

ORCA Digital Cameras



The Hamamatsu Series of ORCA Digital CCD Camera offer a wide range of solutions for all of your imaging requirements with cameras including the new ORCA 285 Digital CCD Camera, the ORCA II ER, the ORCA HR High Resolution, ORCA II Back Thinned Cameras in both 512 and 1024 configurations, and the ORCA 3CCD Color Digital Camera. All ORCA cameras are supported by Hamamatsu expertise and support to provide a complete solution to any imaging requirement.



HAMAMATSU

High Resolution Digital B/W CCD Camera



ORCA-285: High resolution model



FEATURES ICX-285 progressive scan interline CCD

- High resolution format: 1 344 (H) × 1 024 (V) pixels
- Low readout noise design: 8 electrons typ.
- Full well capacity: 18 000 electrons typ.
- Low dark current: 0.8 electrons/pixel/s typ.
- 2/3-inch format CCD: 8.67 mm (H) × 6.60 mm (V)
- Progressive scan interline readout
- Binning function to improve sensitivity and achieve a frame rate up to 41 Hz
- Compatible with IEEE1394-based digital camera specifications
- Operate as a color camera by combining with a CRI filter

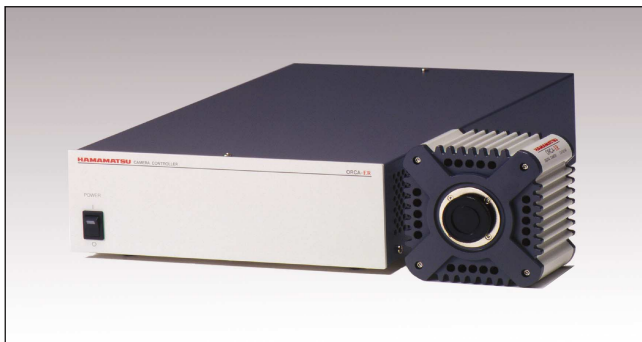
ORCA-HR: Super high resolution model



FEATURES HR-1000 interline CCD

- High resolution format: 4 000 (H) × 2 624 (V) pixels
- Large effective area: 23.6 mm (H) × 15.5 mm (V)
- Low readout noise design: 13 electrons typ.
- Full well capacity: 13 300 electrons typ.
- Low dark current: 0.5 electrons/pixel/s typ.
- Large format interline CCD chip with no mechanical shutter
- Binning function to improve sensitivity
- TIA/EIA-644(LVDS) parallel output 12 bit

ORCA-AG: High resolution cooled model



FEATURES ER-150 progressive scan interline CCD

- Broad spectral range: 300 nm to 950 nm
- High resolution format: 1 344 (H) × 1 024 (V) pixels
- Low readout noise design: 6 electrons typ.
- Full well capacity: 18 000 electrons typ.
- Low dark current: 0.03 electrons/pixel/s typ.
- 2/3-inch format CCD: 8.67 mm (H) × 6.60 mm (V)
- Progressive scan interline readout
- Binning function to achieve a frame rate up to 41 Hz
- Compatible with IEEE1394-based digital camera specifications

ORCAII-ERG: Dual scan high performance model



FEATURES ER-150 progressive scan interline CCD

- Broad spectral range: 300 nm to 950 nm
- High resolution format: 1 344 (H) × 1 024 (V) pixels
- Low readout noise design: 4 electrons typ.
- Software selectable full well capacity:
18 500 or 40 500* electrons typ.
- Low dark current: 0.0045 electrons/pixel/s typ.
- 2/3-inch format CCD: 8.67 mm (H) × 6.60 mm (V)
- Progressive scan interline readout
- Compatible with IEEE1394-based digital camera specifications

*2 x 2 binning mode offers 40500 electrons full well capacity

ORCAII-BT-512G : Wide dynamic range and Broad spectrum model



FEATURES

S7170 full-frame transfer CCD

- High quantum efficiency from UV to NIR
- Wide dynamic range: 32 875 : 1 typ.
- Large effective area: 12.29 mm (H) × 12.29 mm (V)
- Very large full well capacity: 230 000 electrons typ.
- Low readout noise design: 7 electrons typ.
- High resolution format: 512 (H) × 512 (V) pixels
- Low dark current: 0.5 electrons/pixel/s typ.
- Compatible with IEEE1394-based digital camera specifications

ORCAII-BT-1024G : High performance back-thinned CCD model

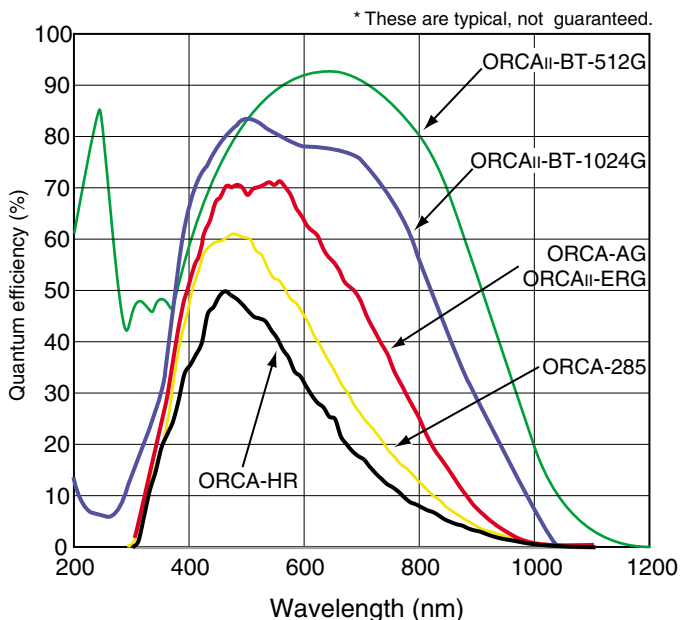


FEATURES

CCD47-10 full-frame transfer CCD

- Broad spectral range: 200 nm to 1000 nm
- High resolution format: 1 024 (H) × 1 024 (V) pixels
- Large effective area: 13.3 mm (H) × 13.3 mm (V)
- Low readout noise design: 4 electrons typ.
- Large full well capacity: 80 000 electrons typ.
- Low dark current: 0.02 electrons/pixel/s typ.
- Compatible with 1394-based digital camera specifications

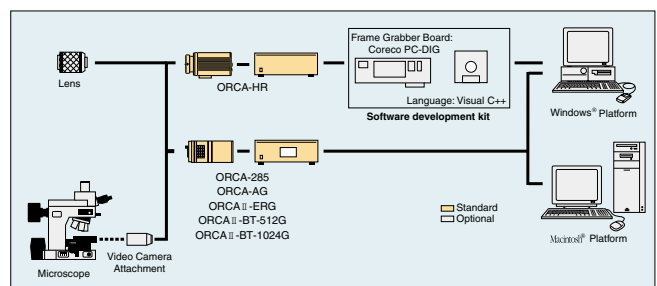
SPECTRAL RESPONSE CHARACTERISTICS



APPLICATIONS

- Routine Fluorescence Microscopy
- Green Fluorescent Protein applications
- DNA and Ploidy analysis
- Fluorescence In Situ Hybridization studies
- Red and Near Infrared Fluorescent applications
- Motility and Motion analysis
- Combined DIC/Phase and Fluorescence
- Histology, Pathology and Cytology
- Metallurgical Microscopy
- Failure analysis
- Semiconductor inspection
- X-ray scintillator readout

SYSTEM CONFIGURATIONS



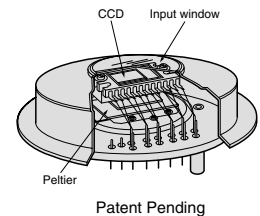
SPECIFICATION COMPARISONS

Model name		ORCA-285	ORCA-AG	
Type number		C4742-96-12G04	C4742-80-12AG	
Camera head type		Passive air-cooled head		
Mechanical shutter			—	
Imaging device		ICX-285 progressive scan interline CCD	ER-150 progressive scan CCD	
Effective number of pixels			1344 (H) × 1024 (V)	
Cell size (square format)			6.45 μm (H) × 6.45 μm (V)	
Effective area			8.67 mm (H) × 6.60 mm (V)	
Pixel clock rate	High-speed readout	14.75 MHz/pixel		
	High-precision readout	—		
Frame rate	High-speed readout	1 × 1	8.8 frame/s	
		binning	2 × 2	16 frame/s
			4 × 4	27 frame/s
			8 × 8	41 frame/s
	High-precision readout	1 × 1	—	
		binning	2 × 2	—
4 × 4			—	
Readout noise (r.m.s.) typ.	High-speed readout	8 electrons	6 electrons	
	High-precision readout	—		
Full well capacity typ.	1 × 1	18000 electrons		
	binning			
Dynamic range ^① typ.	High-speed readout	2250 : 1	3000 : 1	
	High-precision readout	1 × 1 binning	—	
Cooling method		Peltier cooling, air radiation system		
Cooling temperature		+ 5 °C	- 30 °C	
Dark current		0.8 electrons/pixel/s	0.03 electrons/pixel/s	
A/D converter	High-speed readout			
	High-precision readout	—		
Interface / Output signal (digital output)		IEEE1394		
Exposure time		10 μs to 10 s	10 μs to 4200 s	
External control		IIDC 1.1		
Sub-array				
External trigger				
Contrast enhancement	High speed readout	Analog Gain (10times max.) and Offset function		
	High-precision readout	—		
Lens mount				
Line voltage				
Power consumption		approx. 70 V·A	approx. 90 V·A	
Ambient storage temperature				
Ambient operating temperature				
Ambient operating/storage humidity				

- ① Calculated from the ratio of the full well capacity and average readout noise.
 ② Please consult with our sales office about RS-422A digital output.
 ③ The resolution of outline scan is 664(H) × 422(V).
 ④ The sub-array setting is available only with binning mode.

	Horizontal width	Horizontal offset	Vertical width	Vertical offset
2 × 2 binning	8 × n	8 × n	8 × n	8 × n
4 × 4 binning	8 × n	8 × n	8 × n	8 × n
n	0 ≤ n ≤ 500	0 ≤ n ≤ 499	0 ≤ n ≤ 328	0 ≤ n ≤ 327

*Structure of the Hermetic vacuum-sealed Head



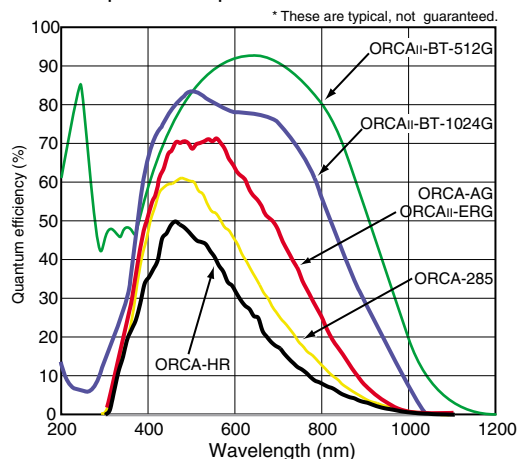
- ⑤ The hermetic vacuum-sealed water-cooled head is available. Please consult with our sales office.
 The dark current is 0.01 electrons/pixel/s at -60°C.
 ⑥ The hermetic vacuum-sealed water-cooled head is available. Please consult with our sales office.
 The dark current is 0.3 electrons/pixel/s at -60°C

ORCAII-ERG	ORCAII-BT-1024G	ORCAII-BT-512G	ORCA-HR
C4742-98-24ERG	C4742-98-26KAG	C4742-98-26LAG	C4742-95-12HR
Hermetic vacuum-sealed* air-cooled head			Passive air-cooled head
Built-in (Control: Open / Close / Auto)			-
Scan interline CCD	CCD47-10 full-frame transfer CCD	S7170 full-frame transfer CCD	HR-1000 interline CCD
	1024 (H) × 1024 (V)	512 (H) × 512 (V)	4000 (H) × 2624 (V)
	13 μm (H) × 13 μm (V)	24 μm (H) × 24 μm (V)	5.9 μm (H) × 5.9 μm (V)
	13.3 mm (H) × 13.3 mm (V)	12.29 mm (H) × 12.29 mm (V)	23.6 mm (H) × 15.5 mm (V)
10 MHz/pixel	5 MHz/pixel	2.5 MHz/pixel	20 MHz/pixel
1.25 MHz/pixel	312.5 kHz/pixel	156 kHz/pixel	-
5.6 frame/s	3 frame/s	6.3 frame/s	1.7 frame/s
9.8 frame/s	4.58 frame/s	9.84 frame/s	3.4 frame/s
15.6 frame/s	6.12 frame/s	13.6 frame/s	6.4 frame/s
22.2 frame/s	7.36 frame/s	16.8 frame/s	Outline scan ³⁾ 8.9 frame/s
0.83 frame/s	0.28 frame/s	0.5 frame/s	-
1.58 frame/s	0.54 frame/s	1.07 frame/s	
2.90 frame/s	1.01 frame/s	2.05 frame/s	
4.97 frame/s	1.83 frame/s	3.75 frame/s	
8 electrons	-	-	
4 electrons	4 electrons	7 electrons	-
18500 electrons	80000 electrons	230000 electrons	13300 electrons
40500 electrons	-	-	1000 : 1
2312 : 1	-	-	-
4625 : 1	20000 : 1	32875 : 1	-
10125 : 1	-	-	-
Forced air peltier cooling, with hermetic sealing			Peltier cooling, air radiation system
- 60 °C	- 55 °C	- 55 °C	+ 5 °C
0.0045 electrons/pixel/s	0.02 electrons/pixel/s ⁶⁾	0.5 electrons/pixel/s ⁶⁾	0.5 electrons/pixel/s
12 bit		-	
14 bit	16 bit		-
4-1995 / Non-compressed data (Mono 16) ²⁾	20 ms to 7200 s		TIA/EIA-644(LVDS) parallel output 12 bit
30 μs to 7200 s	20 ms to 7200 s		330 μs to 1 s
94-Based Digital Camera Specification Ver.1.30**			RS-232C
yes			yes ⁴⁾
yes			
	1 to 6 times	Analog Gain (10times max.) and Offset function	
1, 2, 10 times	1, 2, 9 times	1, 4, 16 times	-
C-mount			F-mount
AC 100 V / AC 117 V / AC 220 V / AC 240 V, 50/60Hz			
approx. 220 V·A			approx. 90 V·A
-10 °C to +50 °C			
0 °C to +40 °C			
70 % max. (no condensation)			

**Hamamatsu is a member of 1394 Trade Association



- Spectral response characteristics -



3 CCD Cooled Digital Color Camera

ORCA-3CCD



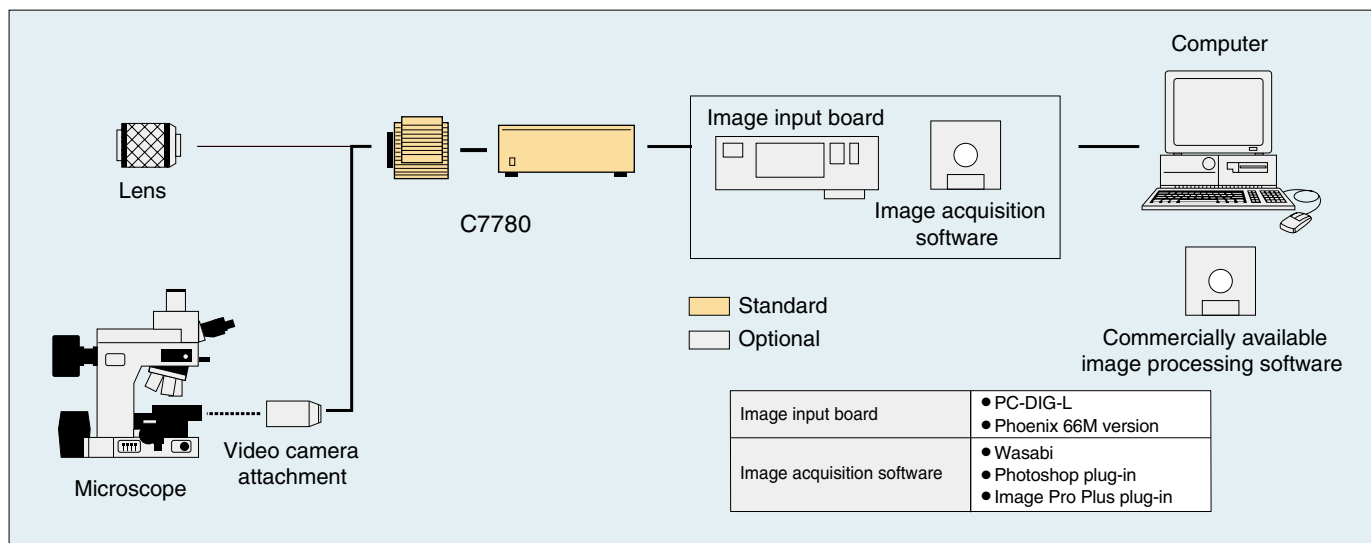
▲ Front cable mount model (Type number : C7780-10)

The ORCA-3CCD cooled digital color camera incorporates three cooled CCD chips, providing the rapid readout, high-resolution and superior S/N ratio of the Hamamatsu ORCA digital camera series. The three color CCDs employ an RGB prism to achieve extremely high quality color representation without color blur, performance difficult to achieve with a single-CCD camera. The CCDs used are the same as those used in the ORCA-ER, providing proven high quantum efficiency and high resolution, cooled to 0°C for high sensitivity detection. It is suitable for a wide range of applications, from brightfield (ie.stained pathological specimens) to fluorescent specimens using GFP and fluorescent antibodies.

APPLICATIONS

- Color digital time-lapse recording
- Fluorescence Resonance Energy Transfer (FRET) studies
- Fluorescence In Situ Hybridization (FISH) studies
- Histology, Pathology and Cytology

SYSTEM CONFIGURATION

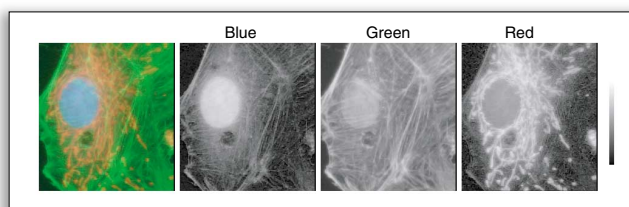


FEATURES

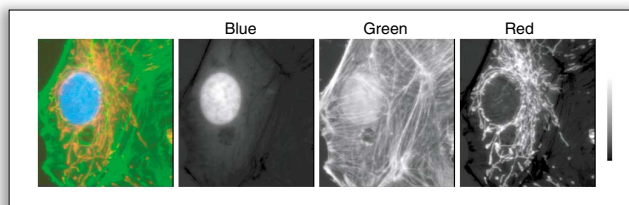
• High performance R,G,and B separation

The ORCA-3CCD incorporates three color CCDs with a RGB prism to achieve color separation superior to that available with a conventional single CCD with mosaic filter for microscope use.

Trichrome stained DAPI (blue), BODIPY FL (green), and MitoTracker (red) specimens were observed simultaneously using a D-F-T triple band mirror cassette. Separation of the color image into B, G, and R revealed admixture of BODIPY FL (green) fluorescence in the B (blue) and R (red) channels when using the single CCD with mosaic filter, however when the ORCA-3CCD was used, skillful matching of the fluorescent dyes with the wavelength separation prism achieved excellent color separation.



▲Color separation of single CCD with mosaic filter



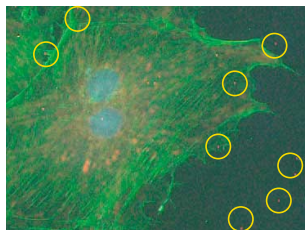
▲Color separation of ORCA-3CCD

• Total 4.13 million pixels

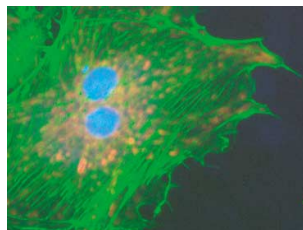
The use of three color CCDs in the ORCA-3CCD eliminates the deterioration in B (blue) and R (red) resolution which tends to occur with single color CCDs. The high spatial resolution of approximately 1 300 000 pixels for each of the R, G, and B channels allows acquisition of highly detailed fluorescing images.

• **Cooling temperature of 0 °C**

The ORCA-3CCD employs Hamamatsu's own cooling technology* to lower the temperature of the CCDs to 0°C. This significantly reduces the noise characteristics often associated with long exposures, thus allowing observation of faint levels of fluorescence.



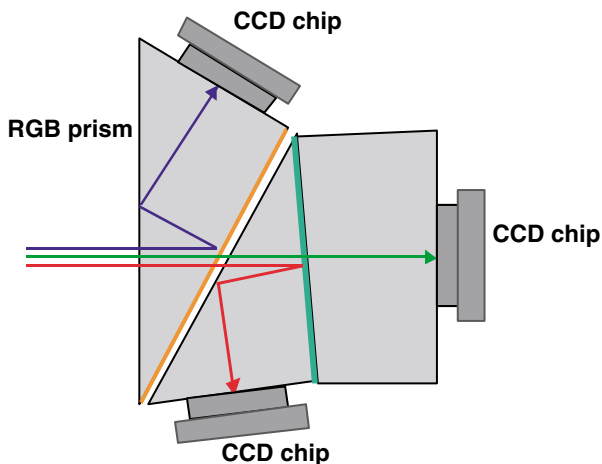
▲ Non-cooled digital color camera
Yellow circles : Location of dark noise



▲ ORCA3CCD

- **8 × 8 binning capability**
- **9.1 Hz full speed display**
- **Low readout noise design (13 electrons typ.)**

• **3 chip CCD with RGB prism**



SPECIFICATIONS

Model name	ORCA-3CCD	
Type number	C7780*	
Sensor structure	3 chip CCD with RGB prism	
Imaging device	Progressive scan interline CCD	
Effective number of pixels	1 344 (H) × 1 024 (V)	
Cell size (square format)	6.45 mm (H) × 6.45 mm (V)	
Effective area	8.67 mm (H) × 6.60 mm (V)	
Pixel clock rate	16 MHz/pixel	
Frame rate	1 × 1	9.1 Hz
	2 × 2	18.1 Hz
	4 × 4	31.8 Hz
	8 × 8	51.5 Hz
Readout noise(r.m.s.) typ.	13 electrons	
Full well capacity typ.	18 000 electrons	
Dynamic range** typ.	1 384 : 1	
Cooling method	Peltier cooling with air radiation	
Cooling temperature	0 °C	
Dark current	0.5 electrons/pixel/sec	
A/D converter	12 bit	
Output signal (digital output)	12-bit, 10 bit and 8 bit × 3 channels parallel output	
Exposure time	128 μs to 10 s	
External control	RS-232C (full remote for all camera functions)	
Sub-array	yes	
External trigger	yes	
Lens mount	2/3-inch bayonet mount (flange back 48 mm)	
Line voltage	AC 100 V / AC 117 V / AC 220 V / AC 240 V, 50/60 Hz	
Power consumption	approx. 140 V·A	
Ambient storage temperature	-10 °C to + 50 °C	
Ambient operating temperature	0 °C to + 40 °C	
Ambient operating/storage humidity	70 % max. (no condensation)	

* "ORCA-3CCD Digital Color Camera w/front cable mount" for the C7780-10

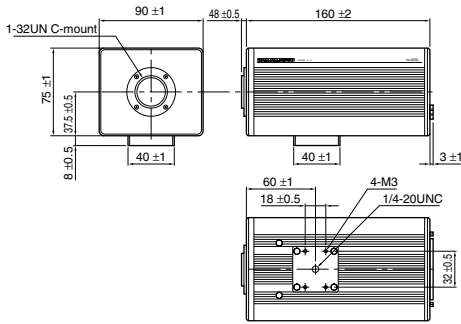
"ORCA-3CCD Digital Color Camera w/rear cable mount" for the C7780-20

** Calculated from the ratio of the full well capacity and the readout noise.

DIMENSIONAL OUTLINES (Unit: mm)

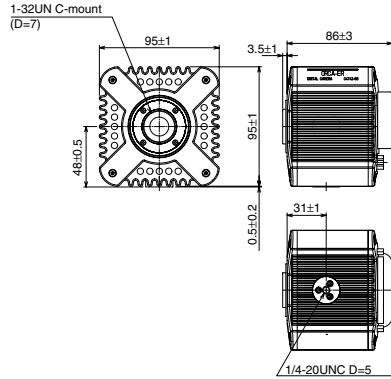
- ORCA-285 -

- Camera head (approx. 1.3 kg)



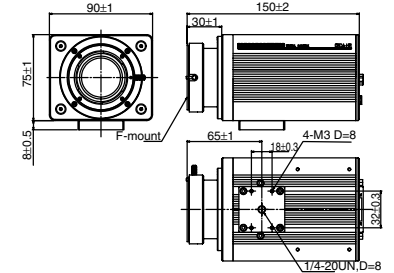
- ORCA-AG -

- Camera head (approx. 1.2 kg)

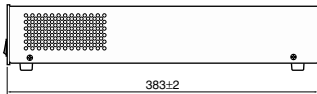
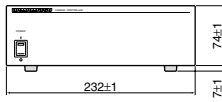


- ORCA-HR -

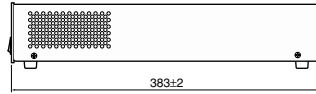
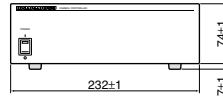
- Camera head (approx. 1.2 kg)



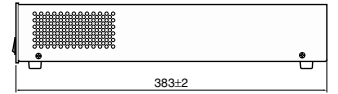
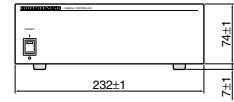
- Camera controller (approx. 6.2 kg)



- Camera controller (approx. 6.2 kg)

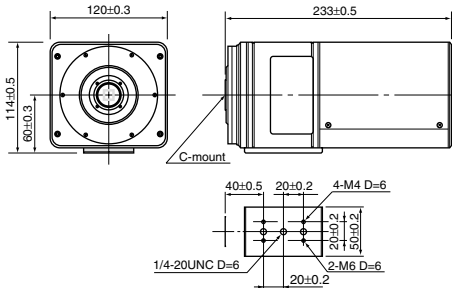


- Camera controller (approx. 6.2 kg)



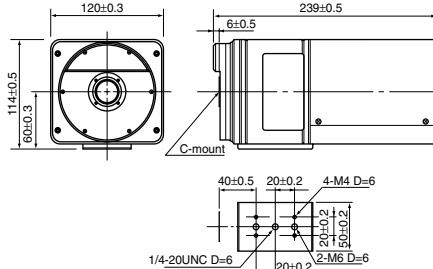
- ORCAII-ERG -

- Camera head (approx. 2.5 kg)



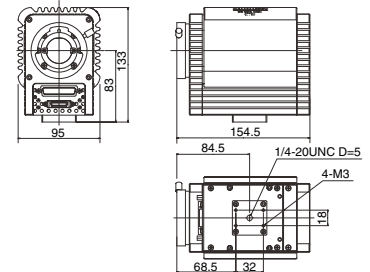
- ORCAII-BT-512G / -1024G -

- Camera head (approx. 2.5 kg)

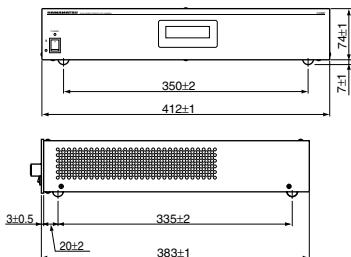


- ORCA-3CCD -

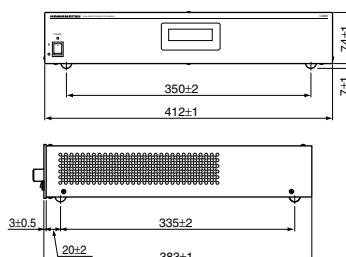
- Camera head (approx. 2.3 kg)



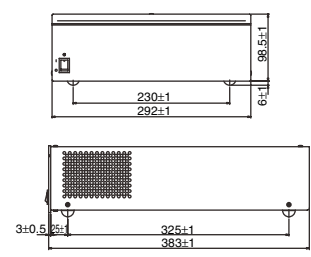
- Camera controller (approx. 8.5 kg)



- Camera controller (approx. 8.5 kg)



- Camera controller (approx. 8.0 kg)



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HAMAMATSU

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