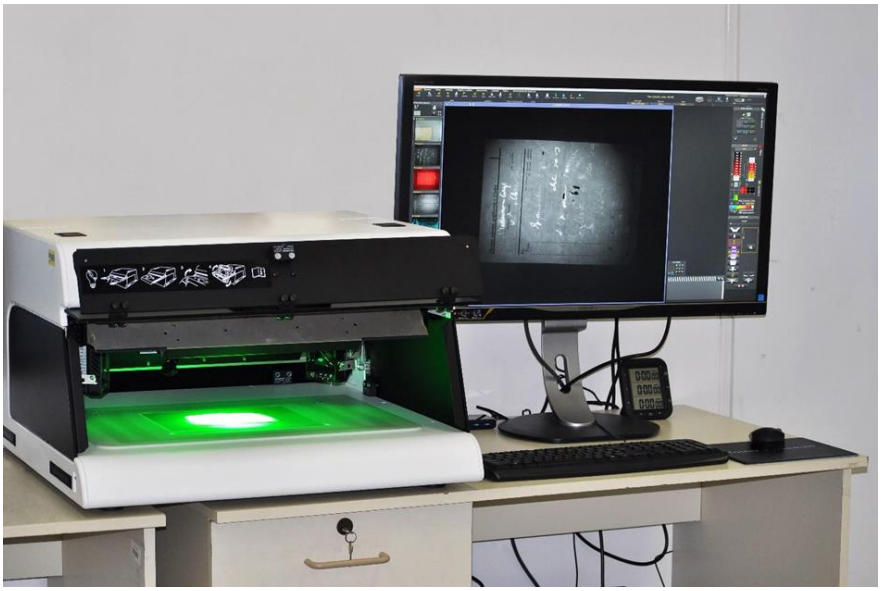
Multispectral Analysis Principle

The principle of multispectral analysis is based on the possibility of observing a historical document in a wide range of wavelengths, namely in the UV (ultraviolet radiation) region, in the VIS (visible light) region or even in the near IR (infrared radiation) region. During multispectral analysis, the document is scanned in all regions of light, at different wavelengths, using various light sources and filters. This allows us to obtain several images in which the elements searched for are displayed very differently, which helps with their interpretation. The acquired images are compared and processed using specialised image analysis software, which enables various operations and combinations with the acquired records (image segmentation, thresholding, addition or subtraction of individual images, etc.) In this way, it is possible to extract the maximum amount of information and thus achieve a significantly better result, for example, in the visualisation of illegible text.

Instrumentation and Functions of VSC 8000

The video spectral comparator is an ideal tool for multispectral observations due to its ability to observe a document in a wide range of wavelengths, namely in the UV region, in the visible light region, as well as in the near IR region. The video spectral comparator VSC 8000, which is used in the National Library of the Czech Republic, consists of a main unit and a PC system. The main unit of the device is a square box with two side covers and one front cover. The camera, light source system and optical filters are important components of the VSC.

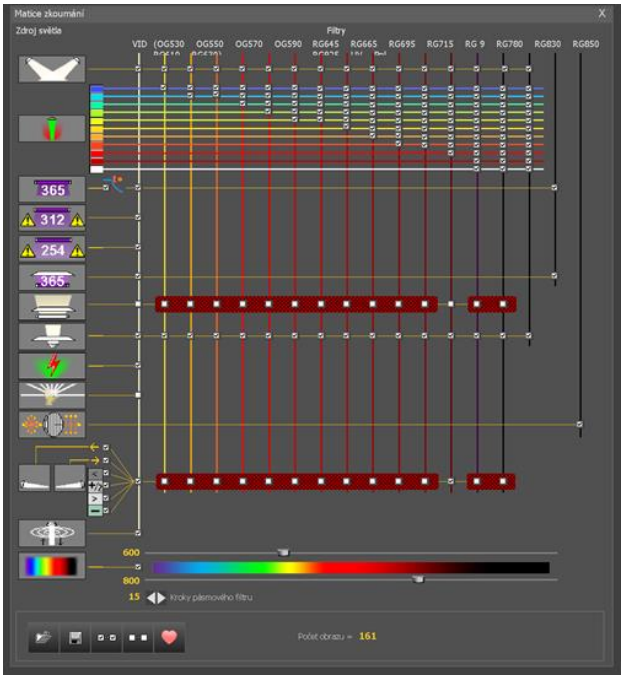


VSC 8000 with accessories.

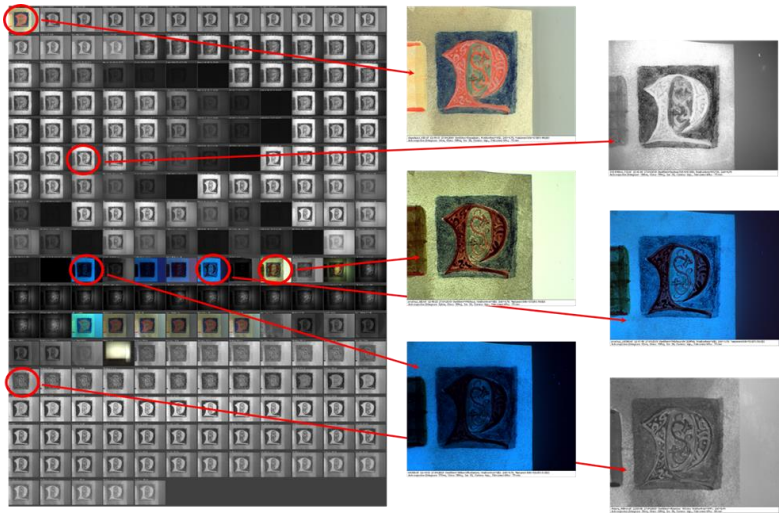
Survey Procedure Using VSC 8000 Automatic Survey

After the instrument and the VSC 8000 software have been started, the survey object is loaded into the comparator's internal compartment. Brightness and aperture adjustment is done automatically, magnification and focus adjustment is done manually and sample position is specified using a motorised X-Y stage.

In the comparator tools, the automatic exploration mode is most useful. Before running it, an exploration matrix is set up to select the optimal number of light and camera filter combinations for a particular sample. The exploration matrix used is shown in Figure 1. When the automatic exploration is started, the device sequentially goes through all the selected combinations of lights and filters and takes a set of images. After completing the examination, the operator can save the overall preview of the examination and proceed to select, edit, compare and save the images with the best light settings. Using the automatic examination mode, a minimum total illumination time of 10–15 minutes can be achieved. Of this, an average of 7 minutes is spent on the automatic examination itself (depending on the number of combinations selected) and the rest on manual image capture. We are unable to achieve such a short illumination time without using this mode.



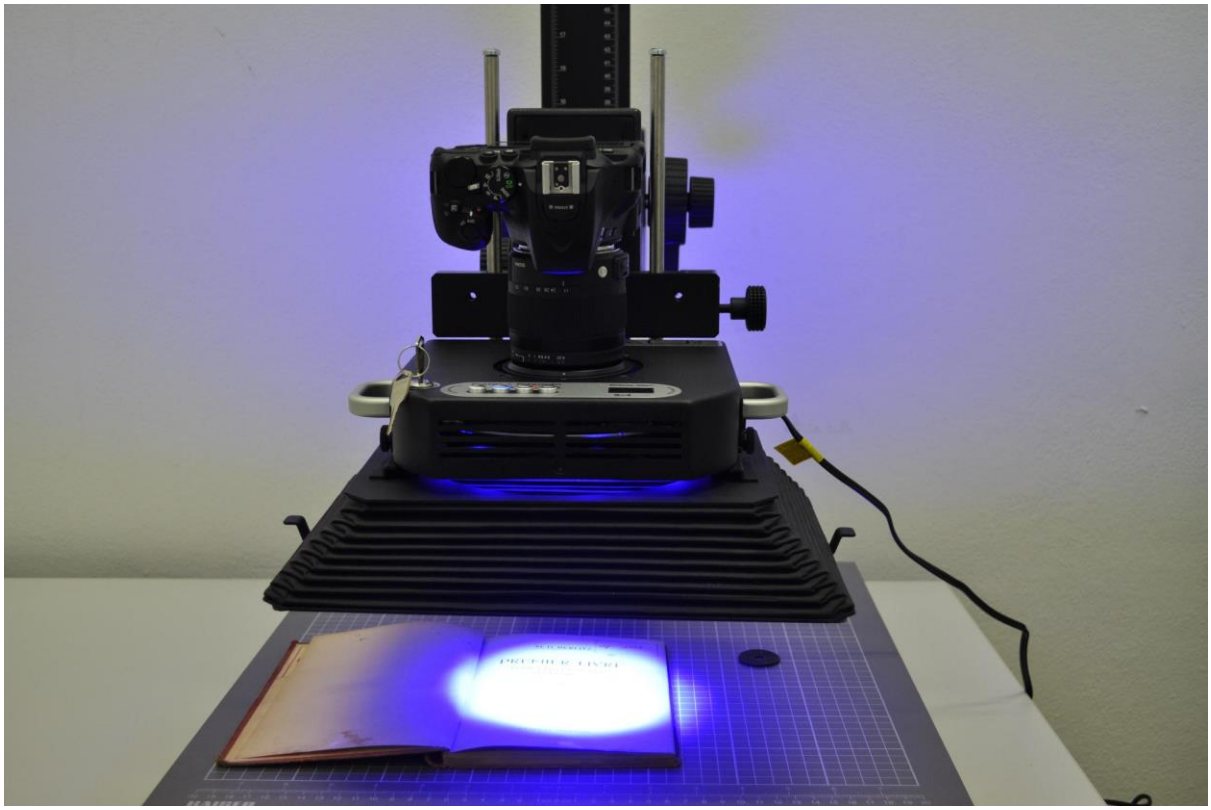
Automatic exploration matrix.



Summary overview of automatic exploration previews and individual shots

Instrumentation and functions of the CRIME-LITE®8X4 MK4 FORENSIC LAMP

Compared to the VSC 8000, the forensic lamp is much more limited in light settings. The lamp itself has only three light settings (IR 780 nm, blue 445 nm, red 640 nm). Two other paired external light sources emitting full spectrum light are used for this setup: electroluminescent diodes – white light and halogen – yellow light. Light filters can also be used with the lamp. The filters that were used are as follows: RG715 AG, RG780 AG, RG850 Sharp Cut, RG900 Sharp Cut. A modified Nikon D5500 digital camera was used to capture the images, replacing the integrated long wave pass filter with a neutral density filter. The following lens filters can be used with the camera: 830 nm and 695 nm.



Forensic lamp with accessories