

## Spectrometry

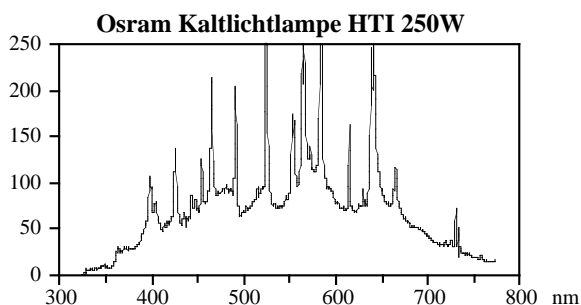
In principle our cameras runs with all kinds of spectrometer, but it should be considered that the spectra must be focused on a straight line. The focal line of a standard monochromator is a curve. Therefore a measured spectra will be defocused on the sensor surface. The offered spectrographs have a special flat field correction for use with linear sensors (i: imaging type). We offer complete systems with camera. The camera can be unmounted and used separately in all systems of us.

For low cost spectroscopic applications we recommend the LC camera with the ILX511 sony sensor. Anyway the best choice for spectroscopy are the Hamamatsu PDA's (Photo Diode Arrays) or FFT's (CCD-arrays, FFT: Full Frame Transfer) with especially large pixel sizes and increased sensitivity.

3 spectrometer with different gratings are ideal suited for our line scan cameras.

### Spectrometer:

CP140 (Jobin Yvon) f/2:	- fixed grating, not turnable, not exchangeable + small dimension, low price
Acton 2156 (PI) f/4.0:	+ 2 grating turnable by computer
Acton 2356/2556 (PI) f/3.9/6.5	- high price + 3 gratings turnable by computer



Example - spectra of a cold light lamp

The covered spectral range could be calculated by the reciprocal dispersion(**r. d.**).

Example:

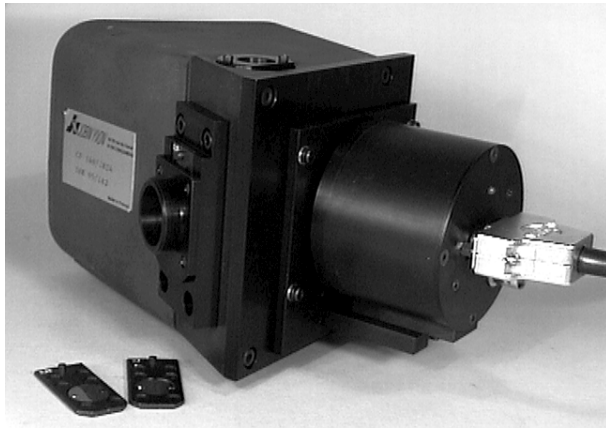
The sensor Th7803 has 1728 pixel with 10  $\mu\text{m}$  pitch.

The length is  $L = 1728 * 10 = 17280 \mu\text{m} = 17.3 \text{ mm}$ .

With grating 77414 a region of  $r.D. * L = 13,3 * 17,3 = 230 \text{ nm}$  is focused to the sensor. The absolute wavelength region depends on the position of the grating.

For example it can be adjusted to 300 - 530 nm. Turning the grating will increase the region to higher wavelength. The sensor has a resolution of  $230 \text{ nm} / 1728 = 0,13 \text{ nm}$ . Anyway the over all resolution is limited by the optical components and the slit width.

## Inexpensive spectrometer with LC-camera



LC-camera with CP140 / 3 interchangeable slits

### Price for such a complete system

Complete spectrometer (1 slit)	€	2360,-
LC- camera ILX511, 12 Bit	€	1450,-
Driver (Win-version)	€	350,-
for PCI interface	€	660,-
<b>Sum</b>	€	<b>4820,-</b>

### Example with grating 1824 and ILX 503

Resolution	better 1.5 nm
Intensity	8 / 12 bit (0..255)
Length of sensor	2048 pixel á 14µm = 28.7mm
Slit width	50µm = 3.5 pixel
Spectral region	400 - 1100nm
Up to 400 spectra / second due to sensitivity	

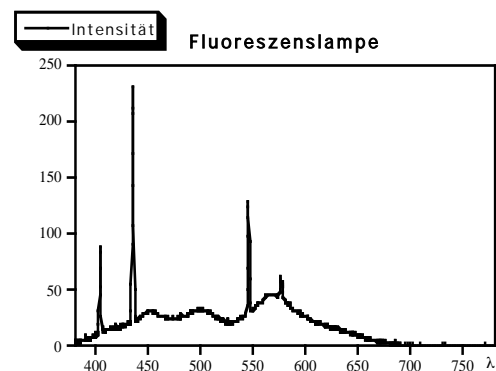
Specifications of spectrometer: focal length : 140 mm ; Effective aperture: f / 2

Data of available gratings with 50µm slit

type	kind	blaze (nm)	l/mm	r.d. [nm/mm]	spectr. range	resolution [nm]	act. length
103	ruled	250	285	24.2	190-800	1.2	25.2 mm
104	ruled	350	285	24.3	250-850	1.2	24.7 mm
1602	ruled	350	405	16.8	285-715	0.8	25.6 mm
1604	ruled	250	405	17	190-625	0.9	25.6 mm
1605	ruled	450	405	16.7	380-780	0.8	24 mm
1821	ruled	-	230	28,6	400-1100	1,5	35 mm
1824	ruled	-	230	30	400-1100	1.5	23.3 mm



Camera series 2000 with CP140



Spectra of a fluorescent lamp

## Computer controlled Spectrometer



here: Acton spectrometer 2156 with sensor head

simple, computer controlled spectrometer for single camera or sensor head

- cover wide wavelength region
- simple adjustable camera focus
- good price/value ratio
- adjustable input slit

### Gratings for spectrometer 2156/2356/2556/2756 i (i : imaging type)

Gitter	150 l/mm	300 l/mm	600 l/mm	1200 l/mm
Sp 2156i	40 nm/mm 1061 nm	19 nm/mm 519 nm	9 nm/mm 246 nm	4 nm/mm 107 nm
Sp 2356i	21 nm/mm 568 nm	11 nm/mm 281 nm	5 nm/mm 136 nm	2.3 nm/mm 62 nm
Sp 2556i	13 nm/mm 346 nm	6.4 nm/mm 171 nm	3.1 nm/mm 83 nm	1.4 nm/mm 39 nm
Sp 2756i	8.8 nm/mm 235 nm	4.4 nm/mm 1061 nm	2.1 nm/mm 57 nm	1 nm/mm 27 nm

r.d. in nm/mm, covered range when using a sensor of 26.8mm length.

Dimensions 2156i : 178 x 178 x 165 mm (long x wide x high)  
 Focal length / plane size : 150mm / 25mm x 10 mm (width x height)  
 Effective aperture : f / 4.0  
 Grating size : 32mm x 32mm

Dimensions 2356i: 337 x 254 x 203mm (long x wide x high)  
 Focal length / plane size: 300 mm / 27mm x 14 mm (width x height)  
 Effective aperture: f / 3.9  
 Grating size: 68mm x 68mm

Dimensions 2556i : 534 x 280 x 203mm (long x wide x high)  
 Focal length / plane size: 500 mm / 27mm x 14 mm (width x height)  
 Effective aperture: f / 6.5  
 Grating size: 68mm x 68mm

## High resolution spectrometer



Shown here:

Acton 2356 with PDA double line sensor head and adjustable fiber input.

The bigger spectrometers have better resolution and can be used for our double line sensor head (2 sensors on one board). Here the build in output diaphragm must be removed.



Here you see an Oriel MS257 (Newport) with 2 exits. One has a cooled IR- Camera Series 2000CV2 (1100-2600nm) and the other a cooled FFT- Camera series 2000CV2 (200-1100nm).

The MS257 has a turret with 4 gratings and a flip mirror at the exit. All functions are motorized and can be controlled with a computer.

### Prices for spectrometer

		<b>04.2015</b>
<b>CP 140</b> (Jobin Yvon)	with grating and flange	€ 2.000,-
	fixed Slit	€ 360,-
	Mount for changeable slit	€ 600,-
	Changeable Slit	€ 100,-
	Slits in 25/50/100/250/500/1000 $\mu\text{m}$ width available	
<b>SP 2156i</b> (Acton)	with mount for all cameras	€ 5.400,-
	Grating 150, 300, 600 oder 1200 l/mm	€ 650,-

other spectrometer and fiber input on demand.