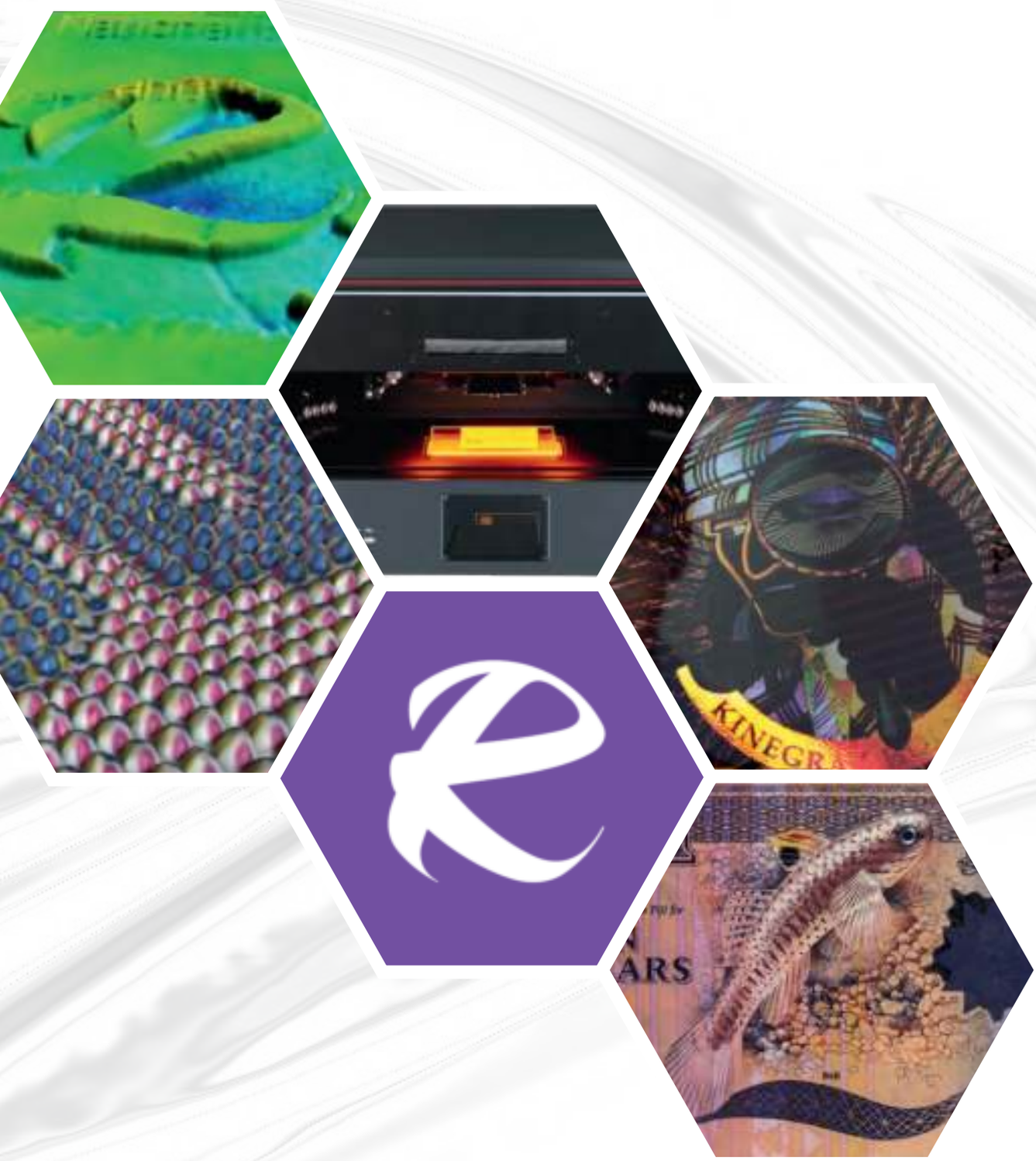
VIDEO SPECTRAL COMPARATOR REGULA 4308S



ABOUT THE COMPANY

Established in 1992

90+ partners all over the world

The equipment produced by Regula is supplied to 150 countries

Regula solutions are used globally by ministries of foreign and internal affairs, border control and customs services and can be found in the aviation, travel, banking, fintech, hospitality and entertainment sectors.

The latest industry developments and technological innovations are constantly being introduced in the company's design and production process. Therefore, several Regula solutions are **unparalleled** in terms of their technical characteristics **in the market today**.

THE REGULA PHENOMENON

Regula is a one-stop-shop company that consolidates activities from **4 different spheres** under one roof:

- **manufacturing devices** for document authenticity verification,
- **developing software** for operating Regula devices, for processing, comparing and storing data,
- **creating information reference systems** of assports, ID cards, banknotes, driver's licenses, visas, etc.,
- **providing training workshops** on authenticity verification of documents and banknotes.

Republic of Botswana

BANK INDONESIA

MINISTRY OF JUSTICE

Kuwait International Airport

CRANE CURRENCY

BanqueNationaleBank DE BELGIQUE VAN BELGIË
Eurosystem

POLICIE ČESKÉ REPUBLIKY

MINISTRY OF PUBLIC SECURITY

WHAT IS REGULA 4308S

Regula 4308S is a video spectral comparator intended for advanced authenticity verification of passports, ID cards and other travel documents, as well as visa stamps, seals, driver's licenses, vehicle registration certificates, signatures, handwriting, paintings, etc.

The comparator **is designed as a single unit for desktop use**. It is used with a built-in PC (it is possible to connect the device to an external PC via USB 3.0) and fully **controlled by the Regula Forensic Studio software**. The installation of an information reference system is optional.

The system of Regula 4308S comprises a 14 MP digital camera with high IR sensitivity, an enhanced optical system, a high-resolution spectrometer, a hyperspectral imaging module, a motorized XY translation stage, an integrated module for reading data from the MRZ, RFID chips, latent images (IPI), 1D and 2D barcodes, integrated modules for 3D visualization and face matching, etc.


Country code
Holder's photo
Signature
Bli
UV
IR 87
IR Lu
Visible

EXAMINATION OF MULTI-LEVEL DOCUMENT SECURITY

Advanced document examination under high magnification:

- **protection of the document basis:**
  – paper opacity; watermarks; security fibers; planchettes; security threads and stripes; holograms, kinegrams; foil stamping; pole feature; all types of clear windows, transparent varnish coating, shadow images, etc.
- **printing methods:**
  – *intaglio:*
  texts, guilloche frames, rosettes and vignettes, microprinting, latent images and moire patterns, signs for the visually impaired, blind embossing, color shifting ink, including OVI with embossing and latent-images, etc.
  – *letterpress:*
  serial numbers, texts, barcodes, etc.
  – *offset printing:*
  including Orlov and rainbow printing – texts, microprinting, moire patterns, background and anti-copy patterns, etc.
  – *screen printing:*
  security features with optically variable effects, etc.
  – *see-through register.*
- **physicochemical protection:**

– anti-Stokes luminescence,
– UV fluorescence with different wavelengths,
– IR luminescence,
– security features with magnetic properties, etc.

- **and other security features:**
  – holographic images (OVD),
  – blind embossing,
  – retroreflective protection,
  – security features with IR-metameric ink,
  – special polymer coating of security laminates,
  – metallized coating,
  – laser engraving on plastic,
  – perforation, etc.

• **3D visualization** (in-built):
  – examination of intersecting lines,
  – height palette & surface topography.

Additional examinations:

• fragments of document images depending on the degree of absorption or reflection of IR light,
• document alterations such as erasure, etching, etc.,
• traces of signature forgery,
• extraneous lines (do not originally belong to the examined object) that are performed with IR opaque inks,
• blurred, crossed out entries, texts and images,
• document mechanical defects such as cuts, tears, folds, etc.

EXCELLENCE IN ADVANCED DOCUMENT EXAMINATION

THE BEST-IN-CLASS OPTICAL MAGNIFICATION AND RESOLUTION OF THE CAMERA

ON-SCREEN MAGNIFICATION
(in the Extra Full HD mode) – up to **310x** on a 32" 4K UHD Monitor.
Additional option – **Super-Magnification up to 640x** with a supplementary lens.

The high-resolution optical system includes a 14 MP BSI digital color camera with high IR sensitivity in the range up to 1100 nm.

Professional quality of imaging is now available in all examination modes.

ADVANCED ALGORITHMS OF IMAGE CAPTURE

An advanced system for capturing high-resolution images preserves all tiny elements for further object examination.

Special functions have been added to reach a new level of detail:

• obtaining a multi-focus image **(MF – Multi-Focus)**,
• obtaining a super resolution image **(SR – Super Resolution)**,
• stitching of video frames,
• obtaining **HDR images**.

New algorithms of image capture and the enhanced optical system allow getting a multi-focused image with a single click.

The entire image is in focus regardless the height of its relief.

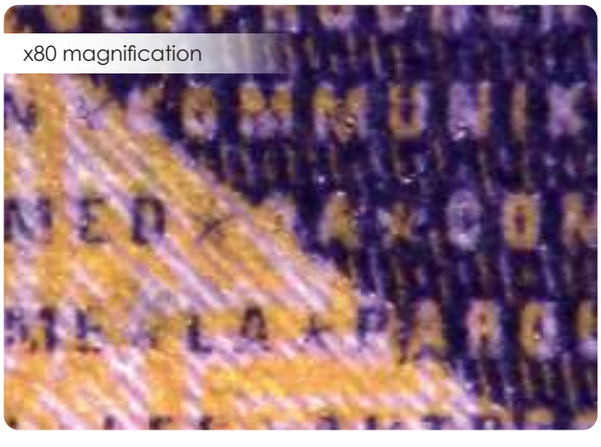
High Dynamic Range Imaging technology enables the formation of an image with increased detailing of high-contrast areas resulting in an HDR image under UV 365 nm.

Swiss franc, 2019

x12 magnification

x40 magnification

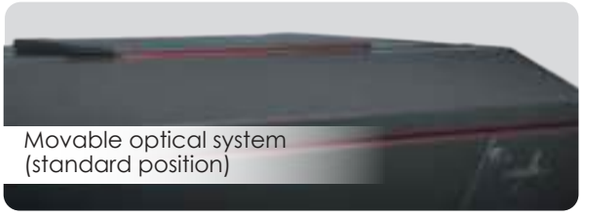
x80 magnification



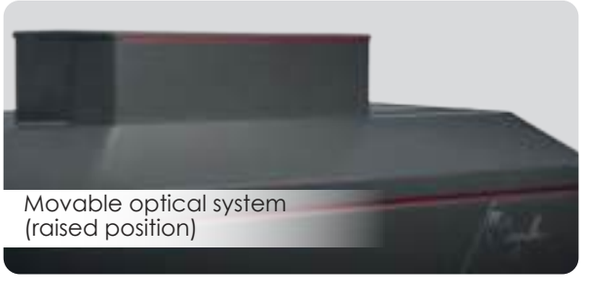
MOVABLE OPTICAL SYSTEM AND ADJUSTABLE FOCAL PLANE

TECHNICAL INNOVATIONS

- A unique system with a lifting mechanism for the optical path the motion of which is adjustable in the range 0–110 mm. This option provides more freedom when changing the field of view and allows examining large-format documents.
- It is possible to move the entire optical system: the optical path + the spectrometer.
- The adjustable focal plane allows for examination of objects with nonstandard thickness and objects of large formats.
- The extended field of view and the updated algorithm of image stitching make it easy to obtain the whole image of an A4 page.
- When examining large-format documents, 4 side flaps are fixed in the raised position.



Movable optical system (standard position)



Movable optical system (raised position)

Examination of objects with nonstandard thickness

Examination of large-format objects

ILLUMINATION SYSTEM & ITS MODULES

The comparator includes over 30 light sources ranging from 254 to 1030 nm and gives the opportunity to conduct advanced document examination at a new level.

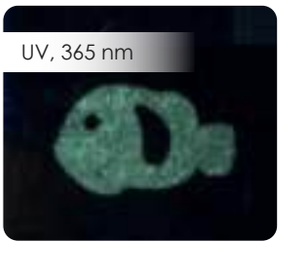
Norwegian krone, 2018
White light

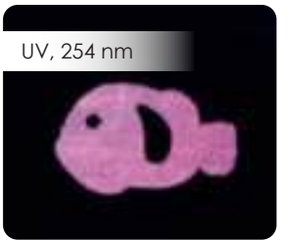
IR light, 850 nm

INCIDENT

Visible and Infrared Light – *LED*

- Incident white
- IR, 700 nm
- IR, 780 nm
- IR, 850 nm
- IR, 950 nm
- IR, 1030 nm

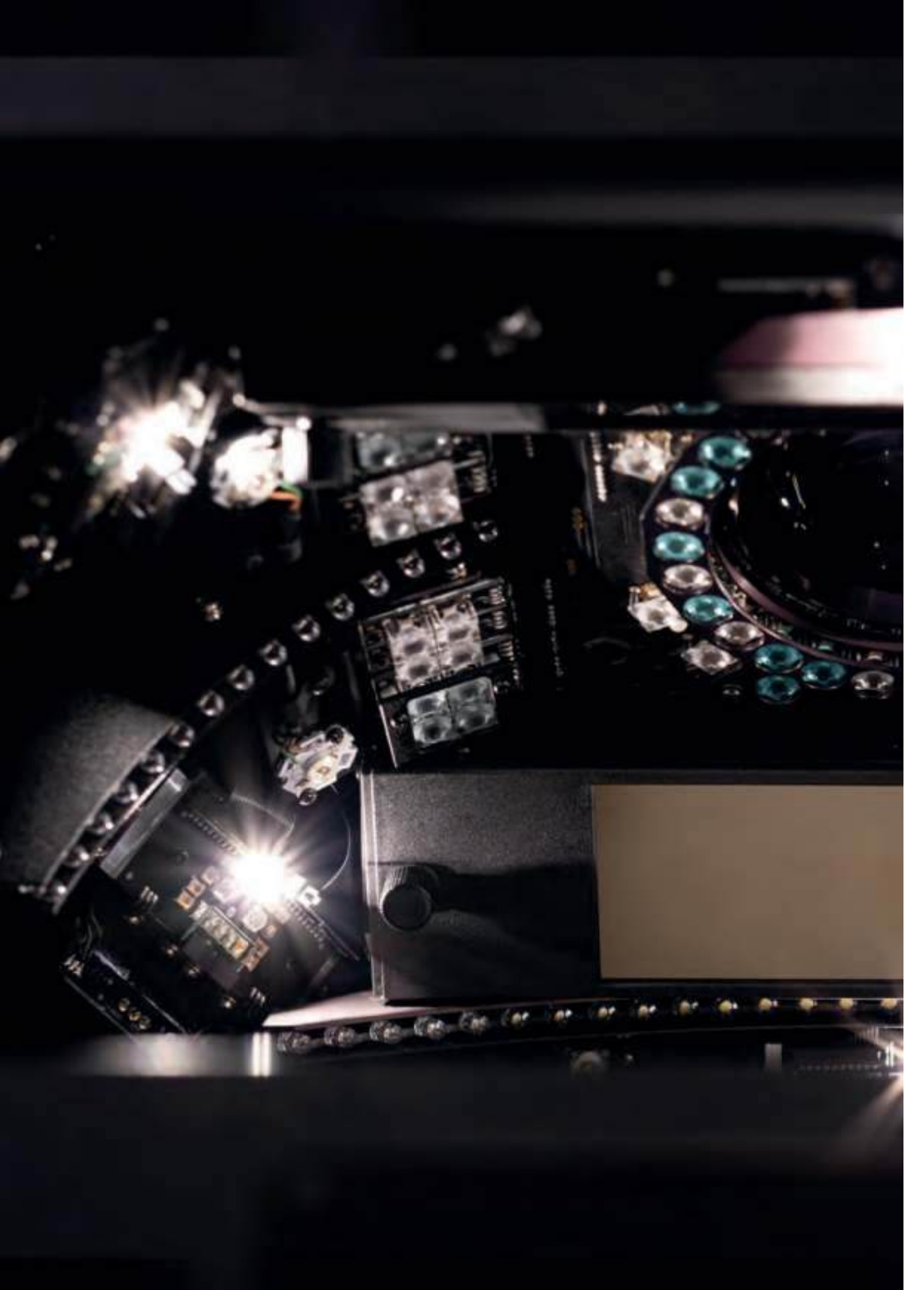

UV, 365 nm


UV, 254 nm

Ultraviolet Light

- UVA, 395 nm – *LED*
- UVA, 365 nm – *LED*
- UVB, 313 nm (lamps)
- UVC, 254 nm (lamps)


Comorian franc, 2006
Viewed in UV 365 nm



Light sources
for IR Luminescence – *LED*

- Violet – 395 nm
- Violet – 420 nm
- Royal Blue – 450 nm
- Blue – 470 nm
- Cyan – 505 nm
- Green – 530 nm
- Amber – 590 nm
- Red-orange – 615 nm
- Red – 635 nm
- Deep Red – 660 nm
- Far Red – 700 nm
- Far Red – 735 nm

Automated examination of IR luminescence – capturing a sequence of examined document images using all suitable combinations of high-intensity LED light sources and camera filters.

Total – 4095 combinations

The innovative LED lighting system provides a uniform illumination over the entire field of view.

Liberian dollar, 2016
IR luminescence

TRANSMITTED – *LED*

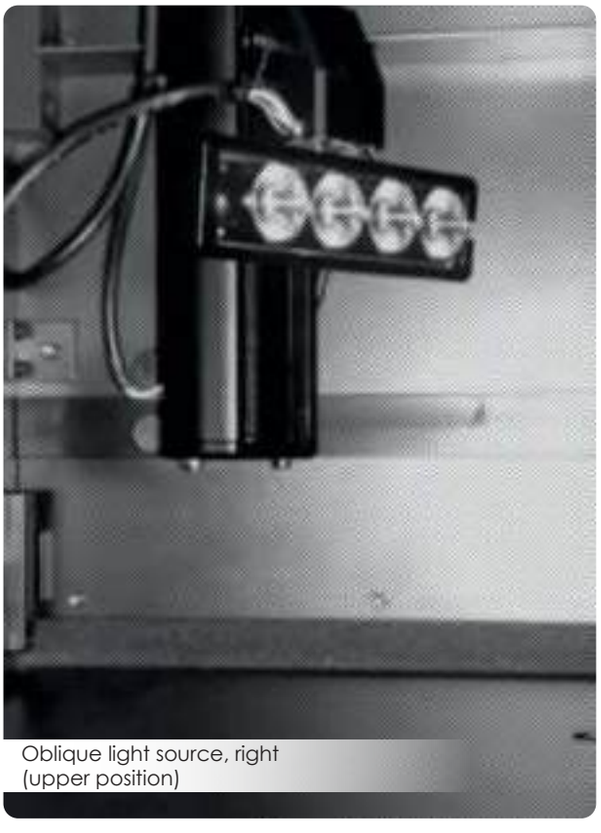
- White
- UVA, 365 nm
- IR, 870 nm
- High-intensity spot white
- High-intensity spot IR, 780–900 nm

OBLIQUE – *LED*

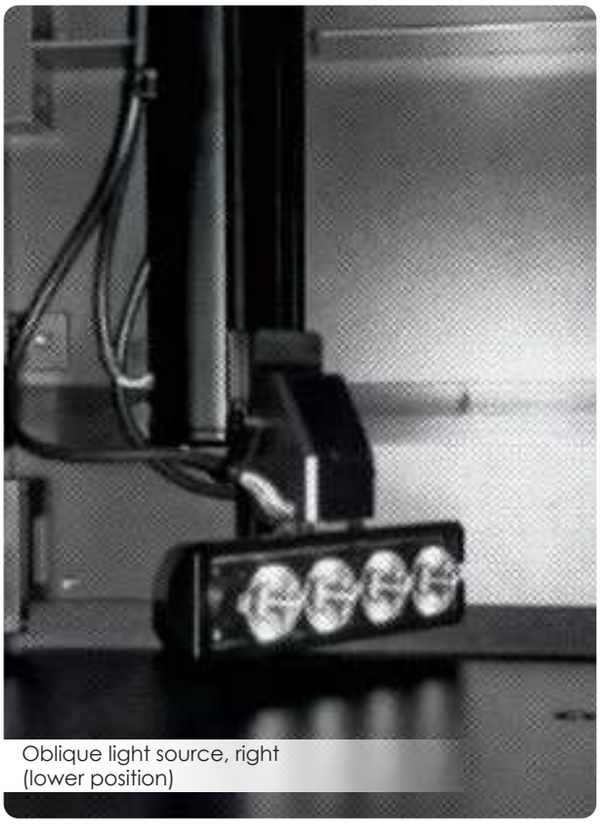
- White
- IR, 850 nm

Motorized LEDs are located from two sides of the object stage. Range of motion in height – 130 mm.

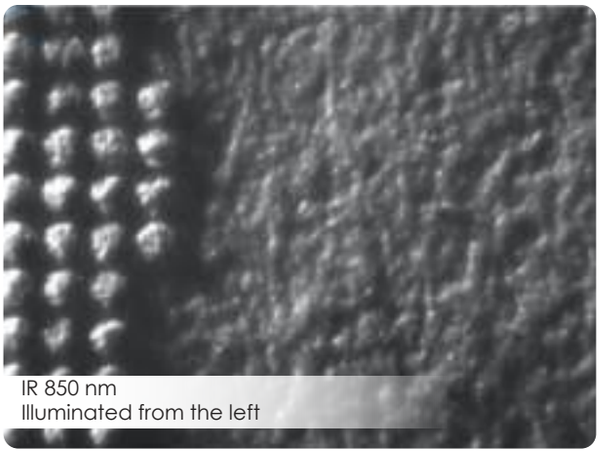
- Detailed examination of document surface microrelief in the visible and infrared spectrum ranges.
- Exceptional oblique lighting with a changeable angle of object illumination.
- The angle of incidence of the beam relative to the central point of the focusing plane (video frame) ranges from 3.5° to 21.7°.
- Direction of illumination – left and right.



Oblique light source, right
(upper position)



Oblique light source, right
(lower position)



IR 850 nm
Illuminated from the left

White light
Illuminated from the right

SPECIAL

Light source for hologram visualization (OVD/DOVID) – *LED*

Horizontal white – 31 LEDs

Vertical white – 16 LEDs

Examination of optically variable security features:

- optically variable inks (OVI),
- diffractive optically variable image devices (DOVID),
- holograms,
- kinegrams,
- diffractive identification elements (DID®).

Animated image of a hologram

Generalized image of a hologram

Demo ID card, KINEGRAM
Generalized image

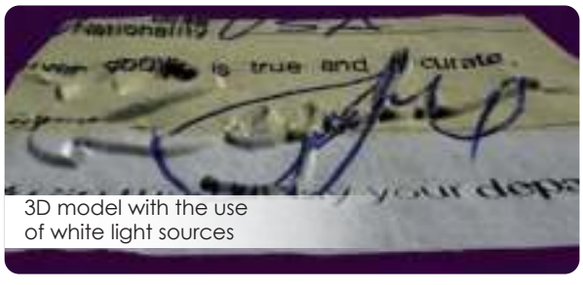
Coaxial light

for examination of retroreflective protection

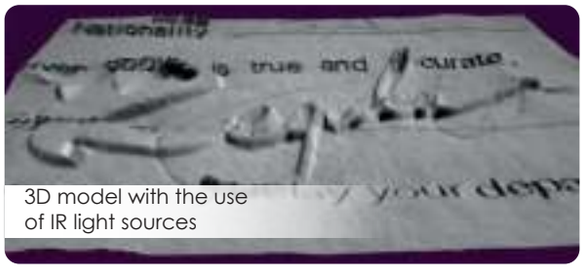
Australia. Emergency passport, 2014

Light sources for 3D visualization – *LED*

- White
- IR, 850 nm



3D model with the use
of white light sources



3D model with the use
of IR light sources

Polarized light – *LED*

- Top visible linear polarization
- Top visible counterclockwise circular polarization
- Top visible clockwise circular polarization

Halogen lamp for spectroscopy – 20 W

D50 light source for spectroscopy – *LED*

BUILT-IN MODULES FOR ADVANCED EXAMINATION

HIGH-RESOLUTION SRECTROMETER

The video spectral comparator Regula 4308S has an integrated high-resolution spectrometer that makes it possible to carry out measurements of the signal relative power in the wavelength range of 350–1000 nm.

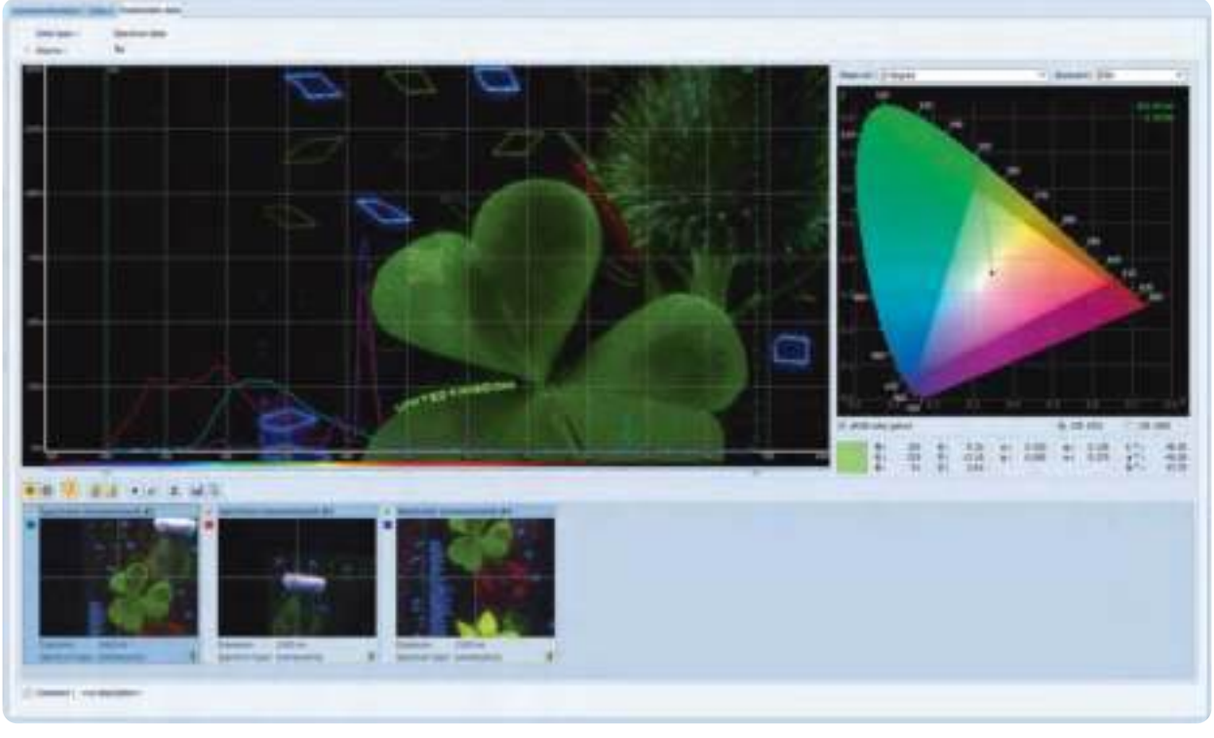
The optical resolution is 3 nm with an adjustable field of view 0.05–2 mm.

• Examination of spectral characteristics of objects in the following modes:
  – reflection,
  – luminescence,
  – transmission.

• Use of a non-destructive method of ink and paper analysis on questioned documents to differentiate various kinds of ink and paper.

• Calculation of object color characteristics in the reflection and luminescence modes. Color characteristics are chromatic coordinates in the CIE **XYZ** color space and in some derivative color spaces **(xyZ, L*a*b, Lyv, RGB)**.

• Values of the dominant (or additional) wavelength and color purity corresponding to the obtained color characteristics indicated on the chromatic diagram.



HYPERSPECTRAL ANALYSIS

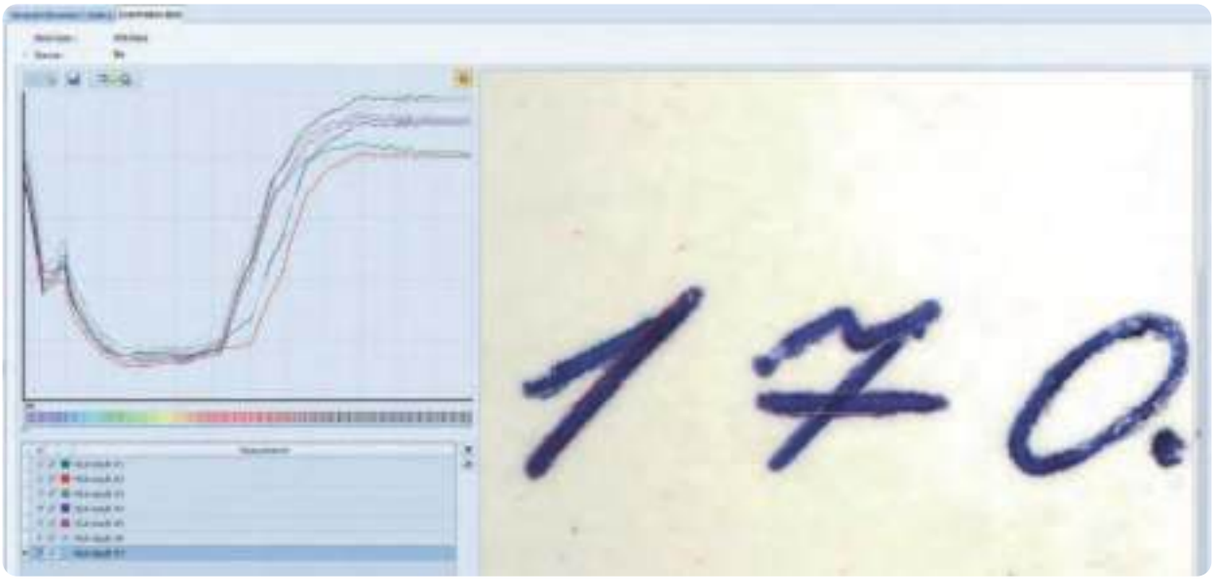
Wavelength range – 395–1000 nm

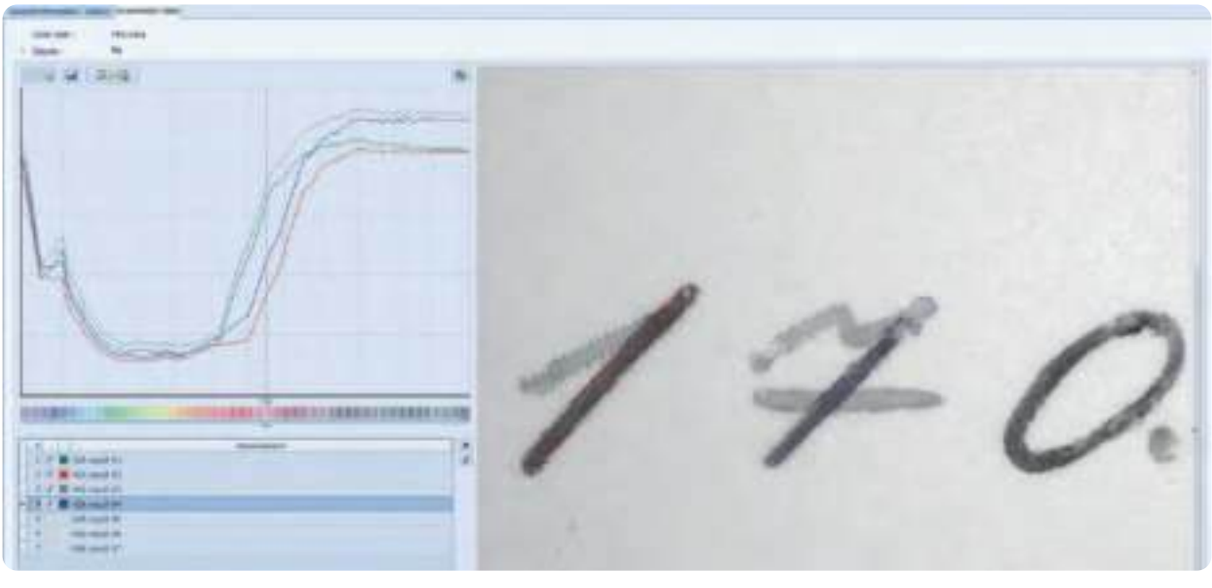
Step of wavelength change – from 1 to 100 nm

Max quantity of images possible to obtain at one scanning session – 605 images with a step of 1 nm.

• Possibility to select an area in any part of the captured image for examining differences in IR absorption (e.g. by different kinds of inks) and for further comparison.

• In the live preview mode, use of the spectrum control bar to predetermine the differentiating wavelength of the light source (the wavelength at which the difference between two different inks is noticeable).





PROTECTIVE SIDE FLAPS

4 side flaps allow positioning and moving examined objects of large formats inside the device.

The extended field of view allows capturing an entire image of A4 page. The enhanced image stitching algorithm allows capturing an entire image of A3 page.

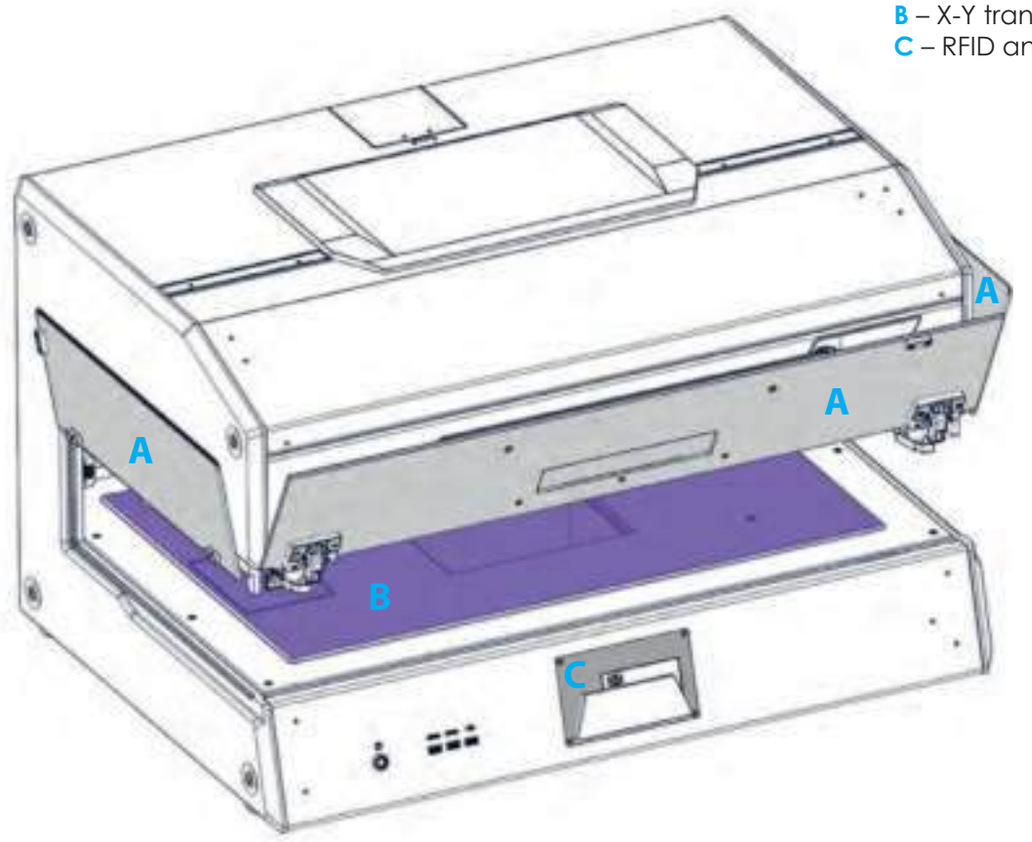
Built-in sensors prevent unintended exposure to UVB and UVC light if any of the side panels is not properly closed.

X-Y TRANSLATION STAGE

The X-Y translation stage is intended for precise positioning of the examined object and for obtaining fragment images for further stitching when the whole object does not fit into the field of view of the camera.

- Displacement along the X-axis – 110 ±2 mm
- Displacement along the Y-axis – 70 ±2 mm
- Adjustable step width – 0.01–1.00 mm

A – protective side flaps
B – X-Y translation stage
C – RFID antenna



MACHINE READABLE ZONE & BARCODE READING

MRZ detection and recognition. Automatic data reading from the MRZ in all types of travel documents defined by the specification of ISO/IEC 7810 (ID-1, ID-2, ID-3).

The MRZ format of the corresponding document type is defined by the ICAO Doc 9303 specification.

Optical character recognition (OCR) of the visual inspection zone (VIZ) in a document. Verification of check digits and the MRZ data structure

in accordance with the requirements of ICAO Doc 9303.

Supported barcode formats:

• 1D: Codabar, Code39 (+extended), Code93, Code128, EAN-8, EAN-13, IATA 2 of 5 (Airline), Interleaved 2 of 5 (ITF), Matrix 2 of 5, STF (Industrial), UPC-A, UPC-E,

• 2D: PDF417, Aztec Code, QR Code, Datamatrix.

RFID CHIP READER

An integrated RFID chip reader is intended for reading data from e-passports and ID cards in compliance with ICAO Doc 9303.

The module allows for:

• access to secure data stored in RFID chips with automatic application of BAC/BAP and EAC procedures (version 1.11) when the user provides all the necessary additional information (MRZ lines, a set of certificates corresponding to the document being read),

• integrity control of the data read from the document, compliance of their format and content with the requirements of relevant regulatory documents.

Supported RFID chip standards:

• ISO/IEC 14443-2 (type A and B),

• ISO/IEC 14443-3 (MIFARE® Classic Protocol),

• ISO/IEC 14443-4.

Data exchange rate: 106, 212, 424, 848 kBd

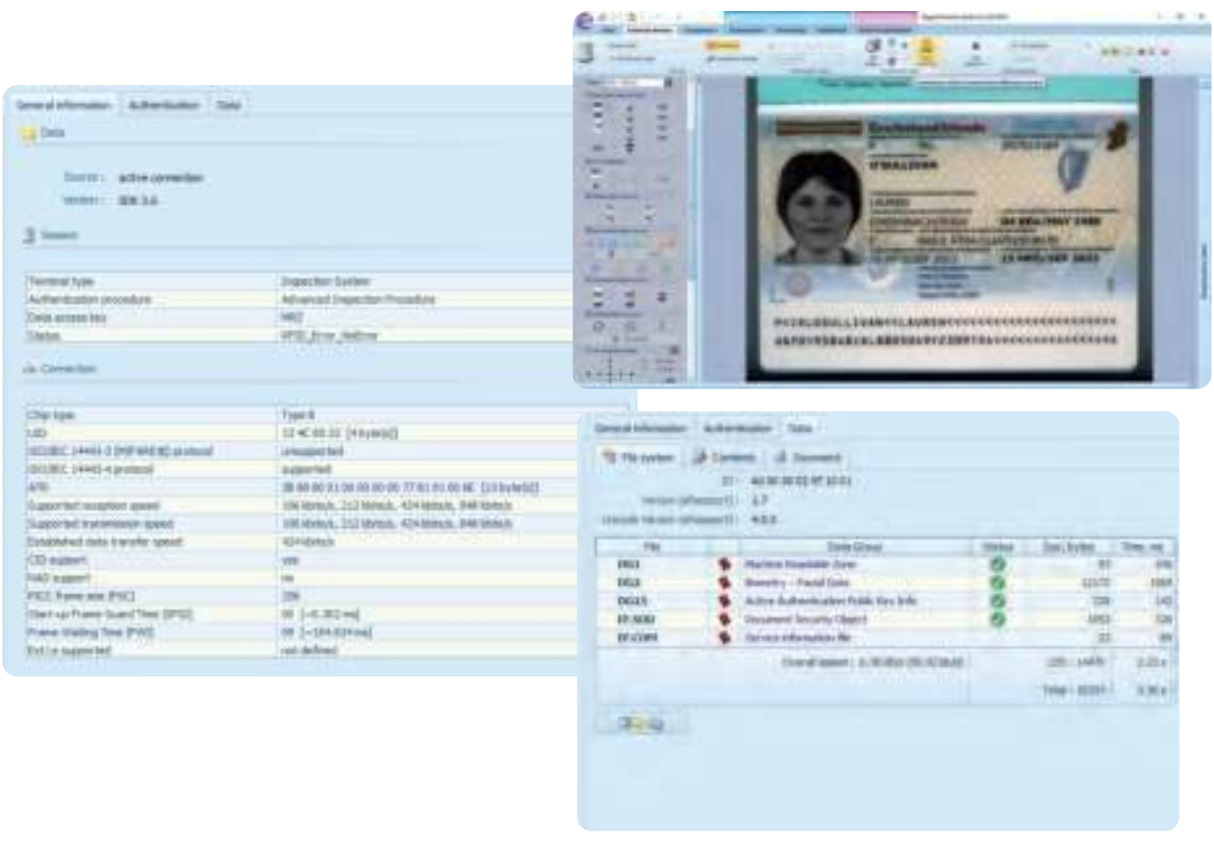
Authentication

• Active (AA)

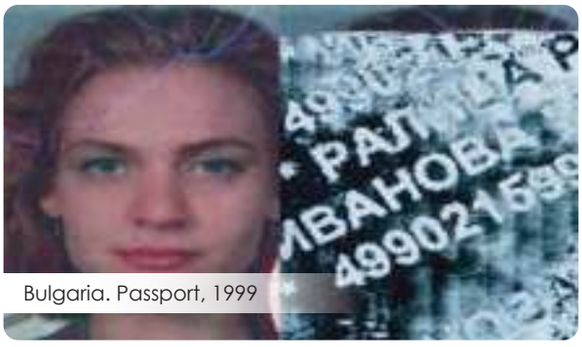
• Passive (PA)

• Chip (CA v1, CA v2)

• Terminal (TA v1, TA v2)



VISUALIZATION OF LATENT IMAGES


Bulgaria. Passport, 1999

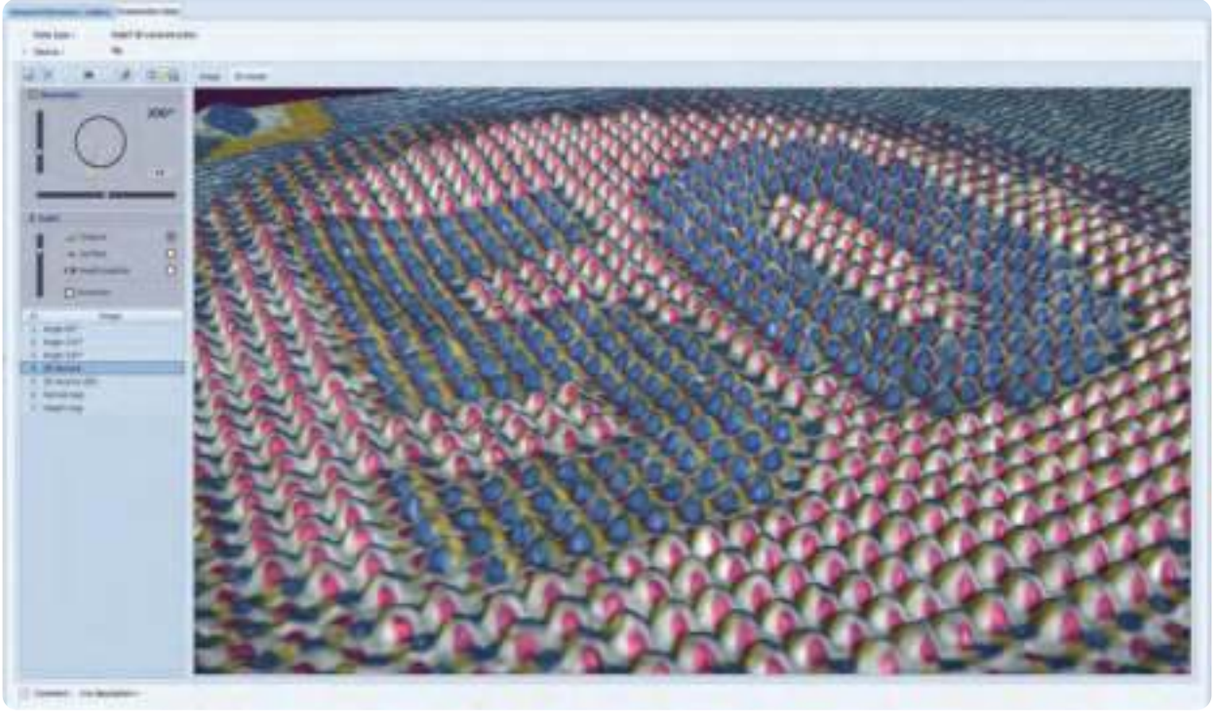
Decoding and reading data – IPI (invisible personal information), ICI (invisible contrast image), Letterscreen++® – from passports, banknotes, ID cards with an option to save visualization parameters that might be quickly restored later.

FACE MATCHING

The face matching module automatically compares the document holder with a photo in his passport and with a photo from the chip of the e-passport or the ID card.

Comparison results are displayed with an indication of the match rate (%) and can be exported as a report with all the images obtained.

3D VISUALIZATION

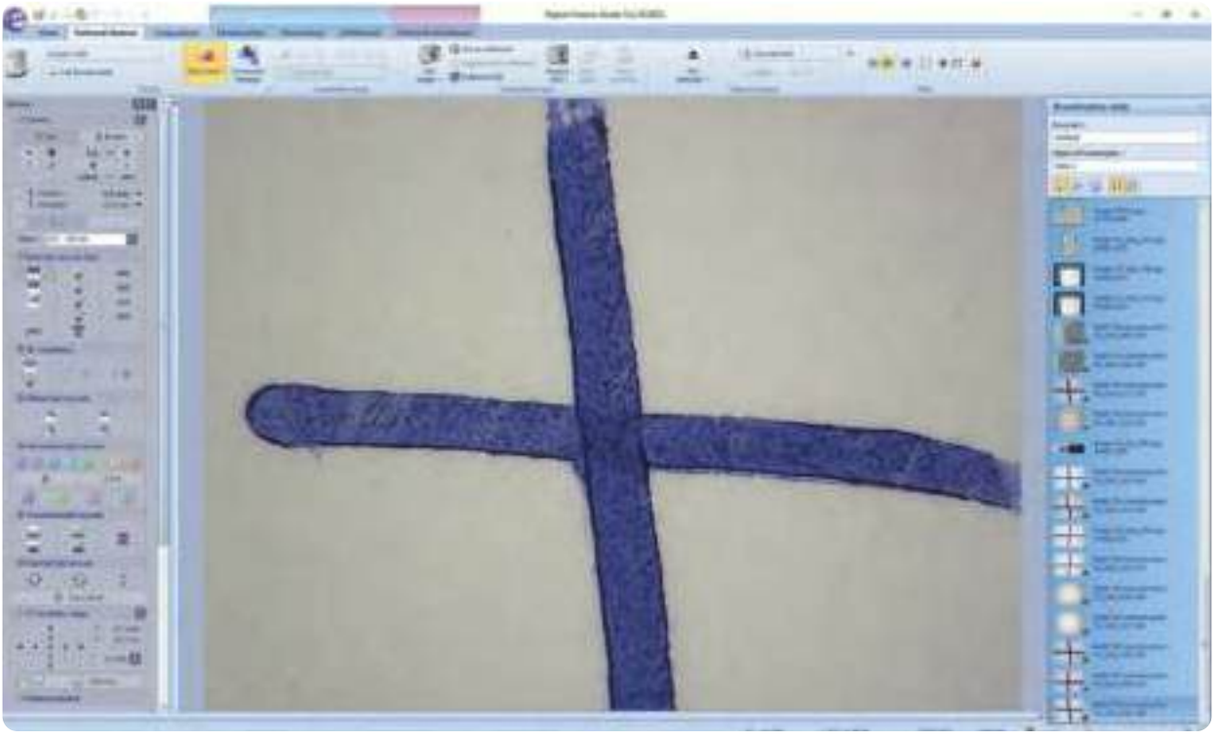


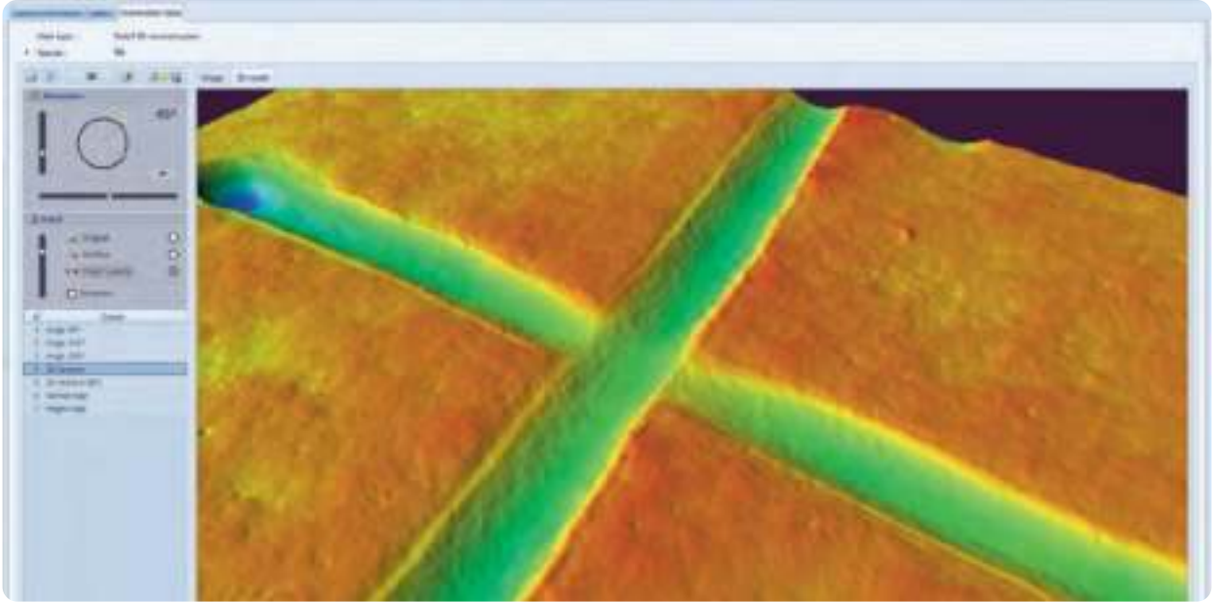
Built-in 3D visualization of the object surface in white and IR light.

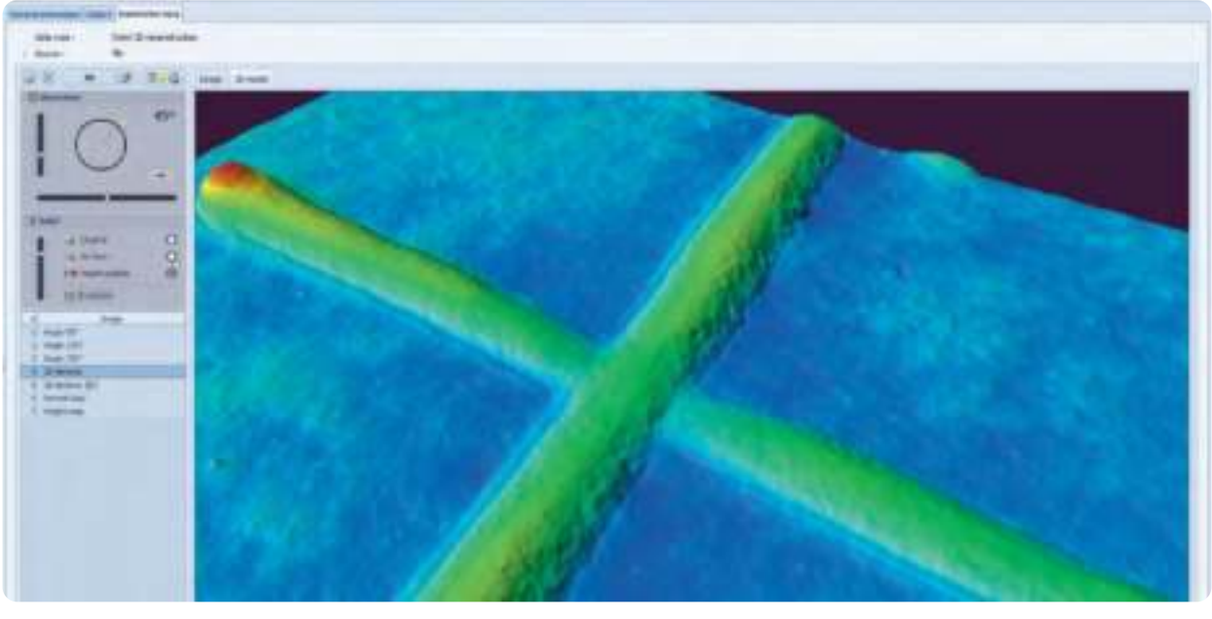
The comparator automatically captures a sequence of images using specific light sources for 3D visualization, analyzes data and creates a 3D model of the examined object surface.

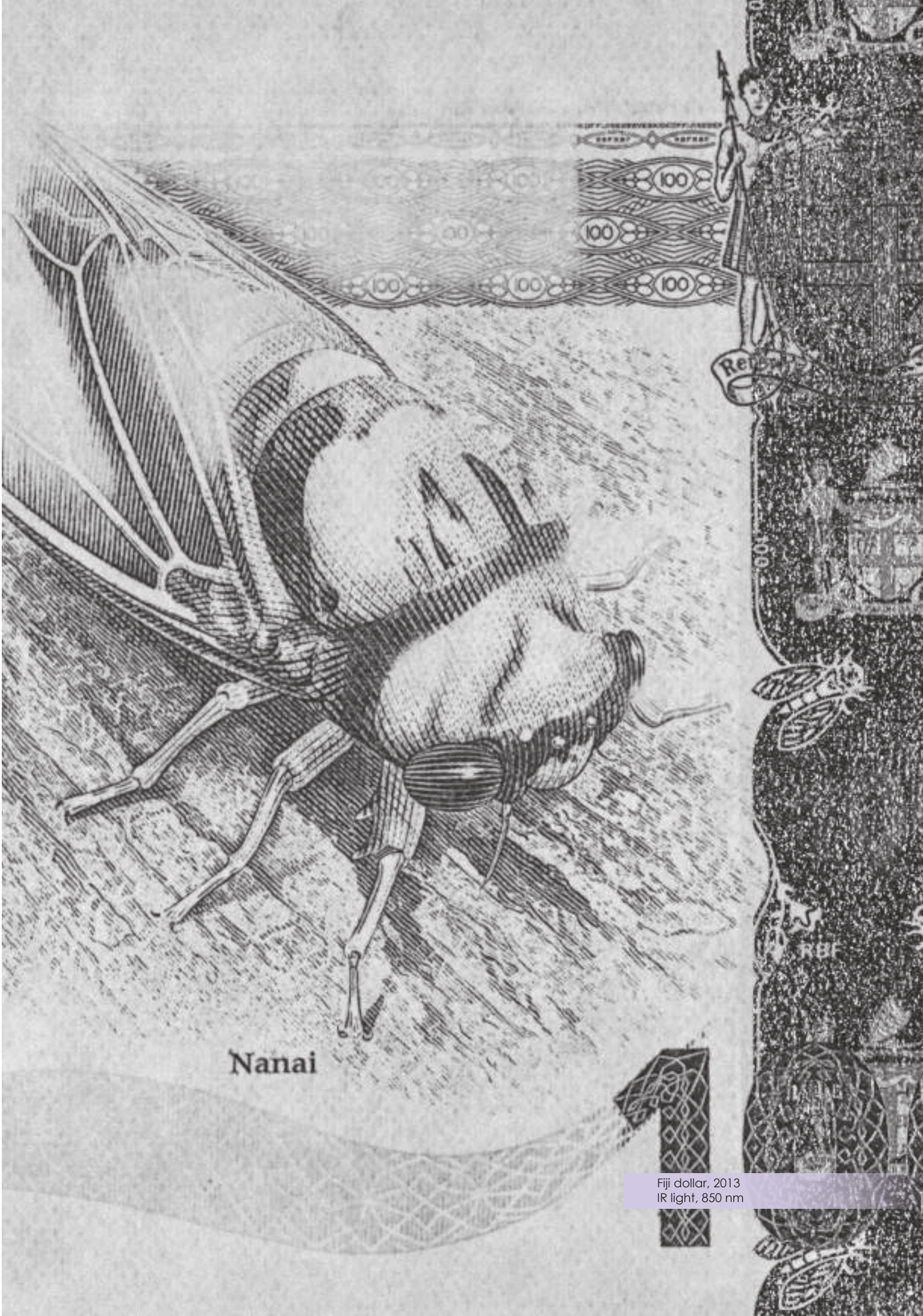
The comparator enables to build a 3D model of a document fragment that is crucial for examination of overlapping objects – a signature and a stamp, a signature and text.

To maximize the quality of 3D visualization of surface relief and intersecting lines, one can adjust the angle of illumination, contrast, the height palette, as well as apply inversion and rotate 3D images in a three-dimensional space.



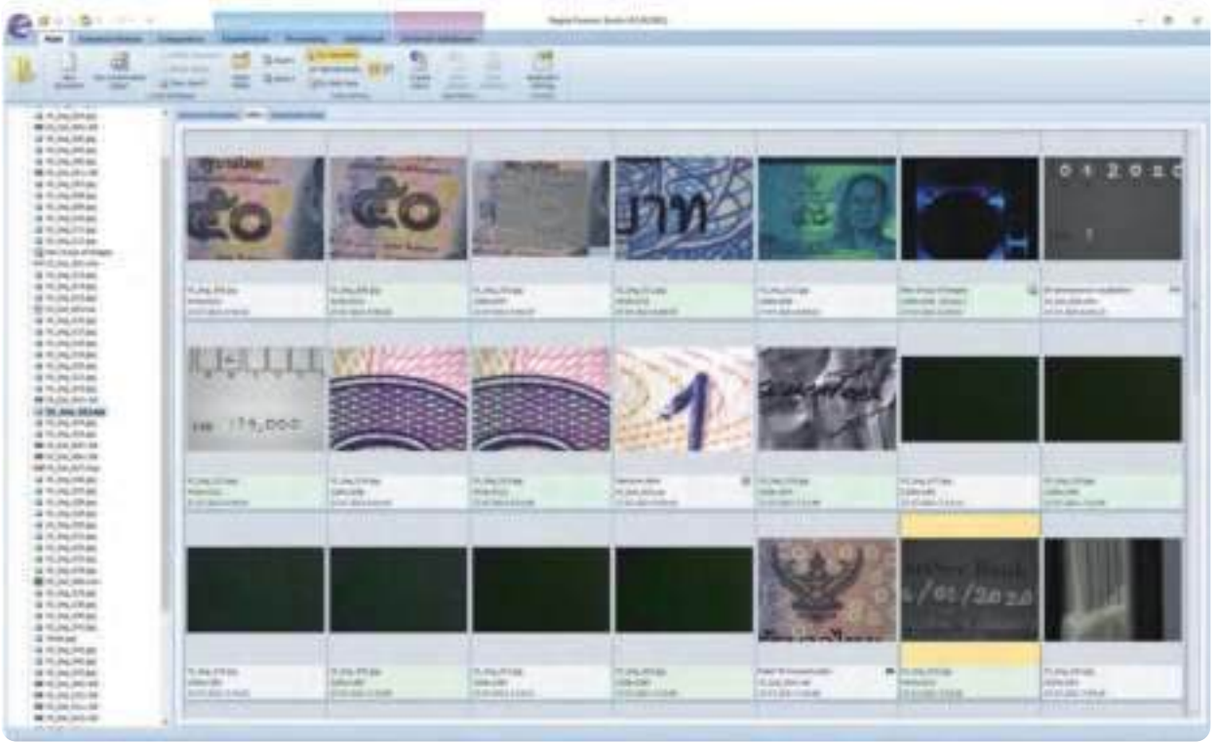






Fiji dollar, 2013
IR light, 850 nm

REGULA FORENSIC STUDIO SOFTWARE



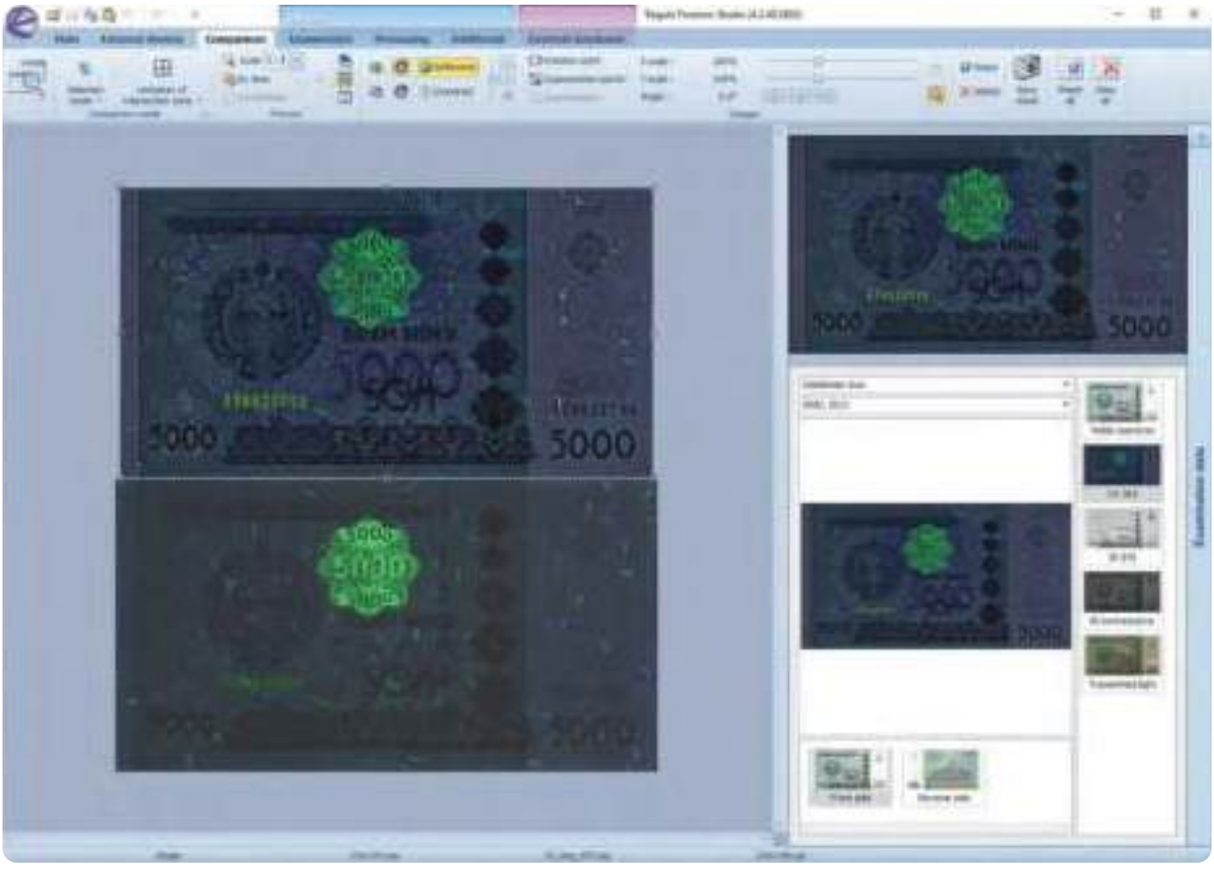
The RFS software is a key to outstanding performance of Regula 4308S. It forms a duet of a computer and the comparator resulting in a laboratory for forensic examination.

The efficient and intuitive interface of the software helps the user easily operate the device and provides a wide range of options for further processing of obtained results.

- Storing examination results in a local database.
- Maintaining the hierarchical structure of examination data.
- Recording, changing and replaying of an unlimited number of macros for automatic document verification.
- The export and import feature for examination data backup.
- During the device lifetime, Regula Forensic Studio software is updated free of charge.
- The RFS software is included in the delivery set of the comparator.

EXAMINATION DATA COMPARISON

- Comparison of images.
- Comparison of image groups.
- Comparison with the live video stream as a reference or examined image.
- Image overlay using different processing algorithms.
- Superposition of examined objects using the two-point alignment method with the possibility to adjust the scale, the rotation angle, etc.
- Basic comparison modes – subtraction, addition, intersection and stitching of reference and examined images.
- Special option activating the mode of alternate visibility-invisibility of the examined image (the button ‘by timer).
- Synchronization of compared objects.
- Comparison of examined objects with reference images from the information reference system (IRS).



INFORMATION REFERENCE SYSTEM
SECURE DOCUMENTS ULTIMATE

The RFS software might use **Secure Documents Ultimate (SDU)** as an external database of reference images.

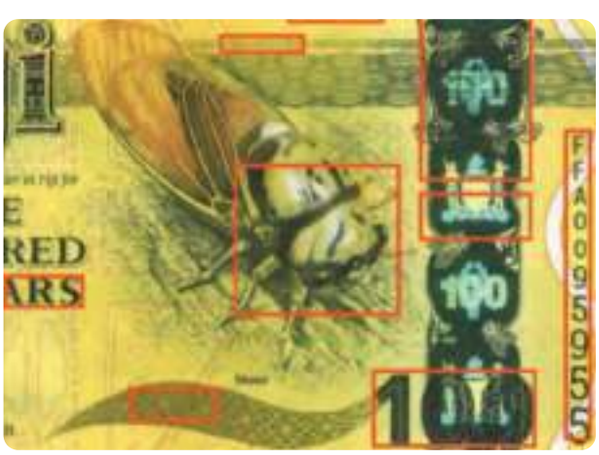
SDU currently contains **over 300 000 images of security documents and banknotes from 214 countries and territories** with a detailed description of security features.

Live comparison of examined document security features with reference images from SDU.

Possibility to add extra information on documents and security features to the local database using the **Document Builder** software.

Annual subscription.

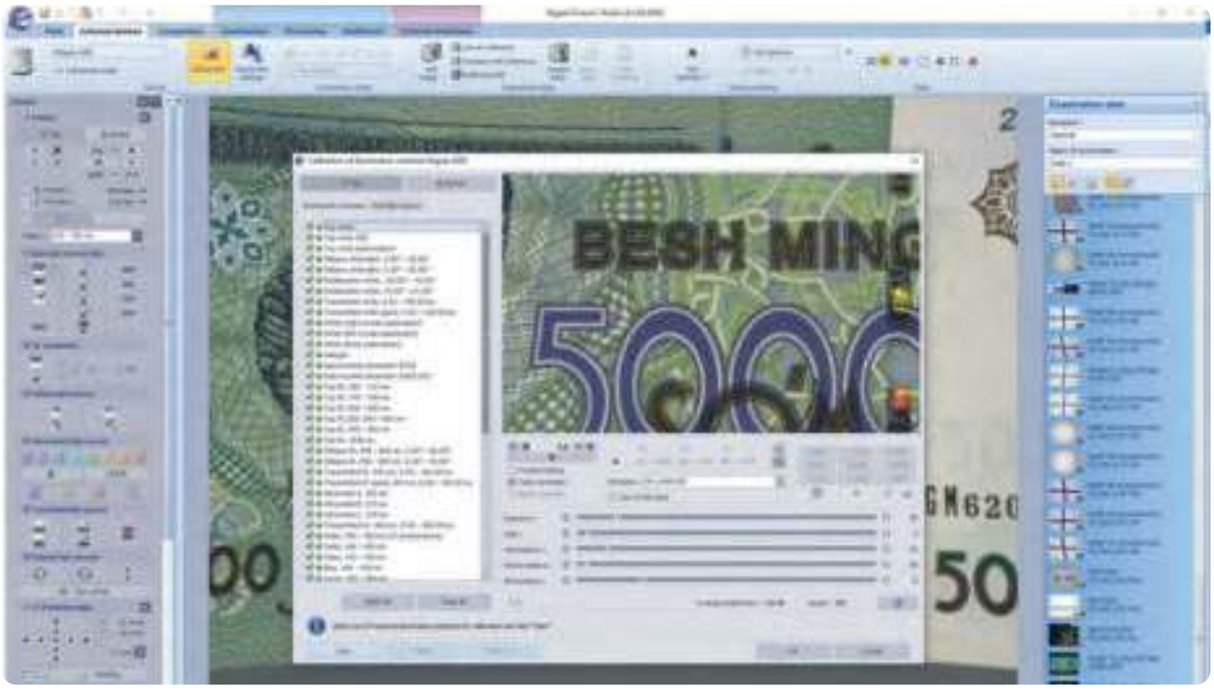
Weekly updates.

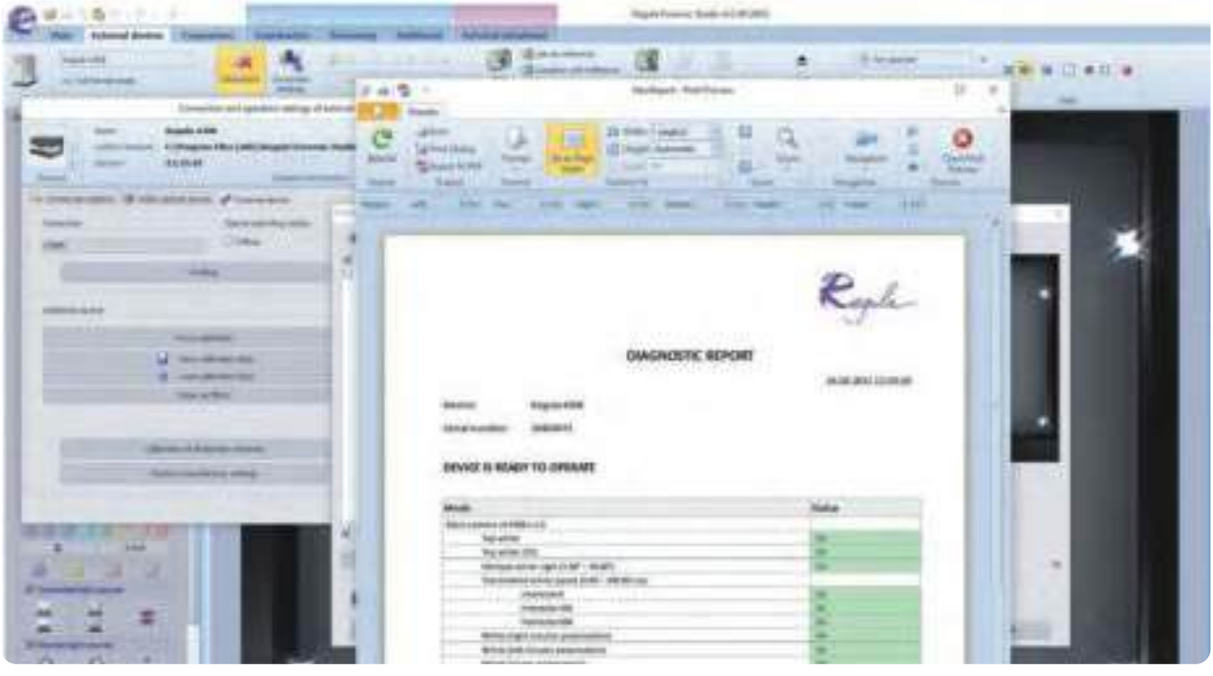


AUTOMATED CALIBRATION AND DIAGNOSTICS

The automated calibration and diagnostics procedure Includes:

- Automated scanning at system startup to check the device status in real time.
- Device profiling to create a diagnostic report.
- Calibration of illumination schemes for light sources & filters.
- Optical system calibration.
- Focus calibration including measurements of area, angle, radius, etc.
- Calibration of the video camera operating modes.
- Calibration and control of the spectrometer with a reference light source HG-2 and a set of calibration objects.



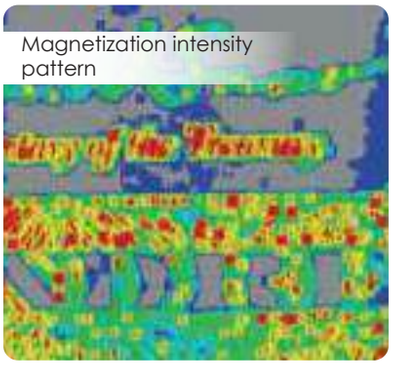


ACCESSORIES

MAGNETO-OPTICAL VISUALIZER REGULA 4197

Examination of banknotes, ID cards and travel documents containing magnetic ink:

- Visualization of magnetically hard and magnetically soft materials,
- Possibility to distinguish different types of magnetic inks by residual magnetization,
- Non-destructive examination of objects with "hard" magnetic properties,
- Reading latent magnetic strokes and codes.



THERMOSTAGE REGULA 4168

Examination of banknotes, ID cards and travel documents containing thermochromic ink at different temperatures.

• Examination of a composite security feature Feel®-ID (developed by Giesecke & Devrient) based on optically variable and thermochromic effects.
• Temperature range – +30...+80 ˚C with a step of 1 ˚C.
• Size of the heated area (length×width) – 78×48 mm.

TRINOCULAR STEREO MICROSCOPE REGULA 5003

Examination of security features in banknotes and travel documents in the mode of live video.

Color camera – 5 MP, CMOS

Magnification, times:

• optical – 0.8...14x
• objective magnification with 10x eyepieces – 8x to 140x
• objective magnification with 30x eyepieces – 24x to 420x
• for a 30 inch (75 cm) monitor – 26x to 1330x*

Light complexes with variable intensity control:

• ring,
• transmitted**,
• gooseneck**.

* – all magnifications are approximate;
** – optional.

PROFESSIONAL 3D VISUALIZER REGULA 4162

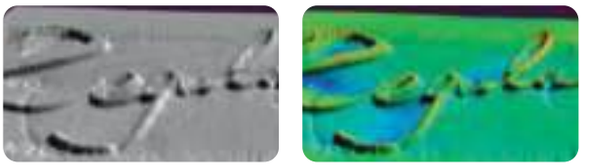
Detailed examination of the surface relief of security documents, banknotes, paintings, handwritings, etc.

Illumination:

- LED, 360°,
- 30 white light sources,
- 60 IR light sources – 860 ±20 nm.

2 laser light pointers intended for positioning the examined object.

The main distinguishing feature – the ability to create a 3D model



of the examined object in two different light sources – white and infrared. During 3D visualization, the position and brightness of the light sources may be adjusted.

The 3D visualizer Regula 4162 allows the user to:

- receive and save images of a 3D model of the examined object,
- modify the 3D model – its texture, scale, rotation angle,
- visualize the pen-tip stroke and stamp imprints,
- identify the sequence of strokes (if two strokes intersect),
- examine intaglio and letterpress printing, as well as blind embossing.

POLARIZER REGULA 4169

Document examination while changing the angle of polarization.

- Angle of filter rotation – 0…360˚ with a step of 2˚
- Field of view (diameter), not less than – 70 mm
- Connection interface – USB 3.0

TILTING STAGE REGULA 4165

The device allows setting the tilt angle of the working surface, fix a certain position of the document and track changes in color/relief, visible when displaying such security features as OVI and KIPP effect.

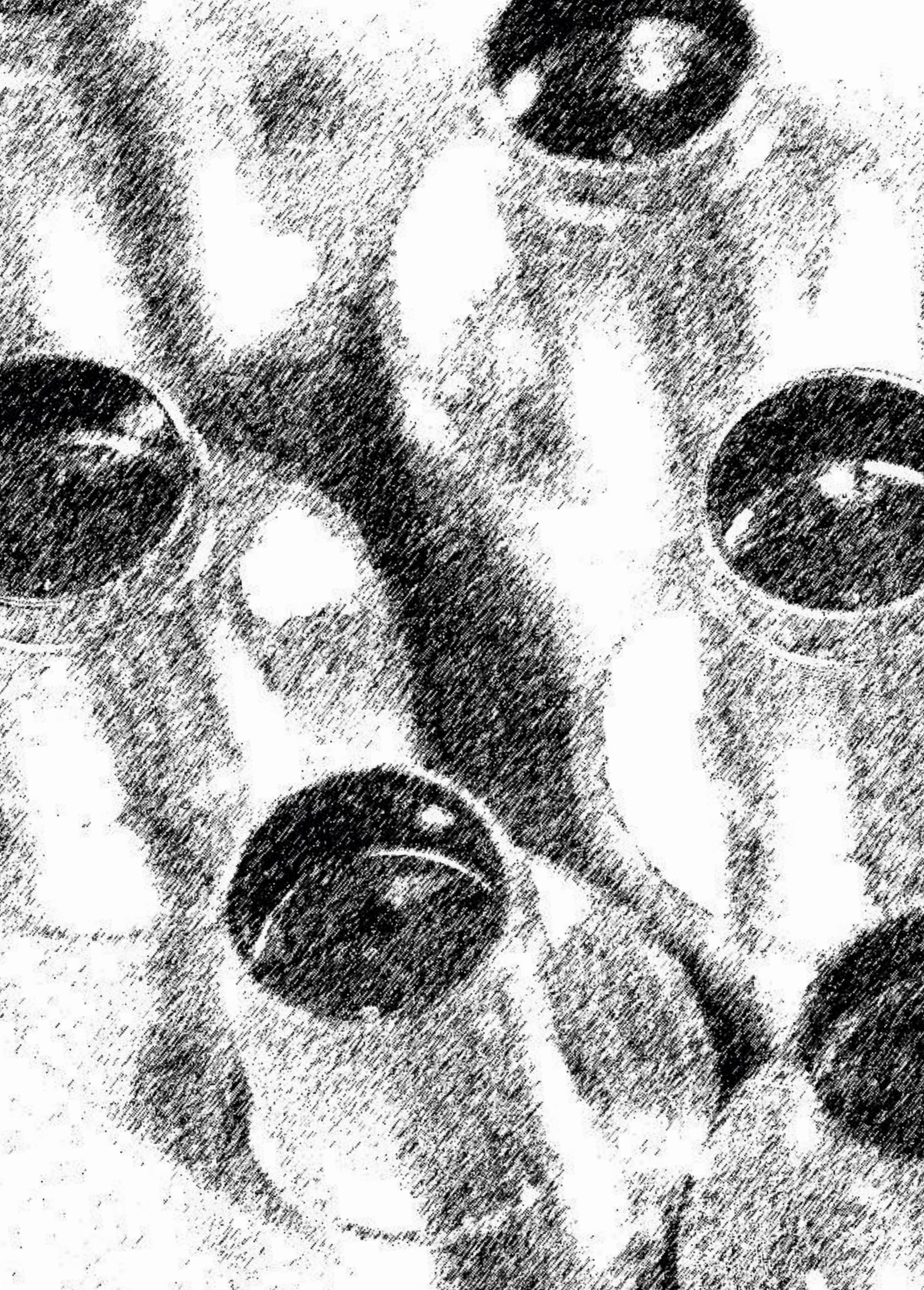
- Tilt angle, max – ±30
- Field of view (length×width) – (180×110) ±1 mm
- Connection interface – USB 3.0

BUILT-IN PC

- CPU – Intel® Core™ i7
- RAM – not less than 16 Gb
- SSD – not less than 250 Gb
- Possibility to connect two monitors – 2 HDMI ports
- RJ45 Ethernet Port
- USB 3.0 ports

MIRROR FOR EXAMINATION OF THE DOCUMENT EDGE

The mirror is intended for examining security features from two viewing angles at the same time.
Included in the delivery set of the comparator.



Lens, a part of the video spectral comparator Regula 4308S

REGULA 4308S
TECHNICAL SPECIFICATIONS

OPTICAL SYSTEM

Camera

Color digital camera with high IR sensitivity

Spectral range – 345–1100 nm

Camera resolution – 14 Mp

Video frame resolution, max – 4416×3312 pixels

Predefined camera parameters for individual selection of lights

Integration time: 1 ms to 180 s with the possibility to accumulate up to 100 frames. Applied for examination of faint luminescence

Unique camera features

- motorized extension of the comparator field of view
- motorized movement of the focal plane

Range of motion of the optical system – 110 mm

The motorized focal plane allows examination of objects with non-standard thickness

Field of view – from 0.8×0.6 mm to 228×171 mm

When used with the X-Y translation stage: maximum field of view – 310×220 mm

The mode of automatic stitching for obtaining images of documents of up to A3 size

Parameters of the lens

Optical zoom – 40x

Fixed optical magnification – 80x

When used with the additional lens-1:

- fixed optical magnification – 160x,
- on-screen magnification in Extra Full HD mode – up to 310x for a 32" 4K UHD monitor.

When used with the additional lens-2:

- fixed optical magnification – 320x,
- on-screen magnification in Extra Full HD mode – up to 640x for a 32" 4K UHD monitor.

Digital zoom – up to 6400x

Camera filters

- Neutral
- IR high-pass with threshold: 515, 530, 550, 570, 590, 610, 630, 645, 665, 695, 715, 730, 780, 830, 850, 920 nm
- Visible pass 370–700 nm
- UV cut off 450–700 nm
- UV low-pass with threshold 240–400 nm
- Linear polarizing filter (motorized)

LIGHT SOURCES

INCIDENT

Visible and Infrared Light – *LED*

- White
- IR, 700 nm
- IR, 780 nm
- IR, 850 nm
- IR, 950 nm
- IR, 1030 nm

Ultraviolet Light

- UVA, 395 nm – *LED*
- UVA, 365 nm – *LED*
- UVB, 313 nm (lamps)
- UVC, 254 nm (lamps)

Light sources for IR Luminescence – *LED*

- Violet – 395 nm
- Violet – 420 nm
- Royal Blue – 450 nm
- Blue – 470 nm
- Cyan – 505 nm
- Green – 530 nm
- Amber – 590 nm
- Red-orange – 615 nm
- Red – 635 nm
- Deep Red – 660 nm
- Far Red – 700 nm
- Far Red – 735 nm

Total – 4095 combinations

TRANSMITTED – *LED*

- Incident white
- UVA, 365 nm
- IR, 870 nm
- High-intensity spot white
- High-intensity spot IR, 780–900 nm

OBLIQUE – *LED*

- White
- IR, 850 nm

Motorized LEDs located from two sides of the object stage

Range of motion in height – 130 mm

SPECIAL

Light source for hologram visualization (OVD/DOVD) – *LED*

Horizontal white – 31 LEDs

Vertical white – 16 LEDs

Automatic and manual examination modes

Animated image of a hologram

Generalized image of a hologram

Coaxial light for examination of retroreflective protection

Polarized light – *LED*

- Top visible linear polarization
- Top visible clockwise circular polarization
- Top visible anticlockwise circular polarization

Light sources for 3D-visualization – *LED*

- Incident white
- IR, 850 nm

Halogen lamp for spectroscopy – 20 W

D50 light source for spectroscopy – *LED*

BUILT-IN MODULES

Hyperspectral imaging module

Wavelength range – 395–1000 nm

Step of wavelength change – from 1 to 100 nm

High-resolution spectrometer

Wavelength range – 350–1000 nm

Field of view, adjustable – 0.05–2 mm

Integration time – from 1 ms to 65 s

Optical resolution – 3 nm

X-Y translation stage

Maximum displacement – 110×70 mm

Step of displacement – 0.01 mm

RFID chip data reading and verification

Supported standards: ISO 14443 (A, B type; MIFARE®)

Data exchange rate – 106, 212, 424, 848 kBd

Authentication

- Active (AA)
- Passive (PA)
- Chip (CA v1, CA v2)
- Terminal (TA v1, TA v2)

Certified by BSI TR-03105 Part 5.1, BSI TR-03105 Part 5.2

SOFTWARE MODULES

Regula Forensic Studio

The comparator is operated via the Regula Forensic Studio software

Software updates – free of charge

Multilingual interface

Information Reference System

A licensed database that includes reference images of passports, TDs, visas, ID cards, driver's licenses, coins and banknotes

Weekly online update

Annual subscription

VERIFICATION OF UNIQUE SECURITY FEATURES

OVI, OVMI (SPARK®)

Birefringent ink (SICPA OASIS®, Polarisafe®, etc.)

UV postluminescence

Magnetic Ink*

LetterScreen™, LetterScreen++®*

Thermochromic Ink (Feel®-ID)*

MOTION® security thread*

* – optional.

GENERAL PARAMETERS

Built-in PC
CPU – Intel® Core™ i7
RAM – not less than 16 Gb
SSD – not less than 250 Gb
Possibility to connect an external PC

Dimensions (L×W×H) – 900×650×680 mm
Net weight – 125 kg

Power supply – 110–240 V, 50–60 Gz
Size of an examined object (W×L), max – 620×550 mm
Side flaps allow movement of large-format documents inside the comparator
Connection interface – USB 3.0 (for connection to an external PC)

DELIVERY SET

- Spectral luminescent magnifier Regula 4147 (for anti-Stokes luminescence)
- Quartz glass, plate – 200×200×5 mm
- Mirror for OVI examination
  It allows viewing OVI security features from two angles simultaneously
- Mirror for examining a document edge
- 3D visualizer Regula 4162*
- Tilting stage Regula 4165*
- Thermostage Regula 4168*
- Polarizer Regula 4169*
- Magneto-optical visualizer Regula 4197*
- Trinocular stereo microscope Regula 5003*
- Face matching module*

CALIBRATION TOOLS

- White balance calibration target (NIST traceable) for spectrometer calibration
- Test-objects for focus and light sources calibration
- X-rite colorchecker®*
- HG-2 light source for spectrometer calibration*

* – optional.