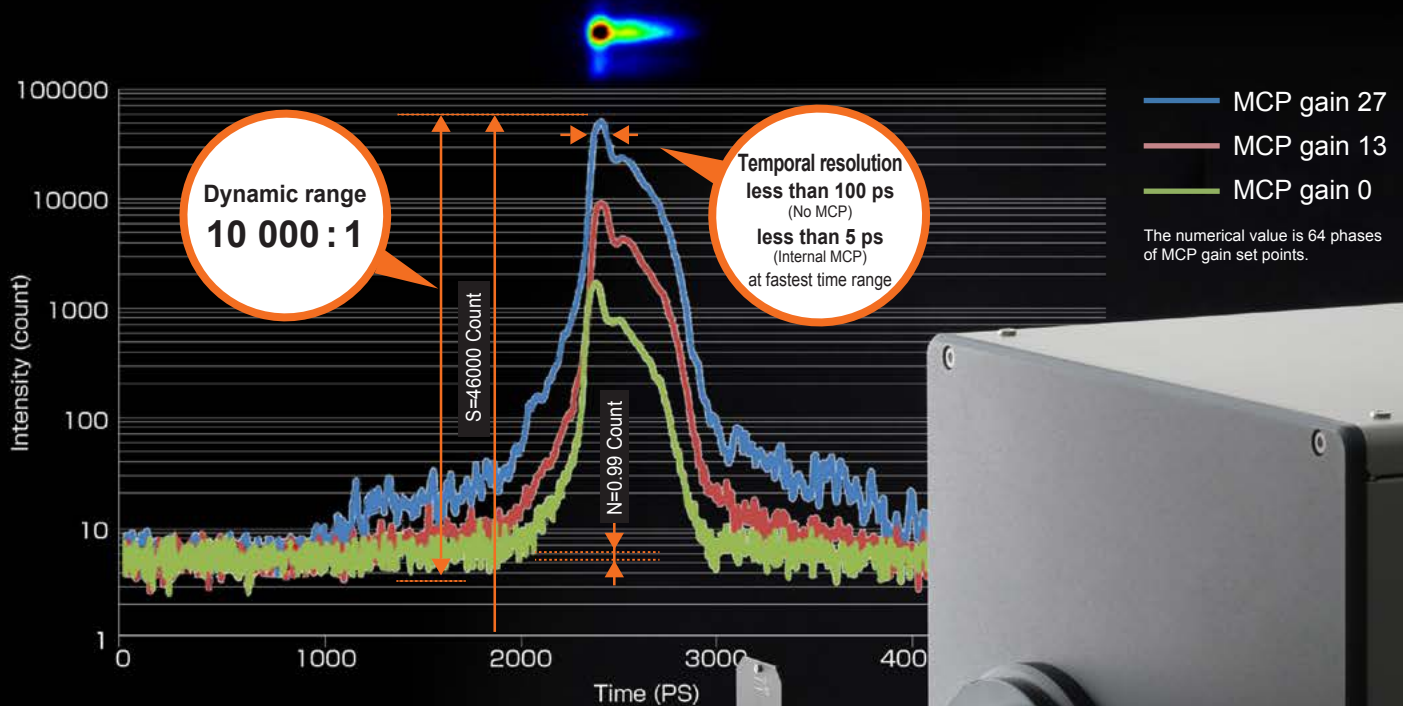


High dynamic range streak camera C13410 series

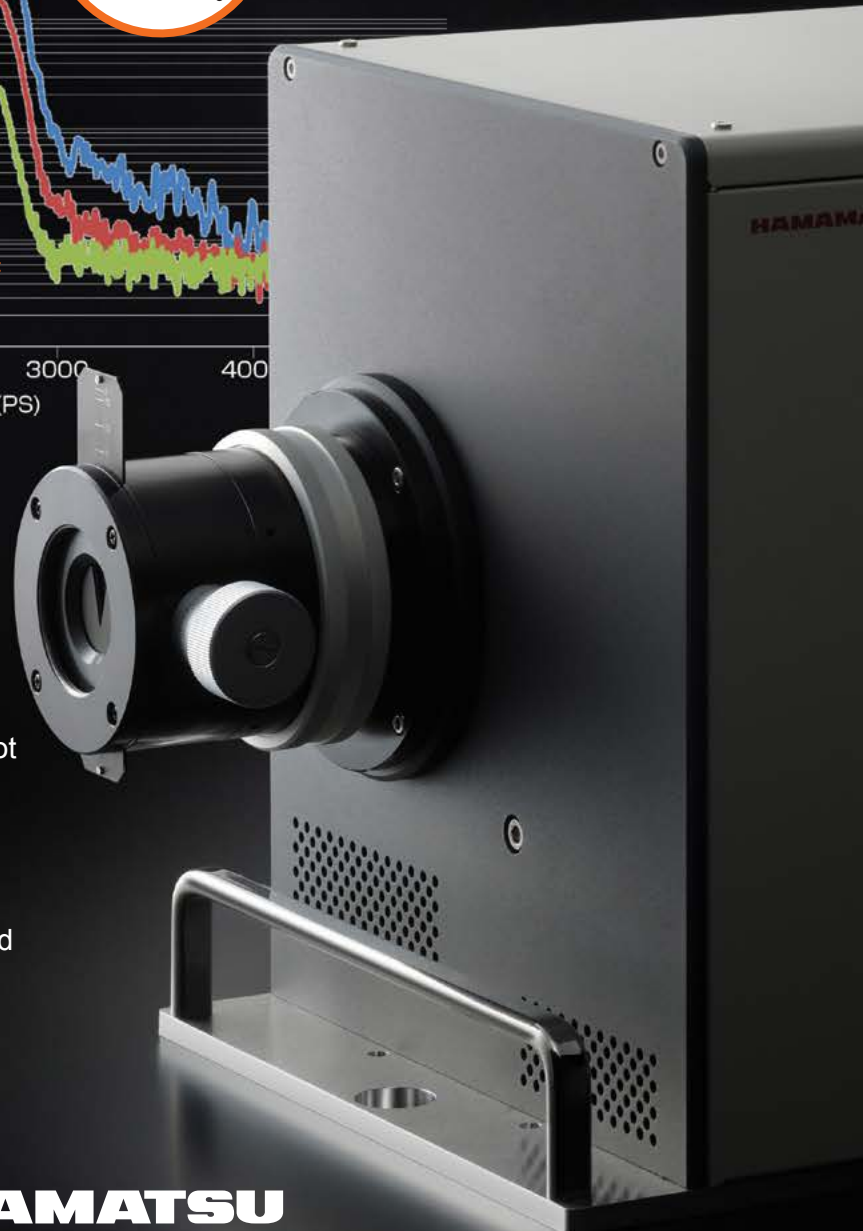
Dynamic range of 10 000 : 1 of ultra fast phenomena under single-shot operation!



▲ Single shot streak image with laser diode
(Equipment used: C13410-01A/V12303-01/ORCA-Flash4.0)

The C13410 is a high dynamic range streak camera that can handle a large number of photo-electrons. This feature enables single-shot measurements of ultra fast phenomena with a dynamic range as high as 10 000 : 1.

This system is suitable for high-precision simultaneous measurement of high-intensity and weak intensity pulse light.



High Dynamic Range Measurement Possible up to 10 000:1

Capture a wide range of light intensities from a single-shot event

Features

High dynamic range of 10 000 : 1 (at temporal resolution 100 ps)

Temporal resolution of 5 ps*

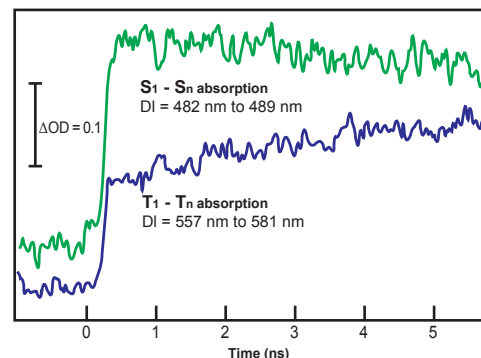
Effective photo cathode size: 17 mm

Simultaneous measurement of light intensity on temporal and spatial (wavelength) axis

* The dynamic range of the streak camera is 1000:1 at the fastest time range with temporal resolution of 5 ps. Image intensifier is required to detect single photo-electron.

Applications

- Research involving laser fusion lasers, free electron lasers and various other types of pulsed lasers
- Plasma light emission, radiation, laser ablation, combustion and explosion
- Picosecond transient absorption measurement (Time dependence of absorption is shown on the right.)
- LIDAR Thomson scattering, time-of-flight laser ranging
- Fluorescence lifetime measurement, time-resolved raman spectroscopy

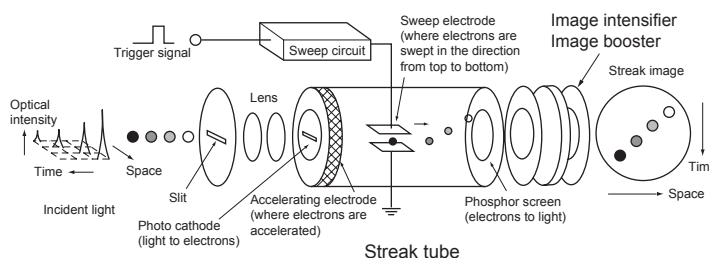


▲ The 266 nm excitation (25 ps, 0.2 mJ, $\Phi 2 \text{ mm}$ focused, single shot) of Chrysenes in THF (0.5 m mol/l)

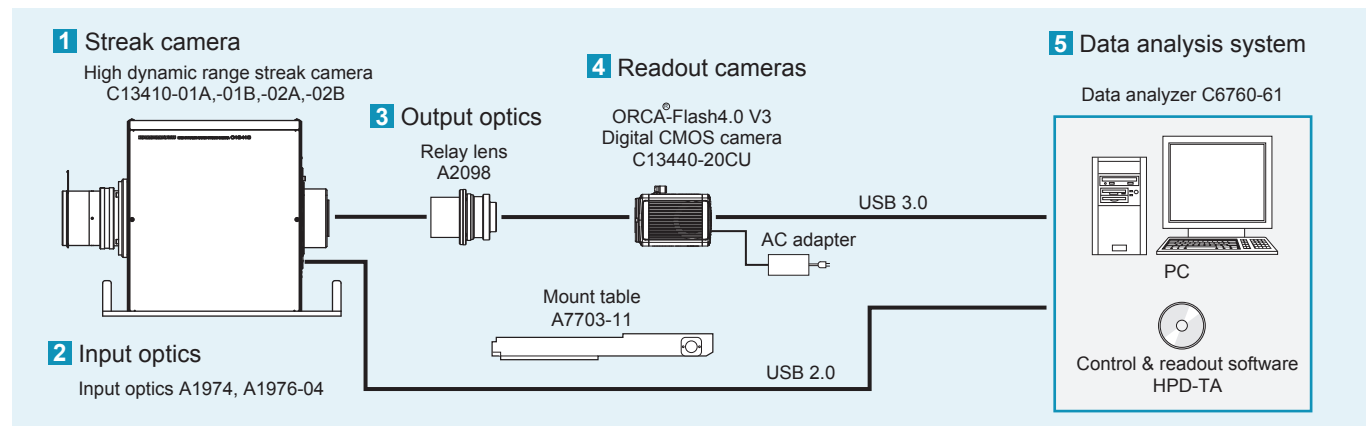
Operating principle

The light pulse to be measured is focused onto the photo cathode of the streak tube through the slit, where the photons are converted into a number of electrons proportional to the intensity of the incident light. These electrons are accelerated and conducted towards the phosphor screen, and a high-speed voltage which is synchronised to the incident light is applied. The electrons are swept at high speed from top to bottom, after which they are bombarded against the phosphor screen of the streak tube and converted to an optical image.

When the light intensity of the streak image is very weak, an image intensifier or an image booster amplifies the low light level streak image.



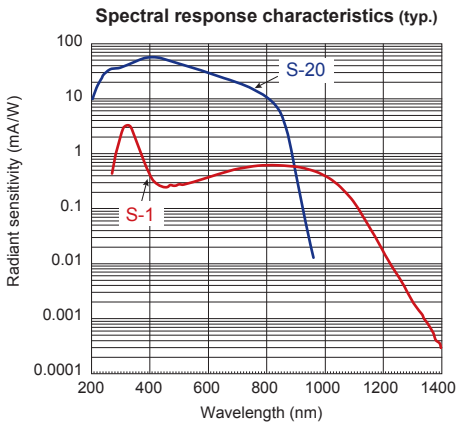
System configuration



1 Streak camera

● High dynamic range streak camera C13410-01A, -01B, -02A, -02B

Type number	C13410-01A	C13410-01B	C13410-02A	C13410-02B	
Streak tube	Photocathode		S-20		
	Spectral response characteristic		200 nm to 850 nm		
	Effective photocathode size		7.0 mm (Width) × 17.48 mm (Length)		
	Phosphor screen		P-43, Φ25 mm, Fiberoptic output		
	Spatial resolution		18 lp/mm or more (center of photocathode, wavelength 530 nm)		
	Image enhancement part		Image Intensifier (I.I.) / Image Booster (I.B.) Outside attachment		
Main unit	Temporal resolution				
	Better than 5 ps (at the fastest sweep range)				
	Sweep time / full screen 1,2,5 step		0.5 ns to 1 ms	0.5 ns to 1 ms	0.5 ns to 10 ms
	Trigger jitter				
	Less than ±20 ps (at the fastest sweep range)				
	Trigger delay				
	Approx. 30 ns (at the fastest sweep range)				
	Maximum sweep repetition frequency				
	1 kHz at OPEN FIXED mode, 100 Hz at NORMAL mode				
	Operation mode				
	FOCUS / OPERATE				
	Streak trigger input	Maximum input voltage			
		±5 V / 50 Ω			
	Gate mode	Trigger level			
		±4 V Adjustable			
	Gate method				
	NORMAL / GATE / OPEN FIXED				
	Gate method				
	Photocathode gate				
	Maximum gate repetition frequency				
100 Hz					
Gate extinction ratio					
More than 1:10 ⁵					
Gate trigger input					
+3.5 V to +5.0 V 50 Ω, rising edge					
Gate delay time					
1 μs					
Interface					
USB 2.0					
Line voltage, Power consumption	Power supply				
	AC 100 V to AC 240 V				
Frequency	50 Hz / 60 Hz				
	Power consumption				
Approx. 100 VA					
Operation environment	Ambient operating temperature				
	0 °C to +40 °C				
	Ambient storage temperature				
	-10 °C to +50 °C				
Ambient operating humidity					
30 % to 80 % (with no condensation)					
Ambient storage humidity					
90 % or less (with no condensation)					



● Image Intensifier V12303-01, -11

Type number	V12303-01	V12303-11
Photo cathode	Bi-alkali	Multi-alkali
Effective photo cathode Size	25 mm	
Luminous gain	Variable max.1000 (typ.)	Variable 10 (typ.)
Single photon detection	Yes	No
MCP	Internal	No

About a dynamic range

The maximum dynamic range of the streak camera essence is set to 1000:1 by the measurement condition of temporal resolution 5 ps, and is set to 10 000:1 by the measurement condition of temporal resolution 100 ps. With a light intensity, the image intensifier tube, Image intensifier is combined with a streak camera. In this case, the image intensifier tube may restrict the dynamic range of the measurement system. Furthermore, a read-out camera may also restrict the dynamic range of the measurement system.

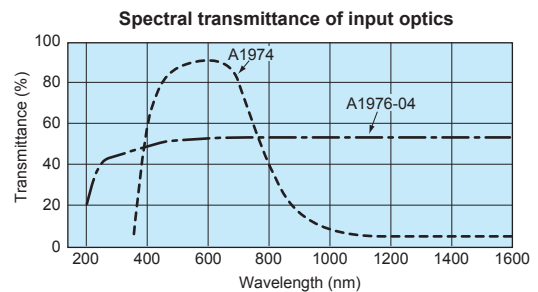
	Temporal resolution 5 ps	Temporal resolution 100 ps
V12303-01	1000:1	2000:1 (10 000:1 *)
V12303-11	—	10 000:1

*With low MCP gain (< 32 at max.64).

2 Input optics

● Input optics A1974, A1976-04

Type number	A1974	A1976-04
Spectral transmission	400 nm to 900 nm	200 nm to 1060 nm
Effective F value	1.2	3.5
Image multiplication ratio	1 : 1	
Slit width	0 mm to 5 mm	
Slit width reading precision	5 μm	
Overall length	159 mm	98.2 mm



3 Output optics

● Relay lens A2098

Type number	A2098
Readout camera	ORCA-Flash4.0 V3 Digital CMOS camera C13440-20CU
Magnification	2 : 1
Effective F value	F = 2.5

4 Readout cameras

● ORCA-Flash4.0 V3 Digital CMOS camera C13440-20CU

Type number	C13440-20CU
Number of pixels on working area	1344 (H) × 1016 (V)
Cell size	6.5 μm (H) × 6.5 μm (V)
Working area	8.74 mm (H) × 6.6 mm (V)
Working area on phosphor screen	17.48 mm (H) × 13.2 mm (V)
Exposure time	1 ms to 10 s
Readout speed	60 frames/s (USB 3.0, 1344 × 1016)
Digital output	16 bit

5 Data analysis system

● Data analyzer C6760-61

Supported camera	ORCA-Flash4.0 V3 Digital CMOS camera C13440-20CU
Component	Computer set
	Software HPD-TA U13313-01
	USB 3.0 cable
	USB 3.0 board
	External trigger cable
System	Windows 10 (64 bit)
Interface	USB 3.0

<Control & readout software HPD-TA>

Data acquisition	Live mode, analog integration photon counting, sequence recording
Device control	streak camera, readout camera, spectrometer, delay units
Profile functions	Real-time display, min/max, FWHM, Gauss fit
Data corrections	Background, sensitivity, curvature, jitter
Axis calibration	Channel, time, wavelength
File formats (images)	Binary (up to 32 bit), TIFF, ASCII
File format (profiles)	ASCII

Options

● Delay unit C1097-05

This passive delay unit provides convenient timing adjustment.

Type number	C1097-05
Variable delay range	0 ns to 31.96 ns
Delay setting range	30 ps, 60 ps, 120 ps, 250 ps, 500 ps, 1 ns, 2 ns, 4 ns, 8 ns, 16 ns
Minimum delay time	Approx. 12 ns
Maximum input voltage	30 V
Interface	USB 2.0
Power supply	AC 100 V to AC 240 V
Power consumption	Approx. 30 VA
Dimensions / weight	(W)215 mm × (D)350 mm × (H)102 mm / 3.2 kg

● PIN diode head C1083-01

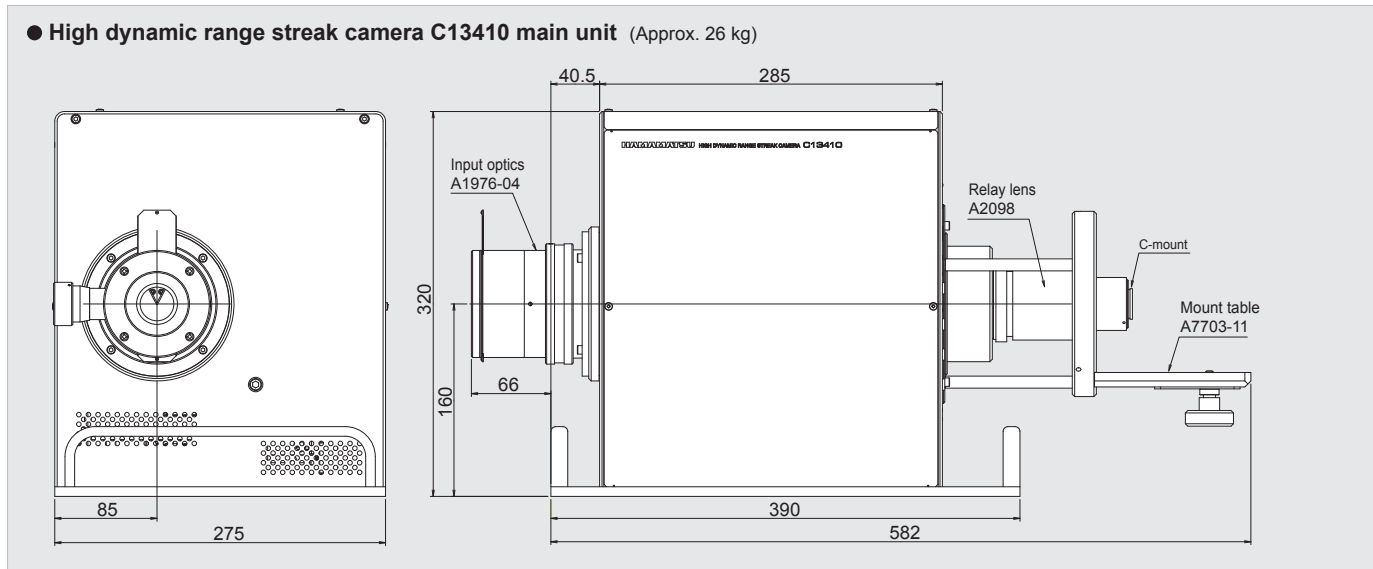
Converts low-repetition light pulses to an electronic trigger for streak sweep.

Type number	C1083-01
Spectral response	400 nm to 1100 nm
Risetime	0.8 ns
Dimensions/ weight	Head: (W)100 mm × (D)50 mm × (H)160 mm to 235 mm / 400 g Power supply unit: (W)100 mm × (D)100 mm × (H)83 mm / 400 g
Power supply	+18 V (battery)

Dimensional outlines

(Unit : mm)

● High dynamic range streak camera C13410 main unit (Approx. 26 kg)



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