HAMAMATSU

DATA SHEET

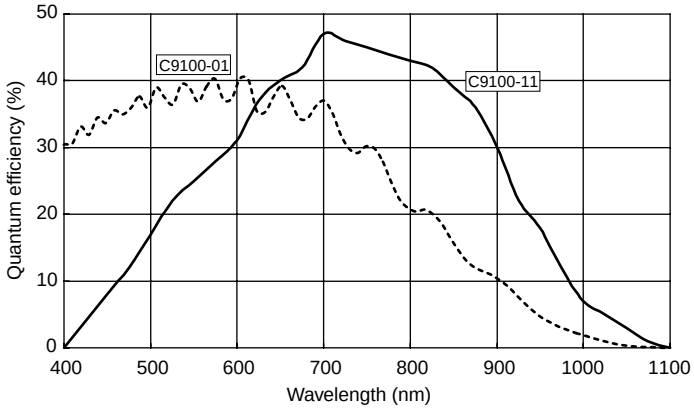
Electron Multiplier CCD Digital Camera C9100-01,-11

The C9100-01,-11 gather all expected features: high gain, high signal to noise ratio, resolution and speed, thanks to new generation EM-CCD sensor in a proprietaly permanently sealed vacuum chamber evacuated to 10^{-8} Torr.

With on-chip multiplication technology of the EM-CCD sensor the signal is drastically boosted while readout noise value is kept less than 1 electron r.m.s. at high gain mode. The gain factor of the C9100 is up to 2000 and this camera is able to grab 30 frames per second keeping 14 bit dynamic range and full resolution.

The C9100 also supports sub-array and binning modes, which enable high frame rate,100 frames per second or higher. The C9100 is recommended for all applications requiring high gain, speed, good resolution, high dynamics and signal to noise ratio.

SPECTRAL RESPONSE CHARACTERISTICS



★ This is typical, not guaranteed

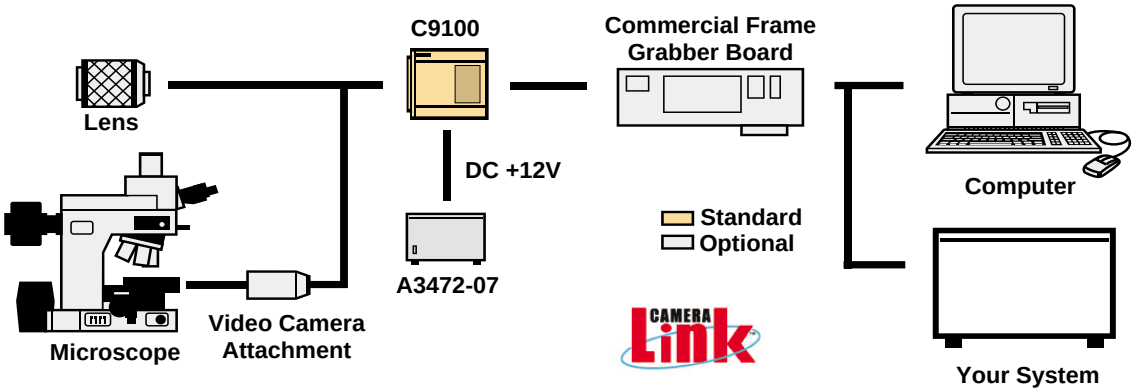
FEATURES

- **High quantum efficiency**
- **High sensitivity with on-chip multiplication**
- **Electron multiplier gain max.**
  C9100-01: 800 times
  C9100-11: 2000 times
- **Easy handling and maintenance**
- **High resolution**
  C9100-01: 640 (H) × 480 (V)
  C9100-11: 512 (H) × 512 (V)

APPLICATIONS

- **Intracellular ion imaging**
- **Intravital microscopy**
  (Real time observation of circulating blood cells in living animals)
- **Fast tracking of small particles**
- **Single molecule observation at the photon level**
- **High speed fluorescence cell tomography**

SYSTEM CONFIGURATION



The C9100 camera outputs data is transmited via a Camera Link interface.

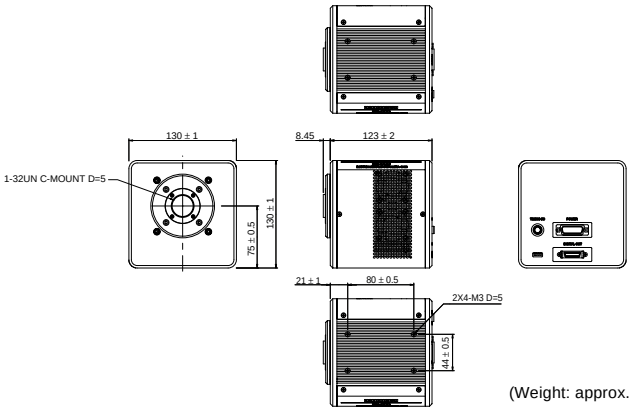
SPECIFICATIONS

Type number			C9100-01	C9100-11
Camera head type			Hermetic vacuum-sealed air-cooled head	
Circulating water cooler			-	
Mechanical shutter			-	
Imaging device			Frame transfer CCD	
Effective no. of pixels			640 (H) × 480 (V)	512 (H) × 512 (V)
Cell size			7.4 µm (H) × 7.4 µm (V)	16 µm (H) × 16 µm (V)
Effective area			4.736 mm (H) × 3.552 mm (V)	8.192 mm (H) × 8.192 mm (V)
Pixel clock rate			11 MHz/pixel	
Frame rate***	1 × 1		31.9 frame/s	35.8 frame/s
	binning	2 × 2	61.1 frame/s	66.9 frame/s
		4 × 4	112.4 frame/s	118.2 frame/s
		8 × 8	194.0 frame/s	191.6 frame/s
		16 × 16	305.0 frame/s	277.0 frame/s
Readout noise(r.m.s.) typ.		at EM-gain min.	30 electrons	100 electrons
		at EM-gain max.	< 1 electrons	< 1 electrons
Full well capacity typ.			40 000 electrons	400 000 electrons
Electron multiplier gain max.			× 800*	× 2000*
Cooling method			Forced-air peltier cooling with hermetic sealing**	
Cooling temperature			absolute and stabilized to - 50 ˚C @ amibient room temperature 0 ˚C to + 40 ˚C	
A/D converter			14 bit	
Output signal / External control			Camera Link	
Exposure time			100 µs to 10 s	27.1 ms to 10 s
Electrical shutter			Yes	-
Sub-array***			Yes	
External trigger			Yes	
Offset enhancement			Yes	
Contrast enhancement			-	
Lens mount			C-mount	
Power requirements			DC +12 V	
Power consumption			approx. 60 V•A	
Ambient storage temperature			- 10 ˚C to + 50 ˚C	
Ambient operating temperature			0 ˚C to + 40 ˚C	
Ambient operating/storage humidity			70 % max. (with no condensation)	

* Even with electron multiplier gain maximum, dark signal is kept low level for low light imaging.
** The hermetic sealed head maintains a high degree of vacuum 10^{-8} Torr, without re-evacuation.

*** Frame rate of each binning and sub-array condition			Effective vertical width (Sub-array)											
			C9100-01						C9100-11					
			480	256	128	64	32	16	512	256	128	64	32	16
Frame rate (frame/s)	1 × 1		31.9	57.5	106.4	185.2	293.2	414.5	35.8	66.9	118.3	191.9	279.3	361.0
	Binning	2 × 2	61.1	106.4	185.2	293.2	414.5	523.6	66.9	118.3	191.9	279.3	361.0	421.9
		4 × 4	112.4	185.2	293.2	414.5	523.6	602.2	118.2	191.9	278.6	359.7	421.9	460.8
		8 × 8	194.0	293.2	414.5	523.6	602.2	649.6	191.6	278.6	359.7	420.2	460.8	483.1
		16 × 16	305.0	414.5	523.6	602.2	649.6	676.2	277.0	357.1	418.4	456.6	478.5	490.2

DIMENSIONAL OUTLINES (Unit: mm)



(Weight: approx. 2.5 kg)

OPTIONAL

- **Power supply unit: A3472-07**
  Line voltage: 100 to 240V AC input
  Output voltage: DC +12V
  Dimension: 182 mm (W) × 240 mm (D) × 60 mm(H)
- **Power cable: A9189-05**

TÜV CERT EN ISO 9001:2000 Certificate: 09 100 79045

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