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Operating instructions

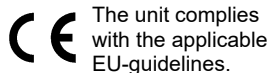


Fig. 1: Digital array camera 35612-99

TABLE OF CONTENTS

- 1 SAFETY PRECAUTIONS
- 2 PURPOSE AND CHARACTERISTICS
- 3 FUNCTIONAL AND OPERATING ELEMENTS
- 4 SOFTWARE
- 5 OPERATING INSTRUCTIONS
- 6 TECHNICAL DATA
- 7 SCOPE OF DELIVERY
- 8 WARRANTY
- 9 DISPOSAL
- 10 EXPLANATION OF THE SYMBOLS

1 SAFETY PRECAUTIONS



- Carefully read these operating instructions completely before operating this instrument. This is necessary to avoid damage to it, as well as for user-safety.
- Take care that no liquids or objects enter in through the ventilation slots.
- Only use the instrument in dry rooms in which there is no risk of explosion.
- Do not start up this instrument in case of visible signs of damage to it or to the line cord.
- Only use the instrument for the purpose for which it was designed.

2 PURPOSE AND CHARACTERISTICS

This device allows the light intensity received by the CCD sensor to be examined as a function of position (in pixels or mm) or time. It allows the investigation of diffraction or interference patterns.

3 FUNCTIONAL AND OPERATING ELEMENTS

The sensor is a CCD sensor with high resolution. Its size is 3648 pixels.

This size allows a fine spatial resolution of the interference or diffraction patterns.

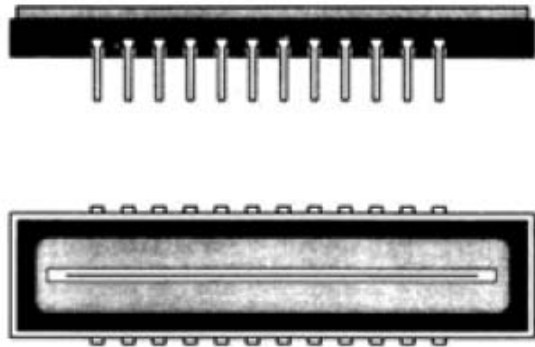


Fig. 2: Example of a linear sensor

The step size of the sensor is $8\mu\text{m}$. If the whole length of the sensor is used, a high qualitative resolution can be achieved. The sensor is equipped without a lens for focusing to obtain observation of the entire pattern without distortion.

In addition to spatial resolution, the sensor has excellent depth accuracy: 16 bits, i.e. 6536 measurement levels. The observation of the main diffraction maxima and the secondary maxima (in case of diffraction or interference patterns) is measured in only one acquisition. This precision of bit depth allows the measurement of variations in light intensity during an experiment. The frame rate of this camera is about 1 Hz, i.e. one frame per second.

4 SOFTWARE

The camera already contains the necessary software, no downloading or installing is required!

Connect the camera to your computer via the USB cable and start the software.

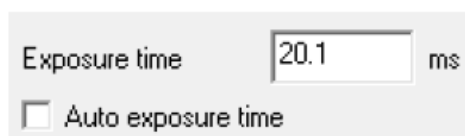
If the software does not open automatically, it can be started with a double click in the explorer.

4.1 The software consists of two main functions:

4.1.1 Acquisition by position

In the first mode, the user acquires the amplitude of the signal received by the CCD sensor, depending on the position.

The exposure time can be set by the user or automatically by the software.



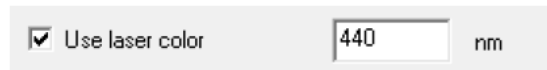
Caution: If the exposure time is not proportional to the flashing frequency of the light, the signal will appear unstable. This is the case with current-driven light sources or with a light source, through a TTL signal.

To solve this problem, select an integration time that is proportional to the delay between two blinks of the light source.

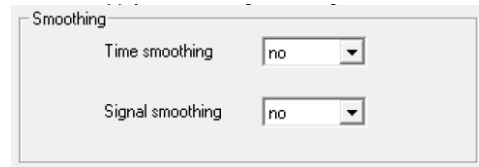
To stop the acquisition, click on "Run/Pause".



To visualize the curve vividly, a color corresponding to the wavelength can be inserted.



In order to reduce the noise of the signal, it can be smoothed. A distinction is made between temporal and spatial smoothing.

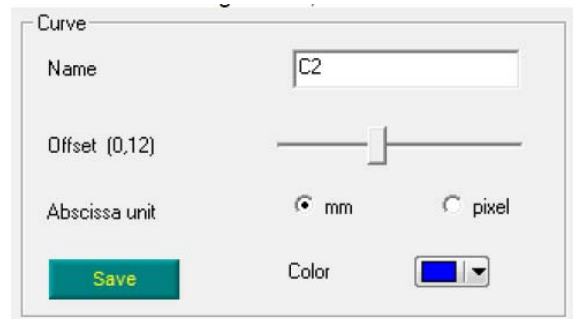


Temporal smoothing

Temporal smoothing calculates the average of several curves acquired by the instrument to reduce electronic noise. The smoothing increases with the index number.

Spatial smoothing

Spatial smoothing takes into account the intensity value of neighboring pixels. This filter reduces the intensity peak from one pixel to another: The values define the number of pixels needed to calculate the smoothing. The higher the filtering, the stronger the smoothing. Once the parameters of the smoothing are set, the user can save the curve.



To do this, select the name for the curve.

Zero point setting: The further the cursor is moved to the right, the greater the offset. This setting cancels the DC component of the signal.

Since we know the pixel size of the sensor and the device does not have an autofocus mode, the software can convert pixels into millimeters.

The size in millimeters allows us to determine the slit width when examining the diffraction pattern.

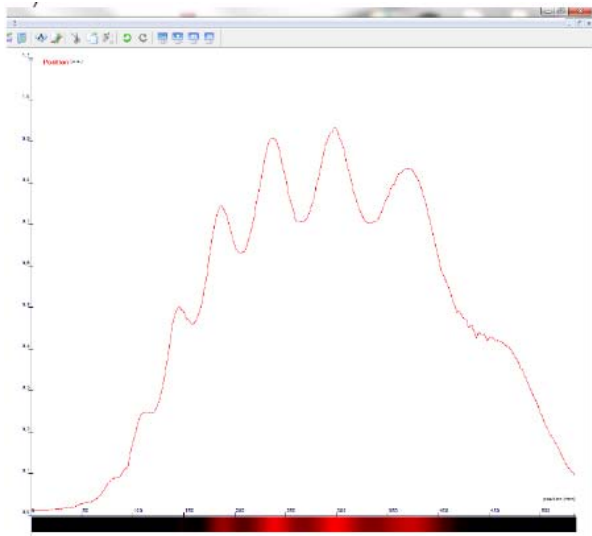
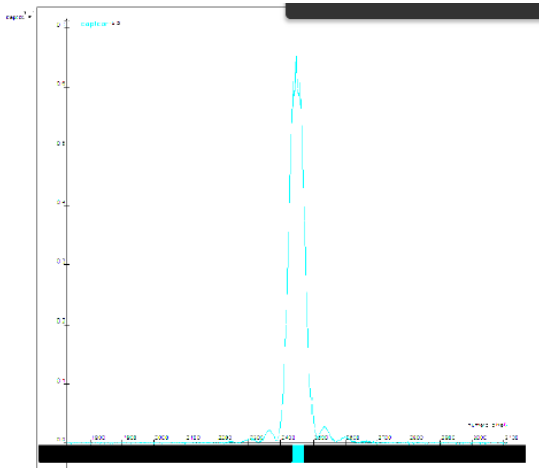
Click on "Save" to save the curve in the diagram. Attention. You must save the entire document to keep your records.

An example of diffraction is shown below.

Below the diagram, a colored area shows a wider representation of the diffraction pattern.

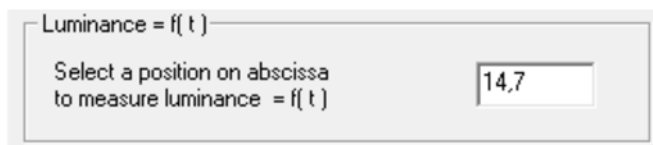
The light intensity depending on the position on the CCD sensor is indicated in the selected color.

This color can be for example the color of the laser wavelength.



Before capturing the intensity as a function of time for a particular position/pixel:

It is necessary to select the pixels on the sensor, i.e. the position of interest.



To select the pixel of the sensor you want to work on:

- Specify the position in mm or in pixels (depending on the mode activated above).
- Otherwise, if the position is not known, click in this field to get a cursor in the graphic area. With this cursor you can select the position directly on the graphic area.

If you want attenuation, you should select a point with a high intensity. Go to the tab "Luminance =f(t)" and observe the evolution over time.

Time acquisition

To perform a capture by time, click on the "Linear Sensor" tab and select the position to be examined.

The "Time acquisition" tab contains various parameters:

- Gap between two acquisitions is the time between 2 consecutive measurements. The range for the gap is [1 - 30 000s].
- Since the maximum number of points is 30000, the maximum running time is calculated automatically. For example, if the acquisition is made every 2s, the maximum number of points is 60000.
- The delay before acquisition allows to set the last adjustments of the measurement.
- Select the name for the curve and its color.
- Activate the mode of continuous acquisition.

When this mode is active, the acquisition is not interrupted even if the maximum number of points is reached:

- By dragging the first captures

The first data of the capture will be deleted. These data are not recoverable.

- By dragging previous acquisitions (every second curve).

The time between 2 acquisitions is doubled in each "loop". Every second sample is deleted.

To know the frequency of acquisition between two points (Delta T). In the table you can calculate Delta T by the difference by two consecutive times.

3.2.3 Tools

Measure

To measure the distance between 2 points, right-click on the graphic area to select the "Pointer" tool. Keep the left mouse button pressed and measure the distance between two points.

Zoom

Right-click on the desired point/area to get better accuracy.

Modeling

Select "View" in the toolbar and then "Modeling".

Two types of modeling are available: automatic and graphical.

Automatic modeling

With this function you can find the nearest slope of the curve. You can thus determine the characteristic values of your experiment, such as the gap dimension.

If, considering the parameters of the curve to be modeled, it is difficult to get close enough to the curve by the automatic modelling, in this case some values have to be set in the control panel:

I_0 = maximum intensity of the curve

X_0 = abscissa of the intensity I_0

Graphical modeling

It allows the same result as automatic modeling but requires the user's interaction.

Two points must be placed as close as possible to the curve.

5 OPERATING INSTRUCTIONS



This high-quality instrument fulfils all of the technical requirements that are compiled in current EC guidelines. The characteristics of this product qualify it for the CE mark. This instrument is only to be put into operation under specialist supervision in research, educational and training facilities (schools, universities, institutes and laboratories).

6 TECHNICAL DATA

Typical for 25°C

Operating temperature 5...40°C

Relative humidity < 80%

Sensor:	3648 Pixel
Resolution:	1 Pixel / 0,8 µm
Housing:	metal
Stem diameter:	10 mm
Stem lenght:	100 mm
Dimensions:	83 x 128 x 63 mm
Weight:	600 g

7 SCOPE OF DELIVERY

- CCD-Camera
- Power supply 12 V, 1,5 A
- Measurement and analysis software

8 WARRANTY

We give a warranty of 24 months for units that we have supplied inside the EU, and a warranty of 12 months outside the EU. The following is excluded from the warranty: damage that is due to non-compliance with the operating instructions, improper use or natural wear.

The manufacturer can only be held liable for the function and safety-relevant properties of the unit if the maintenance, service and modifications of the unit are performed by the manufacturer or by an institution that is expressly authorised by the manufacturer.

9 DISPOSAL

The packaging mainly consists of environmentally-friendly materials that should be returned to the local recycling stations.



Do not dispose of this product with normal household waste. If this unit needs to be disposed of, please return it to the address that is stated below for proper disposal.

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10 EXPLANATION OF THE SYMBOLS



Important information about the device. Compliance with the operating instructions is required



Attention!

Potentially harmful situation (property damage) General hazard area
Compliance with the operating instructions is required.