EdgeMasterX

Product Information

Contents

EdgeMasterX

Product

Automatic cutting edge measurement

The EdgeMasterX is a fully automated cutting edge measurement device for production integrated quality assurance of inserts, drills, mills and other round tools. Specifically, the EdgeMasterX enables automated multi-edge measurement of tools. In a single measurement run, a complete series of user defined measurements at multiple edge positions can be achieved. The system is designed to implement fully automated quality assurance into the production process. All results are traceable, repeatable, and in high vertical resolution.

The EdgeMasterX enables high resolution cutting edge measurement.

Benefits

Automatic measurement of multiple edges

Users can measure defined edge parameters on various tool positions to verify, for example, cutting edge preparation processes. In addition, form and roughness of a specific position can be analyzed and compared across multiple tools within a batch. When utilized in combination with a motorized rotation unit, users benefit from the measurement of multiple tool edges, even chamfered edges, in one single measurement run. The user interface design is simplistic and user-friendly having a single button solution allowing for measurements to occur without any further user interactions. Upon completion of the scan, deviations from a CAD dataset are easily visible since a traffic light system is used to indicate differences and non-conformities.
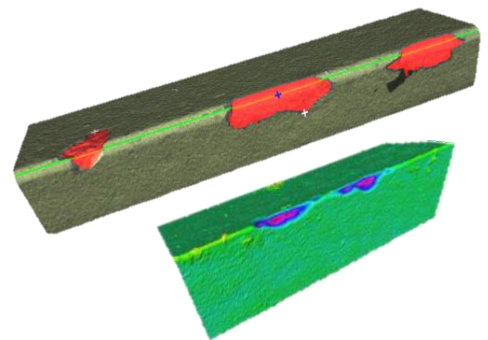
Edge quality verification

Applications

High resolution cutting edge measurement systems in production

The EdgeMasterX originates from the Alicona product line for automatic tool measurement and represents an enhancement over the original EdgeMaster. Both systems are designed for production integrated quality assurance and enable traceable and repeatable measurements even when vibrations, changing temperatures and ambient light are incurred. Typically, users measure edge parameters such as radii, angles, chipping, wear and roughness.

Multi edge measurement
of inserts, drills and other tools

Applications
on round tools

EdgeQuality
Automatic chipping measurement

RoundToolMeasurement
Measurement of angles on round tools
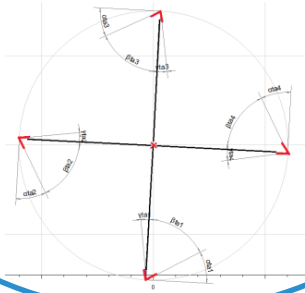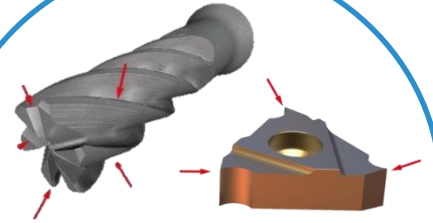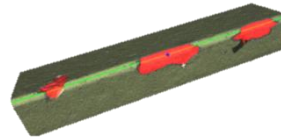
MultiEdgeMeasurement
Measurement of multiple edges in a single measurement run

tool axis
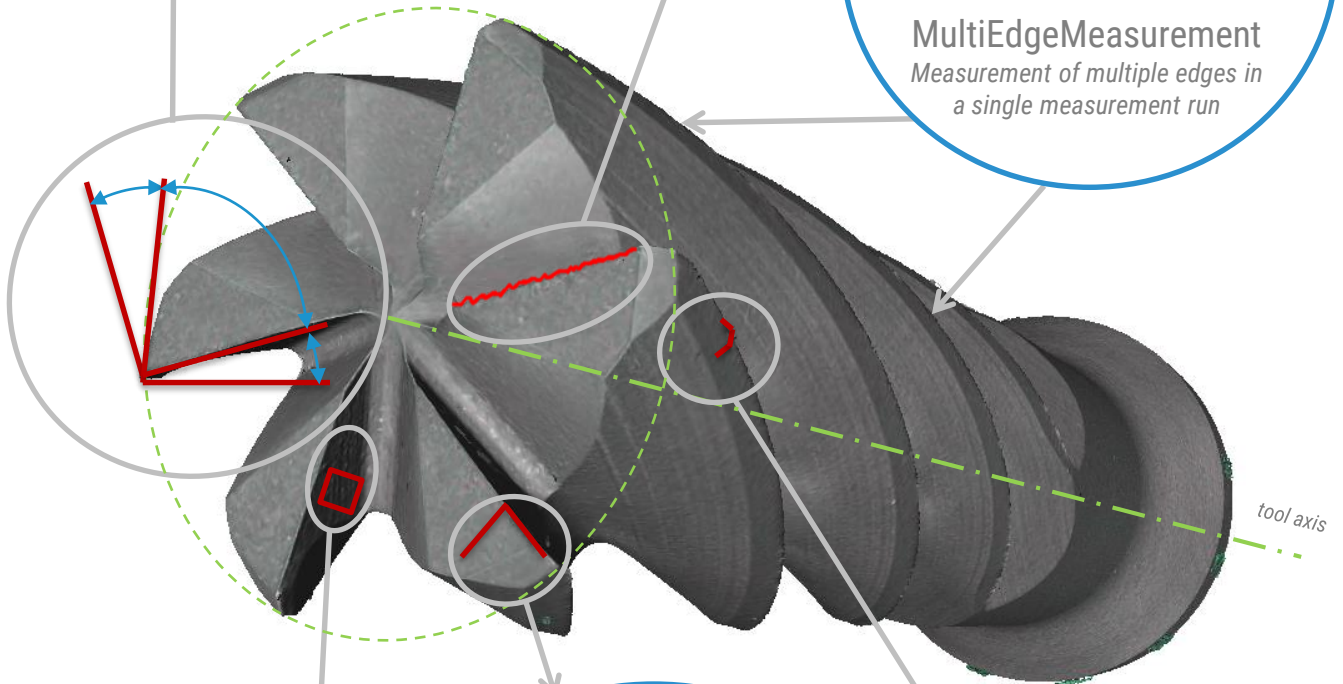
ToolRoughness
Roughness measurement on rake and clearance surface

Edge Measurement
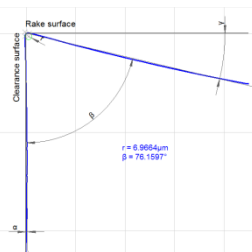
EdgeBreakMeasurement
Chamfer and edge break measurement

Applications
on inserts

MultiEdgeMeasurement
Measurement of multiple edges in a single measurement run

Edge Measurement

ToolRoughness
Roughness measurement on rake and clearance surface

Mean and Single Profile Measurement

EdgeBreak Measurement
Chamfer and edge break measurement

EdgeQuality
Automatic chipping measurement
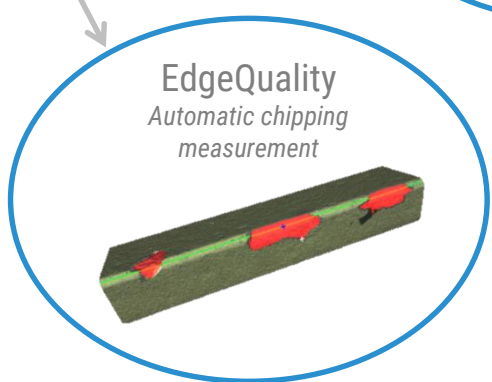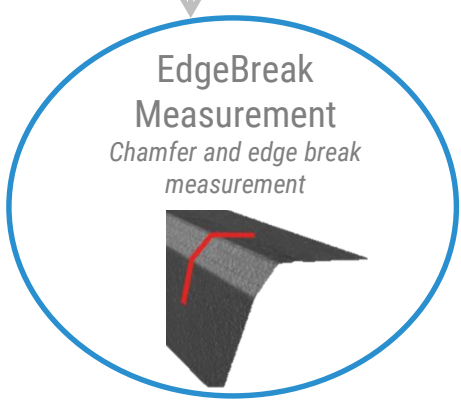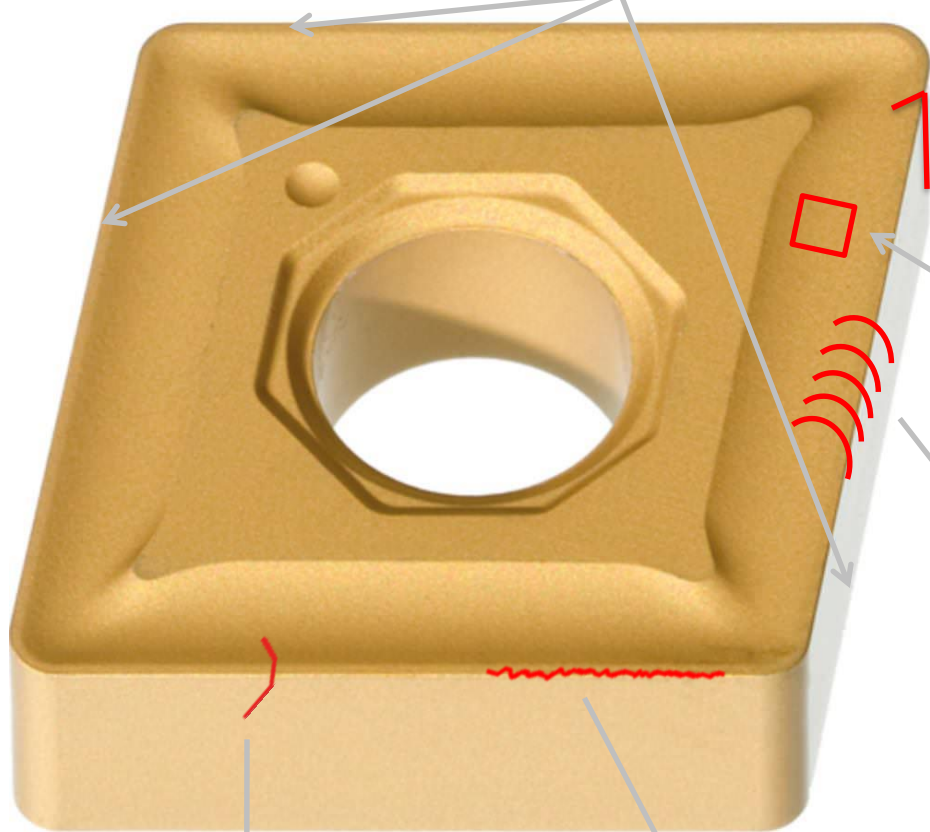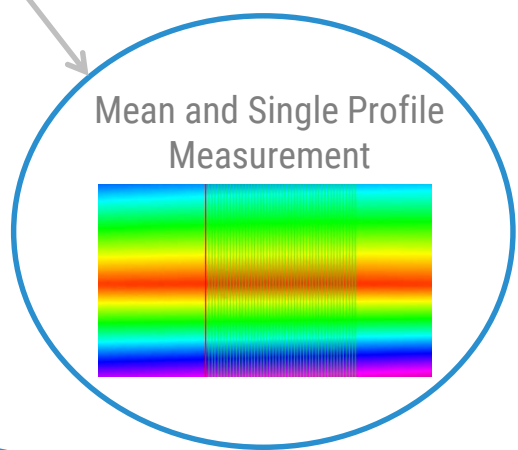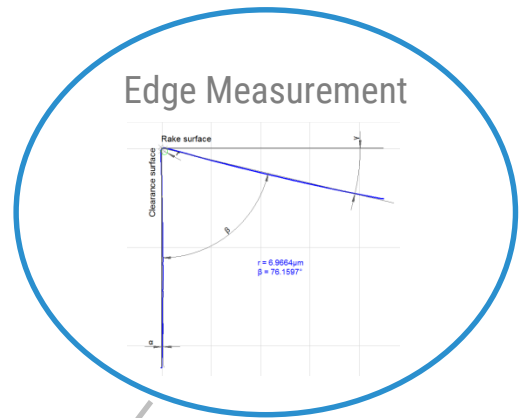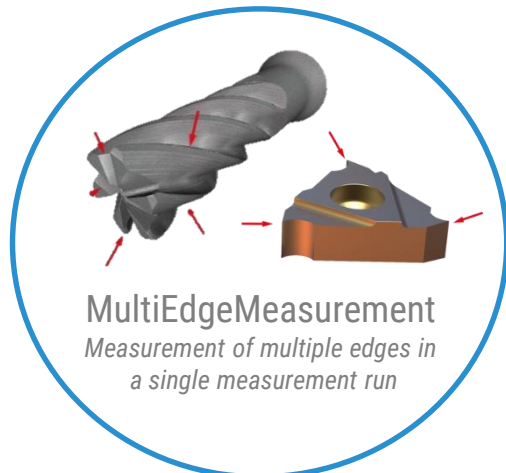
Applications

Edge Preparation Measurement
standard

» With the EdgeMasterX users measure complex geometries of deburred, ground, smoothed and polished components.

» It enables the measurement of straight and curved edges, as well as edges with or without bevel.

» Among other things, users measure radius, clearance angle (α), wedge angle (β), rake angle (γ), edge symmetry as well as negative and positive bevel lengths.

» Measurements include projected bevel length, true bevel length and bevel angles.

» Also basket arches with both waterfall and trumpet shape are traceably measured in high repeatability.
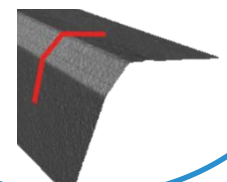
  • A fit of elliptic shapes into the edge region describes the shape with many additional radial parameters.

  • Additionally, the edge can be compared to user-defined basket arch files of arbitrary shape.

» Defined tolerances in terms of cutting edge preparation are verified.
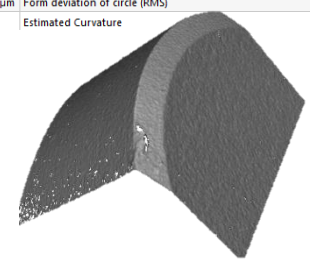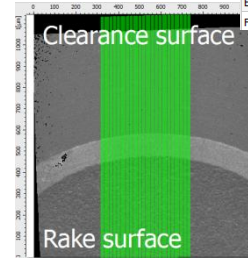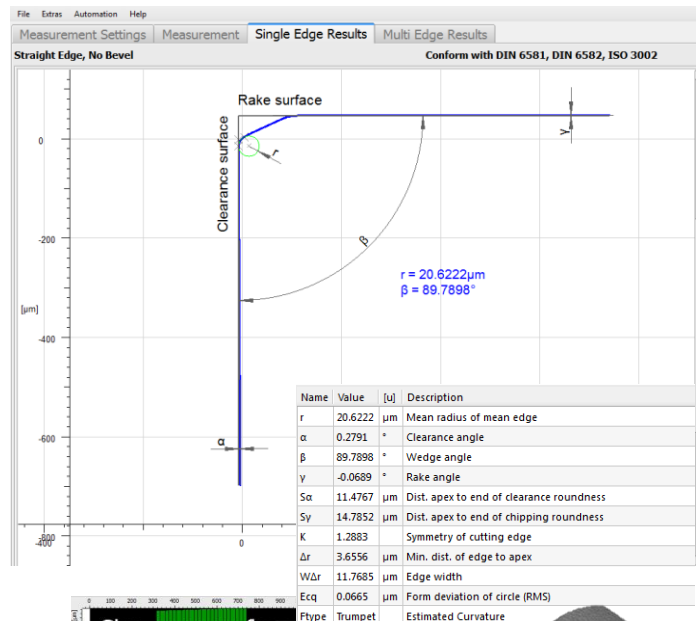
The edge geometry is analyzed with parameters such as radius, clearance, wedge and rake angle, and many more.

Both, waterfall and trumpet shape are traceably measurable in high repeatability.

Wear Measurement
standard

» The EdgeMasterX automatically compares the measured cutting tool to a previously imported CAD dataset or reference geometry.

» Differences to a measured „golden" standard are clearly visible. This is achieved through advanced pseudo color visualization: all points that lie within the tolerance remain green whereas all others are shown in red and blue.
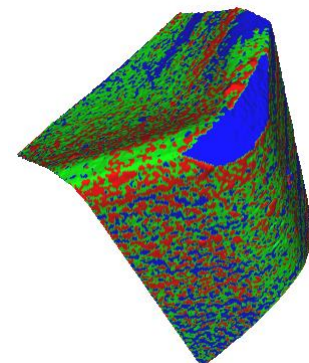
3D measurements are automatically compared to CAD data

Applications

Measurement of Multiple Edges
standard

MultiEdgeMeasurement offers fully automatic measurement of user defined parameters at various tool positions in a single measurement run. Metrology expertise is not needed to verify the quality of inserts, cutters, drills or other round tools. The administrator just sets necessary parameters and measurement positions in the software and then the sequence can be started and carried out at any time without further user influence.

Upon completion, all results are clearly summarized in a single chart with a traffic light system reporting immediately if the work pieces comply with the tool specifications. For additional details on the parameters, users can just click on the result of interest.

This automation decreases the inspection time for both individual tools as well as entire batches. In addition, personnel resources are set free as the measured tools do not require repositioning or modification in the software settings.

Three typical application areas are:

Verification of edge geometries through the measurement of various edge positions

» The user defines the measurement parameters for various tool positions.

» All parameters are then measured automatically and users receive results for each selected position.

Automatic inspection of drill, cutting miller or insert

» In combination with a rotation unit users measure multiple edges of tools.

» This even includes chamfered edges of e.g. drills, cutters and other round tools.

Rapid quality assurance of an entire batch

» Users can measure a number of parameters across multiple tools. This enables, for example, quality assurance of an entire batch.
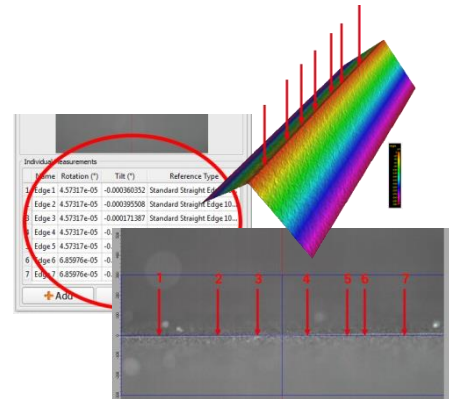
Several measurements on one edge by a single command to verify the homogenous edge preparation process
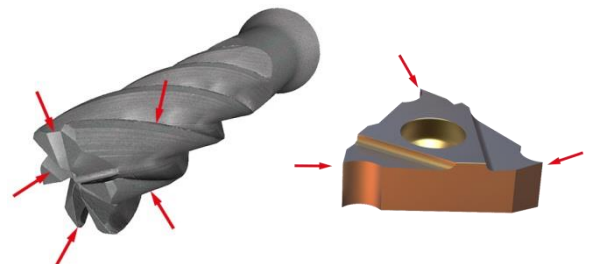
Automatic measurement sequence including multiple parameters at different positions on a tool e.g. end mill or insert
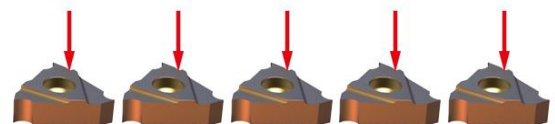
Automatic measurements on various tools e.g. to assure the quality of an entire batch
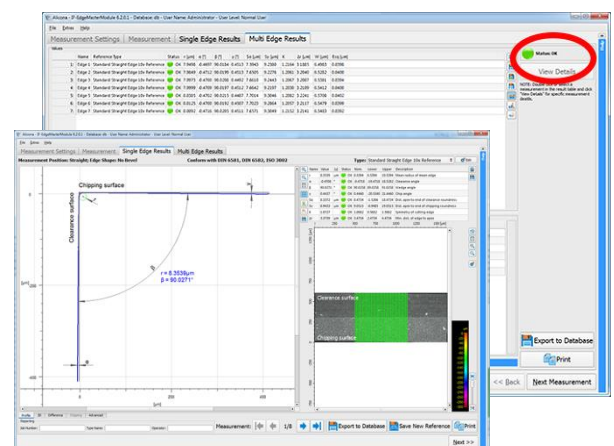
All measuring data is clearly summarized in one chart. A traffic light system reports immediately if a work piece or work pieces comply with the requirements. Details are provided as well.

Applications

Chamfer and Edge Break Measurement
(EdgeBreakMeasurement)

optional

» Users measure the shape and length of a chamfer.

» Measurements include chamfer width, various angles, width of edge break, normal distances and other ISO 13715 conform parameters. Just like edge measurement, chamfer measurement is designed as a one-button solution that can be applied in production.

Edge Break Normal Lenght 1 (B1)	44.56μm
Edge Break Normal Lenght 2 (B2)	41.65μm
Edge Break Projected Lenght 1 (B1p)	44.56μm
Edge Break Projected Lenght 2 (B2p)	41.65μm
Edge Break Width (Bw)	60.95μm
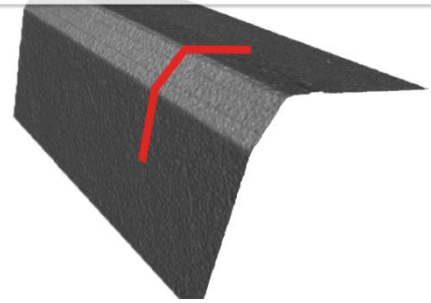
Measurable parameters of an edge break include chamfer width, various angles and other ISO 13715 conform parameters.

Measurement of Angles on Round Tools
(RoundToolMeasurement)

delivered with Real3DRotationUnit G2

» In combination with the Real3DRotationUnit G2 users measure additional important parameters such as rake angle, wedge angle and clearance angle with respect to the tool axis.

» In addition to the result table, users receive a graphical visualization, more precisely a profile, of the measured round tool with the measured parameters included.

Real3DRotationUnit G2

β1	69.8253	[°]
α1	16.4779	[°]
γ1	3.6968	[°]

Orthogonal to the rotation axis

Cutting edge

Orthogonal to the edge
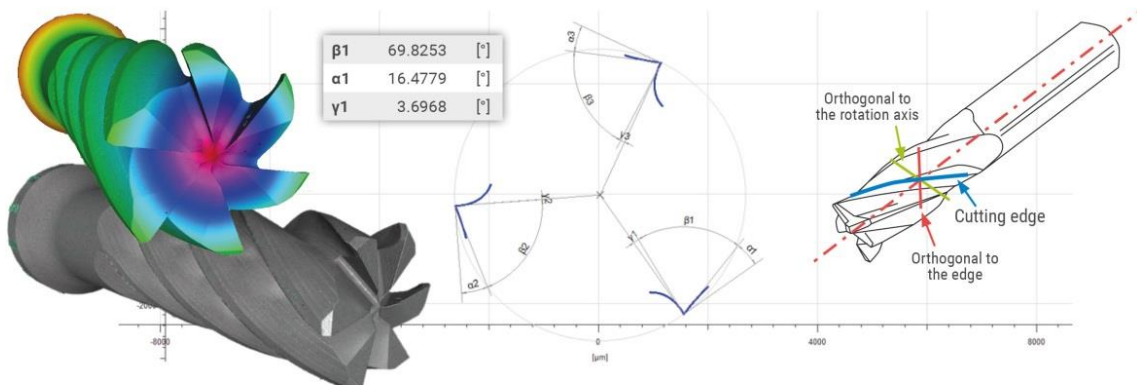
Measurement of parameters such as rake angle, wedge angle and clearance angle with respect to the tool axis.

alicona
That's metrology!

Applications

Measurement of Roughness
(ToolRoughness)
optional

» ToolRoughness allows to automatically calculate the roughness of a tool with both profile and area based parameters on the rake and clearance surface as well as in the flute of a tool.

» Typical measurable parameters: Ra, Rq, Rz, Sa, Sq, Sz
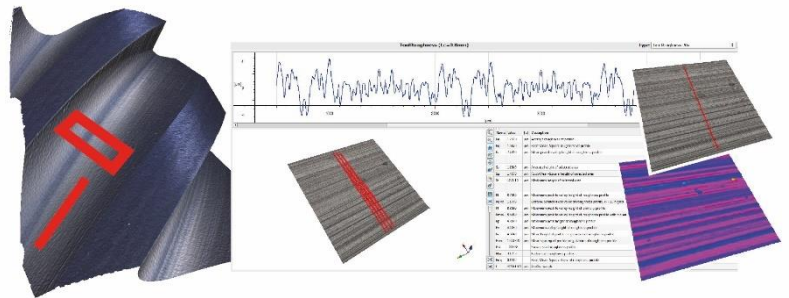
Roughness measurement on rake and clearance surface or in the flute of a tool

Features

» Automatic alignment of profiles orthogonal to the dominant structure.

» Option to choose between calculating parameters from a mean profile or calculating mean parameters from multiple profiles.

» Form removal of cylinders and spheres.

» Warning if repeatability of a measured dataset is not good enough, or if Ra value is smaller than the min. measurable Ra stated in the technical specifications.

» Automatic choice of lambdaC according to ISO 4288.

» Automatic choice of the profile length according to ISO 4288.

» Definition of number of sampling lengths.

» Automatic extraction of the profile in a zigzag path if the profile length is larger than the field of view.

» Predefined profile lengths.

» Adjustment of reference types to individual needs.

» Add tolerances to certain parameters.
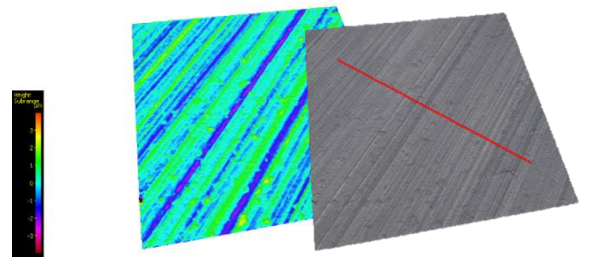
Profile extraction orthogonal to the dominant structure of the surface
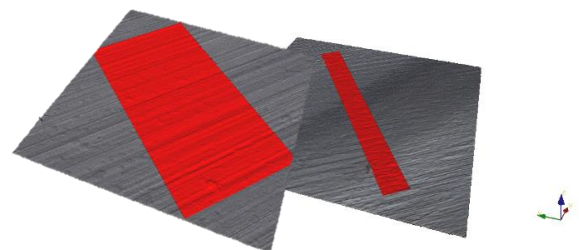
Mean parameters calculated from multiple profiles vs. roughness parameters calculated from a mean profile
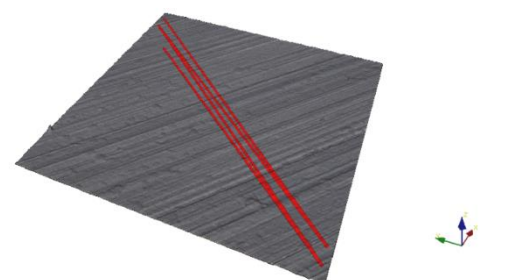
Automatic profile extraction along zigzag path if profile lengths larger than field of view

alicona]

That's metrology!

Applications

EdgeQuality and Chipping

standard

» EdgeQuality offers fully automatic chipping measurement: depth, length and volume for edge quality verification

» Users measure
  • the quality of cutting edges
  • edges with or without edge radius
  • the defect depth along the clearance and rake surface as well as along the edge profile
  • the roughness on the edge

» Typical measurable parameters:
  • percentage of edge length with defects
  • max. defect depth along the profile
  • max. defect length along the clearance/rake surface
  • (robust) radius in areas without defect

Other features

» High resolution enables the measurement of ISO 4287 conforming parameters (Ra, Rq, Rz, Rp, Rv …) along the edge.

» Possibility to calculate defects with respect to a previously measured golden standard or an imported CAD dataset.

» Warning if repeatability of a measured dataset is not good enough, or if Ra value is smaller than the min. measurable Ra stated in the technical specifications.

» Warning if roughness on rake/clearance surface is too high for desired detection parameters.

Extracted surface profile along the edge
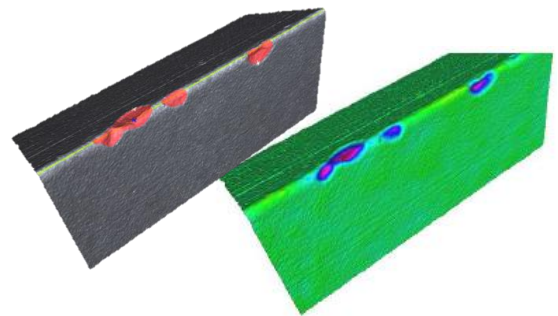
3D dataset with marked defects (true and pseudo color)

Cross section at position i
D_{di} = depth of defect at position i
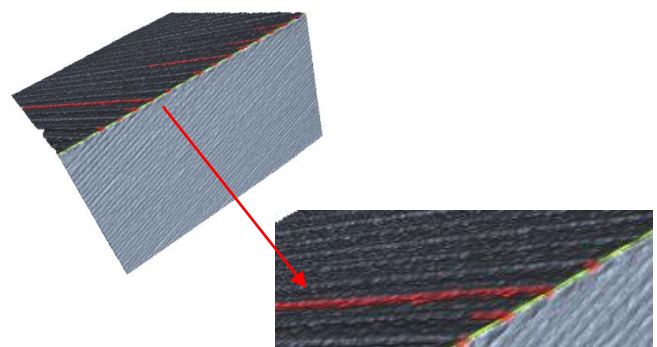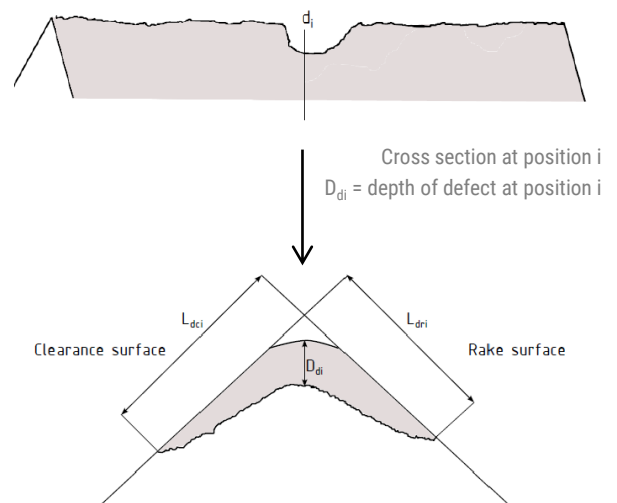
Warning options: If roughness on rake/clearance surface is higher than specified average Rv value, a warning can be displayed.

alicona
That's metrology!

General Features

Illumination

» An integrated high-power LED ring light with 24 individually controllable segments allows the measurement of highly reflective surfaces and steep flanks.

» Due to this ring light, the range of measurable surfaces is nearly unlimited.

24 individually controllably segments ensure ideal illumination and enable measuring of even highly reflective surfaces and steep flanks.

Positioning help

» The coaxial laser beam enhances usability and ensures fast and easy focusing on the measurement object.
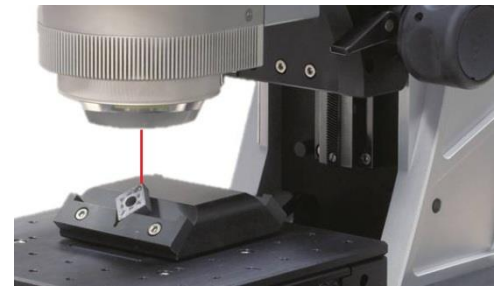
Fast and easy focusing on the sample due to laser positioning help

ControlServerHP

» The ControlServerHP is the central control unit that allows both managing and controlling the measurement system including the sensor head and the software.

» The multiple-core CPU guarantees high performance even at an increased workload.

» Easy wiring

ControlServerHP

Objectives

» RL objectives: 10x, 20x, 50x

» SXRL objectives: 2x, 50x

» AXRL objectives: 5x, 10x, 20x

» Objectives with higher working distance are available upon request

» Since the objectives do not need readjustment, they can easily be exchanged.

The objectives enable edge measurement in highest vertical resolution.

General Features

Mean and Single Profile Measurement
standard

» Cutting edges are usually verified throughout the measurement of the mean profile.

» The software additionally offers the measurement of up to 100 edge profiles within the measurement area.

» This enables detailed analysis of the selected measurement area. Users easily detect variances along the edge to deeply analyze its homogeneity.
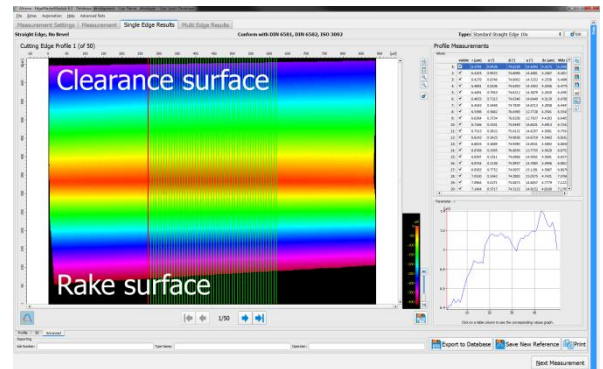
Up to 100 edge profiles enable to verify the homogeneity of a cutting edge

Automated Measurement
standard

» Measurements are performed fully automatic as a „single-button" solution.

» The user only chooses a reference type from either a selection of pre-defined edge types or by using a bar-code reader.

» Parameter settings only have to be defined once by an administrator.

Quality Assurance and Reporting
standard

» All measurements are automatically saved and can be imported into Microsoft Excel for statistical evaluation.

» Detailed reports can be generated and printed for each measurement.

» All measurements are archived in a database for quality assurance.
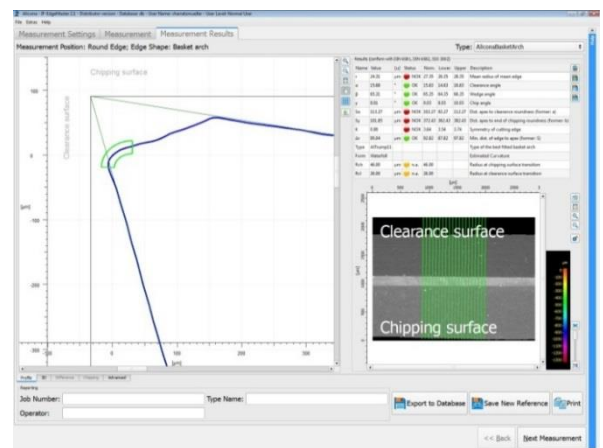
Measurement results and detailed information on parameters are provided on a result page.

General Features

Customization
standard

The software of the EdgeMasterX is individually extendable – new measurement parameters can be quickly and easily implemented in order to meet new requirements. Additionally, the graphical user interface can be adapted to the customer's needs and customer-specific parameter names can be assigned.

Name	Value	[u]	Status	Nom.	Lower	Upper	Description
r_C	65.7487	µm	OK	70.0000	55.0000	85.0000	Edge Radius

Users define customized parameters which are measured by customized scripts. These parameters are shown on the result page.
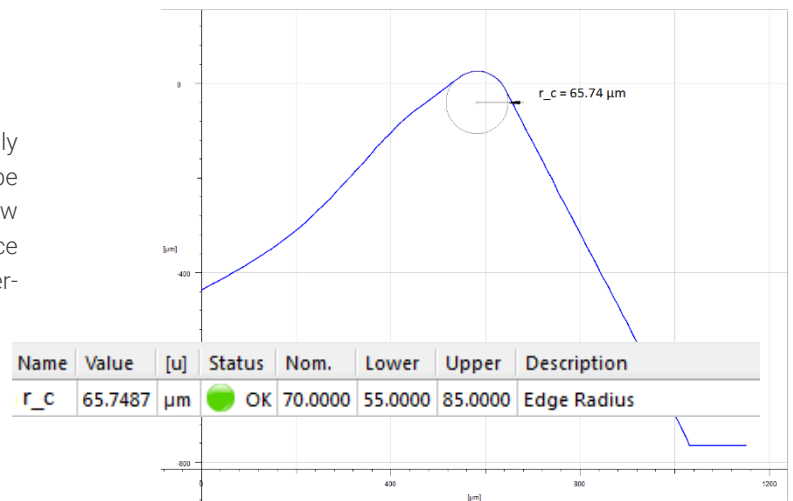
Remoting Interface
optional

The Remoting Interface can be used to automate edge measurement sequences via a .NET interface. Additionally this interface allows to control the system from a different computer.

Measurement Database
standard

» Database in which the measured datasets can be saved and organized.

» Users can examine previously performed measurements as well as import and export 3D datasets.
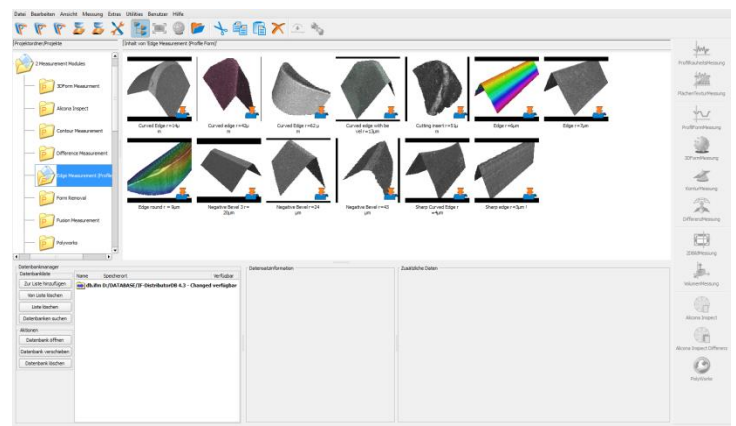
Graphical user interface and database

Order Management Module

optional

Intuitive, customizable order management with user-specific reporting

The Alicona OrderManagementModule enables **order processing and management with a customizable interface and user-specific reporting.**

» Order-related and database-supported measurement data management with **adjustable fields according to individual requirements**.

» **Fast allocation of the measurement to the order,** optionally supported by a barcode scanner.

» **Automatic selection of the correct measurement settings** for the selected order, for **efficient processes and significant time savings**.

Production-near interface and transparent order processing

» **User-specific reports** to monitor the constant quality of production, e. g. by comparing different measurement runs or operators.

» **Intuitive and production-oriented user interface with different user levels,** from basic to administrative system privileges.

» Overview of all orders, including the fulfillment status, makes order processing transparent and allows for **early detection and correction of deviations in order processes.**

Alicona edge measurement systems
with EdgeMasterModule

→ Measurement results →

Measurement data management, order linkage & reporting

↓

Visualization

IT - Interface

» IT- Interface: Option to connect Alicona edge measurement devices to ERP and QM systems
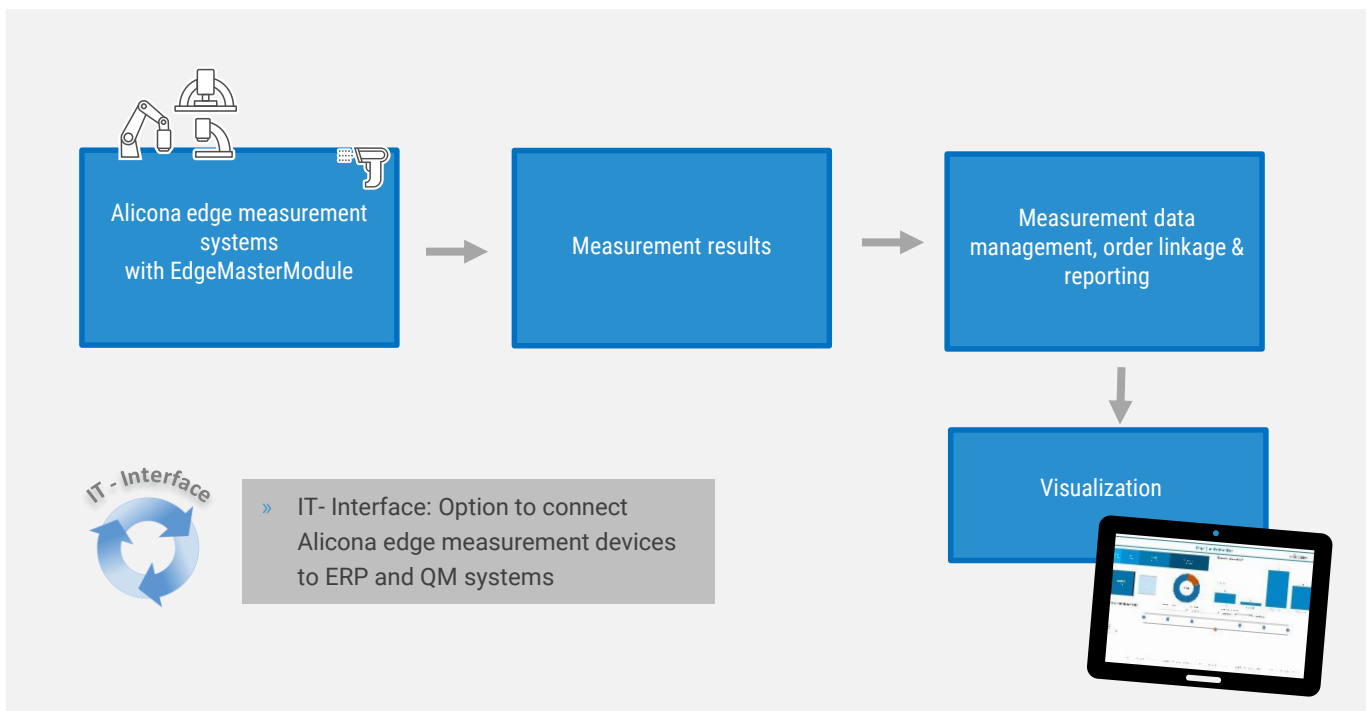
IT-Interface

optional

Integration of measurement technology in ERP and QM systems

The IT-Interface enables the **integration of Alicona measurement technology** into the IT environment of your production. Measurement data is fed into your company's ERP and QM systems. This facilitates intelligent networking and **communication between measurement technology and production systems**.

» Alicona edge measuring systems are connected to the ERP system, **hence access nominal values, tolerances and measuring strategies** of all tools. Measurements are achieved fully automatically, at the same time measurement results are fed into the QM system.

» The **networking of measurement data, ERP and QM systems** enables self-sufficient, user independent generation of measurement programs.

» Production managers **have access to all production data** and can react immediately to negative and positive trends. This supports global manufacturing **at several production sites in uniform quality**.

Order Management Module

Alicona edge measurement systems
with EdgeMasterModule

Measurement results

Measurement data management, order linkage & reporting

IT - Interface

ERP
QM

Visualization of production trends in existing QM system
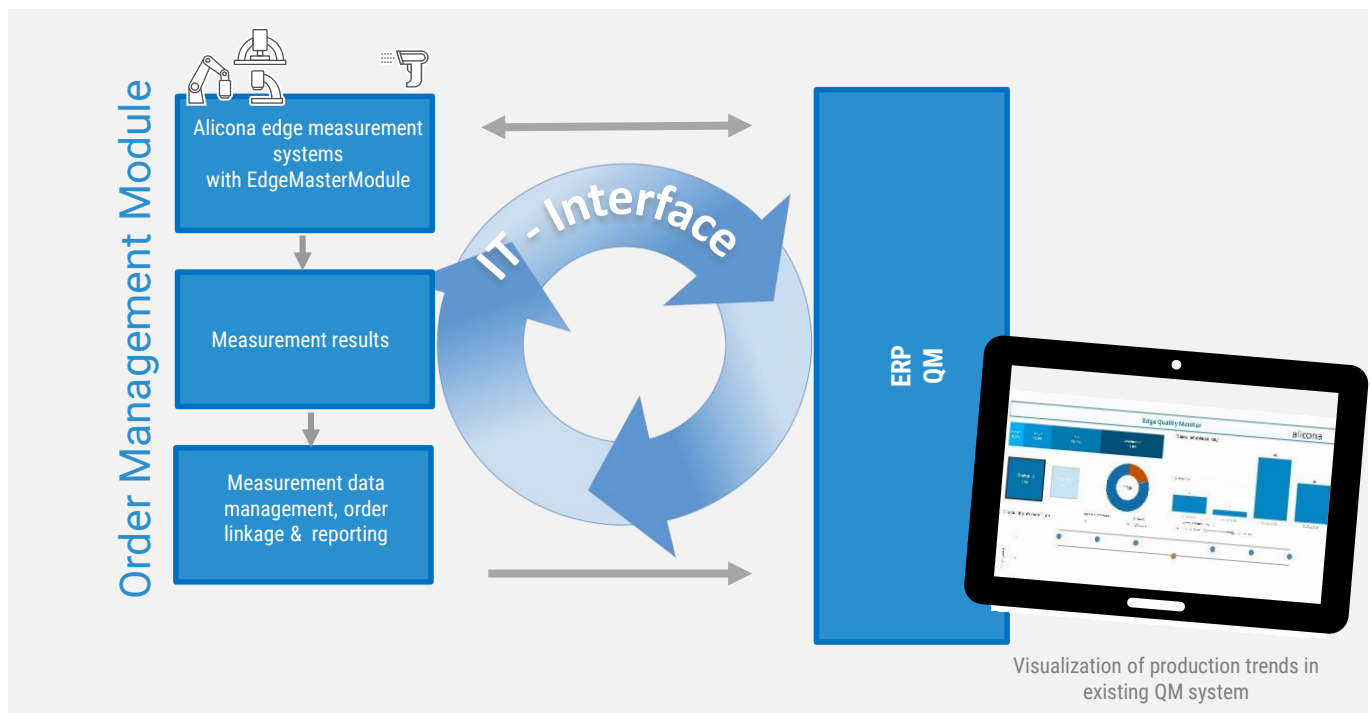
LANGUAGES	German, English
REQUIRED ALICONA SOFTWARE	EdgeMasterModule 7.0 or higher
SUPPORTED OPERATING SYSTEMS	Windows 7 64bit
	Windows 10

Measurable parameters

Edge parameters

» S_α, S_γ – distance between the apex (intersection of both dashed lines) and the end of the clearance or rake roundness, respectively

» Δr – shortest distance from the intersection of the dashed lines to the fitted circle

» $W\Delta r$ – edge width

» r – radius of the cutting edge

» E_{cq} – form deviation of circle

» E_{bq} – form deviation of basket arch

» Ftype – form deviation parameter (indicates whether the form of the cutting edge is waterfall, trumpet or not defined)

» R_{mean} – mean value of the radii of all single profiles

» γ – rake angle

» α – clearance angle

» β – wedge angle

» K – edge symmetry

» K_a – edge symmetry based on areas

» L_{a1}, L_{b2}, L_{a2}, L_{b2}, L_{b3} – length of honing width projected to rake/clearance surface

» K_{ea} – ratio of the ellipse half axis length along the rake surface to the half axis length along the clearance surface

» K_{er} – ratio of the fitted circle's radius on the rake surface to the radius of the circle on the clearance surface

» rE – measure of the mean radius of the cutting edge

» ψE – tilt angle between the rake surface and the half axis of the ellipse whose angle to the rake surface is smaller

» Φ – symmetry angle (angle between the bisector of the wedge angle β and S_β (= Δr))

» E_γ – ellipse half axis length along the rake surface

» E_α – ellipse half axis length along the clearance surface

» R_{cl} – ellipse-radius clearance face

» R_r – ellipse-radius rake face

» R_{calc} – calculated radius based on Δr

$$K = \frac{S_\gamma}{S_\alpha}$$

$$K_a = \frac{A\gamma}{A\alpha}$$
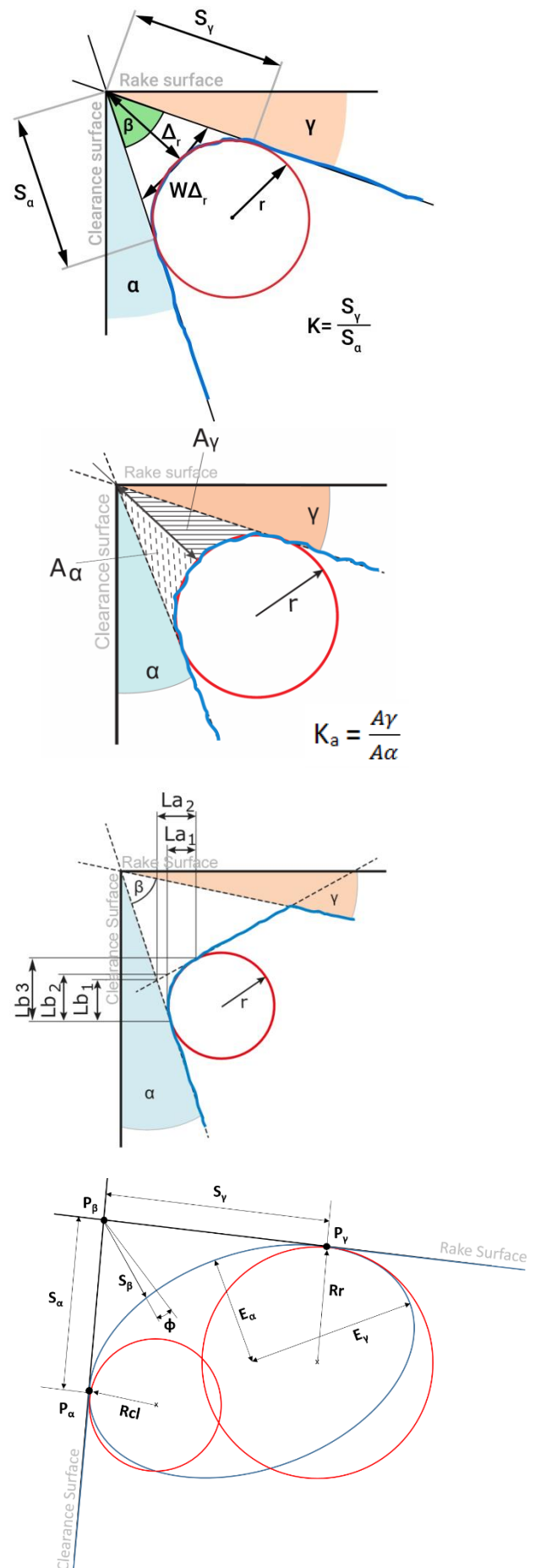
Measurable parameters

Edge parameters for negative bevel

» $b_{p1\gamma}$, $b_{p2\gamma}$, $b_{p3\gamma}$ – projected bevel length

» b_γ, $b_{\gamma1}$ – true bevel lengths

» $b_{\gamma mean}$ – mean value of the b_γ values of all single profiles

» γ_b – angle of negative bevel

Negative bevel
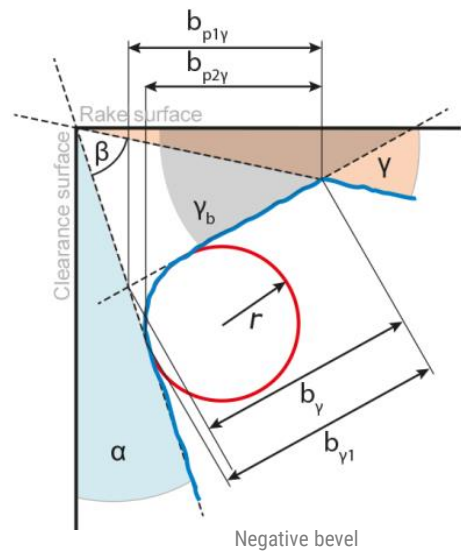
Edge parameters for supporting bevel

» $b_{p1\alpha}$, $b_{p2\alpha}$ – projected bevel length

» b_α – true bevel length

» α_b – angle of supporting bevel

Supporting bevel
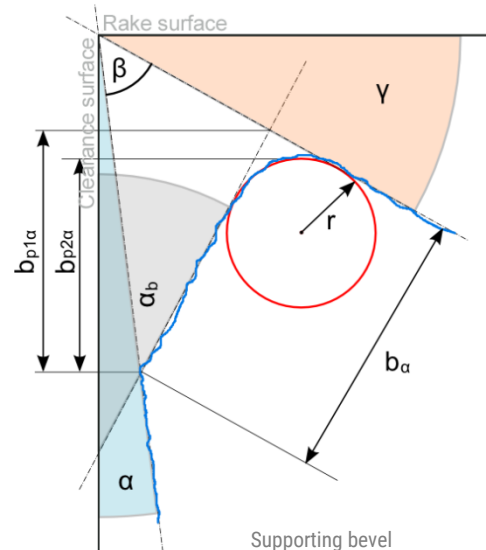
Parameters for edge break

» Bw – width of edge break

» β1, β2– edge break angles

» B1, B2 – lengths between fitted lines and edge break points (ISO 13715)

» B1p, B2p – projected lengths

» x1 neg, x2 neg – normal distances between corridors and exit points

» Bd, Bda – (absolute) mean deviation of edge break

» Bf – indicates the form of the edge

» Bg – indicates the form of the edge

» Fc – indicates whether the shape of the edge is more like a circle or a line

» γB – angle of cutting edge removal

Edge break parameters

Measurable parameters

Parameters for tool roughness measurement on the rake and clearance surface

Profile parameters

» Ra – average roughness of profile

» Rq – root-mean-square roughness of profile

» Rz – mean peak to valley height of roughness profile

» Rt – maximum peak to valley height of roughness profile

» Rt/Rz – extreme scratch/peak value of roughness profile, (>=1), higher values represent larger scratches/peaks

» Pt – maximum peak to valley height of primary profile

» Rmax – maximum peak to valley height of roughness profile within a sampling length

» Rp – maximum peak height of roughness profile

» Rv – maximum valley height of roughness profile

» Rc – mean height of profile irregularities of roughness profile

» Rsm – mean spacing of profile irregularities of roughness profile

» Rsk – skewness of roughness profile

» Rku – kurtosis of roughness profile

» Rdq – root-mean-square slope of roughness profile

» Rk – core roughness depth, height of the core material

» Rpk – reduced peak height, mean height of the peaks above the core material

» Rvk – reduced valley height, mean depth of the valleys below the core material

» Rmr1 – peak material component, the fraction of the surface which consists of peaks above the core material

» Rmr2 – peak material component, the fraction of the surface which carries the load

Rz = mean value of Z1, Z2, Z3, Z4, Z5

Material ratio parameters

Measurable parameters

Parameters for tool roughness measurement on the rake and clearance surface

Surface texture parameters

» Sa – average height of selected area

» Sq – root-mean-square height of selected area

» Sz – maximum height of selected area

» Sp – maximum peak height of selected area

» Sv – maximum valley depth of selected area

» S10z – ten point height of selected area

» Ssk – skewness of selected area

» Sku – kurtosis of selected area

» Sdq – root-mean-square gradient

» Sdr – developed interfacial area ratio

» Sk – core roughness depth height of the core material

» Spk – reduced peak height, mean height of the peaks above the core material

» Svk – reduced valley height, mean depth of the valleys below the core material

» Smr1 – peak material component, the fraction of the surface which consists of peaks above the core material

» Smr2 – peak material component, the fraction of the surface which carries the load

» Vmp – peak material volume of the topographic surface

» Vmc – core material volume of the topographic surface

» Vvc – core void volume of the surface

» Vvv – valley void volume of the surface
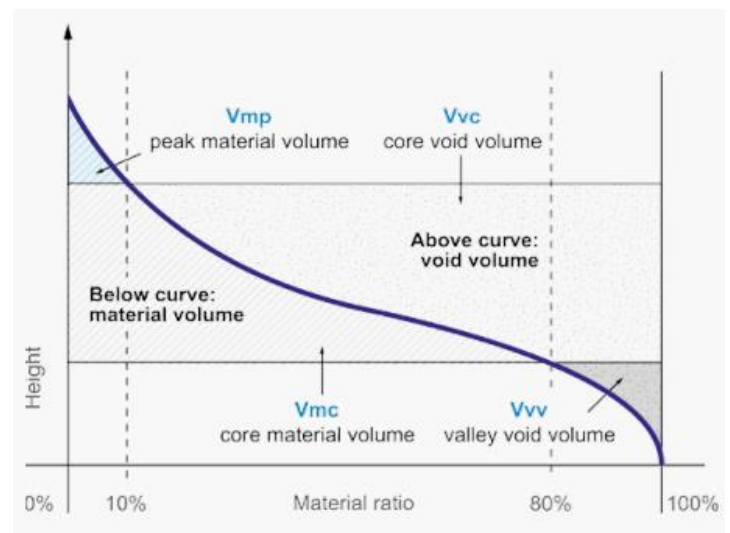
Volume parameters can distinguish differences between surfaces better than others. Volume parameters are calculated for entire surfaces

Measurable parameters

Parameters for difference measurement

- » Dmin – max. deviation below reference surface

- » Dmax – max. deviation above reference surface

- » Dmean – mean deviation

- » Vp – volume of peaks above reference surface

- » Vv – volume of valleys below reference surface

- » Vdp – volume of peak defects extending above tolerance

- » Vdv – volume of valley defects extending below tolerance

- » AProj – projected area of specimen

- » Adp – projected area of peaks above tolerance

- » Adv – projected area of valleys below tolerance

- » Pc – coverage percentage (area within tolerance)

- » SIMcd – greatest depth of defects (ISO 8785)

- » SIMch – greatest height of defects (ISO 8785)

- » SIMt – whole area of defects (ISO 8785)

Measurable parameters

Parameters for edge quality measurement

» L – evaluated length

» Pd – percentage of edge length that has defects

» Vdrel – relative defect volume per length

» Ddmax – max. defect depth along the profile

» Ddmean – mean defect depth along the profile

» Vdmax – max. defect volume

» Vdmean – mean defect volume

» Ldmax – max. defect length along the profile

» Ldmean – mean defect length along the profile

» Ldcmax – max. defect length along the clearance surface

» Ldcmean – mean defect length along the clearance surface

» Ldrmax – max. defect length along the rake surface

» Ldrmean – mean defect length along the rake surface

» Rmean_robust – radius in areas without defects
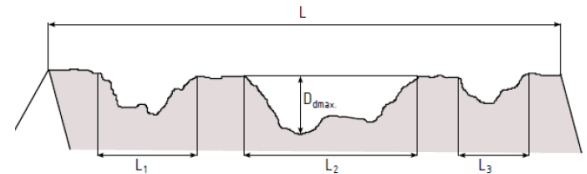
Example of an edge with three defects
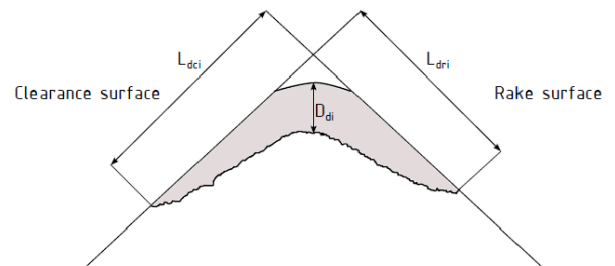
Depth of defect at a certain position (here position i)

Parameters for chipping measurement along the profile

» Ra – average roughness of profile

» Rq – root-mean-square roughness of profile

» Rz – mean peak to valley height of profile

» Rp – maximum peak height of profile

» Rv – maximum valley depth of profile

Pick & Place
Automated placing and measurement of components
optional

» Easy teach-in in 3 steps

» Option for closed loop process and ERP integration

» Pays for itself within 10 months

Alicona InfiniteFocus with Pick&Place

Automated placing and measurement

Alicona Pick & Place is an automation solution that makes it possible to set up a complete automation process within ten minutes. Therefore an optical measurement system is extended with a robot arm to automatically pick, place, measure and sort components. Pick & Place can also be used in smaller production environments and pays for itself within ten months.

The system is based on the interaction between an administrator who pre-defines automation processes, the collaborative robot for the manipulation and placing of components as well as high-resolution optical 3D measurement technology. The possible connection to existing production systems including ERP facilitates adaptive production planning.

High-resolution optical 3D measurement technology in combination with a collaborative robot arm enables automated placing, measuring and OK/NOT OK sorting in production.

Automated placement and measurement with drills

Automated placement and measurement with turbine blades

Teach-in of measurement series is carried out in only three steps and does not require any programming knowledge.

MANUFACTURING PROCESS

Places sample
Chooses project
Starts measurement

TAKE SAMPLE

MEASUREMENT PROCESS

ERP/CIM/…

SORT SAMPLE

MEASUREMENT RESULTS

MEASUREMENT RESULTS OK/NOT OK

MEASUREMENT RESULTS OK/NOT OK

ERP/CIM/…
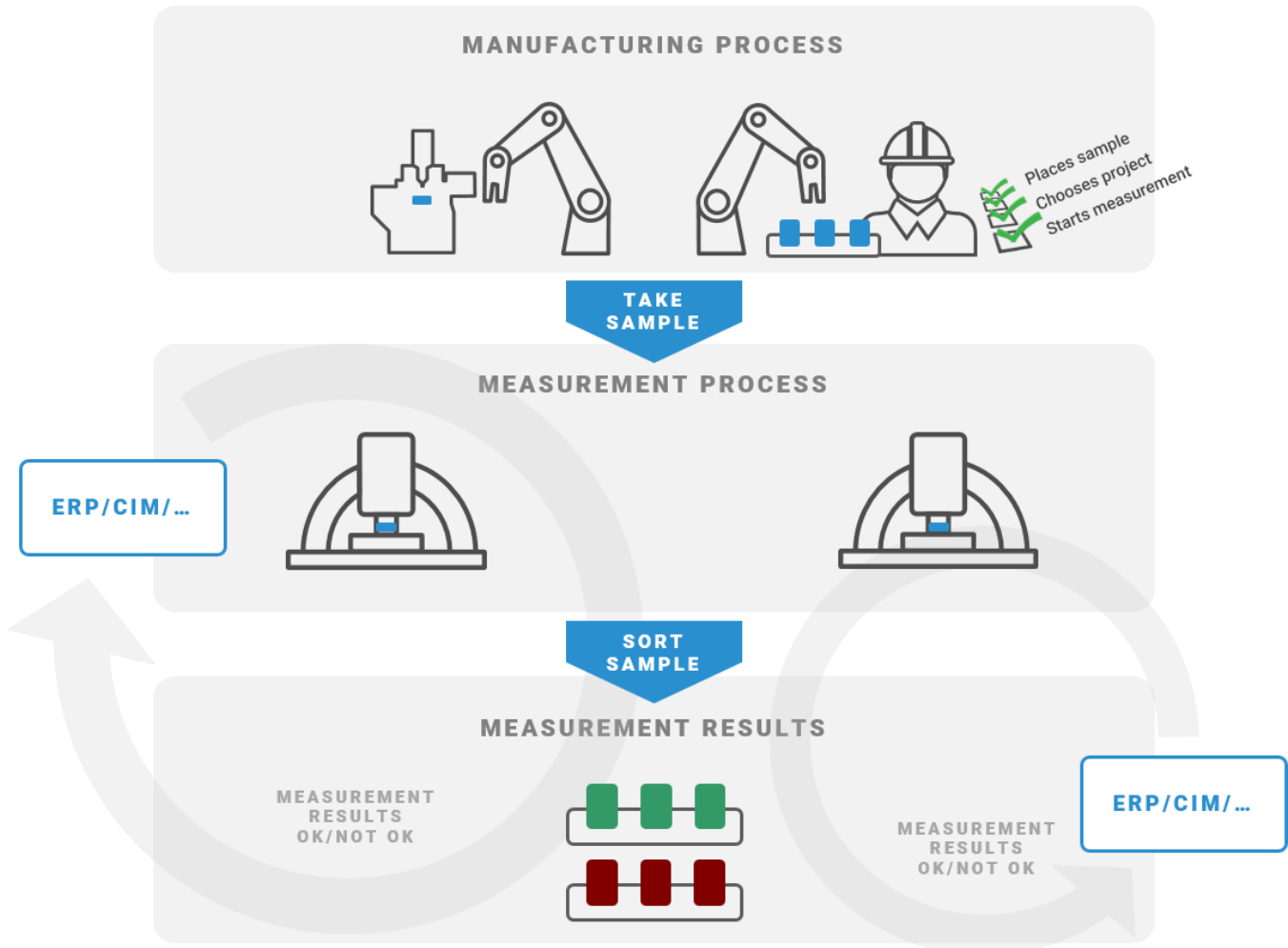
INTERACTING WITH MACHINE
ADAPTIVE CLOSED LOOP PRODUCTION

The machined component is removed from the machine by the robot, clamped on the measuring system and measured automatically. Depending on the manufacturing strategy, there are different options of continuing the production process afterwards. Either the measurement result is fed back into the tool machine following a closed-loop strategy, where machine parameters are corrected automatically and manufacturing continues in a self-controlling manner. Alternatively, an automatic sorting into OK/NOT OK pallets follows after the 3D measurement for further processing.

INTERACTING WITH WORKER
EASY TEACH-IN IN ONLY 3 STEPS

The user teaches-in an automated procedure in only three step with no programming knowledge required. The robot handles component manipulation including the positioning on the measuring system and further sorting in OK/NO OK pallets. Regardless of the number of components, only four parts per pallet have to be pre-defined. At the push of a button the operator starts the entire process in production. After the measurement is finished, the component is sorted by measurement results OK/NOK and put in the respective pallet by the robot.

Technical specifications

GENERAL SPECIFICATIONS

Robot type	UR-3, UR-5, UR-10
Reach	500mm, 800mm, 1300mm
Safety	15 advanced adjustable safety functions. TÜV NORD Approved Safety Function Tested in accordance with: EN ISO 13849:2008 PL d
Axis	6 joints
Repeatability	+/- 0.1 mm
Payload	3kg, 5kg, 10kg
Compatibility	InfiniteFocusSL, EdgeMasterX and InfiniteFocus G5 with AdvancedReal3DRotationUnit (EROWA and 3R)
Optional	» Stable table with integrated status lights and emergency switch » Pallets for 3R and EROWA, customized pallets possible » Additional HW – Laser scanner, camera system

FEATURES

Software	Teach-in in 3 simple steps: a. Define project b. Define pallets (First pallet, OK pallet, NOK pallet) c. Define procedure Administrator/Worker mode for teach-in or just starting a project
Interfaces	» TCP/IP, Profinet » Customized available
Software compatibility	AutomationManager

alicona
That's metrology!

ServiceSoftware
Adjustment and calibration
standard

Product

Automatic adjustment and calibration

The software allows the automatic adjustment and calibration of the EdgeMasterX. The adjustment methods include those for optical axis, sensor rotation, sampling distance, flatness error and grey balance. The calibration methods include lateral calibration, vertical calibration, flatness error calibration and roughness calibration.

Application

Adjustment and calibration

» Users check the functionality of the measurement device with automatic calibration routines.

» In production, the software is used to adjust and calibrate Alicona measurement devices.

» Service technicians check and assure the functionality of a measurement device at the customer's site.

Calibration	» Lateral calibration » Vertical calibration » Roughness calibration » Flatness error calibration
Adjustment	» Grey balance adjustment
Additional Features	» Single Measurement » Automatic update of the calibration state » Report generation
Services performed by service technicians only	» Adjustment of the optical axis » Adjustment of the sensor rotation » Lateral adjustment » Adjustment of the flatness error » Orthogonality adjustment » Calibration of the optical axis » Calibration of the sensor rotation
Supported Standards	ISO 25178-606, ISO 25178-6

Grips

Alicona offers a range of sample holders to ensure flexible and highly precise tool positioning. These grips not only increase the range of measurable tools, but also the level of automation in the measurement process. Each grip is designed to offer another gadget: enabling multi edge measurement, precise positioning and measurement of multiple inserts in one measurement run as well as enhancing the range of measurable tool types and sizes.

Real3DRotationUnit

» Optional accessory designed for the needs of full form and roughness measurement.

» Individual measurement sequences can be imported into a global coordinate system.

» Users can visualize and accurately measure surface features such as rake and clearance angle.

» Three-jaw lever scroll chuck supports different tool sizes and forms.

» Rotation unit with motorized rotation and manual tilt axis.
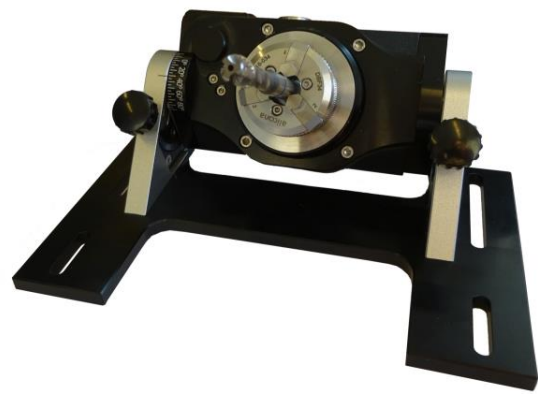
In combination with the Real3DRotationUnit G2 multiple edges of a tool can be measured in one sequence.

Rotation axis	motorized 360° (endless rotation)
Tilt axis	manually -15° to +90° (locking every 5°)
Max. torque rotation axis	0.1 Nm
Max. speed rotation axis	20°/s
Accuracy rotation axis	+/- 20"
Dimensions (W x D x H)	180mm x 133.8mm x 76.6mm
Max. specimen weight	0.5kg (more on request)
Max. specimen length	150 mm

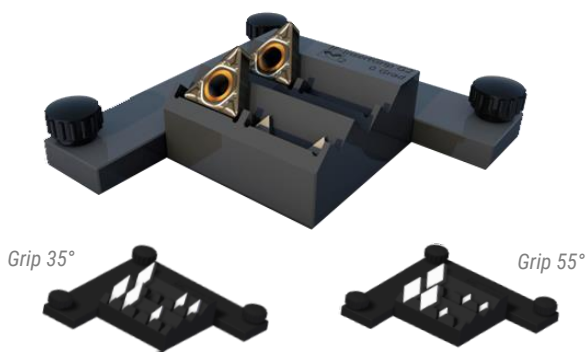| Clamping range	
Three-jaw lever scroll chuck	
Jaw position	Standard position
Inside clamping	ø 0.5 – 16mm
Outside clamping	ø 11 – 27mm
Clear aperture	12mm

Three-jaw lever scroll chuck

(*) Depending on the geometry of the specimen the indicated parameters may be limited.

Grips

InsertGrip G2

Grip 35°

Grip 55°

Measurement of multiple inserts at predefined angles without repositioning

» Predefined slots at six different angles ensure precise positioning of up to 10 inserts and enable automated single as well as multi edge measurement of cutting edges, while at the same time supporting the automation process and reducing time and labor to a minimum.

» As the tools do not need to be repositioned, measurement accuracy is increased.

» Quality assurance, difference, chipping or edge break measurement can be performed on multiple inserts in one measurement with one single click and no further repositioning.

Dimensions (W x D x H)	116 x 116 x 28mm
Angles	0°, 35°, 55°, 60°, 80°, 90° *(other angles available on request)*
both the mechanical stop and the grips have magnets	

ToolGrip

The ToolGrip enables repeatable measurements of complex cutting edge geometries.

» Grip to enhance the range of measurable tool sizes and types.

» Enables the measurement of drills, milling cutters and other round tools with larger diameters and lengths.

» Tiltable from 0 up to 90°

» Tools can be additionally rotated inside the v-shaped socket.

» Adjustable axial and radial stop collar allows repeatable insert of samples.

» Well-suited for production environment due to easy and fast sample exchange.

Dimensions (W x D x H)	103.7 x 45.5 x 151.1mm
Tilt range	0-90°
Sample diameter	2mm-30mm
Sample length	40mm-250mm
Max. sample weight	1kg

Grips

AdvancedInsertGrip

» Adjustable sample holder for a multitude of cutting inserts.

» Cutting tools can be put into the same position more then once which guarantees repeatable measurement results.

Dimensions at tilt angle 0° (W x D x H)	70 x 52.5 x 79mm
Dimensions at tilt angle 25° (W x D x H)	70 x 61.82 x 79mm
Tilt range	-25° - +25°
Opening angle	60° and 90°
Slope angle at 0° tilt angle	45°

RotationGrip

» Clamping device with three-jaw scroll chuck and manual tilt and rotation axis

» For precise positioning of tools at various tilt and rotation angles results.

Dimensions (W x D x H)	108 x 96 x 80mm
Max. specimen weight	1.5 kg
Max. specimen length	150mm
Aperture	11mm
Tilt range	ca. 0-60°
Rotation range	0-360°

Outer gripping range	10-50mm
Inner gripping range	0.5-16mm

Accessories

Traveller G2

» The Traveller G2 is an accessory especially designed for the mobile use of Alicona's measurement system EdgeMasterX.

» Consisting of two lightweight and stable travelling cases – one small, one big – the Traveller G2 is fast and easy to (un-)pack and comfortable to transport either by car or plane.

» It offers space for the following components:
  – measurement system,
  – ControlServerL G2,
  – monitor,
  – keyboard,
  – 4 objectives,
  – calibration standards and various accessories

» Foam inlays with compartments protect the components and keep them in place.

» In addition to the **two travelling cases** with foam inlays, the high-performance **ControlServerL G2**, a portable **monitor**, small **keyboard** and a **travel adapter** are included in the delivery.

Traveller G2 – mobile use of Alicona measurement systems

Dimensions (H x W x D)	
Big case	815mm x 535mm x 260mm
Small case	440mm x 470mm x 230mm
Volume	
Big case	98l
Small case	30l
Weight	
Big case (fully packed, incl. EdgeMasterX, 4 SX objectives, 2 calibration standards and InsertGrip)	33.5kg
Big case (incl. EdgeMasterX, 3 RL objectives, 5x AX objective, without calibration standards and InsertGrip)	31.3kg
Small case (fully packed, incl. ControlServerL G2)	9.9kg

ControlServerL G2	
CPU	4 Core, 3.1 GHz
RAM	8GB DDR3
Mass storage	SSD 256GB
USB ports	4x USB 3.0, 3x USB 2.0
LAN	2x 1Gbit/s
WLAN	two external antennas, 300 Mbit/s
Power supply PC	300 W; 100-240 VAC; 50-60 Hz
Power supply sensor	integrated DC/DC converter, 24 VDC

Calibration standards

Alicona offers a variety of certified standards for traceable optical measurement and verification of measurement results. Users can trace back optical roughness measurements as well as verify the lateral and vertical accuracy of an edge. Each standard is traced back to nationally recognized metrology institutes and comes with a certificate.

EdgeCalibrationTool G2

The EdgeCalibrationTool is particularly designed for the verification of optical edge measurements. Users verify high resolution measurements performed in both research and production. Based on the technology of Focus-Variation, also complex components with steep flanks and varying material properties are traceably measured. METAS (Federal Institute of Metrology, Berne/Switzerland) calibration certificate included.

EdgeCalibrationTool – traceable verification of radius, K-factor and angle

| Radii	5µm, 10µm, 25µm (3x), 50µm, 75µm
Elliptical shape	2 edges
K-factor	8 edges with K-factor K=1 2 edges with K-factor K=1.5
Angles	8 with 90° 1 edge with 70° 1 edge with 110°
Certification	**Option 1:** Two edges with METAS certificate as well as factory certificate for all edges. **Option 2:** All edges with METAS certificate.

$$K = \frac{S\gamma}{S\alpha}$$
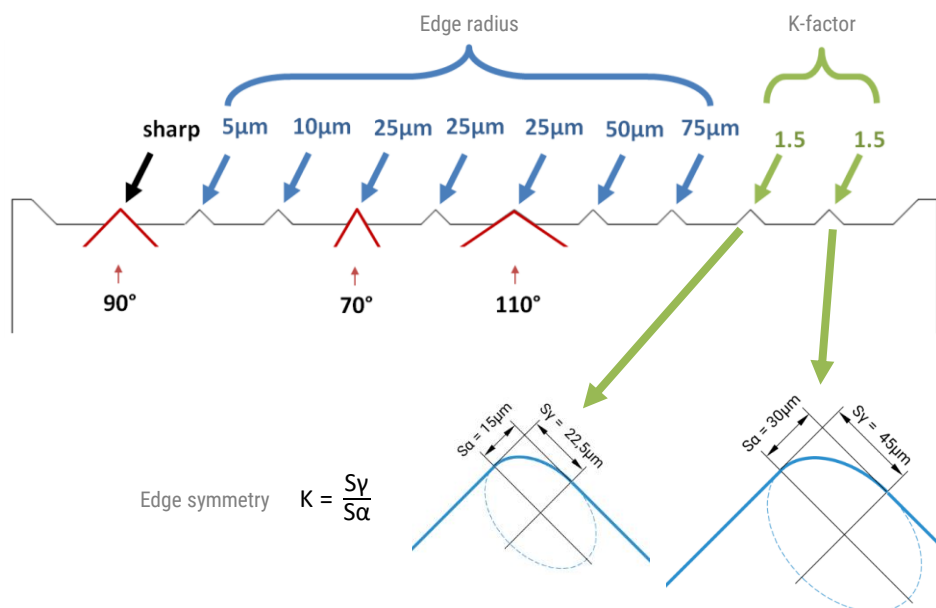
Calibration standards

RoughnessTool

This roughness standard can be applied for both tactile and optical measurement systems. Its traceability provides comparison with other measured values, certified standards or target values. Users can measure and verify surface geometry and roughness according to ISO 4287/88. DAkkS- or NPL-calibrated.

| Sinusoidal Roughness Standard	
RoughnessTool-500	Ra = 0.5µm
RoughnessTool-3000	Ra = 3µm
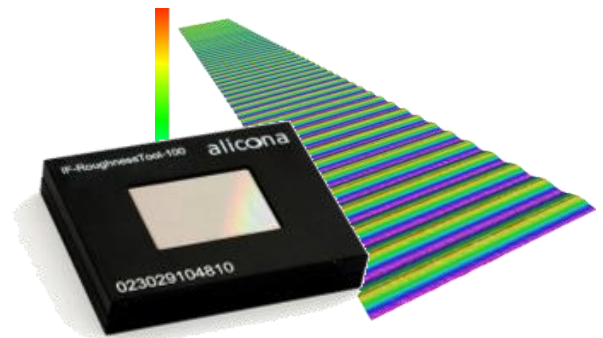
RoughnessTool –
to verify roughness measurements

ArealRoughnessTool

Areal roughness standard for optical measurements traceable to NPL. With this tool, users verify the accuracy of optical roughness measurements.

Roughness standard	Sa = 0.75µm, Sq = 1µm
Calibrated area	1.4 x 1.4mm
Dimensions (W x D x H)	82 x 63 x 14mm
Temperature range	20 °C +/- 2 °C
Humidity range	40-65 %
Recalibration interval	3 years
Calibration laboratory	NPL
Calibration according to	ISO 25178
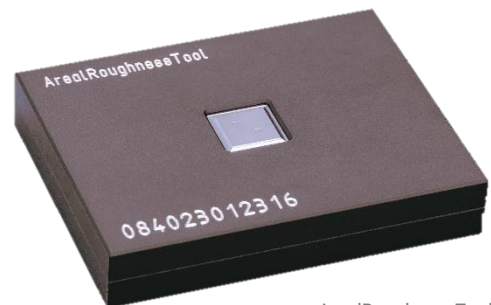
ArealRoughnessTool –
Verification of optical roughness measurements

CalibrationTool

The Alicona CalibrationTool is particularly designed for verifying the vertical and lateral accuracy of all Alicona 3D measurement devices. It provides a height step (1000µm) for the vertical check and various chess patterns for the verification of lateral results. DAkkS-calibrated (*optional*).

Circle diameters	2000µm, 1000µm, 500µm, 250µm, 100µm, 50µm
Grid spacings	120µm, 50µm, 24µm, 12µm, 5µm
Height step	1000µm

3D dataset of the measured height step

CalibrationTool

Chess pattern for the verification of lateral measurements

Technical specifications

The following specifications conform to the guidelines of the *Initiative Fair Datasheet*. Specifications in blue mark Alicona specific values.

Initiative Fair Datasheet

The "Fair Datasheet" considers itself a quality label to encourage manufacturers of measurement instruments to provide practice-oriented and comparable specifications. The initiative is supported by various manufacturers of measurement instruments, users such as Audi, Bosch and Daimler as well as by the Kaiserslautern University of Technology, with PTB, ZVEI and VDI considerably contributing to its operation.

Technical specifications

GENERAL SPECIFICATIONS

Measurement principle	non-contact, optical, three-dimensional, based on Focus-Variation
Max. number of measurement points in a single measurement	X: 2040, Y: 2040; X x Y: 4.16 million
Max. number of measurement points	X: 62500, Y: 62500; X x Y: 500 million
Positioning volume (X x Y x Z)	RL objectives:　　　　mot.: 50 mm x 50 mm x 155 mm (Z: 25 mm mot., 130 mm man.) = 387500 mm³ SXRL/AXRL objectives:　mot.: 50 mm x 50 mm x 120 mm (Z: 25 mm mot., 95 mm man.) = 300000 mm³
Ring light illumination	white LED high-power ring light, 24 segments
Positioning help	coaxial laser beam
Dimensions (W x D x H)	measurement instrument: 195 mm x 340 mm x 485 mm, ControlServerHP: 200 mm x 490 mm x 440 mm
Mass	measurement instrument: 15 kg, depending on set-up; ControlServerHP: 16.9 kg
IP code	IP20
Applications	automated tool measurement in production with automatic multi edge measurement; applied for quality assurance of inserts, mills, drills and other round tools

ENVIRONMENTAL CONDITIONS

Ambient temperature range	measurement instrument: possible: 18°C - 28°C; calibrated for 18°C - 22°C (can be calibrated for other temperature ranges), ControlServerHP: possible: 0°C - 30°C
Permissible temperature gradient	less than 1°C/h
Permissible relative humidity	recommended: 45 % (+/-5 %), possible: 45 % (+/- 15 %)
Supply voltage and current	ControlServerHP: 100-240 VAC, 50-60 Hz; measurement instrument: 24 VDC
Electric power	ControlServerHP: 700 W; measurement instrument: 200 W

CONTROLSERVERHP

CPU	4 Core, 3.4 GHz
RAM	32 GB DDR4
HDD memory	2 TB
Operating system	Windows 10 IoT Enterprise, 64bit
Monitor	24" Full HD LED monitor with integrated USB hub

MEASUREMENT OBJECT

Surface texture	surface topography Ra above 0.009 µm with λ_c 2 µm; depending on surface structure
Max. height	155 mm
Max. weight	4 kg; more on request
Diameter	0.5 mm – 40 mm (in combination with Real3DRotationUnit G2)

OBJECTIVE SPECIFIC FEATURES

Objective magnification (*)		10x	20x	50x	2x SX	5x AX	10x AX	20x AX	50x SX
Numerical aperture		0.3	0.4	0.6	0.055	0.14	0.28	0.42	0.55
Working distance	mm	17.5	16	10.1	34	34	33.5	20	13
Lateral measurement area (X, Y) (X x Y)	 mm mm²	 2 4	 1 1	 0.4 0.16	 10 100	 3.61 13.03	 2 4	 1 1	 0.4 0.16
Measurement point distance	µm	1	0.5	0.2	5	2	1	0.5	0.2
Calculated lateral optical limiting resolution	µm	1.09	0.82	0.54	5.93	2.33	1.17	0.78	0.59
Finest lateral topographic resolution	µm	2	1	0.64	10	4	2	1	0.64
Measurement noise	nm	40	20	10	1240	165	45	25	15
Vertical resolution	nm	100	50	20	3500	460	130	70	45
Vertical measurement range	mm	16	15	9	25	25	25	19	12
Measurement speed		≤ 1.7 million measurement points/sec.							
Accessibility	°	31	29	19	40	51	51	39	26

(*) Objectives with longer working distance available upon request

Technical specifications

EXTENDED MEASUREMENT RANGE

Objective magnification		10x	20x	50x	2x SX	5x AX	10x AX	20x AX	50x SX
Extended lateral measurement range (X, Y) (*) (X x Y) (**)	mm mm²	50 500	50 125	50 20	50 2500	50 2000	50 500	50 125	50 20
Extended lateral measurement range with data reduction (X, Y) (*) (X x Y) (**)	mm mm²	50 2500	50 2500	50 2500	50 2500	50 2500	50 2500	50 2500	50 2500

(*) Maximum unidirectional measurement area along the X- and Y-axis
(**) Maximum X/Y-measurement area

RESOLUTION AND APPLICATION SPECIFICATIONS

Objective magnification (*)		10x	20x	50x	2x SX	5x AX	10x AX	20x AX	50x SX
Height step accuracy (1 mm)	%				0.1				
Min. measurable roughness (Ra)	µm	0.3	0.15	0.08	n.a.	n.a.	0.45	0.25	0.15
Min. measurable roughness (Sa)	µm	0.15	0.075	0.05	n.a.	n.a.	0.25	0.1	0.08
Min. measurable radius	µm	5	3	2	20	10	5	3	2
Max. bevel length	µm	800	400	160	4000	2000	800	400	160
Min. measurable wedge angle	°				20				
Max. measurable slope angle	°				87				

ACCURACY

| Flatness deviation	2 mm x 2 mm with 10x objective	U = 0.1 µm
Max. deviation of a height step measurement	height step 1000 µm height step 100 µm height step 10 µm height step 1 µm	$E_{Uni:St:ODS,MPE}$ = 1 µm, σ = 0.1 µm $E_{Uni:St:ODS,MPE}$ = 0.4 µm, σ = 0.05 µm $E_{Uni:St:ODS,MPE}$ = 0.3 µm, σ = 0.025 µm $E_{Uni:St:ODS,MPE}$ = 0.15 µm, σ = 0.01 µm
Profile roughness	Ra = 0.5µm	U = 0.04 µm, σ = 0.002µm
Area roughness	Sa = 0.5µm	U = 0.03 µm, σ = 0.002µm
Distance measurement	XY up to 2 mm	$E_{Bi:Tr:ODS,MPE}$ = 0.8 µm
Wedge angle	β = 70° - 110°	U = 0.15°, σ = 0.02°
Edge radius	R = 5 µm - 20µm R > 20µm	U = 1.5 µm, σ = 0.15µm U = 2 µm, σ = 0.3µm

$E_{Uni:St:ODS,MPE}$ & $E_{Bi:Tr:ODS,MPE}$ conform to ISO 10360-8

SOFTWARE

Measurement modules	Standard: automatic edge measurement (edge radius, form, contour, form deviation), MultiEdgeMeasurement Optional: chipping, roughness, edge break; OrderManagementModule
Automation	integrated scripting language; LabVIEW framework; .NET remoting interface
Languages	German, English, French, Korean, Japanese
Export formats	3D datasets (e.g.: AL3D, STL, G3D, CSV, QDAS), image formats (e.g.: BMP, JPG, PNG)
Import formats	3D datasets (e.g.: AL3D, STL, G3D), image formats (e.g.: BMP, JPG, PNG)

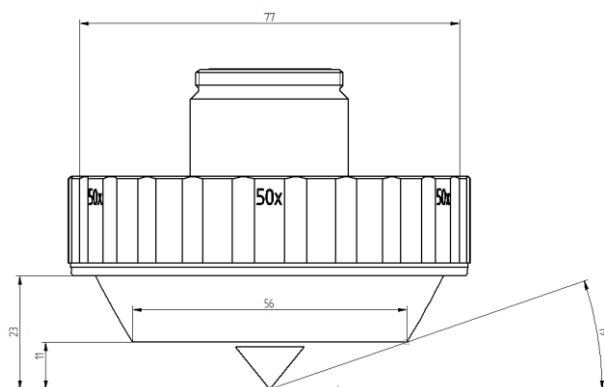# Technical specifications

Objectives RL: accessibility and dimensions
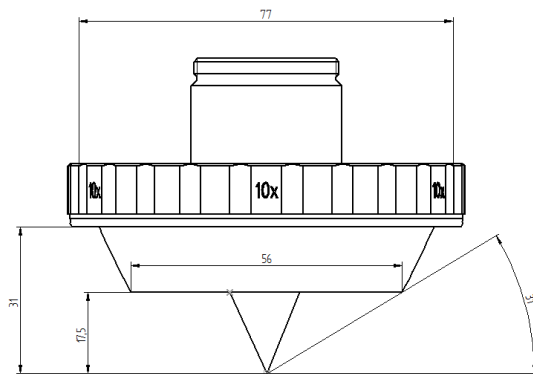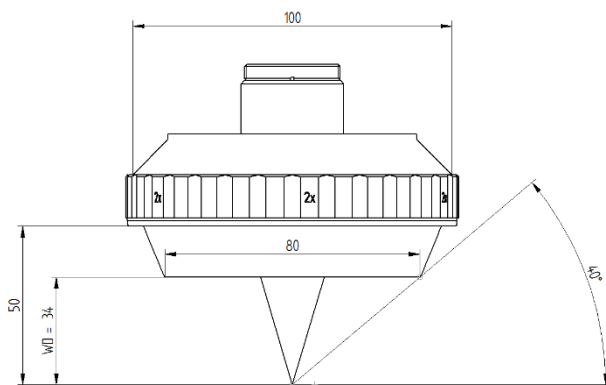

Objective RL 10x, accessibility: 31°
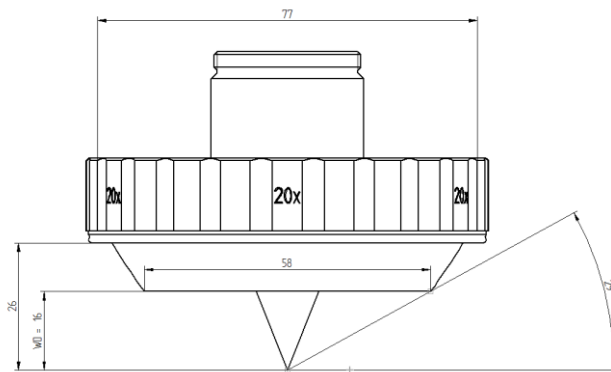
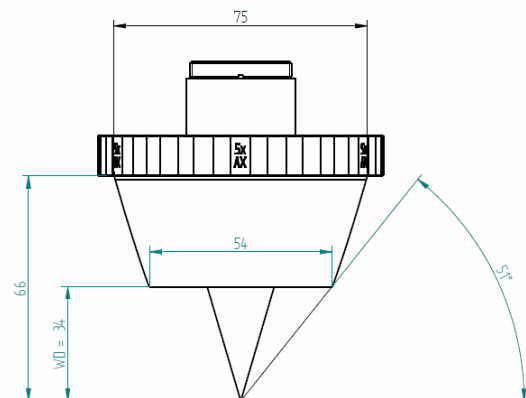Objective RL 20x, accessibility: 29°

Objective RL 50x, accessibility: 19°

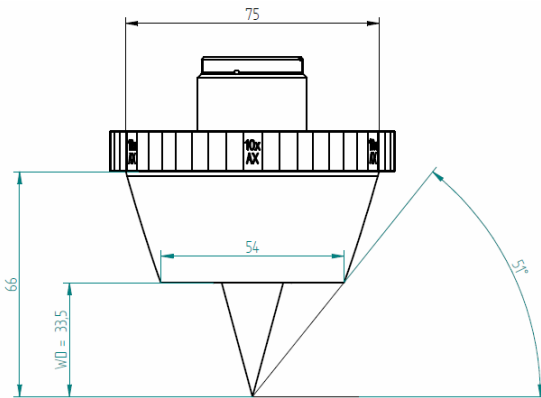# Technical specifications

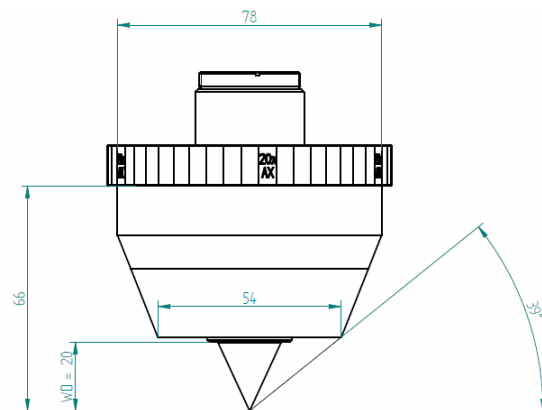## Objectives SXRL/AXRL: accessibility and dimensions

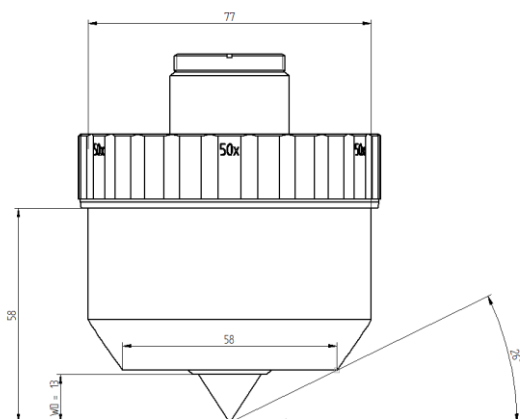Objective SXRL 2x, accessibility: 40°

Objective AXRL 5x, accessibility: 51°

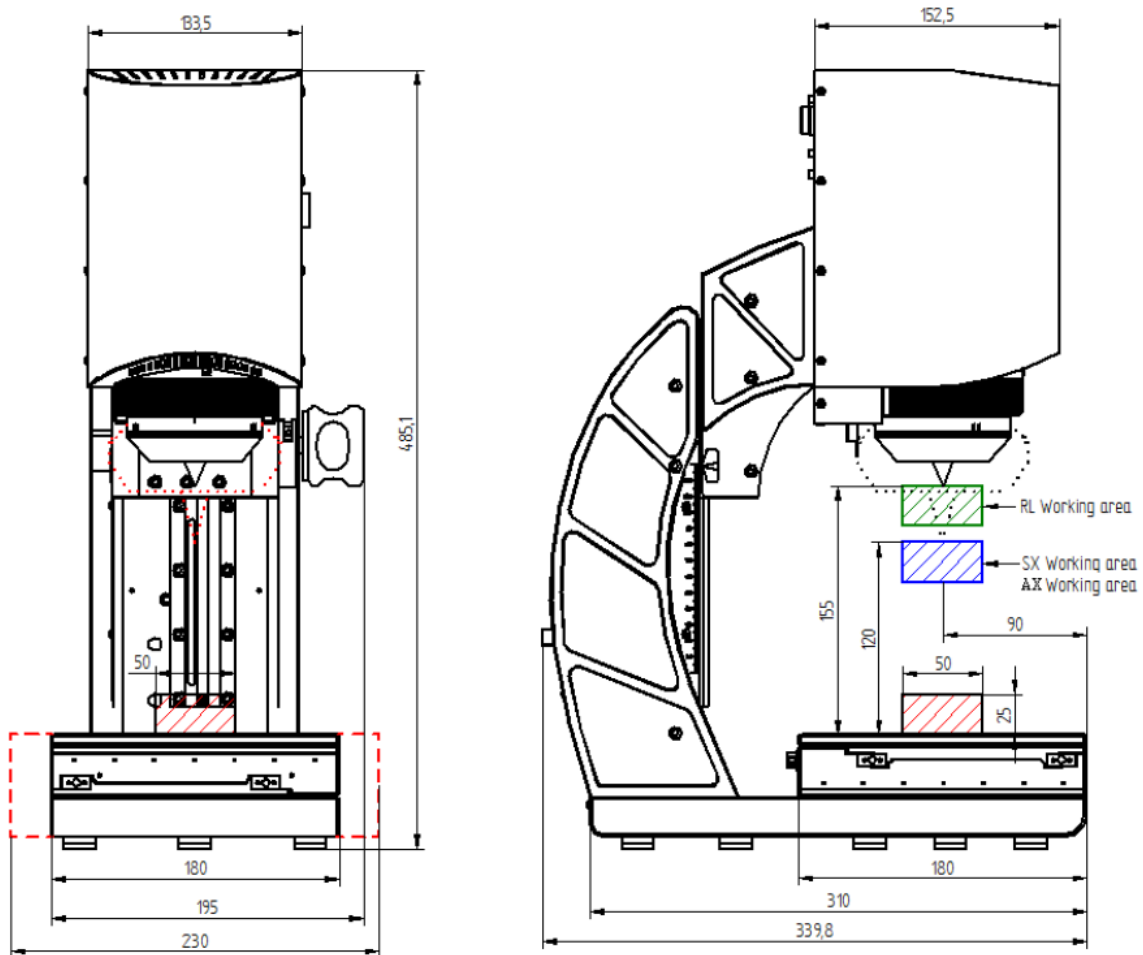Objective AXRL 10x, accessibility: 51°

Objective AXRL 20x, accessibility: 39°

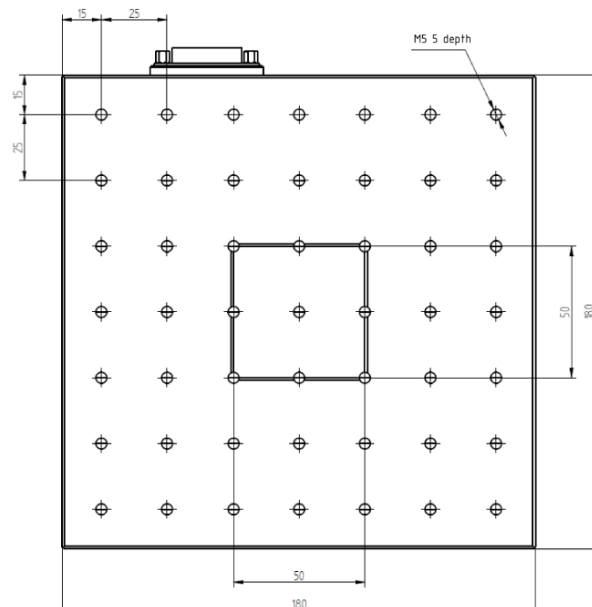Objective SXRL 50x, accessibility: 26°

Technical specifications

Working area

Motorized X/Y stage

Dimensions	180 mm x 180 mm
Travel range	50 mm x 50 mm (mot.)
Weight limit	4 kg; more on request
Thread hole	M5x5

Technical specifications

Working area with Real3DRotationUnit G2

RL Objectiv
SX Objectiv
RL Working area
SX Working area
Typical Working area

153
90
25
50
155
120
42
180
310
340

133.5
485
41.2
180
195
230
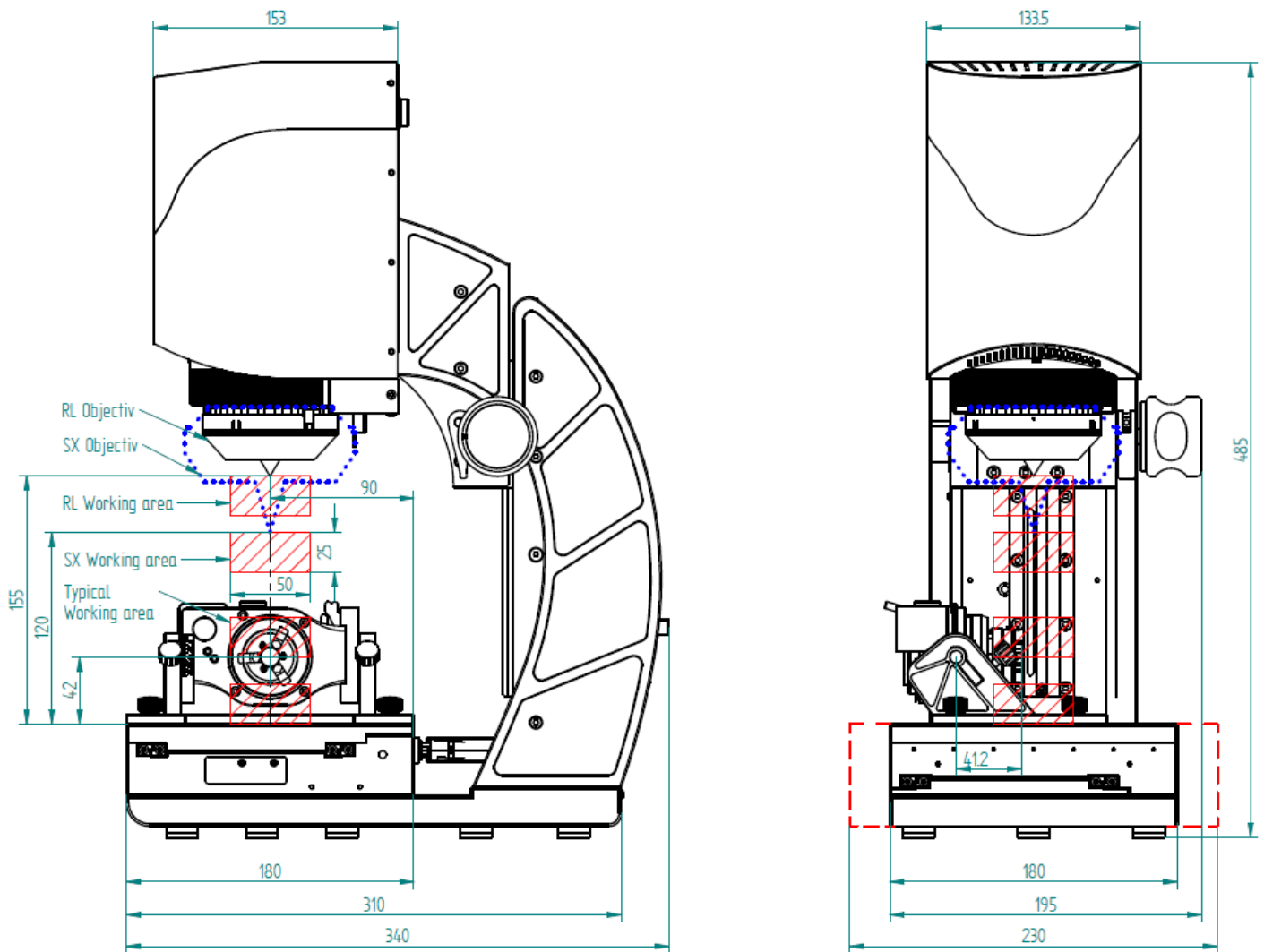
(*) The indicated working area of the SX objectives also applies to the AX objectives.

Overview: Included and optional components/features

Components	Version		Order-Number
ControlServerHP (incl. CableSetHP3m)	G1 Vf2	✓	
Joystick	G1 Vc	✓	
Monitor		✓	
Keyboard		✓	
Mouse		✓	
Dongle		✓	
EmergencyStopBypass	G1 Va1	✓	
EmergencyStop	G1 Vb	optional	HWO-127

Objectives
RL: 10x
        20x
        50x   or
	G1 Vc1
	G1 Vc1
	G1 Vc1
			OPO-113
			OPO-114
			OPO-115

SXRL: 2x 50x or	G1 Va2 G1 Vb2	optional	OPO-120 OPO-119

AXRL: 5x
        10x
        20x
    (depending on order)
	G1 Va1
	G1 Va1
	G1 Va1
			OPO-125
			OPO-121
			OPO-122

Grips			
Real3DRotationUnit	G2 Vc1	optional	GHO-119E
InsertGrip	G2 Va	optional	GHO-121
ToolGrip	G1 Va	optional	GHO-110
AdvancedInsertGrip	G1 Vc	optional	GHO-102
RotationGrip	G1 Vd1	optional	GHO-103
Accessories			
Traveller	G2 Va	optional	HWO-134
Calibration Standards			

EdgeCalibrationTool
    Certificate for 2 edges
    Certificate for all edges
	G2 Vb	optional	HWO-143
			HWO-144

RoughnessTool
    RoughnessTool-500
    RoughnessTool-3000
	G1 Vd1
	G1 Vb1
		optional	HWO-114
			HWO-115

ArealRoughnessTool	G1 Vb	optional	HWO-142
CalibrationTool	G1 Ve1	optional	HWO-109

Overview: Included and optional components/features

General Features & Applications	Version		Order-Number
Mean and Single Profile Measurement	7.1	✓	
Edge Preparation Measurement	7.1	✓	
Automated Measurement	7.1	✓	
Quality Assurance and Reporting	7.1	✓	
Wear Measurement	7.1	✓	
EdgeBreakMeasurement	7.1	optional	USP-102
MultiEdgeMeasurement	7.1	✓	
ToolRoughness	1.2.1	optional	USP-109
EdgeQuality	1.1	✓	
Customization	7.1	✓	
RoundToolMeasurement	7.1	*comes with Real3DRotationUnit G2*	
Remoting Interface	7.1	optional	SWO-126
MeasureSuite *(without standard measurement modules)*	5.3.4	✓	
Order Management Module	1.1	optional	USP-125
IT Interface		optional	USP-137
Pick&Place 3 Pick&Place 5		optional	USP-124 USP-126
ServiceSoftware	6.5.1	✓	

Version: Stand 01.08.2018