network based algorithms can be used to implement robust machine vision functions which do not require formal description, but simply learn from training data.

Typical applications that are realizable with built-in machine vision functions include:

- **Sorting of parts**
- **Completeness checking**
- **Detection of scratches and other defects on optical components**
- **Vision-assisted alignment of fiberoptic components**
- **Position detection of components for automatic placement**
- **Detection of alignment marks**
- **Inspection and metrology for quality control**

Cross-vendor imaging equipment such as cameras, frame grabbers and lighting systems can be easily integrated.



Neural network based image processing

Highly developed convolutional neural networks can be used e. g. to achieve robust real-time detection of defects for automatic inspection of optical components, which works reliably even in non-cleanroom environments.

InstruNEXT Automation Center uses the TensorFlow™ library for Machine Learning and neural net based computing. TensorFlow™ graphs can be designed by use of external frameworks and imported into the application at run-time, where they can be immediately addressed from the script language, allowing to connect process parameters or image data with neural networks of various topologies.

› This enables seamless integration of powerful deep learning algorithms into your automation or testing application.

```
a = dialog(Query, "Begin process?", "Yes", "No")

if ($a > 0) {
          # Move to start position
          dialog(Warning, "Stage will move!", "OK")
          set(Stage.StageX.MoveAbsolute, 102.7µm)
          wait(0.5s)
          while ($stage_next < ($stage_max + $stage_step)) {
                    set(Stage.StageY.MoveAbsolute, $stage_next)
                    stage_next = $stage_next + $stage_step
                    $avg = PDAmp.Signal + $avg
          }
          avg = $avg / $N
          log_str = buildString("Average power: %f", $avg)
          writeLog($log_str)
} else {
```

A powerful script language is used to set up sequential processes. It allows to significantly speed up the development of tailored applications, ready to be used in the productive environment after a short time. A development environment for scripts is fully integrated in the runtime application.

- **Control sequences can be created, modified or expanded directly in the application at run-time.**

The script language smoothly combines the functionality for direct device control with functions for data analysis, machine learning and machine vision.

Standard programming features like variables, conditional branches, loops, subroutine calls, arithmetical operations, as well as various built-in functions for plotting, data-logging, database interfacing, machine vision, math, optimization, machine learning, user interfacing, accessing device parameters and variables from a process image, etc. are provided.

```
MoveToCamera($slot_nr)

set(Camera_1.RingLightIntensity, 0.35)
grabFrame("InspectCircle", Camera_1)
set(Camera_1.RingLightIntensity, 0.00)

convertToGrayscale("InspectCircle")
filterGaussian("InspectCircle", 3, 3)
binarizeByThreshold("InspectCircle", "InspectCircle_binImg", 40)

localizeEllipse("InspectCircle_binImg",10000,30000,$x,$y,$a,$b,$angle)
GetROI("InspectCircle", $x, $y, $width, $height)
classifyObject("InspectCircle","GlassPlateClassifier",$classCount)
c1=classifyResult("InspectCircle",0)
c2=classifyResult("InspectCircle",1)
c3=classifyResult("InspectCircle",2)

defectFactorThreshold = 0.2
```

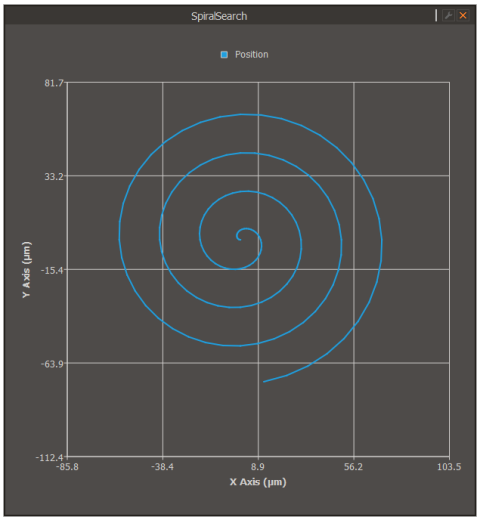
- **The script language is very easy to learn and allows for a clean layout of sequential processes, that are easy to maintain and modify.**

```
MoveAbsoluteXY(10.0mm, 5.0mm)
while((Tip.SurfaceTouch != true) && ($max_count < 100)) {
          MoveRelativeZ(2.0µm)
          max_count = $max_count + 1
}


MoveRelativeX(2.0µm)
MoveRelativeY(12.7µm)

set(PrecisionStage.MaxVelocityY, 10.0mm/s)
MoveRelativeY(0.1mm)
set(PrecisionStage.MaxVelocityY, 0.1mm/s)
{
MoveRelativeX(3.0µm)
MoveRelativeX(1.6µm)
}
wait(2.0s)
MoveAbsoluteZ(0.0mm)
MoveAbsoluteXY(0.0mm, 0.0mm)
```

The script language can be used at different levels of complexity, allowing to set up complex processes and algorithms in detail as well as to create simple recipes for automated production or testing sequences.

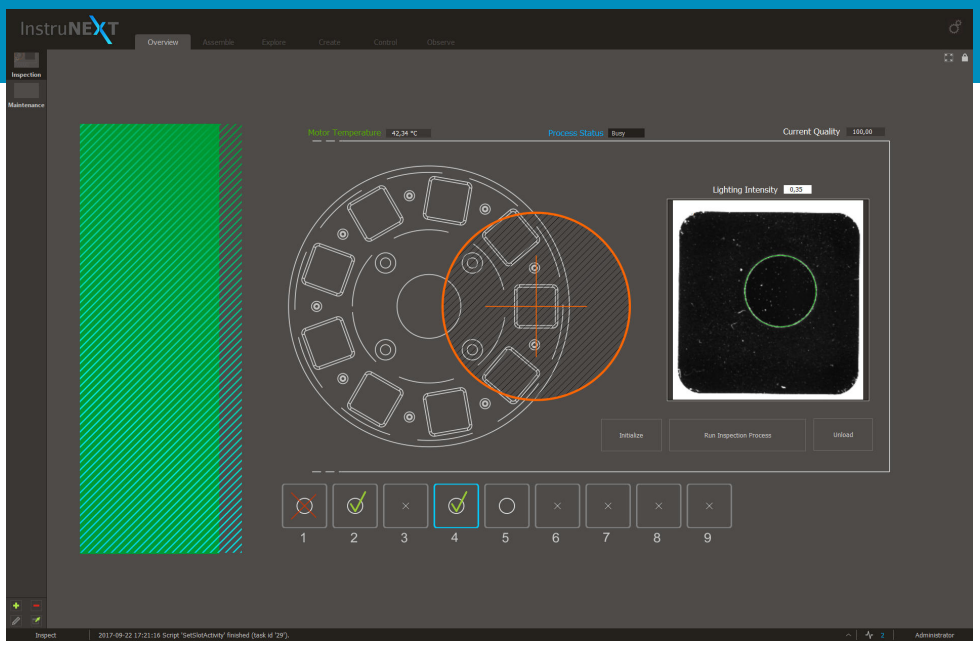
Typical applications of the integrated script language include:

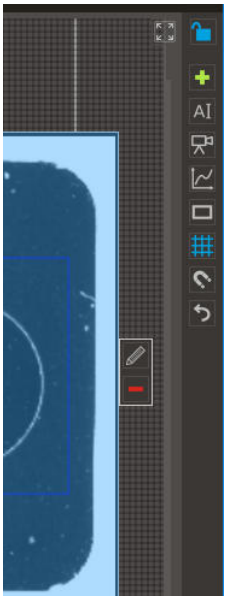
- **Motion control or step sequences for multi-axis positioning systems**
- **Production recipes for automated manufacturing and assembly processes**
- **Realization of automated test and inspection sequences**
- **Design of processes and algorithms for the evaluation of measurement data**
- **Set up of procedures for image processing and machine learning**



HMI & Visualization

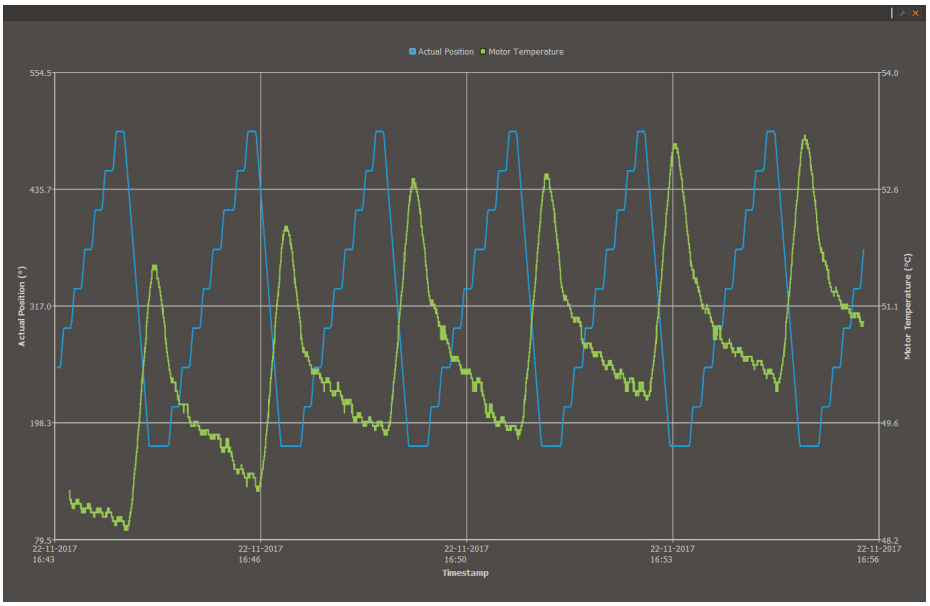
The graphical user interface is a separate frontend application that connects to the main control software via TCP/IP. This allows the user interface to be run remotely on an industrial HMI panel-PC, a standard desktop PC, a notebook or even a mobile tablet computer.





Appealing and intuitive multi-page overview screens, providing control and visualization of different process sections or aspects of a machine or a test stand in a clear and structured manner can be quickly designed via drag & drop.

Various freely configurable control and display elements, like buttons, numerical input and output fields, switches and selection boxes, diagrams, camera-viewers, etc. are available. In addition, customer specific graphic elements can be easily integrated.



Freely configurable diagrams can be used to visualize process data or measurement results.

Such diagrams can be integrated as fixed components of the user interface or can be dynamically opened by process sequences or users.

Applications

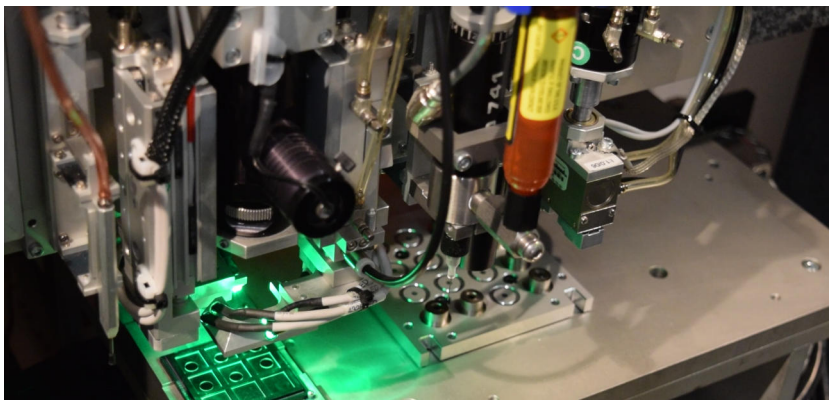
InstruNEXT Automation Center has been successfully used to realize tailored applications for:

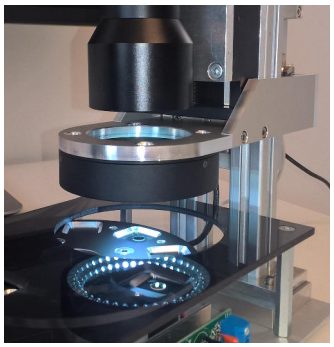
- **Microassembly and advanced packaging**
- **Fiberoptics alignment and assembly**
- **Testing and characterization of semiconductor devices**
- **Automated optical inspection and defect detection on optical components**

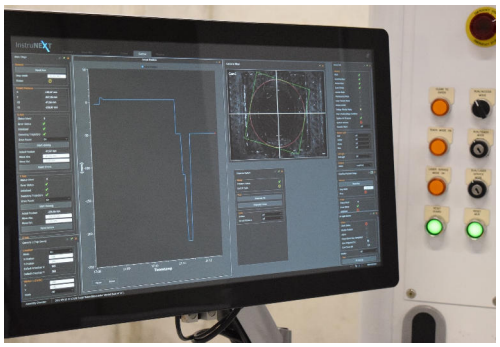
The software is suitable both for the realization of tailored solutions for newly developed systems and for cost-efficient retrofitting of existing equipment.

Further applications and technologies which will profit from the use of InstruNEXT Automation Center include:

- **Semiconductor equipment**
- **(Semi-) automatic production lines in the electronics manufacturing**
- **Test stands and measuring stations in the automotive industry**
- **Experimental setups in R&D and academic research**
- **Interactive instruction and quality control in manual production and assembly**



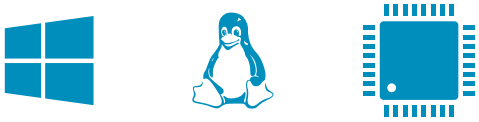




Upon customer request, we also provide tailored turnkey solutions based on our software platform, as well as customer-specific extensions.

Do not hesitate to contact us to discuss your specific application and the ways it can profit from InstruNEXT Automation Center.

Supported Platforms



Both the frontend GUI-application and the main control application are available for PC-based (x86/x64) systems under Windows® and Linux®.

The main control application is additionally also available for Arm®-based industrial controllers and embedded systems.

- **The same functionality, workflow and look are maintained on all platforms.**

About our Company

At the company's location in Würzburg, Germany, our agile and skilled interdisciplinary team with a background in engineering, nanotechnology, physics and computer science develops both of-the-shelf software and customer specific solutions for automation of machines and processes with a focus on production and R&D in innovative high-tech industries and academic research.

The company InstruNEXT GmbH was founded in 2012 as a spin-off from the department of technical physics at the University of Würzburg.

Our technological background in the semiconductor science and nanotechnology and our close links to research give us the ability to quickly grasp challenging problems of our customers and to realize innovative software solutions, which are precisely tailored to our customers' needs and yet flexible and easily maintainable.

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