



MAGNETO-OPTICAL DEVICES
for identification and detection of vehicle units numbers falsification

REGULA, model 7505M
Operating Manual



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INTRODUCTION

The Operating Manual (OM) is the main operational document for the device **Regula 7505M** (hereinafter referred to as "the device") designed for identification and detection of falsifications of VINs (vehicle identification numbers) and vehicle documents.

OM contains information about device design, principles of operation and properties of the device and its components. It also provides instructions on correct and safe operation of the device (intended use, maintenance, repairs, storage and transportation) and on evaluation of product technical condition when defining the necessity of repairs.

Description of the device software is enclosed in a separate document consisting of the following paragraphs: application description, system programmer's manual; programmer's manual, operator's guide .

Personnel operating the device are required to:

- have higher or specialized technical education,
- pass special training and get clearance to perform expert examination in the field of trace evidence and technical expertise of documents,
- be an OS Windows user,
- study techniques of authenticity control of VINs and related vehicle documents and the OM,
- pass practical training on the use of equipment supplied,
- pass training on safety measures observed when working with the device.

WARNING!

USB-devices have no dangerous voltage as they are powered by a secondary power supply source – a PC USB-bus with nominal voltage 5 V. However, the mains power source and PC peripherals (supplied optionally) can have life hazardous nominal voltage ~ 220 V 50 Hz. To avoid electric shock personnel are obliged to strictly observe the safety measures described in paragraph 2.1.1. Device is classified as Class I Equipment IEC950A according to its electric safety properties.

The magnetic copying accessory set contains inflammable liquid (alcohol). Combustibles, lubricants and power supply systems of examined vehicles may cause additional fire hazard.

To ensure device proper operation it is strongly recommended not to change settings of the special software. The device should be operated, maintained, repaired, stored and transported in conformity with chapters 2-6 of this OM. Violation of these requirements will result in the loss of the manufacturer's warranty.

1 DESCRIPTION AND OPERATION

1.1 Description and Operation

1.1.1 Device Function

Regula 7505M is designed for non-destructive investigation of metal surface and for document examination to control their authenticity and detect falsification of VINs and vehicle documents.

The device is a set of hardware and software products enabling visualization (video imaging) of the relief and structural inhomogeneity of the metal surface with magnetic properties (traces of mechanical processing, inclusion of non-ferromagnetic materials, surface flaws of welding seams), without removing the lacquer-and-paint coating (if applicable) by methods of magneto-optical visualization. A PC is used for capturing, collecting, processing, transferring and displaying information.

Application

The device is intended for use by forensic laboratories, law enforcement agencies, judicial authorities, customs and insurance companies. As Regula 7505M provides high-quality results, uses non-destructive methods, operative and obvious character of magneto-optical investigations, it can be used for express inspection (e.g. at customs or by highway patrol), as well as for advanced forensic examination of vehicle VINs in laboratory conditions. In case any VIN changes are detected, further investigations can be carried out using a special set of peripheral hardware tools (supplied optionally) suitable for a case.

Objects of control are divided into two categories:

Category "A" —

vehicle unit surface (data carrier – body, engine and chassis) with relief identification number applied by mechanical processing, electro sparking or laser mode .

Data carriers of integral body frame in mass production passenger cars are normally made of sheet steel: RRST 1405 (DIN 1623 quality standard) cold rolled sheet steel; UST 1203, UST 1303 unkillied sheet steel. Exceptions are made for Audi A8/S8 series bodies, produced since February 1994, because their body panels are made of aluminum alloys Engine cylinder blocks are mostly made of special cast iron and aluminum alloys.

Thickness of non-magnetic coating (galvanic and lacquer-and-paint coating) of manufactured vehicle body parts is 185 µm (with 6 layer coating); but typically it is 40-80 µm.

Category "B" —

materials and printing methods of vehicle related documents .

Device components enable to examine vehicle related documents security features activated in different spectral ranges (absorption, reflection, luminescence) when they are viewed under lights with different wavelengths (for more information see *Spectral Luminescent Magnifier Regula 4177 Operational Manual*).

Operational conditions and storage

Climatic conditions:

air temperature	from +10 °C to +35 °C
relative air humidity	up to 80 % at temperature of +25 °C
atmospheric pressure	from 84 to 107 KPa (from 630 to 800 mm mercury)

Working temperatures on vehicle data carrier surface during magnetic copying: from -20°C to +50 °C.

Working temperatures on the surface of the Combination Magnetic Scanner during magnetic copying: from -20°C to +50°C.

For climatic storage conditions see paragraph 5.

For transportation conditions see paragraph 6.

It is recommended to avoid hitting and vibrations during device transportation and operation.

1.1.2 Technical Specifications

Technical specifications of the device are laid out in the description of its components (see paragraphs 1.2.1–1.2.3).

The device nonstop operation in working conditions lasts for up to 8 hours.

Warm up time for device operation — not more than 3 minutes.

Power supply sources:

Autonomous power	internal PC battery
Mains power	PC external mains power supply source, converting AC voltage of 220 V -15% +10%, frequency 50 Hz ± 1 Hz into DC voltage of PC power supply. External PC power supply source, converting DC voltage of vehicle-on-board system (nominal value =12/24/48 V) into DC voltage of PC power supply.

Power Consumption:

USB-device for Magneto-Optical Visualization	not more than 2,5 W
Spectral Luminescent Magnifier Regula 4177	not more than 2 W

Reliability:

Time to failure	not less than 10 000 hours
Average service life	not more than 5 years
Operation warranty period	12 months from the date the device is delivered to the Customer
Storage warranty period	12 months

Dimensions:

In transportation packaging	up to 550x420x220 mm
Ready for transportation (with the case closed)	up to 460x370x180 mm
In working position (open case)	up to 460x370x550 mm
Folder for documents	up to 420x320x60 mm

Weight:

In transportation packaging (gross weight)	not more than 20 kg
In transportation packaging (net weight)	not more than 12 kg
Device in a standard delivery set (without a PC)	up to 10 kg
Folder for documents	up to 1 kg

1.1.3 Device Composition

A complete delivery set of the device is shown in Table 1

Table 1

Item	Quantity	Packing	Figure #	Marking
USB-device for Magneto-Optical Visualization	1	Body-case	3	Regula, 7505M, serial #, year of production
USB cable to connect to a PC	1			
**Laptop 12"	1			
**External PC mains power source	1			
Magnetic Copying Accessories Set:		Body-case	1b	Regula, 7505M, serial #, year of production
Combination Magnetic Scanner (CMS) - demagnetizer with the set of changeable concentrators:	1	Casing	1b	
- Rotary — 15 mm	1	Casing	1b	
- Rotary — 21 mm	1	Bag	1b	
- Flat — 11 mm	1	Casing	1b	
Compact Magnetic Scanner 11 mm	1	Bag	10	
**Eddy-current scanners	+/-	Body-case	1b	
Magnetic tape (MT) cartridges	2	Casing	1b	
Magnetic tape (MT) reserve (magnetic tape strip 250 mm long)	10	Casing	1b	
Magnetic clamps for MT	2	Casing	1b	
Universal handle with a hinge	1	Bag	9b	
Extension handles	2	Bag	9b	
Container for alcohol (10 g)	1	Bag	7d	
Brush	1	Bag	—	
Marker	1	Bag	—	
Accessories bag	1	Body-case	1b	
Carrier bag for accessories	1	Body-case	1b	
Spectral luminescent magnifier Regula 4177	+/-	Body-case	1b	Regula 4177
Peripheral VIN examination tools		Body-case		Regula 7516
Folder with documents	1	Transportation packing	—	Regula, 7505M
Software:	+/-			—
**PC Drivers and Utilities		CD#1		
**OS Windows XP	+/-	CD#2		
**MS Office	+/-	CD#3		
Special software for managing USB-devices for input, processing and images stitching:				
Videoscope	1	CD#4		
NUCA (EYER)	1	CD#5		
** IRS (Information Reference System) "Autodocs"	+/-	CD#6		
Driver for magneto-optical visualization	1	CD#4		
Driver for Spectral Luminescent Magnifier	+/-	CD#4		
Graphic files for printing paper cartridges intended for threading plastic magnetic tape	2	CD#4		
Complete Set of operational documents:		Bag	—	—
PC Passport	1			
Regula 7505M Operating Manual	1			
Regula 4177 Operating Manual	1			
**Regula 7515 Operating Manual				

Item	Quantity	Packing	Figure #	Marking
**Regula 7516 Operating Manual	+/-			
Videoscope User Guide	1			
"NUCA" (EYER) User Guide	1			
**IRS (Information Reference System) "Autodoc" User Guide	1			
**PC User Guide	+/-			
Warranty card	1			
Spare Parts and Repair Kit (SPRK)				—
Magnetic tape cutter with metal magnetic tape reserve (10 m roll)	1	Bag		
1" plastic magnetic tape reserve (10 m roll)	1	Bag		
½" plastic magnetic tape reserve (5 m roll)	1	Bag		
Paper cartridges intended for threading plastic magnetic tape	11	Bag		
Test-Object	1	Bag	1b, 2	
Combination Magnetic Scanner sleeve gaskets	2	Bag	—	
7 mm wrench	1	Bag	—	
Set of air-cushions (6+6 psc.)	1	Bag	—	
Transportation locking plate	1	Body-case	—	
Polyethylene bag	1	Body-case	—	
Transportation packaging	1	—	—	Regula 7505M, serial #, year of production

Note: Positions marked as "***" are supplied optionally.

1.1.4 Structure and Operation

The device consists of hardware components and a set of specialized software products. Special equipment of the device allows investigating objects by applying different methods.

Category "A" objects examination starts with magnetic copying (magnetogram) of the investigated surface of a ferromagnetic sample. **Magnetic Copying Accessories Set (MCAS)** contains various kinds of magnetic scanners which locally magnetize the object, excite its magnetic stray fields and copy them to the intermediate flexible magnetic carrier (magnetic tape) without removing the lacquer-and-paint coating (LPC) from object's examined surface. Detailed investigation of internal stresses in ferromagnetic objects and examination of aluminum objects' surface can be performed with **an eddy-current scanner** (supplied optionally).

Magnetic copy is loaded into the **USB-device for Magnetic-Optical Visualization (MOV)** where information about object's surface layer is scanned. This unit combines two functional components: Optic-Mechanical Block and Block of Electronics.

Optic-Mechanical Block (OMB) contains a magneto-optical visualizer which converts magnetic stray fields of a magnetic copy into an image and a special tape drive mechanism where the magnetic copy travels in relation to the visualizer.

A magnetic copy is loaded into the tape drive where it is automatically introduced into the tape drive tract. Then it is scanned step-by-step by a sensor designed on the basis of a magneto-optical crystal. Magneto-optical visualization of magnetic copies of the investigated object is based on Faraday magneto-optical effect which occurs in crystalline films of Bi-containing ferrite garnets.

Light distribution is received by the sensitive CMOS video camera matrix where it is converted into a digital TV signal to be processed and examined with PC software.

Step-by-step input of images into a PC allows making automatic panoramic stitching of a digital image from several sub-shots.

Block of Electronics manages OMB resources (electric drive, inductor, illuminator, video camera and indicators).

Operation of Regula 7505 USB-devices is carried out with the help of a **Personal Computer (PC)** via special software. A PC displays newly obtained and stored examination data which are processed, examined and documented.

Spectral Luminescent Magnifier (SLM) is used for optical examination of documents (category "B" objects). It enables the user to examine objects in visible light (white, blue, yellow and green), in infrared (IR), ultraviolet (UV) and oblique light, as well as IR and UV luminescence. Complete description of SLM can be found in the corresponding Operating Manual.

Peripherals (supplied optionally) extend examination possibilities of the device by applying additional methods and means of investigation of category "A" objects. The device is designed to operate together with the following peripherals:

- USB-device for optical input,
- magnetic powder visualization device,
- eddy-current probe,
- electrochemical etching device.

Basic functions of **VideoScope/NUCA (EYER) Software**: operating USB-devices; input and processing of images; automatic program correction and panoramic shots stitching of MOV; images processing; comparison of images; measurements of linear and angular sizes; saving and printing of image files as illustrations to the photo charts.

Information Reference System "Autodocs" is a collection of document templates from a number of countries related to vehicle ownership and driving.

Set of operational documents contains data on design, principles of operation, properties of the device and its components. It also contains instructions on correct and safe device operation and evaluation of its technical condition when deciding whether it is necessary to send it for repairs.

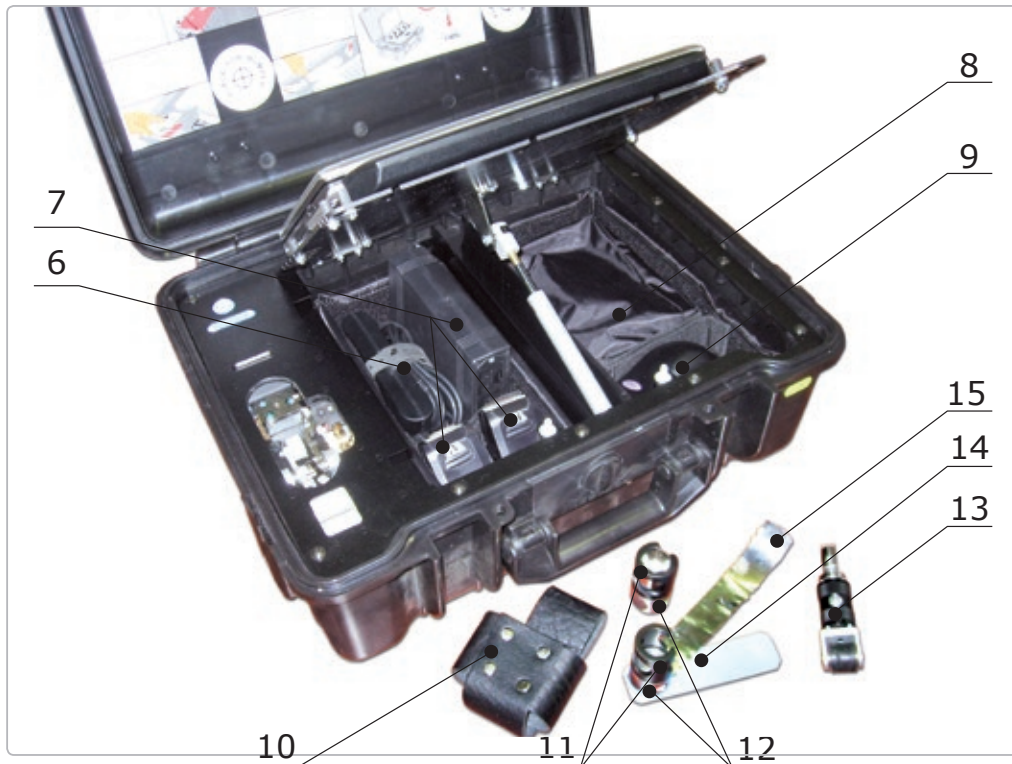
The device is manufactured in a compact portable case (tight, shock-resistant, plastic body-case) on the basis of a standard model "WONDERFUL PC-4618N" or similar. The device in working position is shown in Figure 1.

Figure 1a



- 1 — body-case
- 2 — laptop 12"
- 3 — USB-device for magneto-optical visualization
- 4 — PC folding panel
- 5 — PC fixing pins

Figure 1b



- | | |
|---|-----------------------------------|
| 6 — PC external mains power source | 11 — cartridges for magnetic tape |
| 7 — eddy-current magnetographing device
Regula 7515M | 12 — magnetic tape clamps |
| 8 — carrier bag for accessories | 13 — combination magnetic scanner |
| 9 — spectral luminescent magnifier Regula 4177 | 14 — test-object |
| 10 — body-case for magnetic copying
accessories set | 15 — magnetic tape strip |

View of the device with the lifted PC panel

1.1.5 Means of measurement, tools and accessories

The device is intended for indexing (not measuring) purposes. Therefore control of device operation is performed by test-objects, simulating several known methods to alter vehicle VINs (cold calking, sealing with fusible metals, dot welding and pressing in fragments). See paragraph 2.2.1.2 for the details of the device operational check-up using the test-object.

Characteristics of test-object:

Test-object (see Figure 2) imitates a category "A" object. It is a plate made of a vehicle body metal sheet (unkilled sheet steel) with the thickness of 0,8-0,9 mm bearing "291634" initial number applied by mechanic pressing (cold stamping). The original number details: manual stamping with the use of "type No.6" markers kit and hammer on a massive anvil. The height of digits relief is about 0,3-0,4 mm.

Three digits of the original number were modified: "9" to "0", "6" to "9" and "4" to "5". Thus, the altered number appears as "201935" (altered digits are underlined).

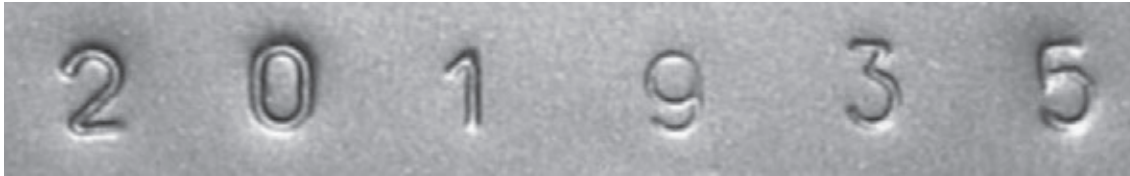
Digit "9" of the original number was altered manually using **cold calking** of one element (crosspiece) of digit "9" with the help of bench tools. Then digit "0" was stamped over the remaining contour of digit "9".

Alterations of digit "6". The original number fragment bearing digit "6" was dismantled (cut out), rotated by 180°, **pressed in** (so that digit "6" transformed to digit "9") and then was fixed in the plate frame by **dot welding**.

Digit "4" of the original number was modified by means of **sealing the digit relief with soft metal (tin)** and then stamping a new digit "5" over the built-up area.

After the original digits were altered, the following operations were performed on the test-object: grinding, spackling, dressing, priming, two-layer spray-on painting with aerosol motor enamel using the technique of cold drying in accordance with the repaired coating type.

Figure 2



Photographic image of the investigated test-object surface

1.1.6 Marking

Device marking is performed in the form of a label on the rear side of the PC panel. The marking label provides the following information:

- manufacturer's name and/or trade mark,
- symbolic notation of the device,
- device serial number in compliance with the numbering system of the manufacturer,
- date of manufacturing (year and month),
- rated voltage, V,
- rated current, A,
- nominal frequency, Hz,
- technical conditions marking,
- national certification mark.

Device sealing is made with the help of destructible security labels applied on the Optic-Mechanical Block body and on the device chassis. Damages of the security label cause a loss of warranty.

Folder with documents is labeled on the cover.

SPRK is labeled on the repair kit's bag.

1.1.7 Packing

Device hardware is packed in the body-case. Software and a set of operational documents are enclosed in a documents folder. SPRK is packed in a bag.

The device is transported and stored in a special wooden box. Device special equipment is arranged in conformity with Table 1.

1.2 Description and Operation of the Device Components

1.2.1 USB-device for Magneto-Optical Visualization (MOV)

Functions

- Magneto-optical visualization of a physical copy from MT.
- Transforming a visualized image into a digital TV signal.
- Changing frames due to step-by-step movement of MT in the tape drive mechanism with further automatic stitching.
- Indicating current system status.

Technical characteristics

Examined object material		ferromagnetic
Width of magnetic tape		25,4 and 12,6 mm
Maximum length of magnetic tape		not limited
Examined width of magnetic tape		not less than 20 mm
Physical size of image point (frame format 1280x1024)		16 µm
Acceptable thickness of non-magnetic coating (Fig. 7-8):	for detailed research (spatial resolution 80 µm)	not more than 0,1 mm
	for general research (spatial resolution 400 µm)	not more than 0,5 mm
Acceptable thickness of removed surface layer of metal		not more than 1,0 mm
Approximate time of input of a magnetic copy of fused area		15 sec
OS		Windows XP
Format of image files		BMP, PCX, GIF, JPG
PC monitor size		12"
Approximate size of a VIN image file (75 % JPG, 640x512)		1,8 Mb
Working time:	in autonomous mode (depends on PC type), usually	not more than 3 hours
	from mains power source, not less than	8 hours
Consumed electric capacity on the USB-bus		not more than 2,5 W

WARNING

It is strongly prohibited to detach the USB-device for MOV from the front panel during the operation of the device.

Design

The USB-device for MOV is designed in the form of a module, built in the body-case of the device. The module is sealed and covered with a protective casing.

Figure 3







- 1 — tape drive (place to insert MT)
- 2 — pressing roller block (for manual extraction of MT)
- 3 — pressing roller

- 4 — status indicators of the USB-device for MOV
- 5 — magnetic tape pressing unit
- 6 — bunker (place to extract MT)

Front panel of the USB-device for MOV
(the arrows show the direction of MT movement)

Status indicators of the USB-device for MOV:

-  "device is passive"
(special software is not operating with the device);  "MT in the bunker"
(insertion or extraction of MT);
-  "device is active"
(special software is operating with the device);  "MT in the tract"
(stitching is in process).

List of main components of the USB-device for MOV:

- electric motor of OMB magnetic tape drive,
- indicators of MT position,
- MOV illuminator,
- inductor.

Algorithm of Automatic Magneto-Optical Visualizer operation:

- Switching the PC on, loading the OS, initializing software. Automatic check-up of the state / pre-installation of OMB equipment.
- MT is manually inserted into the OMB buffer. Then MT is captured by the magnetic tape drive and moved to MOV working zone.
- Step-by-step movement of MT is followed by panoramic stitching of an MOV image.
- The quality of stitching and its informative value is controlled.
- MT extraction: direct or reverse rotation depending on the length of the inserted MT strip. Manual extraction of MT from OMB buffer. The device switches to a stand-by mode.
- The equipment automatically switches to a stand-by mode when the "Stop" mode lasts longer than ≈ 5 minutes. Stand-by mode is switched off as soon as a new command is received.

1.2.2

Magnetic Copying Accessories Set (MCAS)

Functions

- Creating a physical copy (recording information to intermediate flexible magnetic carrier – magnetic tape) of magnetic stray fields distribution over the object surface. The copy reflects relief and structural inhomogeneity of the material. Permanent magnets of the Combination Magnetic Scanner concentrators serve as sources of magnetic stray fields' excitation.
- Demagnetizing magnetic tapes for further use.
- Arranging, marking, storing and carrying the operative reserve of MT and recorded magnetic copies.
- Service functions while performing magnetic copying.

Technical Characteristics

Dimensions of physical copies:	length	unlimited. Recommended length – 250 mm
	width	11 mm (Combination Magnetic Scanner flat concentrator and Compact Magnetic Scanner)
	width	15 mm (Combination Magnetic Scanner rotary concentrator)
	width	21 mm (Combination Magnetic Scanner rotary concentrator)
MT cartridge capacity	not more than 10 strips (250 mm long)	
MCAS casing dimensions	120x80x40 mm	
Weight of the loaded MCAS casing	0,4 kg	
CMS dimensions	105x30x30 mm	
CMS weight	0,2 kg	

Design

MCAS casing is designed as a leather waist carrier pouch (Figure 1b, pos. 10) intended for carrying accessories for magnetic copying. MCAS casing is placed in a special niche under the front panel of the device body-case.

Main elements of the loaded MCAS casing are shown in Figure 1b:

- | | |
|--------------------------------|---------------------------|
| 10 — MCAS casing, | 13 — CMS, |
| 11 — magnetic tape cartridges, | 15 — magnetic tape strip. |
| 12 — magnetic tape clamps, | |

Combination Magnetic Scanner (CMS) (Figure 1b, pos. 13) is intended for magnetization of an examined object and magnetic biasing of magnetic tape while performing a magnetogram. It is also used for demagnetizing magnetic copies for their further reuse. CMS is equipped with three replaceable concentrators on permanent magnets for use on different surfaces of objects with various properties: a flat concentrator (effective width of 11 mm), a rotary concentrator (effective width of 15 mm) and another rotary concentrator (effective width of 21 mm).

Flat concentrator of CMS is designed for copying relief surfaces with unevenness not exceeding 0,5 mm at the base width of 11 mm (number platforms of the majority of vehicle engines and number areas of some vehicle bodies). The flat concentrator of CMS has the strongest magnetic flow compared to other scanners. Thus it is mainly used for examination of structural homogeneity of metal surfaces.

Rotary concentrators of CMS are designed as floating disks system for magnetic copying of more complex relief surfaces with unevenness not exceeding 1 mm at the base width of 20 mm (number platforms of most vehicle bodies). CMS rotary concentrators form surface magnetic flow. Therefore they are mainly used for examination of relief homogeneity of metal surfaces (front side of number platform, defective welded seams). They have the highest penetrating ability through lacquer-and-paint coating. Stronger magnetization is provided by the concentrator with a smaller effective width. That is why the use of 15 mm concentrator is more preferable for detailed examination. The use of 21 mm concentrator is more preferable for increasing the examined area.

Compact Magnetic Scanner (Figure 10, pos.1) is equipped with a flat concentrator on permanent magnets with effective width of 11 mm. Due to the minimal size the scanner can be used on difficult surfaces: grooves, joints or abutment of examined object elements. Magnetizing properties of this scanner occupy an intermediate position among CMS concentrators. The compact magnetic scanner is equipped with a spring clip which can be fixed in one of two positions. The operator can choose a suitable position relative to the direction of scanning.

The most effective device for advanced examination of metal structure of objects is the eddy-current scanner (supplied optionally). Its specifications are given further in this Operating Manual.

Magnetic Tape Cartridges (Figure 1b, pos. 11) are used for storing operative reserve of MT. The cartridges have two compartments: 1) for MT that has recorded information (marked with a red marker) and 2) for demagnetized MT (marked with a green marker). Cartridges can be either attached to magnetic clamps (Figure 1b, pos. 11–12) or kept separately.

Magnetic Clamps (Figure 1b, pos. 12) are used to fix a MT strip on the examined area during magnetic copying.

Universal Handle with a Hinge (Figure 9b, pos. 5) allows fixing one of CMS concentrators on the tip of the handle. As a result, magnetic copying becomes possible in hard-to-reach areas of a vehicle body. The length of the universal handle with a hinge can be extended by attaching extension handles (Figure 9b, pos. 6).

Use a container with operative reserve of alcohol and a brush when preparing the object surface for magnetic copying. Use a marker for marking magnetic copies.

Some accessories for magnetic copying and SPRK are kept in the accessories bag (Figure 1b, pos. 8):

- CMS rotary concentrator (21 mm),
- compact magnetic scanner (11 mm) (Figure 10, pos. 1),
- universal handle with a hinge (Figure 9b, pos. 5),
- extension handles (Figure 9b, pos. 6),
- container for alcohol (10 g),
- marker,

- brush,
- MT cutter with technological reserve of MT – 10 m roll (**Figure 5**),
- test-object (**Figure 1, pos. 14, Figure 2**),
- combination magnetic scanner sleeve gaskets.

1.2.3 Spectral Luminescent Magnifier Regula model 4177 (SLM)

Functions

Spectral Luminescent Magnifier (SLM) is designed for examination of documents with the purpose of detecting altered areas in the original document. The examination is based on difference in physical and chemical properties of document materials (polygraphic inks) in different spectrum ranges ($\lambda = 450-1000 \text{ nm}$).

Area of application

SLM is used for expert examination of documents. The device is stored in a special compartment under the PC folding panel (Figure 1, pos. 9).

Specifications of Regula 4177 are given in this Operating Manual.

1.2.4 Personal Computer (PC)

Function

A PC with special software manages various USB-devices of Regula 7505M (MOV, SLM, optical input), displays operative and stored information, provides conditions for its processing, examination and documenting.

Technical specifications

The device can operate both with a stationary PC and with a 12" laptop.

If the User purchases a 12" laptop, it should meet the following requirements in order to be installed correctly:

Dimensions	not more than 310x230x42 mm (minimal dimensions LxW: 270x190 mm)
USB-ports location	on the rear side (minimum – 1 port)
Total number of USB-ports	minimum – 2 ports
CD-disk drive location	on the right or in front of the PC

For Videoscope/NUCA (EYER) special software operation the following PC specifications are required:

Minimum configuration:

- IBM-compatible PC,
- processor Celeron 2 GHz, Intel Pentium IV or higher,
- OS Windows XP (SP2 or higher), Windows 2000 (SP2 or higher),
- available USB 2.0 port with High Speed support,
- 512Mb RAM or higher,
- video adapter supporting 1280x1024, 24bit color mode,
- MS DirectX v.9.0b or higher.

1.2.5 Software

Videoscope and NUCA (EYER) are designed for input and processing of VIN images .

The software performs the following functions:

- operating "Regula 7505M",
- input of images from scanners,
- automatic panoramic stitching of images of VINs,
- processing images,
- comparing images with specimens,
- recording images with different formats,
- documenting examination results.

The description of Videoscope/Nuca (EYER) is given in this Operation Manual.

1.2.6 Spare Parts and Repair Kit (SPRK)

Functions

SPRK is designed for routine maintenance and repairs of the device, for renewing operative reserve of consumables and for servicing during examination.

Full composition and application:

- the cutter is used for cutting magnetic tape from stock to fill up operative MCAS reserve,
- test-object is used to control device operation,
- metal magnetic tape reserve (10 m roll) in the bunker of the cutter,
- 1" plastic magnetic tape reserve (10 m roll),
- ½" plastic magnetic tape reserve (5 m roll),
- combined magnetic scanner gaskets (2 pieces),
- 7 mm wrench to adjust PC fixing pins,
- set of air-cushions to fill the gap between a PC and the plate,
- transportation locking plate used to protect the device mechanisms during transportation.

2 INTENDED USE

2.1 Intended Use of the Device

2.1.1 Operating Limitations

IT IS STRONGLY PROHIBITED TO:

- use ungrounded mains sockets,
- use faulty mains sockets and power supply sources,
- use power supply sources different from the ones described in paragraph 1.1.2,
- switch on the device with visible damage of protective isolation, of cables conductors and of power supply cords,
- switch on the device when protective shrouds are removed.

To avoid a fire hazard, the personnel must observe fire safety measures.

- Do not use the device near open fire. Do not allow smoking at working place.
- Do not use the device for examining vehicles having apparent defects of fuel and power supply systems.
- Avoid a short circuit of vehicle accumulator contacts and power circuit of device power supply.
- Avoid starting the vehicle engine. Do not use electrical equipment systems (lights, air-conditioner, cassette recorder, etc.).
- Vehicle examination is to be carried out on the working platform (in a box) equipped with firefighting appliances.

Operating limitations

- It is prohibited to use the device under rain. In case water or condensate appear on device components case, device operation must be stopped and can be renewed only after drying.
- The device should not be exposed to hitting and strong vibrations during operation and transportation.
- Observe specified electric parameters for power supply sources in conformity with paragraph 1.1.2.
- Place the device and its cables far from sources of strong magnetic and electrostatic fields.
- Consider operating limitations for the components of the device in conformity with paragraph 2.2.

Failure to observe operating limitations given in paragraphs 2.1.1, 2.2.1.1, 2.2.2.1 will result in the loss of the manufacturer's warranties.

2.1.2 Preparation of the Device for Operation

Step-by-step preparation of the device for operation.

- Take the device out from the packaging and place its hardware on the working surface.
- Open the cover of the device body-case (see Figure 1). Unscrew 3 screws and remove transportation locking plate (see picture on the case cover). Screw in screws into corresponding sockets on the front panel.
- Inspect the device components visually.

- Check the device components and prepare them for operation in accordance with paragraphs 2.2.1–2.2.3.
- Prepare the PC and its peripherals for operation in accordance with the corresponding technical description.

In case a PC is purchased by the User (see requirements listed in paragraph 1.2.4), the following operations should be performed to install the PC correctly:

- Install the OS and necessary programs in conformity with their technical description.
- Install the software (Videoscope/NUCA (EYER), Autodocs) and their drivers following the installation guide.
- Install and adjust fixing pins to fix the PC (Figure 1, pos. 5) according to PC sizes and its components (disk storages, memory cards, slots and etc.) position.
- Adjust the length of the cable of the USB-device for MOV. The cable must have some length reserve which provides its freedom of movement when opening/closing the PC folding panel (Figure 1, pos. 4).
- Stick air-cushions on the inner side of the body-case cover in order to fill in the gap between the body-case cover and the PC. Air-cushions should be stuck opposite the PC front corners. The thickness of air-cushions is chosen according to the laptop thickness.

2.2 Intended Use of Device Components

2.2.1 USB-device for Magneto-Optical Visualization (MOV)

2.2.1.1 Operating Limitations

- It is possible to examine ferromagnetic materials only (iron, steel, cast iron). Non-ferromagnetic materials (aluminum) are examined with the corresponding eddy-current scanner (supplied optionally).
- Do not use damaged MT (having breaks with sharp edges, strongly crumpled), MT with bent on edges or dirty MT (see paragraphs 2.2.2.2 and 3.2). Failure to observe these requirements may result in discrepancies during MT stitching and MT jamming in MOV.
- Avoid large abrasive particles (dust, sand, scale, etc.), oils, preservatives and other objects (coins, paper clips, etc.) getting into the OMB tape receiving magazine.
- Do not interfere with MT movement in the OMB tape drive tract. Do not try to extract an MT strip manually when it is automatically moving in the OMB tract.
- Do not reinstall the operational system and drivers for the device components without emergency.
- Do not change settings of the special software. If it is necessary to reinstall the software, follow the instructions given in the corresponding software User's Guide.
- Do not change the arrangement of USB-cables connecting the device components and PC slots. The change in cables arrangement may require drivers reinstallation.

Do not use MT strips shorter than 150 mm. Otherwise in case of tape jamming in the tape path, there won't be a possibility of manual tape removal. This situation may require qualified service.

2.2.1.2 Preparation for Operation

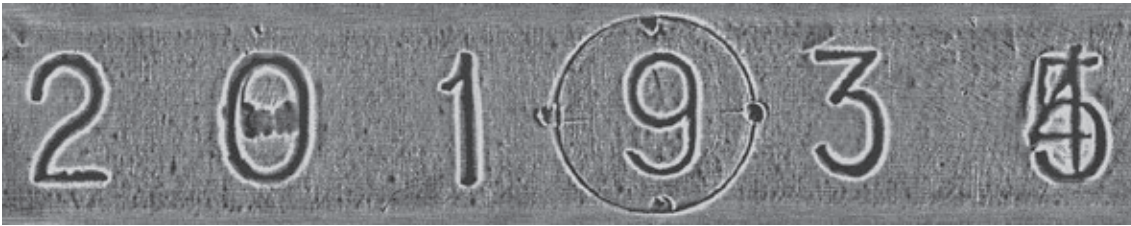
Switching the device on

- Connect the PC to an external power supply source. The device can be powered by the internal (autonomous) PC battery. In this case power supply cables are not connected.
- Switch on the PC. Start the operating system and launch special Videoscope/NUCA (EYER) software. As soon as the USB-device for MOV is connected, the yellow LED (Figure 3, pos. 4) comes on. The device is ready to operate.

Operational check-up

- Take out test-object #1 intended for testing the USB-device for MOV (see paragraph 1.1.5) from the Spare Parts and Repair Kit (SPRK) and make its magnetic copy in conformity with paragraph 2.2.2.3.
- Perform magnetic copy stitching in the PC in conformity with paragraph 2.2.1.3.
- Compare the results of obtained magnetic copy stitching with the template shown in Figure 4. In case of positive results, operation of the unit is considered normal. Criteria of comparing the obtained magnetic copy stitching results with the templates are as follows:
 - match the quality of displaying the original metal surface (surface texture shall be visible),
 - compare the quality of displaying signs of the original number digits alterations (traces of mechanical processing on the 2nd, 4th and 6th digit positions, as well as traces of spot welding and contours of pressing-in fragments on the 4th digit position shall be visible),
 - match the quality of displaying residual digits of the original number that were altered (fragments of the original number digits shall be visible on the 2nd and 6th digit position).
- In case of malfunction at any stage of operation control, see paragraphs 3 and 4.

Figure 4



Magneto-optical visualization of the test object surface through the layer with thickness of 0.1 mm. Spatial resolution is around 80 μm

Switching the device off

To switch the device off do the following:

- Close special Videoscope/NUCA(EYER) software. A yellow LED (Figure 3, pos. 4) goes off and the device enters sleep mode. Exit the operational system and switch off the PC.
- Disconnect the external PC power supply source from the mains (if it was connected).
- Unplug the device. Place the power cable and the AC adapter into the corresponding body-case compartment.

2.2.1.3 Intended Use

The USB-device for MOV performs the following operations:

- magnetic copy stitching,
- extracting a used magnetic copy,
- processing and analyzing magnetic copy stitching,
- documenting examination results.

Magnetic copy stitching

- Ensure that no magnetic tape is present in OMB tape drive tract - thus, neither red LED "MT in the buffer" (Figure 3, pos. 4), nor the green LED "MT in the tract" (Figure 3, pos. 4) comes on. Otherwise, first remove the previous magnetic copy.

- **For plastic MT (1" and ½"). Put the MT with its working surface (of brown colour) facing down** (facing MOV). It should be noted that when using ½" MT, it is inserted into a paper cartridge beforehand. It means that the ½" MT is put with its working surface (of brown colour) facing down while the paper cartridge is located on top of MT.
- Straighten MT holding it by its edges and insert it into the mouth of the tape receiving magazine (Figure 3, pos.1). Insert MT into the tape receiving magazine to a depth of 30 mm (until blocked). The red LED (Figure 3, pos. 4) lights up confirming the state "MT in the buffer" and the electric motor starts to capture the tape. Insert the tape further inside the tract until it is captured by the drive shaft of OMB. The green LED (Figure 3, pos. 4) lights up confirming the state "MT in the tract"). **Release MT strip and it will move forward automatically.**
- Wait for approximately 5 seconds to load the potentially informative sector of the magnetic copy into MOV zone. Start stitching process by corresponding software command. Stitching process is confirmed by green LED blinking (Figure 3, pos. 4) with the meaning "MT in the tract". The first visualization sub-frame appears on the PC screen.
- Control the quality of stitching visually. When signs of low quality of magnetic copying are observed (due to MT non-contact with tested surface, MT or scanner warp during copying, etc.), it is possible to stop stitching process with "Eject MT" command. As soon as MT is returned to the buffer, extract it, demagnetize, and make another magnetic copy in conformity with paragraph 2.2.2.3.
- In case of satisfactory magnetic copy quality, stitching can be continued until the end of the informative sector and be stopped with "Eject MT" command, or wait for OMB termination in automatic mode ("MT end" led comes on).

Extraction of a used magnetic copy

- As soon as the OMB receives the command "Eject MT", used MT automatically returns to the buffer – to the tape-receiving magazine or to the bunker – (to the closest location). The green LED "MT in the tract" is fading indicating that MT stopped moving. The red LED "MT in the buffer" comes on. **Do not remove an MT strip from the tape-receiving magazine until it fully stops and the led "MT in the tract" is off!**
- Take the MT by its edges and remove it from the buffer. The red LED "MT in the buffer" will go out. It is required to demagnetize the used magnetic copy for its further use and place it into the Combination Magnetic Scanner case or store it for future use.

Processing and analyzing magnetic copy stitching

- Rotate the stitched copy and match it with the original, using manipulation functions: image rotation and flipping.
- Evaluate the quality of stitching visually. If the quality is satisfactory, save the initial file and start processing and analyzing. If the quality is unsatisfactory, repeat magnetic copy stitching or make a new magnetic copy.
- Process the stitched image using software functions. In general the following functions give the most effective results: threshold processing with the possibility of brightness levels band spreading, image differentiation and spatial filtering.
- Examine magnetic copy stitching:
 - visually determine signs of number digits alteration, such as traces of mechanical processing taking the form of traces or flutes (Figure 4: 2nd, 4th and 6th digit positions); original number fragments (Figure 4: 2nd and 6th digit positions); non-ferromagnetic materials fragments (Figure 4: 4th digit position); welded seams and borders of pressing in (Figure 4: 4th digit position);
 - additional investigated features are: deviation of form and arrangement of digits in the number; different intensity (clearness) of the number digits contour; non-uniformity or absence of the object surface texture processing. It should be taken into account that the last two features can result from a poor quality copying (magnetic tape poor fitting to the surface);
 - compare digits images with specimen VINs or with repeating symbols in examined number;

- measuring geometrical sizes of symbols images and their arrangement. Software applications allow measuring linear and angular sizes of images;
- analyze the investigation results.

Documenting investigation results

- Saving initial magneto-optical visualization file of the number platform. Processed images can also be saved.
- Saving magnetic copy as material evidence.
- Printing images.

2.2.2 Magnetic Copying Accessories Set (MCAS)

2.2.2.1 Operating limitations

- Only ferromagnetic materials (iron, steel, cast iron) can be investigated. For non-ferromagnetic materials (aluminum) eddy-current scanner must be used (supplied optionally).
- Thickness of investigated lacquer-and-paint coating shall not exceed 0,5 mm and the thickness of investigated rust or scale layer shall not exceed 0,3 mm.
- Investigated surface unevenness shall not exceed 0,5 mm at the basic width of 11 mm when using a flat concentrator of the Combination Magnetic Scanner (CMS).
- Investigated surface unevenness shall not exceed 1 mm at the basic width of 20 mm when using a rotary concentrator of the CMS.
- Protect CMS from impacts and falls to avoid magnets failure and loss of magnetic properties.
- Damaged rubber protective sleeve gaskets should not be used during the operation of CMS with rotary concentrator.

Do not use the magnetic tape shorter than 150 mm, otherwise in case of tape jamming in the tape path there won't be a possibility of manual tape removal and this case may require the backup of the service engineer.

2.2.2.2 Preparation of the device for operation

Set Inspection

- Check availability and proper arrangement of the set components.
- Check availability of reserve of the magnetic tape and ethyl alcohol.
- Inspect the integrity and cleanliness of magnetic tapes surface. (See "The Order of Refilling").
- Visually control integrity of rubber protection sleeve gasket of the Combination Magnetic Scanner with rotary concentrator. If necessary replace the worn out sleeve gasket with a new one (see paragraph 4.2).

The Order of Magnetic Tape Refilling

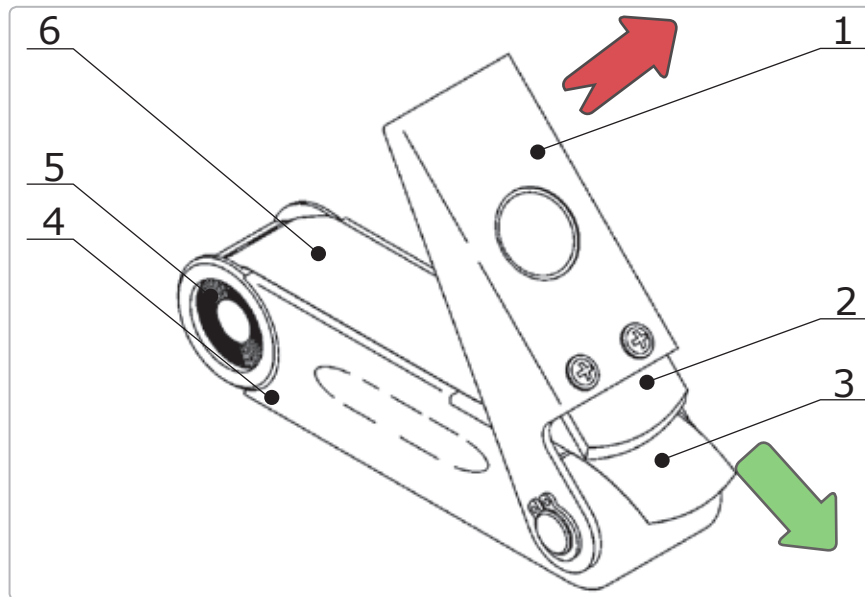
Magnetic tape (MT) and ethyl alcohol are consumable materials.

To fill up an operative stock of magnetic tape perform the following: take MT from Spare Parts and Repair Kit (SPRK), cut it into necessary length strips and enclose them into the cartridge for magnetic tapes storage (Figure 1, pos. 11).

Cut metal MT with the cutter from SPRK in the following sequence:

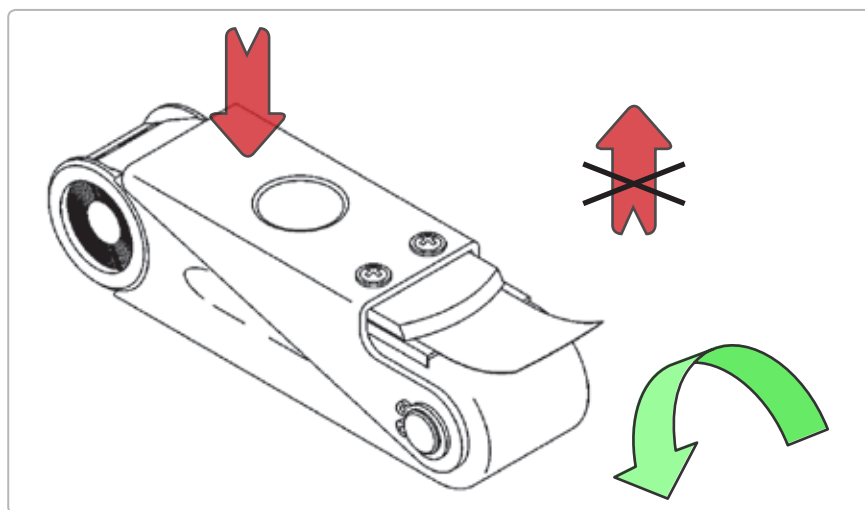
- set the cutter lever in the upper position (Figure 5, pos .1), letting the tape freely pass through the slot as it is shown in Figure 5a;
- push the magnetic tape strip (Figure 5, pos .3) out of the blade edges (Figure 5, pos. 2), pressing the surface of the magnetic tape at the number area site (Figure 5, pos .6);

Figure 5



a) magnetic tape extraction from the bunker of the cutter

- 1 – lever;
- 2 – blade;
- 3 – magnetic tape;
- 4 – case;
- 5 – bunker with magnetic tape reserve;
- 6 – site for magnetic tape pulling out.



b) cutting magnetic tapes by the cutter

- seize the magnetic tape by its edge (see Figure 5, pos. 3) and pull it out for a desired length, relative to the blade edge (Figure 5, pos. 2). Case of the cutter can be used for measuring the approximate length of the magnetic tape strip (Figure 5, pos. 4): a full loop of a tape around the case is equal to the working magnetic tape strip length – 250 mm;
- lower the cutter lever (Figure 5, pos. 1) and slightly press it down to fix the tape as shown in Figure 5b;
- tear the tape along the blade edge (Figure 5, pos. 2). It is better to "twist" the tape but not "tear" it (Figure 5b). When tearing the MT avoid forming fins on strips' edges;
- put the obtained magnetic tape strip by its concave edge under the blade of the cutter and tear another edge similarly;
- stack the cut MT strips into the cartridge for magnetic tapes storage (Figure 1b, pos. 11) into the compartment marked with green marker (demagnetized MT).

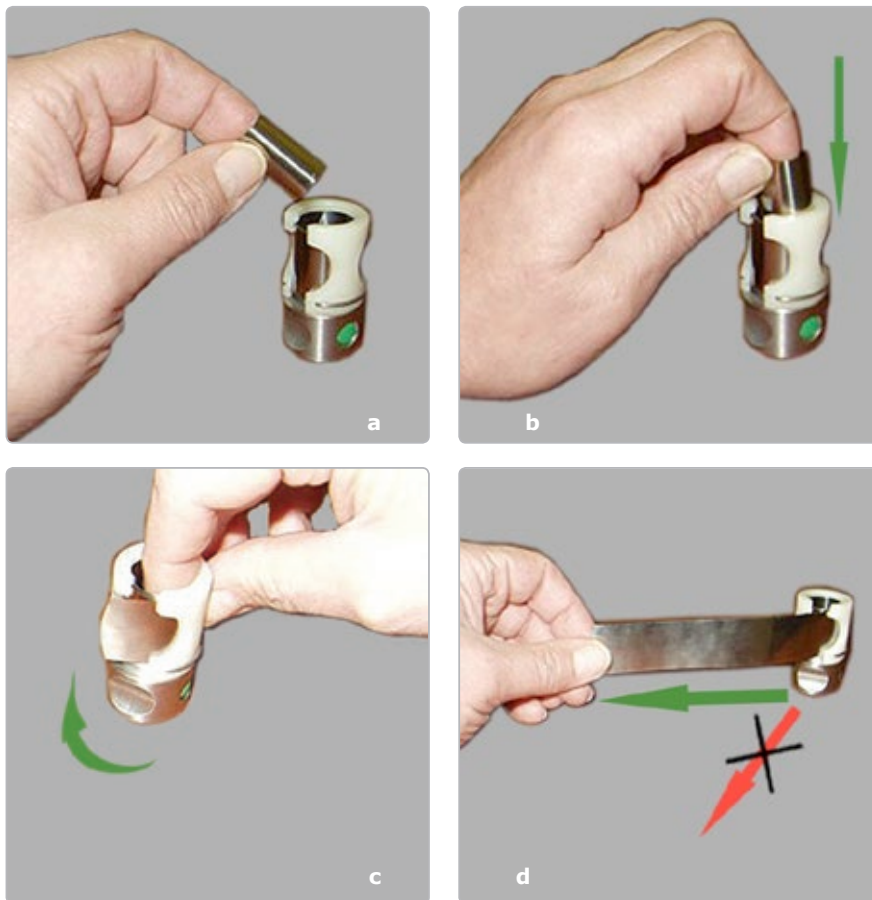
Cut plastic MT using paper scissors. When cutting, it is recommended to trim MT edges so that they are rounded in shape.

Cut paper cartridges for ½" plastic MT from printed stencils using paper scissors. Cut along the lines.

MT pieces stacking inside the cartridge is carried out as follows. The stacked MT piece should be rolled into a roll of $\approx \text{Ø}20 \text{ mm}$ (for example, it can be rolled on your finger as shown in Figure 6a), then pushed inside the cartridge (Figure 6b). Each subsequent roll is stacked inside the previous one.

MT pieces extraction from the cartridge is carried out as follows. Turn a roll of MT pieces inside the cartridge that the butt end of the upper whorl of the tape would appear opposite to the cut of the cartridge (Figure 6c). Then, pull MT strip by its edge in the tangent direction towards the cartridge circumference (Figure 6d).

Figure 6



Magnetic tapes stacking inside the cartridge and their extraction

Correct the defects of MT strips or replace the damaged strips during the routine inspection of accessories.

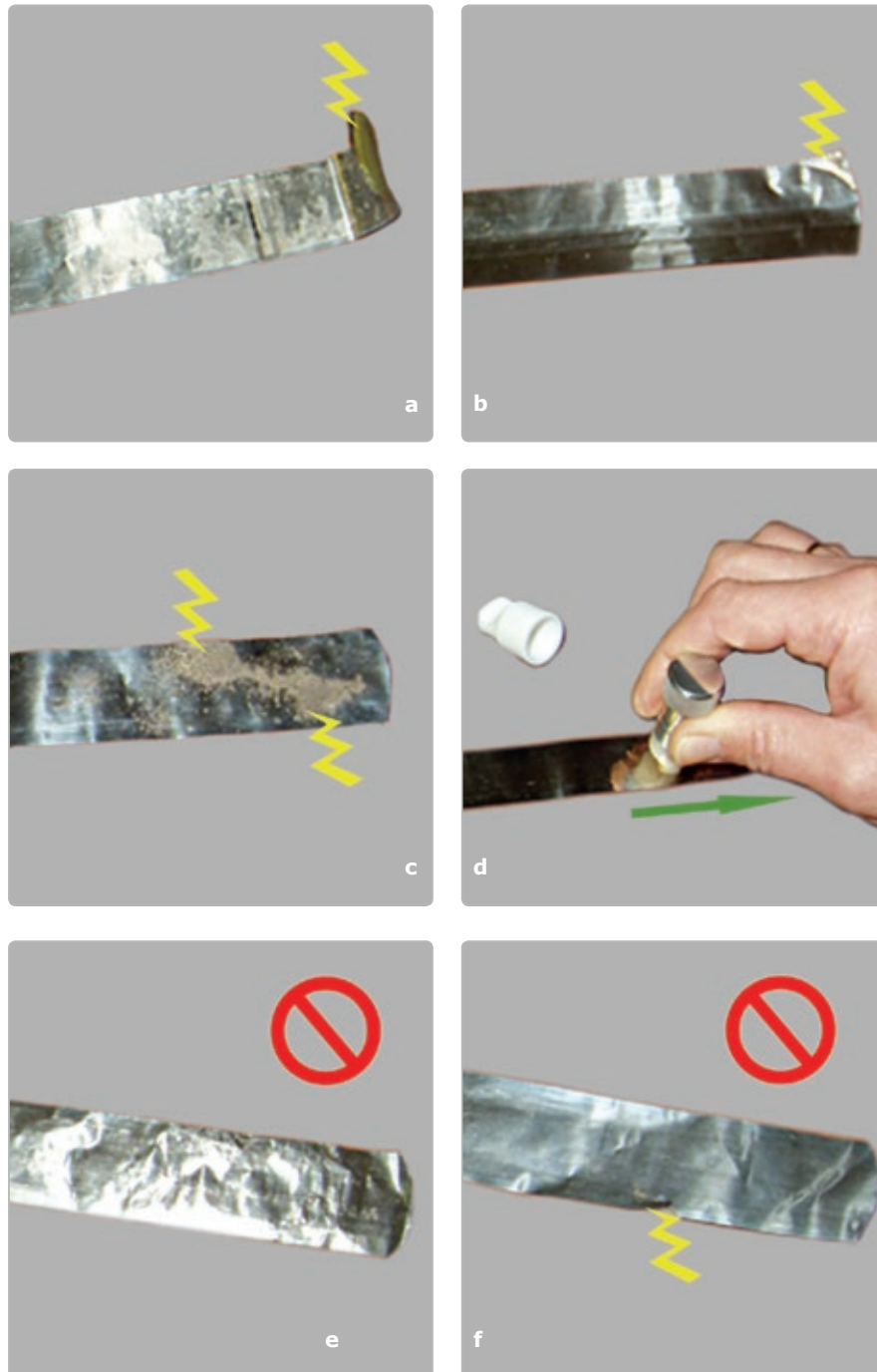
If the marginal areas of the tape (20–30 mm from the strip ends) have transverse bends with curvature radius less than 20 mm (Figure 7a), they have to be straightened to an acceptable condition. Densely roll the tape in the inverse curvature or slightly stretch it on an angular edge (for example, on the table's edge) to get it straightened. The same is applied to the bent MT strip corners (Figure 7b). In case the tapes' edges are failing to straighten up, cut them by the cutter from SPRK.

Another kind of MT eliminated defect (Figure 7c) is MT surface pollution (polluted films, water, solvents, chemical solutions, dust particles, rust, metal, etc.). MT surface should be cleaned with alcohol using a special container from SPRK (Figure 7d).

MT with considerable bends (breaks) (Figure 7e), breaks of edges (Figure 7f) and punctures cannot be mended. Such tapes should not be used in case the fault area cannot be removed with the SPRK cutter.

As a result of being damaged and worn out, plastic MT loses particles of the working layer. Consequently the quality of copying worsens and the USB-device for MOV becomes dirty. If the defects of MT working layer are visible, the MT is to be withdrawn from use.

Figure 7



Non-observance of the recommended form of MT strip edges can result in stitching discrepancies and MTs jamming in USB-device for Magneto-Optical Visualization (MOV), and use of polluted and damaged MTs leads to device malfunction.

To renew ethyl alcohol operative reserve – take the container for alcohol from the box (Figure 7d), remove the cap, unscrew the head and pour about 5 ml of alcohol. Screw the head of the container and establish the cap on its place.

2.2.2.3 Intended Use of the Device

Intended use of the device is possible after the requirements given in paragraph 2.2.1 are observed and the procedures described in paragraph 2.2.2.2 are performed.

Magnetic copying of an object using MCAS consists of the following steps:

- preparation of the investigated surface,
- selecting MT type,
- preparation (demagnetization) of MT,
- magnetic copying.

Selecting MT Type

The User is to select MT type (metal or plastic) and width (1" or ½"). The following recommendations should be taken into consideration:

- **Plastic MT is considerably less expensive than metal MT. As technical properties of both MT types are almost the same, plastic MT can be used in the majority of cases.**
- It is recommended **not to use plastic MT** in the conditions which worsen the quality of magnetic copying and shortens MT lifetime, e.g. on very rough surfaces (severe corrosion, premilling), on hot surfaces (when surface temperature exceeds +50 °C), on surfaces with sticky stains that cannot be removed.
- It is recommended to **use plastic MT** in the conditions which improve the quality of magnetic copying, e.g. for examining the relief and structure of aluminum objects, for examining weak internal stresses in ferromagnetic objects, for magnetic copying in narrow openings and in grooves where the only way to avoid MT damage is to use ½" plastic MT.

Preparation of the Investigated Surface

- Provide easy access to investigated surface: disconnect vehicle shrouds, cables and vehicle branch pipes blocking the access. Hereinafter the investigated surface means both front and rear areas of the vehicle body data carriers, as well as the front of the engine number area.
- Clean investigated surface from foreign particles (such as dust, dirt, sand, tar, etc.), as well as from lubricants film with a tissue paper or a brush and, if necessary, clean it with alcohol, dry or remove a moisture. Impurity slightly decreases the quality of magnetic copying, but results in untimely magnetic tape wear, while the particles adhered to the tape will damage the magneto-optical crystal and foul the tape-drive mechanism.

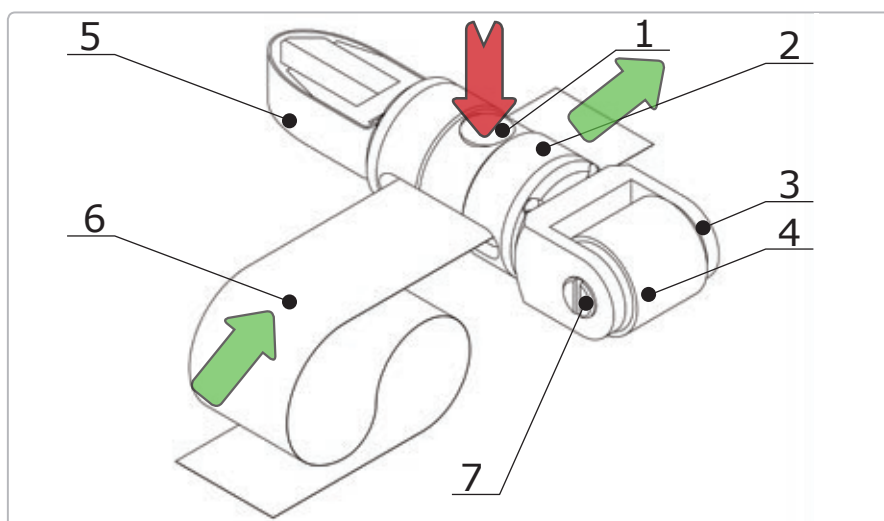
ATTENTION! Do not remove rust from the surface!

Rust layer, especially on the heavily corroded surfaces, often is the only remaining carrier of information about original numbers.

Preparation (Demagnetization) of MT

- take the Combination Magnetic Scanner (CMS) out of the compartment of MCAS (Figure 1, pos. 13),
- choose the used (processed) magnetic tape strip,
- press and hold the demagnetizer drive button (Figure 8, pos. 1), insert the end of the magnetic tape strip into the demagnetizer slot (Figure 8, pos. 6) slightly pushing it forward until its end appears on the opposite side,
- release the demagnetizer drive button (Figure 8, pos. 1), take the threaded end of the magnetic tape strip and pull it through the demagnetizer,
- use the demagnetized magnetic tape for a new magnetic copy or place it into the cartridge for demagnetized MTs (marked with green marker) (Figure 6a, b).

Figure 8



- 1 — demagnetizer drive button
- 2 — frame-handle
- 3 — rotary concentrator plug
- 4 — rotary concentrator
- 5 — flat concentrator
- 6 — MT strip
- 7 — rotary concentrator screw

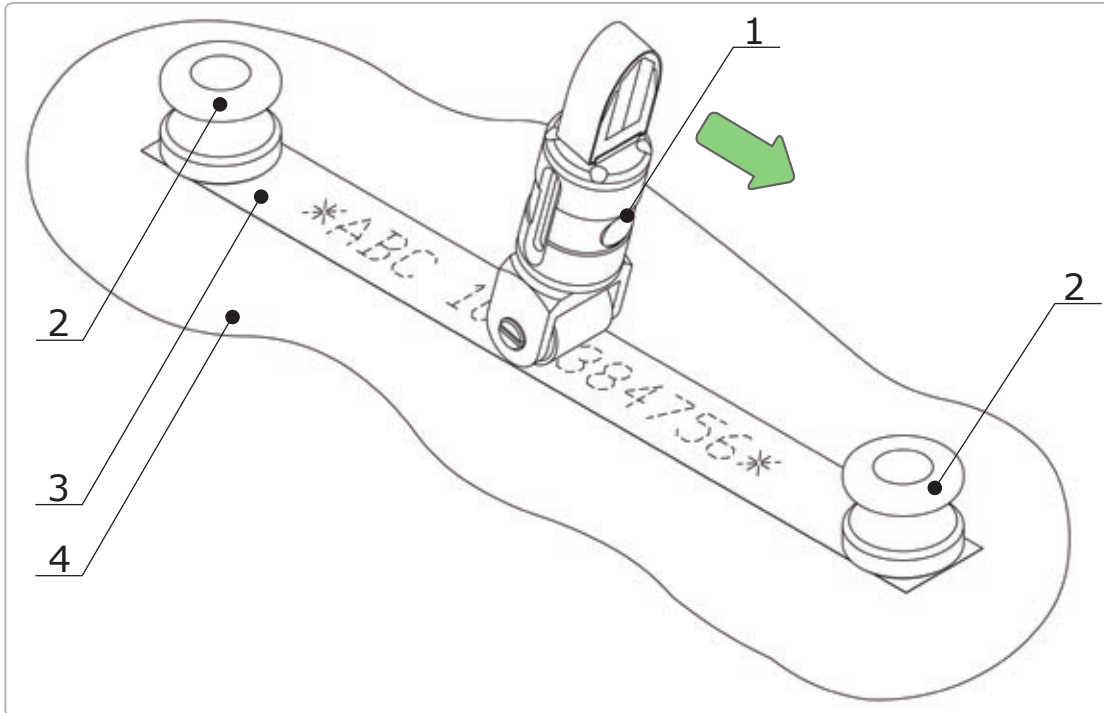
Magnetic Copying

- Fix one end of the demagnetized magnetic tape strip with a magnetic clamp (Figure 9, pos. 2).
- Put MT upon the prepared vehicle number platform and fix MT end on the examined surface using a magnetic clamp (avoid warps and shifts relative to the number examined). For plastic MT: put the MT with its working surface (of brown colour) facing down (facing the examined surface).
- Similarly fix the other end of the magnetic tape with a magnetic clamp (see Figure 9).
- Fixing magnetic tape on the investigated surface can also be done manually – without using magnetic clamps.
- Select the concentrator of the Combination Magnetic Scanner and a handle according to the properties of the investigated object.

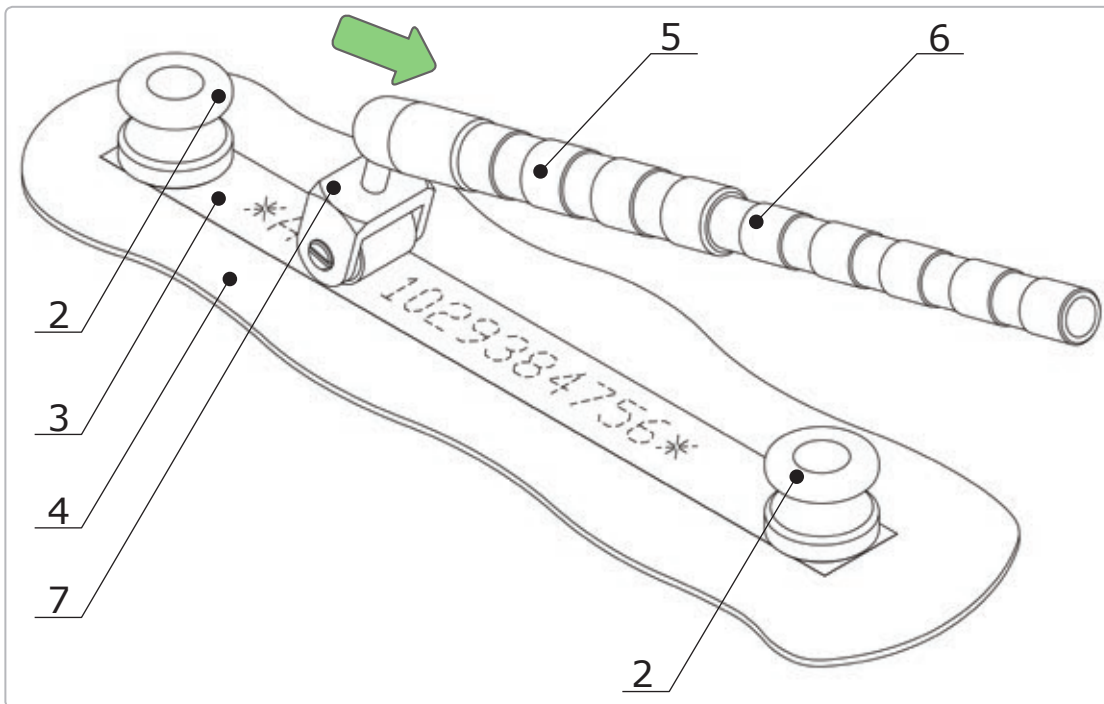
CMS concentrators can be positioned (screwed) on one of the two handles: on CMS handle (Figure 8, pos. 1) or on the universal handle with hinge (Figure 9b, pos. 5). The latter is used for inspecting hard-to-reach areas and it ensures rotation and inclination of the scanner head; besides, it can be extended with the help of extension handles (Figure 9b, pos. 6). Example of magnetic copying for the vehicle number platform, located in a hard to reach place is shown in Figure 9b.

- Make a magnetic copy. Lower the concentrator of the magnetic scanner unto the fixed magnetic tape strip and, slightly pressing it down, move it from the beginning to the end of the investigated area (see Figure 9a). Operator should visually and tacitly control the perpendicularity of flat scanner in relation to the researched surface to receive magnetic copy of good quality. Rotary and compact scanners firmly adjoin to the researched surface because of magnets gravitation. In case copying conditions were not followed (magnetic tape shift, lack of contact of the scanner), all operations should be repeated starting from magnetic tape demagnetizing.
- Remove magnetic tape with copy from the investigated object and disconnect the magnetic clamps. Avoid contact of magnetic clamps and scanner with the magnetic tape surface. Otherwise, the magnetic tape can be partly demagnetized or it can receive appearance of unnecessary magnetization elements (blemishes or strips unrelated to the investigated object) which can obstruct the subsequent investigations.

Figure 9



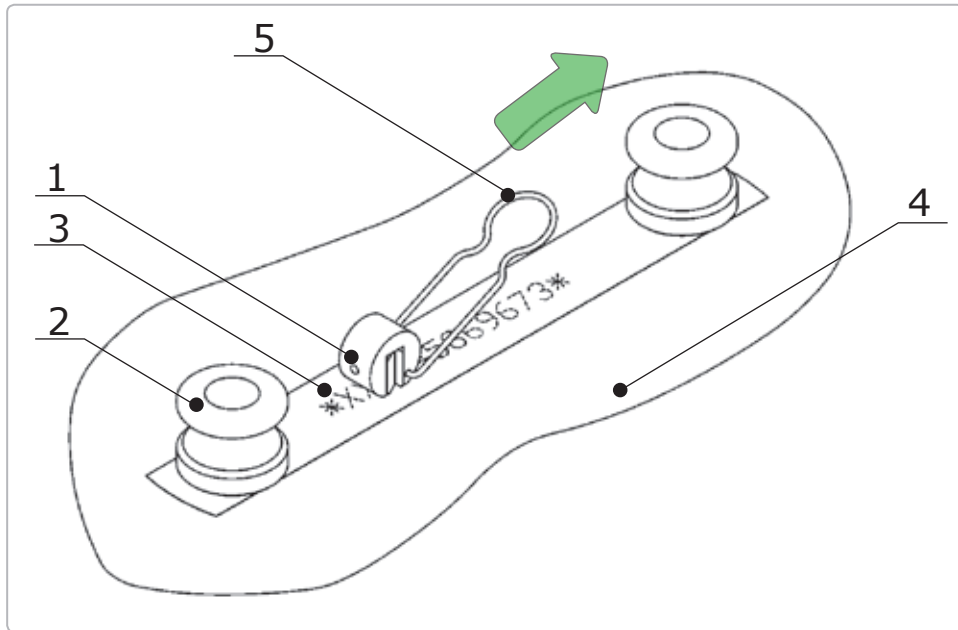
a) Making magnetic copy of a vehicle number platform using the Compact Magnetic Scanner with rotary concentrator



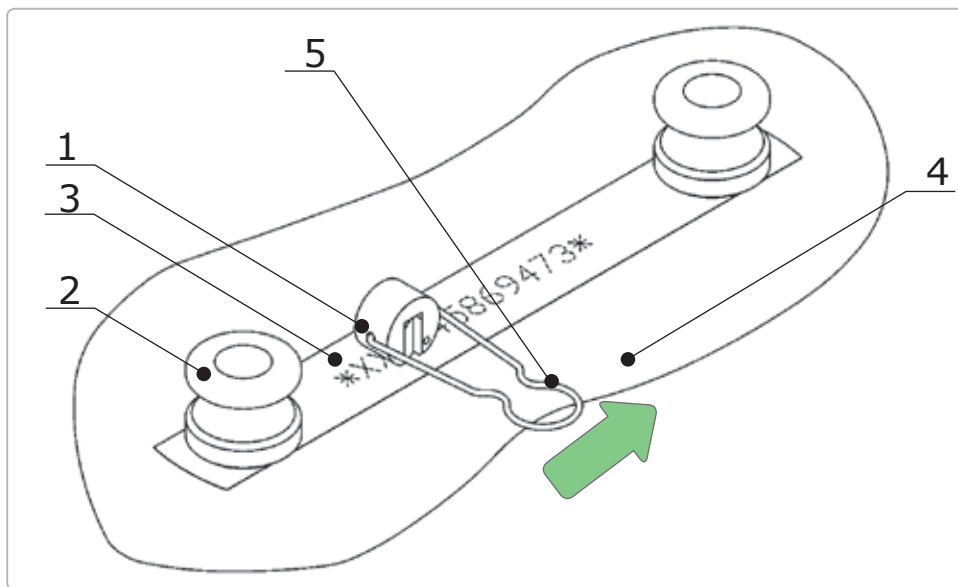
b) Making magnetic copy of a vehicle number platform located in hard to reach place

- 1 – CMS
- 2 – magnetic clamp
- 3 – MT strip
- 4 – investigated surface
- 5 – universal handle with hinge
- 6 – extension handle
- 7 – rotary concentrator of CMS

Figure 10



a) Making magnetic copy of vehicle number platform using the Compact Magnetic Scanner with longitudinal fixation of the spring clip



b) Making a magnetic copy of a vehicle number platform using the Compact Magnetic Scanner with transverse fixation of the spring clip

- 1 — compact scanner
- 2 — magnetic clamp
- 3 — MT strip
- 4 — investigated surface
- 5 — spring clip

2.2.3 Spectral Luminescent Magnifier Regula model 4177

Technical characteristics of SLM are specified in "REGULA Spectral Luminescent Magnifier" Operating Manual.

3 TECHNICAL MAINTENANCE OF THE DEVICE AND ITS COMPONENTS

3.1 USB-device for Magneto-Optical Visualization (MOV)

Daily technical maintenance of the device provides the following procedures:

- external examination (visually check integrity of controls, indication and switching, isolation and USB-cable),
- check-up for PC battery charging that is performed by OS or with the help of "Videoscope"/NUCA (EYER) software in the menu "Operation / Device operation / Power sources",
- cleaning the front panel and controls from dust and oily films with soft tissue or a wad wetted in ethyl alcohol (rate of alcohol application – 5 g).

Device routine technical maintenance for USB-device for MOV is carried out upon pollution leading surfaces of the tape drive (appears in decreasing stitching quality, image doubling). Surfaces of the used magnetic copies, of the MOV tape drive and of the bunker of the magnetic tape drive should be kept clean; otherwise there are no special cleaning requirements.

To clean **Magneto-Optical Visualization tape drive tract** do the following:

- cut a paper strip from a clean writing paper sheet of 24–25 mm width, 280–300 mm length and density of 80 g/m². This paper cut is used as a cleaning tape,
- wet half of the paper length with 10–20 drops of the ethyl alcohol (0,1–0,2 g). **Do not use other solvents!**
- insert the wetted end of paper in the tape receiving magazine of OMB and perform 2–3 runs of cleaning tape through the tape drive in the mode of magnetic copy stitching, as described in paragraph 2.2.1.3. Cleaning tape can stop during the stitching (this occurs because of the tape drive leading surfaces dampening and it is not a sign of the device malfunction). If the alcohol dosage or the paper density is selected incorrectly, cleaning tape can be jammed in the tract. In this case it is required to extract the cleaning tape manually, as described in paragraph 4.2. It is recommended not to reuse cleaning tapes,
- after cleaning tape extraction, it is required to wait at least 3 minutes until the tape drive leading surfaces get dry. Rate of one-time alcohol application – 0,5 g.

Technical maintenance of the device when preparing it for storage and during the storage period:

- arrange all the components of the device and place them in the industrial packaging,
- at least once a month recharge PC battery,
- during recharging (at least once a month) it is recommended to perform 5–10 magnetic copy stitchings in PC in conformity with paragraph 2.2.1.3 for preventive maintenance of OMB parts.

3.2 **Magnetic Copying Accessories Set**

Daily technical maintenance of the device includes the following procedures:

- external inspection (visually check integrity of cases and groove connections of the components in the set),
- check integrity and cleanness of magnetic tapes surface. Remove damaged tapes (cut through breaks with sharp edges, strongly crumpled), straighten up the bent edges of tapes, clean foul tapes (see paragraph 2.2.2.2),
- control the stock of consumables (magnetic tape and ethyl alcohol). Renew the stock if necessary (see paragraph 2.2.2.2),
- visually inspect integrity and quality of the protection rubber sleeve gasket . If required, replace the worn sleeve gasket (see paragraph 4.2),
- clean the working surfaces of concentrators for magnetic scanners from dust, metal particles and fatty films. The cleaning is carried out with dry tissue or with a wad wetted in ethyl alcohol,
- clean the cases and groove connections from dust and oily films. Cleaning is carried out with dry tissue or with a wad wetted in ethyl alcohol,

- clean magnetic tapes surfaces with ethyl alcohol container capillary from MCAS (see paragraph 2.2.2.2). It is required to demagnetize the magnetic tapes after cleaning. This operation is to be carried out whenever the surface becomes polluted. Approximate rate of alcohol application – 25 g.

Technical maintenance of the device when putting it for storage: pack the components of the device into the industrial packaging.

3.3 Spectral Luminescent Magnifier Regula model 4177

Daily technical maintenance of this device includes visual inspection (integrity of the case, cable and socket).

4 ROUTINE REPAIRS

4.1 Safety measures

Safety measures during routine repairs should comply with the requirements described in paragraph 2.1.1 of the present Operating Manual. **All repairs shall be carried out with PC power supply cables disconnected from the mains.**

4.2 General Instructions

The list of possible problems and troubleshooting is given in Table 2.

Table 2

Device	Problem	Cause	Solution
USB-Device for MOV	When connecting PC USB-port after initialization the power supply indicator does not come on	USB connector is not connected	Check the power cord, unplug it and plug it back
		The controller or power cord has broken down	Service center repairs
	Spontaneous magnetic tape (MT) stopping in the Optic-Mechanical Block (OMB) tape drive tract	Polluting the tract by foreign objects	Clean the polluted tract as described in paragraph 4.2 Straighten or replace the tape
		Magnetic tape jamming due to its ruptures	
Low stitching quality – image doubling	Magnetic tape sliding due to the tape drive mechanism pollution	Clean the tape drive mechanism as described in paragraph 3.1	
	The device does not respond to the executive commands	Software error	Restart the software; if necessary restart the operating system
Magnetic Copying Accessories Set (MCAS)	Rubber sleeve gasket of the Combination Magnetic Scanner with rotary concentrator is damaged	Natural wear-and-tear	Replace the rubber sleeve gasket as described in paragraph 4.2
	No precision when viewing the stitched image	Improper preparation of the investigated surface; or a thick lacquer-and-paint coating	Improve preparation of the investigated surface, measure the thickness of lacquer-and-paint coating
	When examining the stitching image, there are image fragments irrelevant to the investigated object	Magnetic tape is not fully demagnetized	Demagnetize the magnetic tape and make a new copy
	When examining the stitched image, there are longitudinal tracks irrelevant to the investigated object	Adhesion of magnetic particles to the scanner surface or scratches on the MT surface	Clean the scanner as described in paragraph 3.2, demagnetize or replace the MT and make a new copy

4.3 Instructions on Repair

Cleaning the tape drive of the Optic-Mechanical Block tract

Cleaning the tape drive of the Optic-Mechanical Block tract is done when it is polluted with foreign objects, impeding the magnetic tape travel. The same is applied to the **MT extraction**, when it was jammed during the automatic injection or reverse motion. Such jamming is possible when the user does not observe the recommended edge form of the magnetic tape strip (see paragraph 2.2.2.2). The OMB tape drive clearing and the MT extraction shall be performed in the following order:

- turn the front side of the device, when in the working position, to the operator (see Figure 1),
- release the pinch roller fork (see Figure 3, pos. 5). Insert a thin core into an aperture (Figure 11) and slightly press – until the lever of the roller is released,

- still holding the pinch roller fork, take the protruding end of the magnetic tape and extract the jammed piece (Figure 11). If two edges of the magnetic tape are sticking out – it can be extracted in any direction. In case length of the tape is less than 200 mm or it is rolled in the tape drive none of magnetic tape edges will stick out. Thus, the magnetic tape extraction is not possible by the User and the professional assistance is advised,
- in case of foreign object remaining in the tract during MT strip removal, it is recommended to expel a foreign object from the tract with high density paper strip or a thin cardboard (when the pinch roller fork is manually released).
It is strictly prohibited to use metal instruments for expelling foreign objects from the tract!
- in case a foreign object still remains in, it is recommended to apply to the manufacturer's service center.

Figure 11



Manual extraction of the magnetic tape from OMB tape drive

Replacement of the rubber sleeve gasket of the Combination Magnetic Scanner (CMS) with rotary concentrator:

- unscrew 2 screws at the rotary concentrator fork face (Figure 8, pos. 7) and pull out the concentrator axle (Figure 8, pos. 3),
- remove the used rubber sleeve gasket and replace it with an auxiliary one from the Spare Parts and Repair Kit,
- assemble the unit in the reverse order.

5 STORAGE

The device is to be stored in the manufacturer's packing.

Climatic storing conditions:

- temperature: from +5 °C to +40 °C,
- relative air humidity: up to 80 % at +15 °C,
- atmospheric pressure: 100 +/- 4 KPa (750 +/- 30 mm Hg).

When preparing the device for storage, it is recommended to perform maintenance works as described in paragraph 3.2.

Devices can be stored in stacks up to 5 items high.

6 TRANSPORTATION

The device can be transported in the industrial packaging of the manufacturer (provided in the delivery set).

The device is to be stored in climatic conditions given in paragraph 5. Protect the device from hitting and vibrations.

7 UTILIZATION

Utilization of the device shall be carried out in conformity with the rules adopted at the Manufacturer's enterprise.

8 ACCEPTANCE CERTIFICATE

Magneto-optical device for identification and detection of vehicle identification numbers falsification **Regula 7505M**.

Serial number _____ is produced and approved as disposable for service in conformity with mandatory requirements of state standards and current technical documentation.

Responsible for acceptance:

Seal:	_____	_____
	Signature	Full Name

	(YY, MM, DD)	

Manufacturer: Regula Ltd .
Address for mailing claims with regard to quality of the device:
1-314 Volokha Street
Minsk 220036
Belarus
Phone: +375 17 286-2825
Fax: +375 17 210-2397
e-mail: mail@regula .by
<http://www.regulaforensics.com>

9 ACT OF SALE

(to be completed by the seller)

Magneto-optical device for identification and detection of vehicle identification numbers falsification **Regula 7505**.

Serial number _____ is sold to:

Buyer's Name: _____

Seal:

Date of sale: _____

Device Price: _____



1-314 Volokha Street, Minsk, 220036, Republic of Belarus
Phone: +375 17 286-2825 Fax: +375 17 210-2397
e-mail: mail@regula.by, <http://www.regulaforensics.com>