Compact spectrographs - the VS family

This new OEM spectrograph family consists of a compact Versatile Spectrograph coupled with a multi-channel array detector and integrated electronics.

Compact spectrograph with integrated electronics

These versatile spectrographs are configurable, high performance spectrographs that can be customized for a variety of OEM applications.

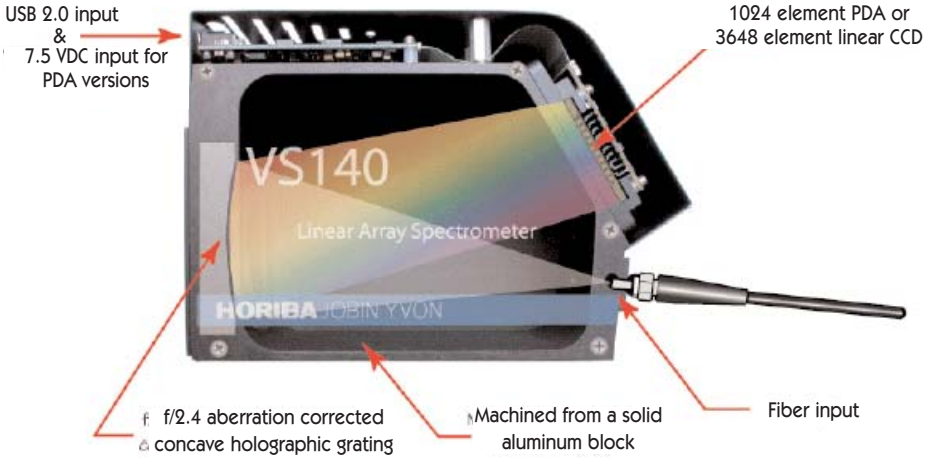
They have been specially designed to easily adapt to a large variety of detectors and electronic drivers.

The optical design has been optimized to minimize stray light and maximize optical throughput.

These spectrographs are based on a high performance aberration corrected concave grating fitted with a custom variable order-sorting filter to eliminate higher orders.

Applications

- ❏ Color measurement
- ❏ Spectrophotometry
- ❏ Process monitoring
- ❏ Life science
- ❏ Etc.



Features

- ❏ High optical performance
- ❏ Versatility
- ❏ Custom OEM design solutions
- ❏ Compact size
- ❏ Robust
- ❏ Stability

Specifications

	VS70	VS140
optical geometry	flat field	
focal length (mm)	70	140
spectral range (nm)	from 190 to 1050*	from 190 to 2500*
aperture (f/#)	2	2.4
average dispersions** (nm/mm)	17 - 23 - 33	17 - 24 - 30 - 70
stray light: (at 340 nm with deuterium lamp)	< 0.1%	< 0.1%
dispersion	grating dependent	
wavelength accuracy (with a mathematical fit) (nm)	< 0.5	
wavelength reproducibility (nm)	< 0.1	
physical dimensions (mm)	90x100x49	120x150x110

* depending on the grating and on the position and the type of the array detector used
** depending on the grating

Input:

The VS spectrographs can accept light directly through either a fixed slit or a through an SMA fiber connector including an integrated slit. Different slit sizes can be offered depending on the resolution required by the application and the type of the detector.

The standard slits come in widths from 50 to 500 µm

VS entrance fiber SMA adapter and integrated slit.

Output:

HJY Order sorting filters

In conjunction with our aberration corrected concave grating, we have developed integrated HORIBA Jobin Yvon order sorting filters.

This specialized order sorting filters permit the instrument to work from 200 to 900 nm and eliminates the issues related to higher orders without degrading the optical performance of the instrument.

Order sorting filters.

Detectors:

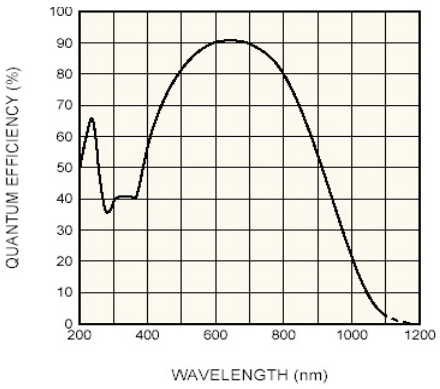
The VS spectrographs are designed for a selection of linear arrays, or for custom arrays for specific applications.

1. CCD image sensors

a. back-thinned CCD S9840

The S9840 is a back-thinned linear CCD. It features high quantum efficiency in the UV region, low readout noise, low dark signal and wide dynamic range.

The array measures 28.672 (H) × 0.196 (W) mm and is comprised of 2048 x 14 pixels measuring 14 x 14 µm. Each 14 pixel column is binned to create an effective pixel size of 14 x 196 µm



*S9840 spectral response (without window)**

Back thinned CCD image sensor S9840

**Courtesy of Hamamatsu*

b. Toshiba CCD TCD1304

The TCD1304DG is a high-sensitivity 3648 element linear image sensor.

It features 3648 pixels (8 microns wide and 200 microns high) and has an electronic shutter function.
A special UV coating process can be applied to the array in order to increase sensitivity below 350 nm.

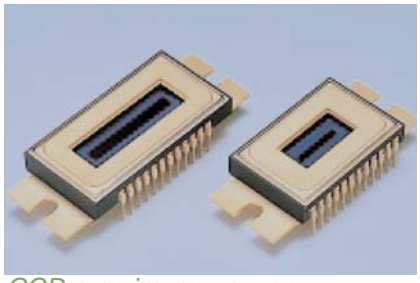
Toshiba detector

c. back-thinned CCD S7030/31

The S7031 is a back-thinned type CCD image sensor. It features high quantum efficiency in the UV region, high dynamic range and low readout noise.
It is also available with a thermoelectric cooler for detection of low-level light and good stability in scientific and industrial applications.

An uncooled version, the S7030 is also available.
It has a pixel size of 24 × 24 µm and is available in image areas from 12.288 (H) x 1.392 (W) mm (512 x 58 pixels) up to 24.576 (H) × 6 (W) mm (1024 × 250 pixels).

This detector is available with the VS140 spectrograph only (physical size issues).



CCD area image sensor S7030/S7031 series

2. PDA: NMOS & CMOS technology

For applications requiring high dynamic range measurements, a PDA is a superior solution.

The VS140 is available with the following PDAs:

- CMOS PDA
  S8377/ S8378-XXX
  512 or 1024 pixels with 25 or 50 µm pixel width and 500 µm height

- NMOS PDA
  S3903/S3904 – XXX
  512 or 1024 pixels with 25 or 50 µm pixel width and 500 or 2500 µm height

CMOS and NMOS Photodiode arrays

Tall and high end chips such as the E2V Open Poly and back-thinned units are also available for integration in custom spectrometer designs, and can allow multiple spectra simultaneous monotoring, or full vertical binning in case of weak signal and tal entrance fiber slit.

Drive Electronics:

Line scan board

These detectors are driven with high performance electronics which feature:

- ❏ high dynamic range with 16-bit pixel resolution
- ❏ a 32 bit processor at MCU 30 Mhz
- ❏ flash memory for data storage of digitized pixel information
- ❏ a Field Programmable Gate Array (FPGA) providing control logic for data transfers, exposure control and CCD readout (optimal)
- ❏ integration time from 5 ms to 65.535 ms
- ❏ user selectable computer interface for communication with host computer and data transfer operations to host memory: Universal Serial Bus (USB) link operating at 3 Mbyte/sec; RS-232 link providing selectable baud rates from 9600 to 38.4 Kbits/sec
- ❏ operating systems: Windows 98/ME/2000/XP

Options

- ❏ Different slit sizes
- ❏ Removable SMA connector
- ❏ CCD or PDA detectors
- ❏ Electronic drivers USB, RS232, etc.

VSXX-B (version with detector and order sorting filter)

The basic version of the VS spectrograph includes an aberration-corrected concave holographic grating, an optical slit, an SMA connector, a detector and an HJY order sorting filter.

These components are in an optimized housing designed to maximize the optical performance of the grating.

There are no optical adjustments and tests; simply connect the electronic driver to the detector to make precision measurements.

VS70

VSXX-E (version with electronic driver)

In addition to the components of the basic version, this version includes a high performance electronic driver.

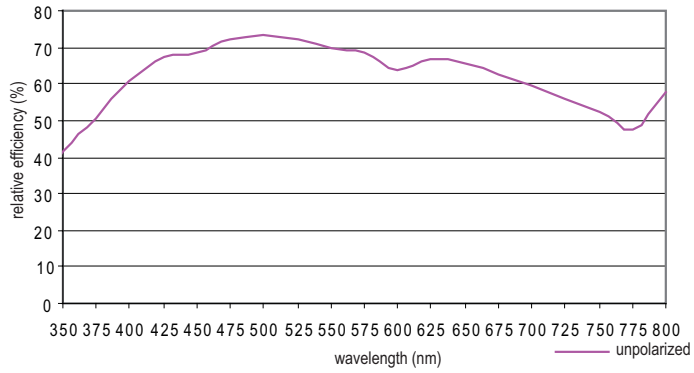
Customers simply connect to the VSxx via the USB or RS232 interface.

VS140

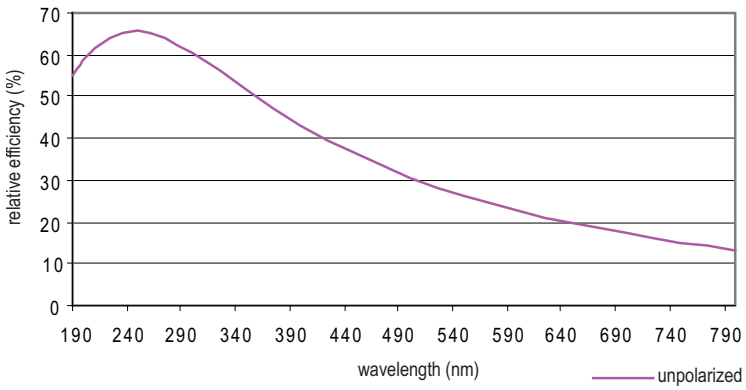
VS70 and VS140 gratings

	Spectral range (nm)	Optimized at (nm)	Number of grooves (l/mm)	Blazed	Average dispersion (nm/mm)	Spectral length (mm)
VS70 Gratings	190-800	250	477	N	25	25.4
	190-1050	250	365	N	30	28.6
	190-1050	250 & 500	365	Double	30	28.6
	330-750	350	582	N	16	25.4
	350-800	500	582	Y	16	25.4
	350-1050	500	365	N	30	25.4
	650-1020	675	365	N	30	12.7

VS70 grating blazed at 500 nm



VS140 grating blazed at 250 nm



	Spectral range (nm)	Optimized at (nm)	Number of grooves (l/mm)	Blazed	Average dispersion (nm/mm)	Spectral length (mm)
VS140 Gratings	190-800	250	285	Y	24.2	25.2
	350-1030	350	285	Y	24.2	28.6
	190-625	250	405	Y	17	25.6
	380-780	450	405	Y	16.7	24
	400-1100	500	230	N	30	23.3
	700-1060	800	230	N	29	12.3
	800-1700	900	97	N	71	12.7
	1100-2500	1200	120	N	56.6	24.7