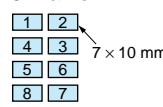
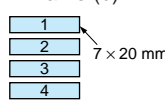
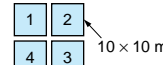
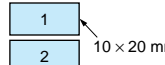
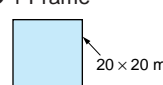


### 5 Framing Unit M4189

Number of frames	1, 2, 4 (a, b), 8
Exposure time	50 ns to 1 ms
Frame interval	300 ns to 10 ms
Shutter closing time	200 ns min.
Resolution (at phosphor screen center)	13 lp/mm
Repetition rate	100 Hz (at max. frame rate)
Frame size on Phosphor Screen (V × H)	<ul style="list-style-type: none"> <li>● 8 Frame  7 × 10 mm</li> <li>● 4 Frame (b)  7 × 20 mm</li> <li>● 4 Frame (a)  10 × 10 mm</li> <li>● 2 Frame  10 × 20 mm</li> <li>● 1 Frame  20 × 20 mm</li> </ul>
Screen mode	Framing, multi-exposure, focus
Operating mode	MODE1, MODE2, MODE3
Trigger delay	Approx. 500 ns
Trigger signal input	3 to 5 V/50 Ω, more than 50 ns

### 6 Streak Unit M4190, M4191

	High-speed Streak Unit M4190	Slow-speed Streak Unit M4191
Temporal resolution (Fastest speed range)	Better than 10 ps	Better than 250 ps
Sweep time/full screen (40 mm)	2, 5, 10, 20, 50 ns	50 ns to 10 ms <sup>①</sup> (17 steps)
Effective slit length	More than 18 mm	More than 18 mm <sup>②</sup>
Trigger jitter	Less than ±30 ps	Less than temporal resolution
Trigger delay (Fastest speed range)	Approx. 30 ns	Approx. 130 ns
Maximum sweep repetition rate	500 Hz	500 Hz
Spatial resolution (at phosphor screen center)	7.6 lp/mm	13 lp/mm
Operating mode	Post-blanking, gate, focus	
Gating method	Simultaneous MCP/photocathode gating	
Gate time	300 ns to DC	
Gate delay time	200 ns	
Control signals	Streak trigger input	
	3.0 to 10 Vp-p/50 Ω	
	Gate trigger input	
	2.0 to 10 Vp-p/50 Ω	

① Longer time is possible (optional).

② The value obtained when combining a cooled CCD camera C3640 with 2 : 1 output optics.

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★ Macintosh is a registered trademark of Apple Computer, Inc.

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Cat. No. SSCS1028E03

DEC/99 CR

Created in Japan (PDF)

### 7 Multi-Pulse Generator C4398-01

The C4398-01 is able to operate the framing streak camera C4187 at an arbitrary framing timing.

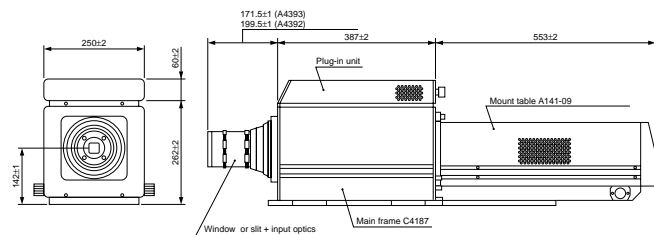
Output channels	3 channels (BNC)
Output level	TTL/50 Ω
Number of output pulses	1 to 32
Output pulse width	10 ns to 9.99 sec
Delay time	10 ns to 9.99 sec
Minimum delay step	10 ns
Repetition rate	Single, 0.1 to 1 Hz/0.1 Hz step 1 Hz to 1 MHz/1 Hz step
SYNC output	TTL/50 Ω
External trigger	TTL 50 Ω/HIGH (100 kΩ) Slope rising or falling edge
Interface	GPIB
Line voltage	100 to 240 VAC 50/60 Hz
Power consumption	50 VA

### 8 Utility

Line voltage	100/117/220/240 VAC
Power consumption	Approx. 570 VA
Operating temperature	0 °C to 40 °C
Operating humidity	Less than 70% (with no condensation)

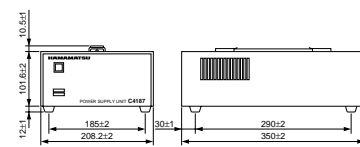
### DIMENSIONAL OUTLINES (Unit: mm)

#### ● Main Head



Weight: Approx. 34 kg (Weight: 26 kg when excluding the mount table and cooled CCD camera)

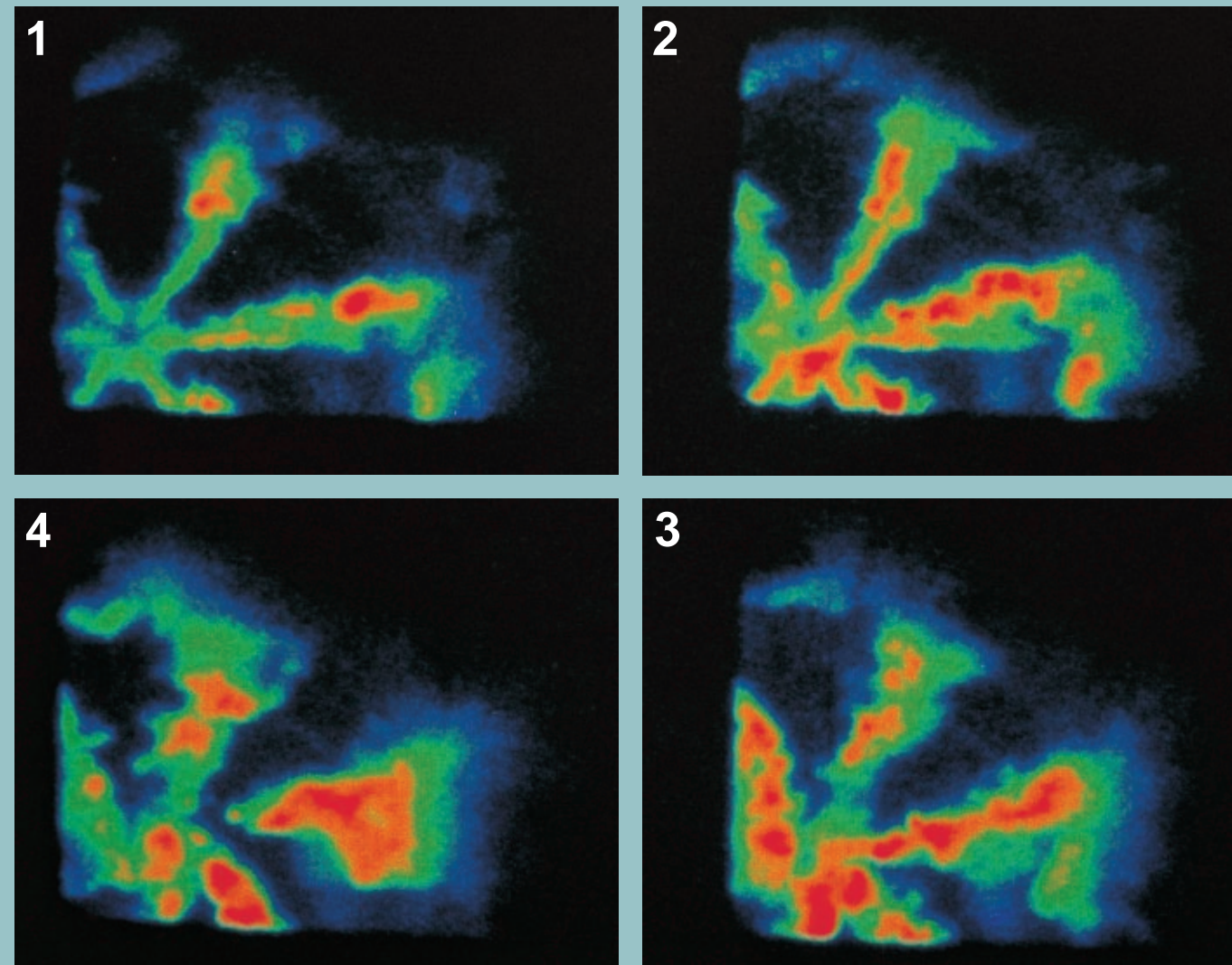
#### ● Power Supply Unit (Supplied with C4187)



Weight: Approx. 8 kg



# Framing Streak Camera C4187



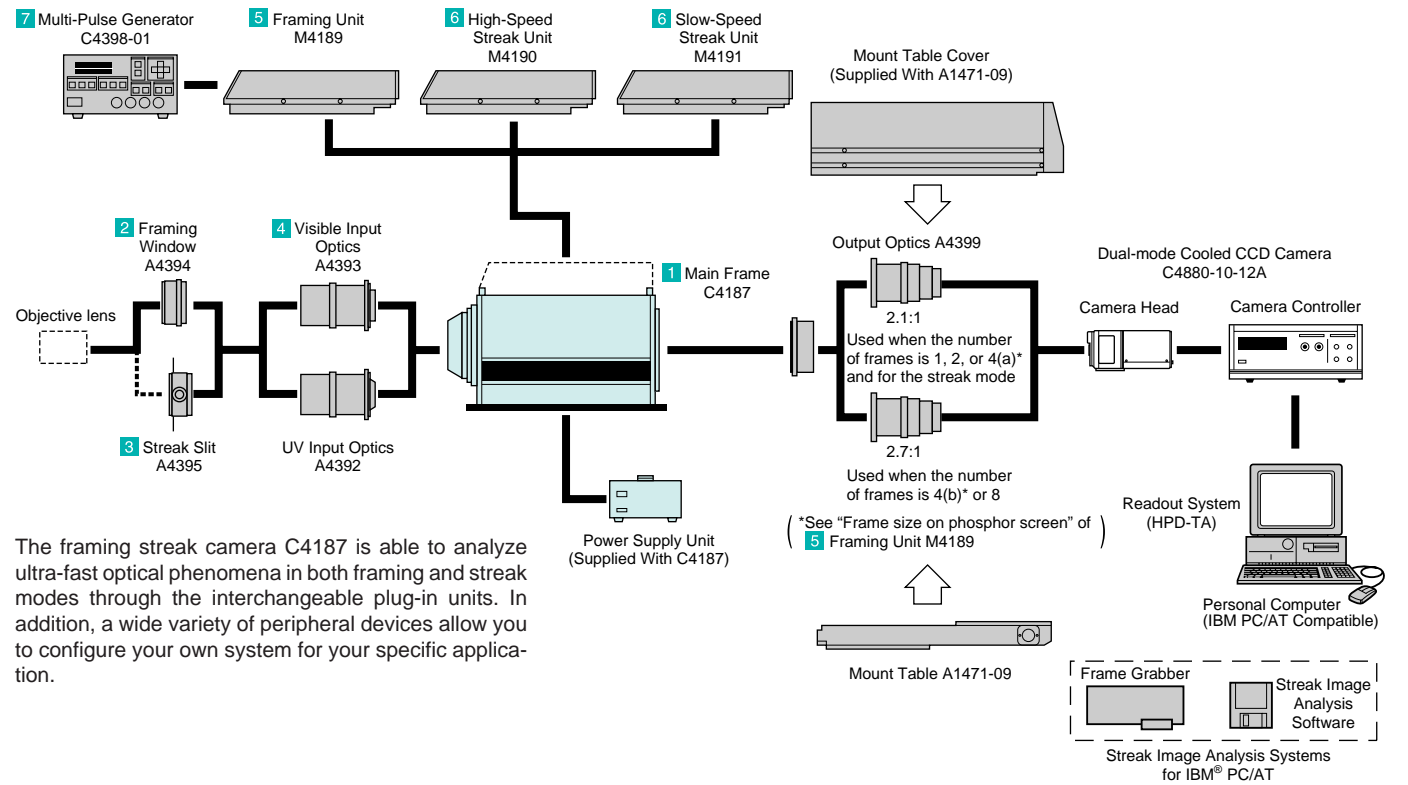
▲ Fuel Combustion Flames in A Diesel Engine  
(Photo courtesy of Advanced Combustion Engineering Inst. Co., LTD.)



# HAMAMATSU

# High-speed Framing Rate Up To 3-million Frames/sec

## SYSTEM CONFIGURATION



The framing streak camera C4187 is able to analyze ultra-fast optical phenomena in both framing and streak modes through the interchangeable plug-in units. In addition, a wide variety of peripheral devices allow you to configure your own system for your specific application.

The HPD-TA is a high-performance digital data acquisition and control system specifically designed to read out images from the C4187 framing or streak camera's phosphor screen. The entire system is controlled through a powerful but user-friendly software application that runs on a Microsoft Windows platform.  
\* A read out system based on the Macintosh® computer is also available. Please consult with our sales office for more details.

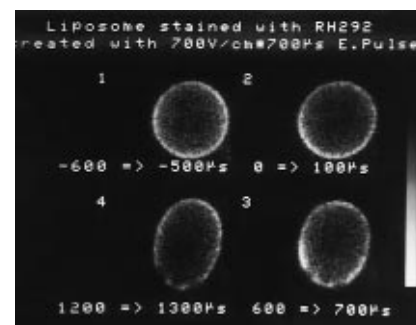
## High framing speed up to 3 million frames/sec., Short exposure time of 50 ns (framing mode) and Temporal resolution of 10 ps (streak mode)!

The Hamamatsu C4187 is a framing streak camera specially designed for the observation and analysis of ultra-fast optical phenomena. The interchangeable plug-in units give easy access to two types of imaging operations: Framing and Streak. In framing mode, the C4187 performs continuous imaging up to 8 frames at a framing rate up to 3 million frames/sec. and a minimum exposure time of 50 ns. In addition, in streak mode, the C4187 measures ultra-fast optical phenomena of 10 ps temporal resolution and provides time, light intensity, and position (or wavelength) information simultaneously. Employing a designed ultra-fast imaging tube, the C4187 makes it possible to observe and analyze ultra-fast optical phenomena at low light levels previously impossible.

The C4187 can be further enhanced by use of a real-time readout system, which is composed of a high-sensitivity video camera, a data analyzer and other peripheral equipment which can analyze image data of optical phenomena in real-time.

## APPLICATIONS

- Fuel injection and combustion in an engine
- Dynamic analysis of highspeed biological phenomena
- Laser ablation
- Discharge phenomena
- Collision-caused destructive phenomena
- Detonation
- Beam monitor
- High-speed optical phenomena in laser fusion
- Observation of plasma radiation



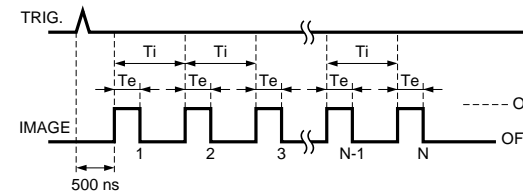
▲ Shape changes after applying pulsed voltage on liposome

## FEATURES

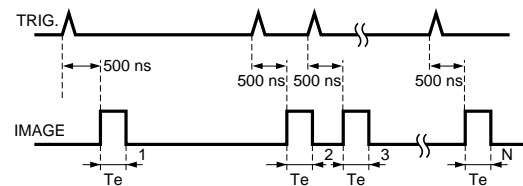
- Two types of imaging modes: framing and streak
- A frame rate up to 3 million frames/sec and a minimum exposure time of 50 ns  
The frame rate and the exposure time can be continuously adjusted between 100 frames/sec and 3 million frames/sec, and 50 nanoseconds and 1 millisecond, respectively
- Continuously adjustable frame rate and exposure time
- Switchable number of frames up to 8 frames
- External synchronization
- Multi-exposure imaging
- Wide wavelength range: 200 nm to 850 nm
- Ultra-high sensitivity imaging
- Dedicated real-time readout system

## OPERATING PRINCIPLE OF FRAME RATE AND SHUTTER SPEED

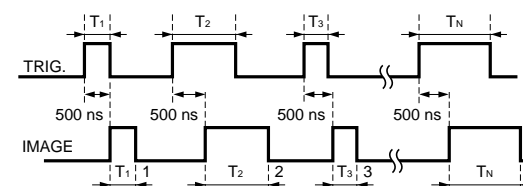
**MODE1:** When inputting an external trigger pulse, continuous N-frame images (N=1,2,4,8) are automatically performed with constant exposure time  $T_e$  and frame interval  $T_i$ .



**MODE2:** Whenever inputting external trigger pulses, each one frame image is performed. The exposure time  $T_e$  is constant. Synchronous imaging with laser pulses are also possible.



**MODE3:** Imaging with exposure time and frame interval based on trigger signal using a multipulse generator C4398 is performed. The exposure time and frame interval can be set by a multi-pulse generator C4398.



## SPECIFICATIONS

### 1 MAINFRAME C4187

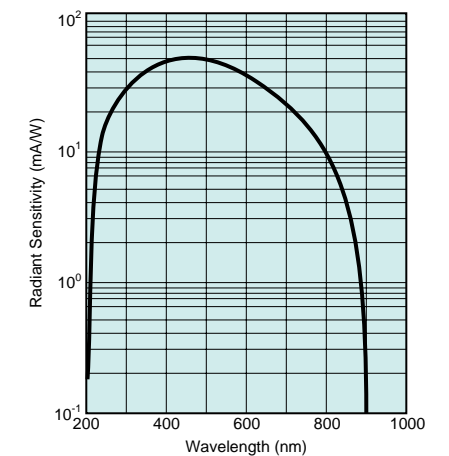
#### ● Imaging Tube N3831

Window material <sup>①</sup>	UV glass
Photocathode	S-20
Spectral response range	200 to 850 nm
Effective photocathode area <sup>②</sup>	15 × 25 mm
Phosphor screen	P-20
Output window material	Fiber optic plate
Effective phosphor screen, area	φ40 mm
Image magnification	1: 1.3
MCP gain (at 900 V)	Greater than 1000

① Fiber optic plates are also be available. The spectral response range is 350 to 850 nanometers.

② In streak mode operation, the effective slit length is 18 mm.

### [Spectral Response Characteristic of N3831]



### 2 Framing Window A4394

This is a window to determine a visual field in framing mode operation. Several windows are available.

Window Sizes	5.4 × 7.7 mm	(Number of Frames: 8)
	5.4 × 15.4 mm	(Number of Frames: 4(b))
	5.4 × 7.7 mm	(Number of Frames: 4(a))
	7.7 × 15.4 mm	(Number of Frames: 2)
	15.4 × 15.4 mm	(Number of Frames: 1)

NOTE: The size can be changed by changing window plates.

### 3 Streak Slit A4395

This is a slit used in streak mode operation.

Slit width	0 to 5 mm
Slit readout accuracy	5 mm
Slit length	0 to 20 μm

### 4 Input Optics A4392, A4393

Two input optics are available: UV input optics (A4392) and visible input optics (A4393).

	UV Type A4392	Visible Type A4393
Spectral transmittance	200 to 1600 nm	400 to 900 nm
Image magnification	1 : 1	1 : 1