THORLABS

DC210, DC310

Firewire CCD Camera ThorSight Image Acquisition Software

Manual

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Part 1. Thor Sight Software Guide

The Thor Sight application is a streaming image viewer used to interface with your DC210/DC310 camera. It allows you to view a live video stream from the camera, save individual images, save AVI movie clips, trigger the camera to capture trigger-generated images, adjust camera settings, select different frame rates, and access the camera registers.

1.1. Image Capture

Launch the Thor Sight executable from the desktop icon. The *Select Camera* dialog box (Figure 1) will appear.

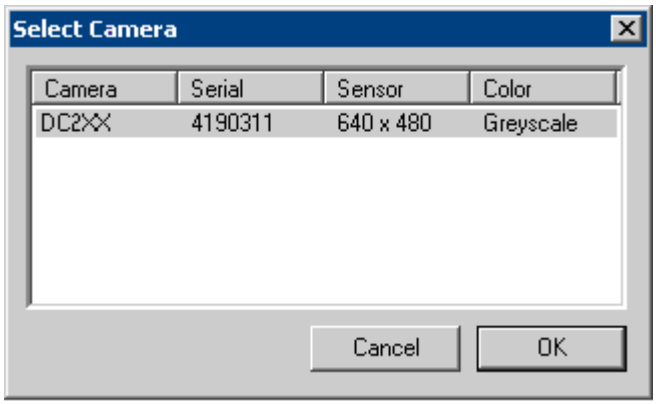


Figure 1: Select Camera Dialog Box

From the list of cameras, choose the one that you wish to use for image capture. Once the camera is selected, click the "OK" button, and the main Thor Sight application window will open. If you wish to change the camera that is being displayed, access the camera dialog box by clicking on the *Camera Dialog* icon (), which is the leftmost icon on the toolbar.

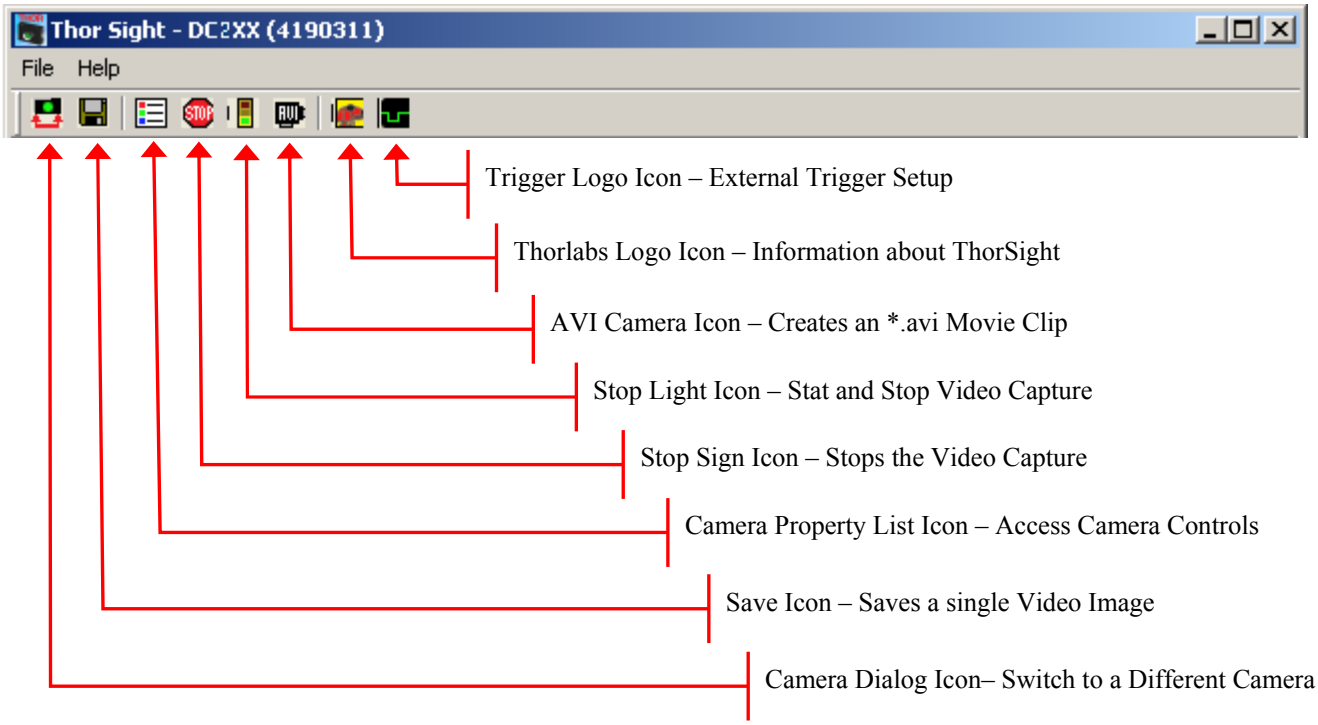


Figure 2: Thor Sight Main Screen and Tool Bar

To start capturing images, click the *Stop Light* icon ( ) on the toolbar. The video will be displayed in the main Thor Sight window with the frame rate and timing information displayed in the lower status bar.

To stop the image capture, click the *Stop Light* icon ( ) again. Alternatively, you can also click the *Stop Sign* icon ( ).

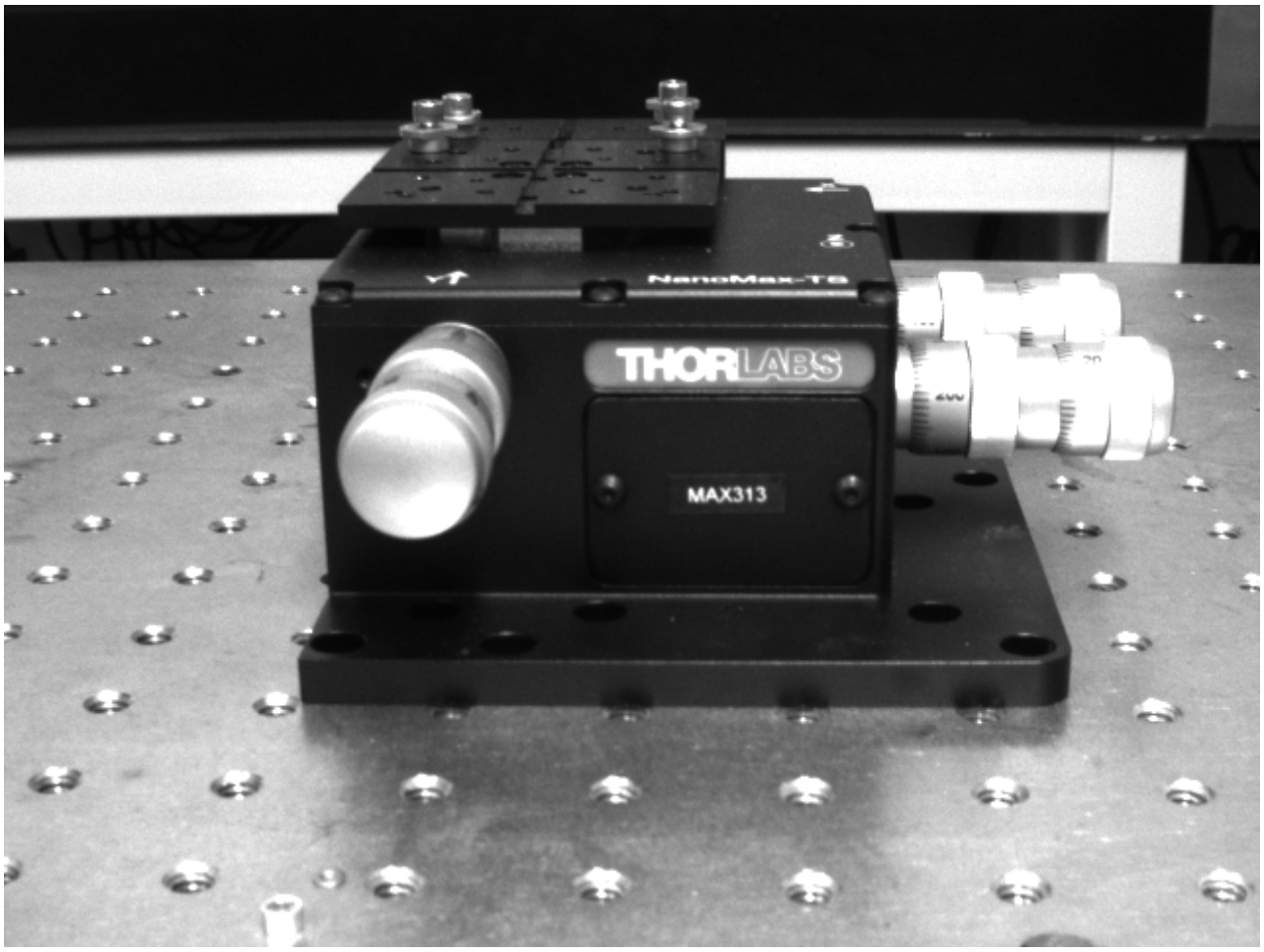


Figure 3: Image from a DC210

1.2. Saving Individual Images

To save a single video frame, click the *Save* icon ( ) on the toolbar. A save file dialog box will appear, enabling you to save the image.

File Types:

1. **Portable Pixelmap** (*.ppm). PPM is a simple color image file format that can store pixel values up to 24 bits in size. These images can be viewed and edited using Paint Shop Pro from Jasc Software.

2. **Bitmap** (*.bmp). BMP are an extremely popular format for Windows. BMP images can range from black and white (1 byte per pixel) up to 24 bit color (16.7 million colors), and can be viewed by most image viewers especially Microsoft Paint.

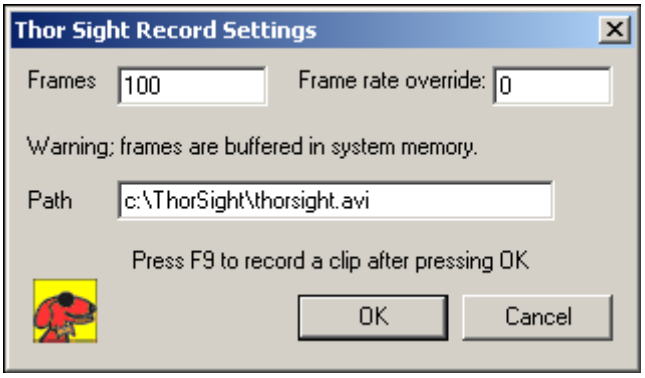
3. **Portable Gray Map** (*.pgm). PGM format is a simple grayscale file format. It is designed to be extremely easy to learn and write programs for, and is capable of storing 16 bit images. Paint

Shop Pro from Jasc Software is a good image editor that can open and display .pgm images. The Linux application XV is the only application know to handle 16 bit images.

4. **Raw** (*.raw). Raw image files contain no header or footer information, and are the basic raw data (pixel values) represented by the image.

1.3. Recording a Movie Clip to an AVI File

Thor Sight allows you to save a specified number of images as an Audio Video Interleave (.avi) movie clip. To access this functionality, stop the camera then click the *AVI Camera* icon ( ) on the toolbar. A dialog box similar to the one below will appear:



- The Frames field is the number of images that will make up the AVI. Each image is allocated its own buffer in main memory which will limit the number of frames that can be specified.

- The Frame rate override controls the playback rate of the AVI. If this is left as 0, the playback rate defaults to the image grab rate of the camera (i.e. 30 Hz). This is useful for creating slow motion video.

- The Path field specifies the directory path and filename of the saved AVI file. The default directory and filename is: *C:\Thorsight\thorsight.avi*.

1.4. Camera Control Dialog Functions

The Camera Control dialog box allows you to manipulate most camera properties, check camera information and allows you to directly access camera hardware registers to get and set specific register values.

To access the Camera Control dialog click the *Camera Property List* icon ( ) on the toolbar. Some of the controls in the camera dialog box may be grayed out. This means that the camera being used does not support that functionality. There are eight register tabs on the camera control dialog. Each tab will be discussed below.

General Camera Properties

Property	Description
Brightness (%)	This is the level of black in an image. A high brightness will result in a low amount of blackness in the image.
Saturation	This is how far a color is from a gray image of the same intensity, i.e. red is highly saturated, where as a pale pink is not.
Exposure (EV)	This is the average intensity of the image. It will use other available (non-manually adjustable) controls to adjust the image. Specifically, when shutter and gain are both in auto mode, manually adjusting the exposure slider control is actually adjusting the auto-exposure, which tries to make the average intensity of the image ¼ of the auto exposure value, i.e. exposure is 400, the camera will try to adjust shutter and gain so that the average image intensity is 100. When the auto checkbox is checked for exposure, auto-exposure is enabled, which tries to manipulate shutter and gain such that a percentage of the image is saturated, i.e. pixel value of 255.
Gain (dB)	The amount of amplification that is applied to a pixel. An increase in gain can result in a brighter image and an increase in noise.
Gamma	Gamma defines the function between incoming light level and output picture level. Gamma can also be useful in emphasizing details in the darkest and/or brightest regions of the image.
Sharpness	This works by filtering the image to reduce blurred edges in an image.
Shutter (ms)	This is the amount of time that the camera shutter stays open for; also know as the integration time.
Frame Rate	This is the speed at which the camera is streaming images to the host system. It basically defines the interval between consecutive image transfers.

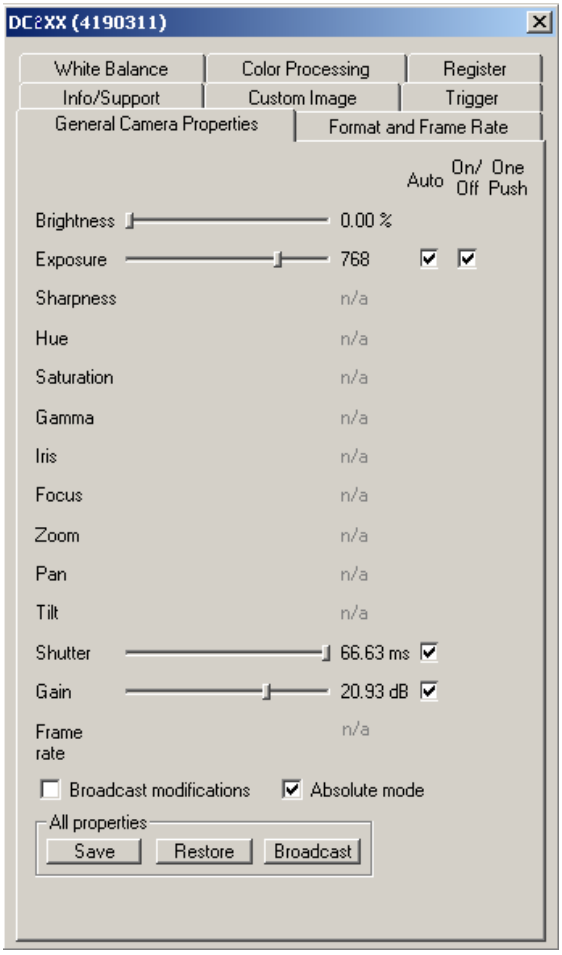


Figure 4: General Camera Properties Tab

Some general properties will have an Auto Mode in which the camera will automatically make property adjustments to get the best image possible (given the environment and lighting conditions). Some properties can also be turned On/Off, effectively disabling the property control. The One Push button is another automatic control mode, but the camera only performs automatic control of the feature for a specific period of time. After this time, automatic setting adjustment stops and manual control is given back to the user.

General camera property values can be displayed in either absolute mode or integer mode. Absolute values are real world values, such milliseconds (ms), decibels (dB) or percent (%). Using the absolute values is easier and more efficient than applying complex conversion formulas to the integer values. In addition, these conversion formulas can change between firmware versions, Thorlabs therefore recommends using the absolute values to determine camera values.

The Broadcast Modifications checkbox allows you to broadcast the current camera's settings to other cameras of the same type that are on the same 1394 bus. Checking this and making a change to your current DCx10's gain settings will cause other DCx10s on the same Fire Wire bus to have the same gain settings. Clicking the Broadcast Properties button causes all current camera settings to be sent one time only to all compatible cameras on the Fire Wire bus.

Thor Sight also provides the ability to save and restore all general camera properties to and from the system registry using the Save and Restore buttons. The specific location these settings are saved to is:

HKEY_CURRENT_USER\Software\Thorlabs, Inc.\Camera Settings

Relevant Camera Registers:

Control and Status Registers for Features: 800h->83Ch

Format and Frame Rate

On the *Format and Frame Rate* tab you can change the resolution (horizontal and vertical pixel dimensions), image format (i.e. Y8, RGB, YUV422, etc.) and frame rate (number of frames of transmitted per second) of the camera. Different cameras may have different formats and frame rates implemented; modes that are not implemented are grayed out. These modes conform to IEEE-1394 Digital Camera specifications.

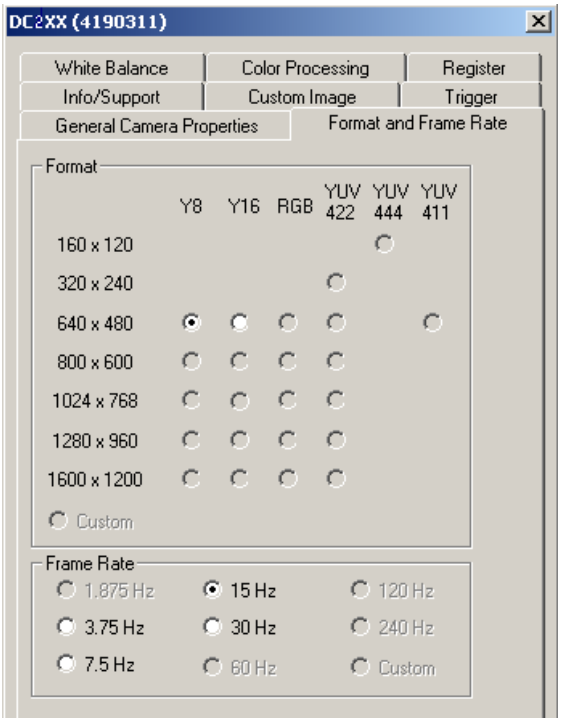


Figure 5: Format and Frame Rate Tab

Relevant Camera Registers

Control and Status Registers for Features: 600h->630h

Custom Image

The *Custom Image* tab provides and interface for putting the camera into Format 7, which is a partial image video mode. Some custom image modes allow faster frame rates due to the reduced amount of data (bytes per packet) being transmitted by the camera to the host system.

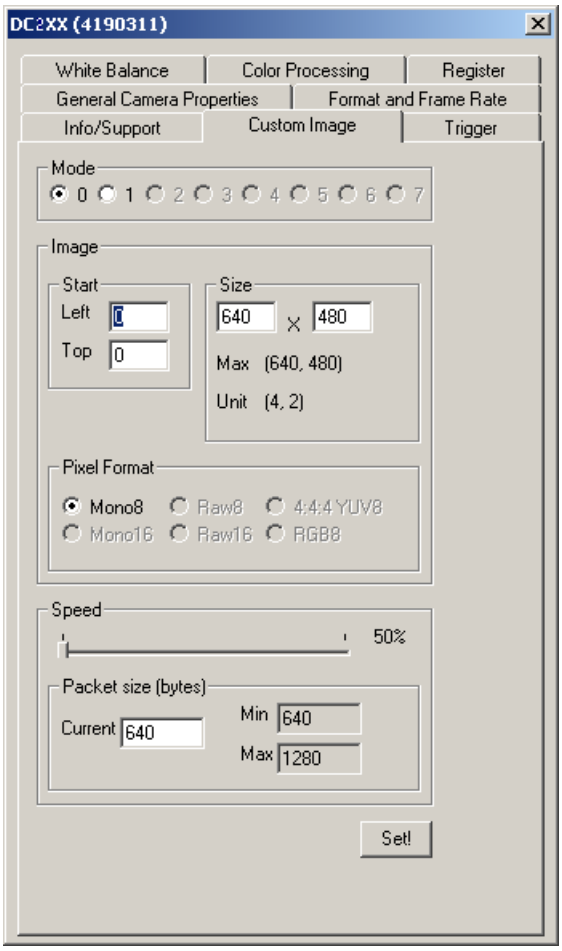


Figure 6: Custom Image Tab

Property	Description
Mode	Most DCx10s allow you to capture custom sized images using a variety of IEEE-1394 DCAM-compliant Format 7 custom image modes.
Image Size/Position	The custom image dimensions are relative to the top left corner of the image sensor. The top left corner is given coordinates (column 0, row 0). The custom image size must be evenly divisible by the Unit Size and less than or equal to the Max Image Size. For example, a size of 120(width) x 60(height) in Mode 0 is correct – 4 divides evenly into 120, and 4 divides evenly into 60.
Pixel Format	The Pixel Format is used to indicate the color-coding capability of the camera. Raw8 and Raw16 images will be color processed and displayed as color in Thor Sight. Specifying Mono8 or Mono16 for a color camera effectively disables color processing, and the raw stippled Bayer images will be displayed.
Speed	The Speed section contains two interfaces into controlling the effective frame rate of the camera while in Custom Image (Format 7) mode. The traditional method is via the Speed slider bar, which sets the number of bytes per packet to be a percentage of the maximum possible bytes per packet. The more bytes of image data that can be sent in each packet, the faster the frame rate. The other method is by manually controlling the Packet Size (in bytes). As values are entered in the Image Size/Position text fields, the minimum and maximum bytes per packet are automatically updated.

Info/Support

The *Info/Support* tab provides information about the camera, installed Thor Sight software, and links to technical support resources.

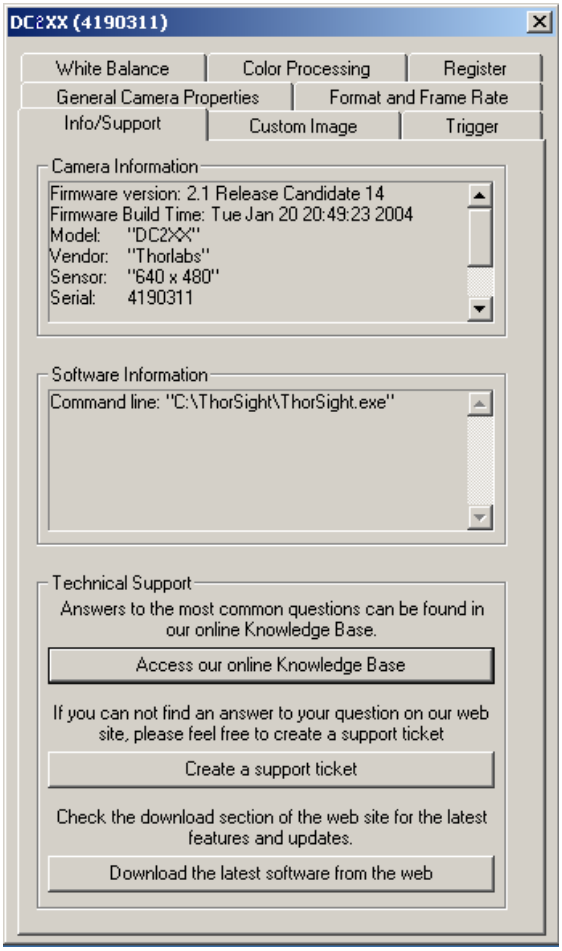


Figure 7: Info/Support Tab

Property	Description
Camera Information	The camera information displayed includes the version of firmware that is loaded onto the camera, the camera serial number, model name, and type of image sensor. Firmware is programming that is inserted into programmable read only memory, thus becoming a permanent part of a computing device. Firmware is created and tested like software and can be loaded onto the camera.
Software Information	The software displayed includes version information for Thor Sight, the DLL's being used by the current instance of Thor Sight and the version number of the driver currently being used by the camera.
Technical Support	Thorlabs, Inc. provides technical support resources by calling our tech support number 973-579-7227.

Register

The *Register* tab provides direct access to camera registers, and is recommended for advanced users.

When the Broadcast checkbox is checked, any register writes are broadcast to all cameras on the same 1394 bus.

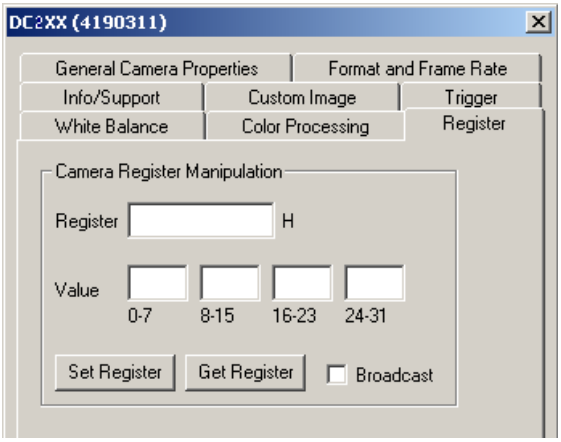
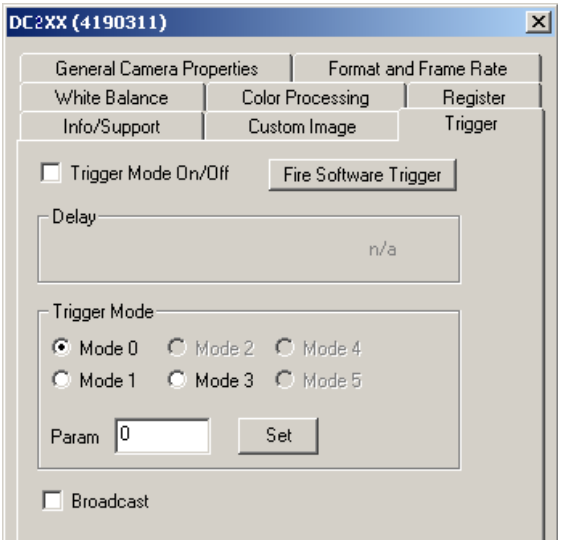


Figure 8: Register Tab

Trigger

The Trigger tab provides easy access to the camera's asynchronous transmission modes, which are implemented on the DCx10 line of cameras.



Property	Description
Trigger Mode On/Off	Checking the Trigger Mode On/Off checkbox turns on or off asynchronous transmission mode.
Delay	This provides control over the time delay between an external asynchronous trigger and the start of integration. (shutter opening)
Trigger Mode	This defines the specific trigger mode the camera is in. Some triggers take a value that can be set using the Param text box.
Fire Software Trigger	This causes a software asynchronous trigger to be fired.

Relevant Camera Registers

TRIGGER_MODE: 830h

TRIGGER_DELAY: 834h
SOFTWARE_TRIGGER: 62Ch
SOFT_ASYNC_TRIGGER: 102Ch

White Balance

This option is only available for color cameras. White Balance allows you to control the relative levels of red and blue in an image to achieve proper color balance. Moving both red and blue values toward zero should make the image appear greener. Green is kept as a constant and the red and blue

Colors are adjusted relative to the green pixel. Hardware white balance is actually performed prior to the signal being digitized as it comes off of the sensor, which results in higher quality images. Selecting the On/Off check box turns on or off white balance control – this functionality only works with cameras that have recent versions of firmware.

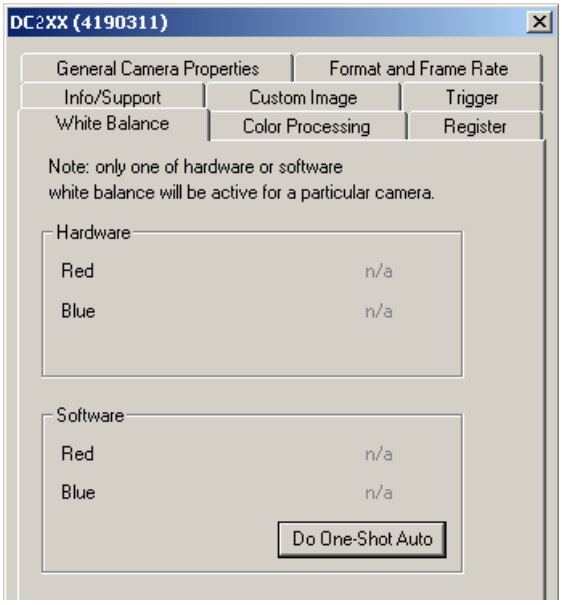


Figure 9: White Balance Tab

Relevant Camera Registers

WHITE_BALANCE: 80Ch
BAYER_TILE_GAIN:1044Ch

Color Processing

The option is only available for color cameras. For most DC210C color cameras, the conversion of the Bayer Tiled images produced by the image sensor into color takes place on the PC, and not on the camera itself. If there is no visible difference in the image quality when selecting different color processing methods, your camera does not color process on the PC.

Which color conversion process is more beneficial will depend on the application of the color conversion. On-board conversion will take more bandwidth on the bus but less processor resources, whereas PC conversion does not take as much bandwidth on the bus but will be more demanding of the processors resources.

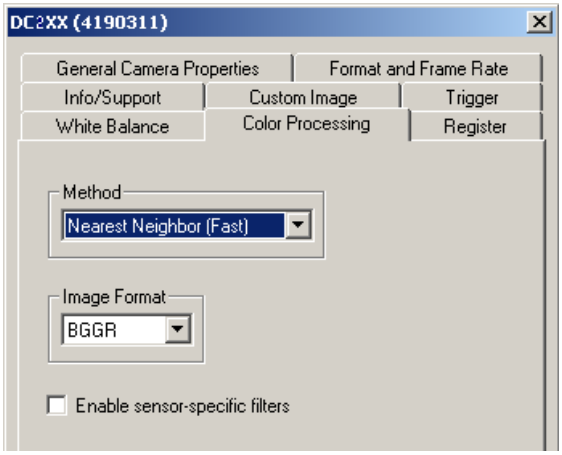


Figure 10: Color Processing Tab

The differences between the various color processing algorithms are as follows:

Property	Description
Nearest Neighbor Faster	This is the fastest of all of the provided color processing algorithms. It is generally considered to provide the poorest results
Nearest Neighbor Fast	Based on a very similar algorithm to the Nearest Neighbor Faster this algorithm is slower but performs slightly better
Edge Sensing	The algorithm is the second slowest algorithm available. The algorithm weights surrounding pixels based on localized edge orientation.
Rigorous	This algorithm is the slowest of all of the algorithms and, without a doubt produces the best color quality. Rigorous image processing takes seconds, not microseconds, and is not meant for real-time processing like the other algorithms
Image Format	The Image Format is the orientation of the Bayer Tiling on your image sensor. This will default to the correct Bayer Tiling. The Enable sensor-specific filters checkbox only applies to some versions of the DCx10 cameras.

Relevant Camera Registers

BAYER_TILE_MAPPING: 1040h

1.5. About Thor Sight

To Learn about Thor Sight, click the *Thorlabs Logo* icon ( ).

Figure 11: Thor Sight About Dialog Box

1.6. External Trigger Setup

1. To Set up the external trigger capture, click the *Trigger Logo* icon ( ).

The Trigger parameters dialog box will appear:

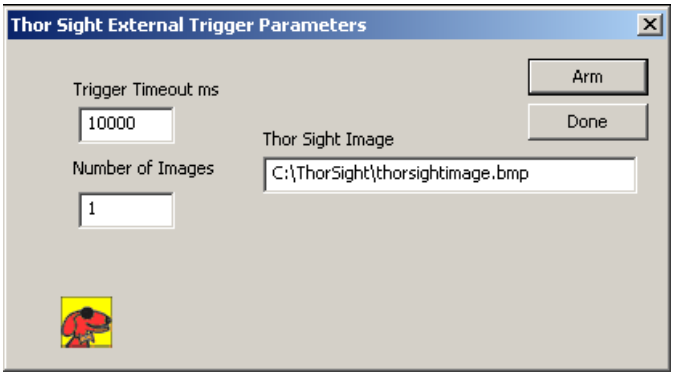


Figure 12: Thor Sight External Trigger Parameters Dialog Box

Property	Description
Trigger Timeout (ms)	The time the camera will wait to receive an external trigger on the input pins. A trigger is generated by a low going pulse between the trig pin and gnd on the external trigger connector. A flying lead cable is included for convenience
Number of Images	The number of images that will be saved. Each image will require a pulse, i.e. 10 images will require 10 pulses.
Thor Sight Image	This path field specifies the directory path and filename of the saved images. Multiple images will be incremented from 0 to number of images saved, i.e. *thorsightimage00.bmp, thorsightimage01.bmp*
Arm Button	Click to have the camera begin waiting for the trigger.

Part 2. DC210 Technical Reference

The DC210/DC310 is a compact CCD camera suitable for a variety of end user applications. This section of the manual attempts to provide the user with a detailed specification of the DC210 camera.

2.1. General Specifications

Specification	DC210	DC310
Style	CCD camera in Black aluminum housing with flying lead cable for external triggering	CCD camera in Black aluminum housing with flying lead cable for external triggering
Sensor	Sony 1/3" Type Sony HAD CCD ICX084/ICX424	Sony 1/3" Type Sony HAD CCD ICX204
Resolution	640x480	1024x768
A/D Converter	Analog Devices AD9841A A/D	n/a
Video Output Signal	8 bits/pixel, 10 bits/pixel Digital Data	
Interfaces	6-Pin IEEE-1394 for camera control and video data transmission 6 pin digital I/O connector with flying lead cable	
Voltage Requirements	8-32V	
Power Consumption	Less than 2W	
Frame Rates	3.75,7.5,15,30 fps	1.875,3.75,7.5,15 fps
Gain	Automatic/Manual Modes 0 dB through 30 dB	0 dB through 27 dB
Shutter	Automatic/Manual/Extended Shutter modes 1/30 s to 1/8000 s @30 Hz	Automatic/Manual/Extended Shutter modes 1/15 s to 1/6000 s @15 Hz
Signal to Noise Ratio	50 dB or better at minimum gain	
External Trigger	DCAM v1.30 Trigger_Mode_0	
Dimensions	2.86 x 2.13 x 0.7 inches	
Lens Adapter	Thorlabs DCM1 C mount adapter or DCSM1 CS Mount adapter	
Camera Specification	IIDC 1394-based Digital Camera Specification v1.30	
Operating Temperature	Commercial Grade Electronics rated from 0 to 70 ºC	
Storage Temperature	Room Temperature	
Camera Upgrades	Please visit our website: www.thorlabs.com	
FCC Compliance	The DC210 and DC310 comply with Part 15 of FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference; and (2) this device must accept any interference received, including interference that may cause undesired operation.	

2.2. Camera Power

The 6 pin 1394 connector connects to a standard IEEE 1394 (Fire Wire) 6 pin cable and provides the camera with both power and a connection to your computer. The ideal input voltage is 12V DC;

however, the camera is designed to handle voltages between 8 V and 32 VDC according to the IEEE 1394 standard. The power consumption of the DCx10 is less than 2 W at 12 VDC.

Some 1394 PCMCIA cards fro laptop / notebook computers require a 4 pin cable. A 4 pin cable does not provide power and will therefore not work with the DCx10.

2.3. Typical Spectral Response

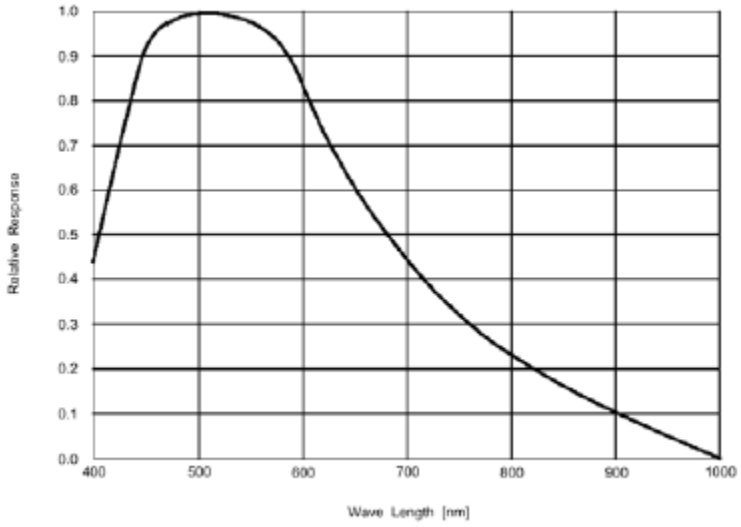


Figure 13: Spectral Response for DC210

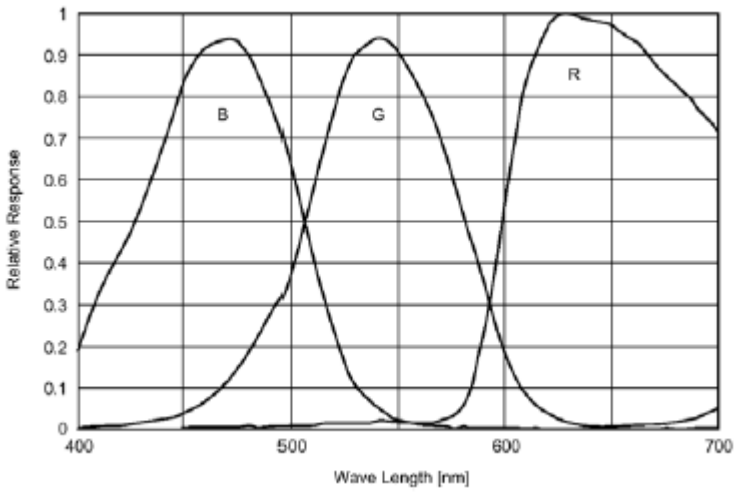


Figure 14: Spectral Response for DC210C

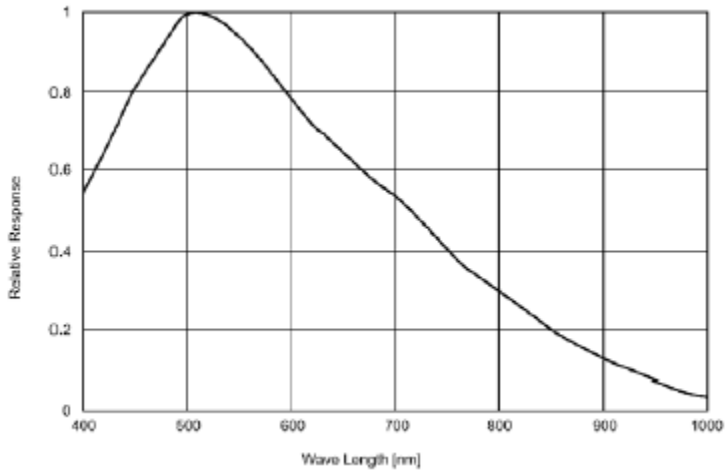
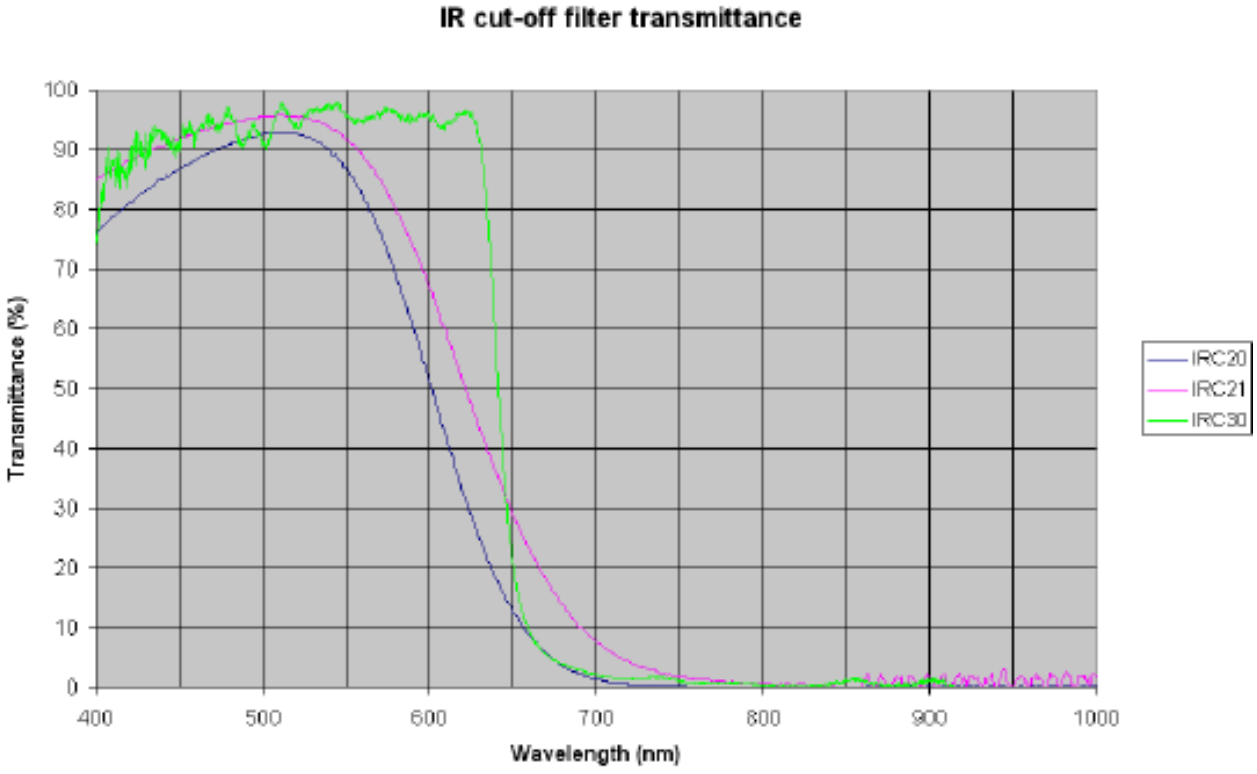


Figure 15: Spectral Response for DC310

2.4. Infrared Cut-Off Filters

The DC210C cameras have an additional infrared cut-off filter included. The approximate properties of this filter are illustrated by the IRC30 curve in the graph below.



2.5. Analog to Digital Converter

The DC210 incorporates an Analog Devices AD9841A A/D converter in order to digitize the images produced by the CCD. The following table illustrates the most important aspects of the processor.

Specification	Value
Resolution	10 bit
Pixel Gain Amplifier	4 ± 6 dB 6-bit
Variable Gain Amplifier	2 to 36 dB 10-bit
Datasheets	http://www.analog.com/static/imported-files/data_sheets/AD9841A_9842A.pdf

Part 3. Camera Operation and Features

3.1. Gain and Shutter Settings

This section describes how to convert Gain and Shutter settings from the format reported by the camera into real world units.

Gain

The gain settings in the Thor Sight program can be converted to dB by using the following formula:

DC210 – 0 dB is 220

If G < 512

Gain = -6.0404 + [20*log((658+G)/(658-G))]

Else if G > 512

Gain = -6.0404 + [0.0354*G]

DC310 – 0dB is 325

If G < 512

Gain = -9.40 + [20*log((658+G)/(658-G))]

Else if G > 512

Gain = -9.40 + [0.0354*G]

G is the gain setting in the software. The absolute gain setting in dB of the camera can be read from the CSR register at offset 928h. The returned number is in the IEEE floating point format.

Shutter

The shutter speed can be calculated using the following formulae:

DC210

T=(S*30) / (16000*F)

DC310

T=(S*15) / (12000*F)

Where S is the setting in the camera control and F is the frame rate.

Extended Shutter

In special cases where the user has modified the EXTENDED_SHUTTER register at offset 1028h this formula generalizes to the following:

T = (S*M) / (U*F)

M is the mode that the EXTENDED_SHUTTER register has been set to (30 for extended mode), and U is the reciprocal of the units of the shutter setting

	S				F		Shutter Time	
Mode	**Min**	**Max**	**M**	**U**	**Min**	**Max**	**Min**	**Max**
DC210								
30 Hz	2	532	30	16000	0.469-	30	1/8000 s	0.468s
32 Hz	2	500	32	16000	0.5	32	1/8000 s	2s
Extended	2	4000	30	16000	0.469	30	1/8000 s	16s
50 Hz	2	256	50	12800	50	50	1/6400 s	1/50s
24 Hz	2	666	24	16000	0.375	24	1/8000 s	2.66s
DC310								
15 Hz	2	800	15	12000	0.469	15	1/6000 s	1/30s
Extended	2	4000	15	12000	0.469	15	1/6000 s	10.66s

Extended shutter works as follows:

DC210	DC310	fps
16	NA	30
8	12	15
4	6	7.5
2	3	3.75
1	1.5	1.875

To calculate the shutter period in seconds:

Maximum number of line periods is given as 61344. this is the maximum we can send to register 0x81C, so it has a range from 0 – 61344. To calculate a shutter period of 1 sec, we could do this in multiple ways:

X/line rate(Hz) = shutter period (sec)

Where X is the number of lines to wait

At 30 fps the X/line rate = 1 sec. At 30 Hz at DC210(640x480), the line rate is 16kHz so X/16000 = 1. So the value you to set is 16000.

At 15 fps, X is 8000 for DC210.

At 7.5fps, X is 4000 for DC210

At 15 fps, X is 12000 for DC310

At 7.5 fps, X is 6000 for DC310

The maximum shutter period is 61344/1000 = 61.344 sec.

In extended shutter mode, the upper limit of 4000 (0x0Fa0) can be extended up to a maximum of 65440(0xFFA0) by simply writing to the high shutter bits [8-19] of the SHUTTER register.

3.2. Camera Interface

General Purpose IO

The DC210 comes with a flying lead cable which is used for general purpose IO. The leads are configured to accept a input trigger signal on the trig and GND pins. The IO3 pin is configured to send a strobe out of the DC210 to an external device

The DC210 IO pins are TTL 3.3V inputs protected by two diodes to +3.3V and GND in parallel. There is also a 10K resistor in series to limit current. When configured as input, the pins can be directly driven from a 3.3V or 5V logic output. For output, each IO pin has almost no drive strength (high impedance) and needs to be buffered with a transistor or driver to lower its impedance.

IO1 is capable of powering external circuitry up to a total of 50 mA. The IO pins are protected from both over and under voltage. It is recommended, however, that they only be connected to 5V or 3.3V digital logic signals. It should be noted that TRIG pin has a weak pull up resistor to allow a shorting of the pin to GND for triggering.

IEEE-1394 Connector

The DC210 has a standard 6-pin IEEE 1394 connector that is used for data transmission, camera control and powering the camera.

Pin	Function
1	Power Input
2	DC GND
3	TPB-
4	TPB+
5	TPA-
6	TPA+

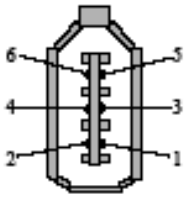


Figure 16: IEEE 1394 Connector

3.3. Automatic Inter-Camera Synchronization

Multiple DCx10s on the same IEEE 1394 bus are automatically synchronized to each other at the hardware level. When using multiple cameras, the timing of one camera to another camera is as follows:

1. If the cameras are on the same bus, the cameras are synchronized to within 125 ms of each other (125 ms is the maximum deviation). The 1394 bandwidth limits the maximum number of cameras that can be on one bus.

2. If the cameras are on separate buses a Sync unit is needed to synchronize the buses. Please contact technical support for information. Without the sync device there is no correlation between separate cameras on separate buses.

3.4. Supported Data Formats and Modes

Standard Formats, Modes and Frame Rates

The following table enumerates the different data formats and modes contained in the IIDC 1394 specification that are supported by the DC210

Camera	Format Mode	Mode	Frame Rate(fps)	Mode Description
DC210	0	5	3.75,7.5,15,30	640 x 480 Y8 (Mono)
	0	6	3.75,7.5,15,30	640 x 480 Y16 (Mono)
DC310	1	5	1.875,3.75,7.5,15	1024 x 768 Y8 (Mono)
	1	7	1.875,3.75,7.5	1024 x 768 Y16 (Mono)

Customizable Formats and Modes

The following table outlines 1394 DCAM-compliant Format 7 custom image modes that are supported by the DCx10 cameras. The frame rates specified, however, are not contained in the specification.

Camera	Format	Mode	Frame Rate (fps)	Mode Description
DC210	7	0	30	Partial Image Format (sub-window) - allows the user to only transmit a selected area of the image. Although no speed improvement is realized, this feature is useful for reducing bandwidth requirements while maintaining frame rate.
	7	1	50	Partial Image Format (sub-sampled) - allows the user to transmit a sub-sampled 640 x 240 image at up to 50 fps
DC310	7	0	15	Partial Image Format (sub-window) - allows the user to only transmit a selected area of the image. Although no speed improvement is realized, this feature is useful for reducing bandwidth requirements while maintaining frame rate.
	7	1	25	Partial Image Format (sub-sampled) - allows the user to transmit a sub-sampled 1024 x 384 image at up to 25 fps

Image Data Formats

The following table illustrates the data format for the various modes.

Mode	Data Format
Y8 8 bit/pixel	0-7 76543210
Y16 16 bit/pixel	0-7 High Byte 8-15 Low Byte this format can be toggled with the Y16_DATA_FORMAT REGISTER 1048H

Mechanical Specifications

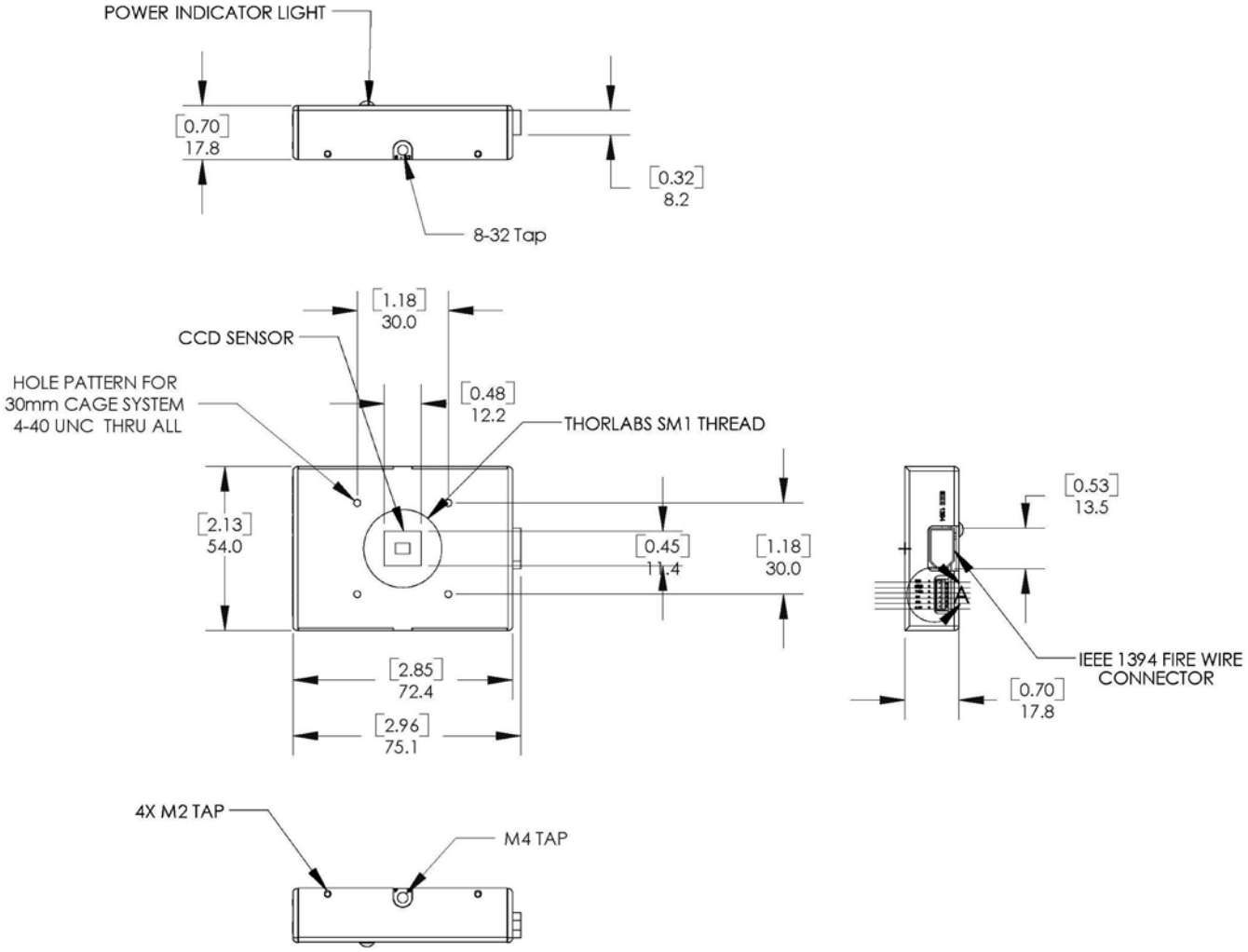


Figure 17: Mechanical Drawing of the DCx10 Housing

Part 4. Regulatory

As required by the WEEE (Waste Electrical and Electronic Equipment Directive) of the European Community and the corresponding national laws, Thorlabs offers all end users in the EC the possibility to return "end of life" units without incurring disposal charges.

- This offer is valid for Thorlabs electrical and electronic equipment:
- Sold after August 13th 2005
- Marked correspondingly with the crossed out "wheelie bin" logo (see)
- Sold to a company or institute within the EC
- Currently owned by a company or institute within the EC
- Still complete, not disassembled and not contaminated

Wheelie Bin Logo

As the WEEE directive applies to self contained operational electrical and electronic products, this end of life take back service does not refer to other Thorlabs products, such as:

- Pure OEM products, that means assemblies to be built into a unit by the user (e. g. OEM laser driver cards)
- Components
- Mechanics and optics
- Left over parts of units disassembled by the user (PCB's, housings etc.).

If you wish to return a Thorlabs unit for waste recovery, please contact Thorlabs or your nearest dealer for further information.

4.1. Waste Treatment is Your Own Responsibility

If you do not return an "end of life" unit to Thorlabs, you must hand it to a company specialized in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.

4.2. Ecological Background

It is well known that WEEE pollutes the environment by releasing toxic products during decomposition. The aim of the European RoHS directive is to reduce the content of toxic substances in electronic products in the future.

The intent of the WEEE directive is to enforce the recycling of WEEE. A controlled recycling of end of live products will thereby avoid negative impacts on the environment.

Part 5. Thorlabs, Inc Worldwide Contacts

For technical support or sales inquiries, please visit us at www.thorlabs.com/contact for our most up-to-date contact information.

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