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THORLABS

DCU224M - FEB 4, 2021
Item # DCU224M was discontinued on FEB 4, 2021. For informational purposes, this is a copy of the website content at that time and is valid only for the stated product.

HIGH-RESOLUTION USB CCD CAMERAS

► **Pixel Resolution of 1024 x 768 or 1280 x 1024**
► **30 fps or 15 fps Models Available**
► **USB 2.0 Interface**
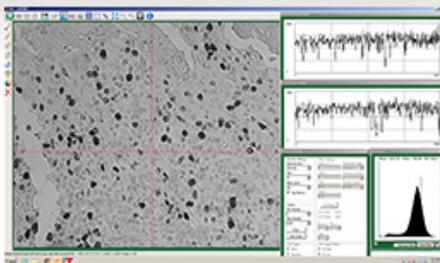
GUI and Software Package Included

DCU223M

O V E R V I E W

Features

- 1024 x 768 or 1280 x 1024 Pixel Color and B&W Versions Available
- 1/3" or 1/2" Image Sensor with Square Pixels
- Choose from 30 fps or 15 fps (Full Frame Mode)
- C-Mount Lens Mount for use with our Standard C-Mount Camera Lenses and High-Magnification Zoom Lenses
- Global Shutter
- Universal Trigger Input
- ThorCam™ Software for Windows[®] 7 and 10 Operating Systems
- SDK and Programming Interfaces Provide Support for:
  - C, C++, C#, and Visual Basic .NET APIs
  - LabVIEW, MATLAB, and µManager Third-Party Software

Item #	DCU223	DCU224
Resolution	1024 x 768 Pixels	1280 x 1024 Pixels
Pixel Clock Range[a]	5-30 MHz	
Binning	Vertical[b]	
AOI	Horizontal, Vertical[b]	
Frame Rate at 320 x 240 Pixel (Cif)	78 fps	38 fps

a. The max possible pixel clock depends on the computer used.
b. Function increases the frame rate.

### Sensors and Functionality

These ultra compact, lightweight CCD cameras feature USB connections, making them extremely versatile for a wide range of applications including industrial automation, quality control, medical imaging, microscopy, and security technology. The DCU223 models are equipped with a high-quality SONY 1/3" CCD sensor with XGA resolution (1024 x 768) and provide a full frame repetition rate of 30 fps. The DCU224 models have a 1/2" CCD sensor with SXGA resolution (1280 x 1024) and provide a full frame repetition rate of 15 fps.

For all models, higher frame rates can be achieved by using the Area of Interest (AOI) or Binning functions; the former increases the frame rate by only reading a selected area of the sensor, whereas the latter increases the frame rate by combining pixel readings before transferring them to the PC, but in this case, image resolution is sacrificed. The computer can communicate digitally with the camera through the USB 2.0 interface, thus enabling the user to transmit images and control camera settings seamlessly.

SM1 Thread Compatibility
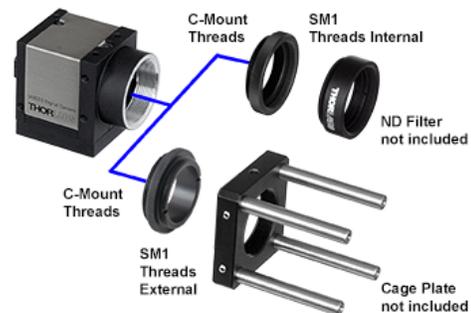
Compatibility of the CCD Camera with Thorlabs' SM1 Internal or External Threadings via the Included SM1 (1.035"-40) Adapters. Replacement adapters are shown below.

Software

Each CCD camera comes with ThorCam, our Windows-compatible software package on CD. In addition, the cameras are supported by an extensive software development kit. Standard drivers like Direct Show (WDM), Active X, and TWAIN are provided. In addition, over 20 demo programs (including source code) are supplied. A USB cable for connecting the camera to a PC is also included.

Lenses

The DCU223 CCD cameras are fully compatible with our standard C-Mount Camera Lenses and High-Magnification Zoom Lenses, which are sold separately. Our standard lenses include fixed focal lengths of 3.5 mm - 75 mm with maximum apertures of up to f/0.95, as well as an 18 - 108 mm f/2.5 zoom lens. Our high-magnification zoom lenses are a modular system that features magnification from 0.07 - 28.

Included Mounting Adapters

Each CCD camera includes two thread adapters: one external C-Mount to internal SM1 (1.035"-40) and one external C-Mount to external SM1. The C-Mount threading of the CCD camera can be easily connected to components with Thorlabs' standard SM1 thread via one of the two included SM1 adapters, as shown in the photo to the right. Additional or replacement adapters may be purchased below. A mounting adapter plate is also provided with the CCD camera; by using the included M4 x 10 mm or 8-32 x 3/4" cap screw, the camera can be threaded onto Thorlabs' TR series Ø1/2" posts. Every unit also ships with four M3 x 6 mm screws for mounting the adapter plate to the camera.

Trigger Option

The optional CAB-DCU-T1 and CAB-DCU-T2 cables can replace the standard USB connection while also enabling the use of the additional trigger input and output ports of these cameras. The exposure and readout/transfer events of the camera can be initiated via the input trigger; external events like strobe lights can be triggered by the camera through the output trigger. The trigger configuration, i.e. the source of the input trigger and the timing for the output trigger, can be set through the provided software or the LabVIEW drivers. Please click here for more details about the cables and the ordering information.

SPECS

Item #	DCU223M	DCU223C	DCU224M	DCU224C
Sensor				
Sensor Type	CCD			
Exposure Mode	Electronic Global Shutter			
Read Out Mode	Progressive Scan			
Resolution	1024 x 768 Pixels		1280 x 1024 Pixels	
Optical Sensor Class	1/3"		1/2"	
Exact Sensitive Area	4.76 mm x 3.57 mm		5.95 mm x 4.76 mm	
Exact Optical Sensor Dimension (Diagonal)	6.0 mm (0.24")		7.6 mm (0.30")	
Pixel Size	4.65 µm x 4.65 µm			
Sensor Name	Sony ICX204AL	Sony ICX204AK	Sony ICX205AL	Sony ICX205AK
A/D Converter Resolution	8 Bit			
S/N Ratio	≥38 dB			
Frame Rates				
Pixel Clock Range[a] (Allowed/Recommended)	5 - 30 MHz/10 - 20 MHz			
Frame Rate, Freerun Mode[b]	30 fps		15 fps	
Frame Rate, Trigger Mode, 1 ms Exposure Time[b]	28.7 fps		17 fps	
Exposure Time in Freerun Mode	30 µs[b] - 773 ms[c]		66 µs[b] - 1360 ms[c]	
Exposure Time in Trigger Mode	30 µs[b]- 10 min[c]		66 µs[b] - 10 min[c]	
Binning	Vertical[d]			
Method	V: Monochrome Binning, Additive			
Factor, Maximum Resolution, Frame Rate	2x, 1024 x 384 Pixel, 53 fps		2x, 1280 x 512 Pixel, 23 fps	
Factor, Maximum Resolution, Frame Rate	4x, 1024 x 192 Pixel, 85 fps		4x, 1280 x 256 Pixel, 31 fps	
Subsampling	-			
AOI	Horizontal, Vertical [d]			
Frame Rate at 320 x 240 Pixel (Cif)	78 fps		38 fps	
Absolute Image Width, Step Width	16 - 1024 Pixel, 4		16 - 1280 Pixel, 4	
Absolute Image Height, Step Width	120 - 768 Pixels, 1	120 - 768 Pixels, 2	120 - 1024 Pixels, 1	120 - 1024 Pixels, 2
Position Raster Horizontal	1	2	1	2
Position Raster Vertical	1	2	1	2
Gain				
Monochrome Model	10.47X (Master)	7.59X/4X (Master/RGB)	13.66X (Master)	8.9X/4.0X (Master/RGB)
Offset Control, Mode	Auto, Manual, Additive			
Gain Boost	2x	n/a	2x	n/a
Trigger				
Hardware Trigger	Asynchronous			
Trigger Delay With Rising Edge, Jitter	39.5 µs ± 2.6 µs		39.9 µs ± 2.5 µs	
Trigger Delay With Falling Edge, Jitter	57.9 µs ± 2.6 µs		57.7 µs ± 2.5 µs	
Additive Trigger Delay To the Sensor	15 µs - 4 s			
Sensor Delay To the Exposure Start	<100 µs[b]			
Trigger Low Level[e]	0 V Min, 2 V Max			
Trigger High Level[e]	5 V Min, 24 V Max			
Power Consumption	1.0 - 1.7 W		1.1 - 2.1 W	
Housing				
Protective Window, Removable	Uncoated Glass (D263)	IR Filter D263 with HQ coating	Uncoated Glass (D263)	IR Filter D263 with HQ coating
Interface	USB 2.0			
Power Supply	1.7 W, via USB		1.1 to 2.1 W	

Item #	DCU223M	DCU223C	DCU224M	DCU224C
Operating Temperature	32 to 122 °F (0 to 50 °C)			
Security Labels	CE, FCC, Class A			
Dimention (H x W x D)	1.59" x 1.26" x 1.35" (40.35 mm x 32 mm x 34.4 mm)			
Weight	0.21 lbs (96 g)			
Lens Connector	C-Mount			
Included Adapters	External C-Mount to External SM1 (Replacement Item # SM1A39) and External C-Mount to Internal SM1 (Replacement Item # SM1A9 or SM1A9TS)			

a. The max. possible pixel clock depends on the used computer.
b. Values are only achieved with maximum pixel clock.
c. Values are only achieved with minimum pixel clock.
d. Function increases the frame rate.
^. Trigger High and Low voltages are for the current USB board revision. A previously purchased camera contains the current USB board revision if it is compatible with our most recent driver (Version 3.82).

PIXEL SENSITIVITY

Pixel Sensitivity of the CCD Camera

Pixel sensitivity versus wavelength plots are shown at the right for the monochromatic and color versions of these CCD cameras. The color model incorporates a removable IR filter that blocks the spectral region marked by the pink background. For this model, the popular Bayer color filter array is used to acquire digital color images. The filter is based on the repeating 2 x 2 pattern shown to the left; half of the total number of pixels are green (G), and the remaining pixels are equally divided between red (R) and blue (B).
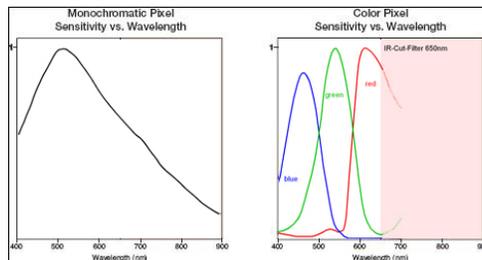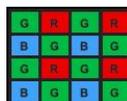
Due to this arrangement, each pixel is only sensitive to one color, and as a result, the overall sensitivity of the color image is three times lower than that achievable with a monochromatic sensor. Thus, B&W CCD cameras are preferred in low-light situations. Even though only one third of the color information is obtained at each pixel, a full-color image can be achieved through the use of various demosaicing algorithms that interpolate a set of red, green, and blue B G B G values at each point.

SOFTWARE

ThorCam™

Software

Version 3.5.1

Click the button below to visit the ThorCam software page.
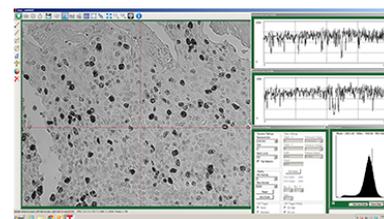
Click to Enlarge
ThorCam Graphical User Interface (GUI)

Software ⬇

ThorCam is a powerful image acquisition software package that is designed for use with our cameras on 32- and 64-bit Windows® 7 or 10 systems. This intuitive, easy-to-use graphical interface provides camera control as well as the ability to acquire and play back images. Single image capture and image sequences are supported. Application programming interfaces (APIs) and a software development kit (SDK) are included for the development of custom applications by OEMs and developers. The SDK provides easy integration with a wide variety of programming languages, such as C, C++, C#, and Visual Basic .NET. Support for third-party software packages, such as LabVIEW, MATLAB, and µManager* is available.

*µManager control of Zelux and 1.3 MP Kiralux cameras is not currently supported. When controlling the Kiralux Polarization-Sensitive Camera using µManager, only intensity images can be taken; the ThorCam software is required to produce images with polarization information.

High-Resolution USB CCD Cameras

Part Number	Description	Price	Availability
DCU223M	CCD Camera, 1024 x 768 Resolution, B&W, USB 2.0	$1,715.58	5-8 Days
DCU223C	CCD Camera, 1024 x 768 Resolution, Color, USB 2.0	$1,715.58	Today
DCU224M	CCD Camera, 1280 x 1024 Resolution, B&W, USB 2.0	$2,386.52	Lead Time
DCU224C	CCD Camera, 1280 x 1024 Resolution, Color, USB 2.0	$2,386.52	Today

High-Resolution USB CCD Cameras

USB and Trigger Cables
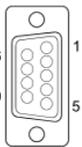
Item #		CAB-DCU-T1		Pin	Assignment
	Connector Device Side	Micro Sub-D, 90° Angled		2	Trigger Input +
	Connector PC Side	USB 2.0 A Male		3	Shield
	USB Standard	Hi-Speed USB2.0		4	USB +5 V
	Trigger In (Bare Wire)	x		5	USB GND
	Flash & Digital Out (Bare Wire)	x		6	Flash Strobe Output +
	Wire Gauge USB	24AWG/2C and 28AWG/1PR		7	Trigger Input -
Click to Enlarge	Shielding	Double Shielded 80 °C 30 V		8	USB D+
	Length	3 m		9	USB D-

Item #		CAB-DCU-T2		Pin	Assignment
	Connector Device Side	Micro Sub-D, Straight		2	Trigger Input +
	Connector PC Side	USB 2.0 A Male		3	Shield
	USB Standard	Hi-Speed USB2.0		4	USB +5 V
	Trigger In (Bare Wire)	x		5	USB GND
	Flash & Digital Out (Bare Wire)	-		6	Not Connected
	Wire Gauge USB	24AWG/2C and 28AWG/1PR		7	Trigger Input -
Click to Enlarge	Shielding	Double Shielded 80 °C 30 V		8	USB D+
	Length	3 m		9	USB D-

Item #		CAB-DCU-T3		Pin	Assignment
	Connector Device Side	Hirose HR25-7TP-8S		2	Flash Output[a]
	End Opposite Connectors	Tinned End of Wires		3	GPIO 1, 3.3 V LVCMOS
	Function	GPIO		4	Trigger Input[a] -
	Trigger In (Bare Wire)	yes		5	Flash Output[a] +
	Flash & Digital Out (Bare Wire)	yes		6	GPIO 2, 3.3 V LVCMOS
	Cable Type	Shielded High-Flexible Control Cable 8 x 0.1 mm, Ø4.9 mm		7	Trigger Input[a] +
Click to Enlarge	Shielding	Single Shielded		8	Output Supply Voltage, 5 V (100 mA)
	Length	2 m		9	N/A

a. These pins are opto-decoupled inside the camera to protect against high or incorrect voltages.

Part Number	Description	Price	Availability
CAB-DCU-T1	Customer Inspired! USB and Trigger Cable (In/Out) for DCU Series and DCC1240 Cameras, 3 m	$145.33	Today
CAB-DCU-T2	Customer Inspired! USB and Trigger Cable (In Only) for DCU Series and DCC1240 Cameras, 3 m	$85.23	Today
CAB-DCU-T3	Trigger and I/O Cable, Hirose 25, for DCC3240, DCC3260, WFS30 and WFS40, 2 m	$103.81	5-8 Days

C-Mount to SM1 Adapters for Cameras

Each CCD camera includes two thread adapters: one external C-Mount to internal SM1 (1.035"-40) and one external C-Mount to external SM1. Replacement adapters are sold below.

Item #	SM1A9	SM1A9TS[a]	SM1A39
Image (Click To Enlarge)			
Thread 1	External C-Mount (1.00"-32)		
Thread 2	Internal SM1 (1.035"-40)		External SM1 (1.035"-40)
Material	Anodized Aluminum	Black Delrin[®b]	Anodized Aluminum
Typical Application	Mount a C-Mount Camera to an Externally Threaded SM1 Lens Tube	Mount a C-Mount Camera to an Externally Threaded SM1 Lens Tube	Mount a C-Mount Camera to an Internally Threaded SM1 Lens Tube

[a] Thermally Insulating Adapter
[b] Delrin® is a registered trademark of DuPont Polymers, Inc.

Part Number	Description	Price	Availability
SM1A9	Adapter with External C-Mount Threads and Internal SM1 Threads, 4.4 mm Spacer	$19.96	Today
SM1A9TS	Customer Inspired! Thermally Insulating Adapter with External C-Mount Threads and Internal SM1 Threads, 6.5 mm Spacer	$23.61	Today
SM1A39	Customer Inspired! Adapter with External C-Mount Threads and External SM1 Threads, 3.2 mm Spacer	$21.21	Today

Visit the *High-Resolution USB CCD Cameras* page for pricing and availability information:
https://www.thorlabs.com/newgrouppage9.cfm?objectgroup_id=2916