

PROSILICA

USER MANUAL

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EC750
EC750C

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Introduction

The EC750 cameras are low cost, 60 frames per second, VGA, Firewire™ cameras specifically designed for machine vision applications.

A detailed description of all camera features and camera control registers can be found in the 1394-DCAM Reference Manual available online at <http://www.prosilica.com/support.htm>.

Precautions



READ INSTALLATION GUIDE CAREFULLY.

This document contains specific information which is necessary for the correct operation and treatment of this product.



DO NOT OPEN THE CAMERA. WARRANTY IS VOID IF CAMERA IS OPENED.

This camera contains sensitive components which can be damaged if handled incorrectly.



KEEP SHIPPING MATERIAL.

Poor packaging of this product can cause damage during shipping.



VERIFY ALL EXTERNAL CONNECTIONS.

Verify all external connections in terms of voltage levels, power requirements, voltage polarity, and signal integrity prior to powering this device.



CLEANING.

This product can be damaged by some volatile cleaning agents. Avoid cleaning the image sensor unless absolutely necessary. Please see instructions on sensor cleaning in this document.



DO NOT EXCEED ENVIRONMENTAL SPECIFICATIONS.

See environmental specifications limits in the Specifications section of this document.

Warranty

Prosilica provides a 2 year warranty which covers the replacement and repair of all Prosilica parts which are found to be defective in the normal use of this product. Prosilica will not warranty parts which have been damaged through the obvious misuse of this product.

Specifications

Sensor Type	CMOS
Sensor Shutter Type	Snapshot (freeze frame)
Sensor Resolution	752 x 480 pixels
Pixel Size	6.0μm x 6.0μm
Optical Format	1/3 inch
Lens Mount	CS-mount
Color Sensor Filter Pattern [†]	Bayer
Full Resolution Frame Rate	64 fps
Frame Rate (320 x 240 ROI)	117 fps
Power Requirements	Less than 2W 8V to 40V as per IEEE1394A specification ^{††}
Digitization	10 Bits
Trigger latency	2μs *
Trigger Jitter	±0.5μs**
Operating Temperature	0 to 60 Celsius
Operating Humidity	20 to 80% non-condensing
Size	33mm (height) x 46mm (width) x 43mm (length)
Weight	70g
Interface Standard	IEEE 1394A (FIREWIRE™)
Interface Standard	IIDC 1394-based Digital Camera Specification 1.31 (DCAM)
Regulatory	Conforms to CE, FCC

[†] Applies to EC750C only.

^{††} Nominal operating voltage is 12V. Cameras have been tested at 12V to 28V.

*

15ms in Version A cameras.

**

±1μs in Version A cameras.

Supported Features

A detailed description of all camera features and camera control registers can be found in the 1394-DCAM Reference Manual available online at <http://www.prosilica.com/support.htm>.

Monochrome Formats	Mono 8, Mono 16
Color Formats	Bayer 8, Bayer 16, RGB 24, RGB48, YUV 411, YUV 422
Image Readout	simultaneous exposure and readout [†]
Triggering	edge mode only; active hi or low
Trigger Delay	1μs to 1s, in 1μs increments
GPO	1 programmable output: exposing, trigger ready, trigger in, general purpose
Exposure Control	20μs to 1s
Offset	factory calibrated, or manual control
Gain	1x to 4x
Gamma	linear, or standard video gamma (1/2.2)
White Balance	off, manual, automatic, one-push automatic
Auto Exposure	off, manual, automatic, one-push automatic
Region of Interest (ROI)	independent x and y control with 1 pixel resolution
Multislope	up to 3 slopes
Multishot	1 to 65536 frames
Look Up Table (LUT)	programmable
Frame Rate Control	approximately 1/60 fps to maximum frame rate
Memory Channels	7 programmable channels, plus factory defaults channel

[†] Sequential exposure and readout in trigger modes.

DCAM Interface

The camera is DCAM (IIDC) version 1.31 compliant.

Prosilica's 1394-DCAM Reference Manual lists all the registers used by this camera.

Feature Controls

Name	Relative Range	Relative Units	On/Off	Auto	One-Push Auto	Absolute Control	Absolute Units
Brightness	0 to 255	digital offset	✓				
White Balance ¹	0 to 255	linear gain		✓	✓		
Gamma	0, 1	on, off	✓				
Exposure Time ²	1 to 4095	20 μ s	✓	✓	✓	✓	sec
Gain	0 to 48	not calibrated	✓				
Trigger Mode	0, 1	edge	✓				
Trigger Delay	0 to 4095	1 μ s	✓			✓	sec
Frame Rate	20 to 600	fps x 10	✓			✓	fps

Modes

Name	Description
Format 7, Mode 0	Variable-size, full image
Format 0, Modes 0 to 6	Fixed resolution, fixed format modes

¹ Color cameras only.

² Exposure Time control is called *SHUTTER* in the DCAM standard.

Mechanical

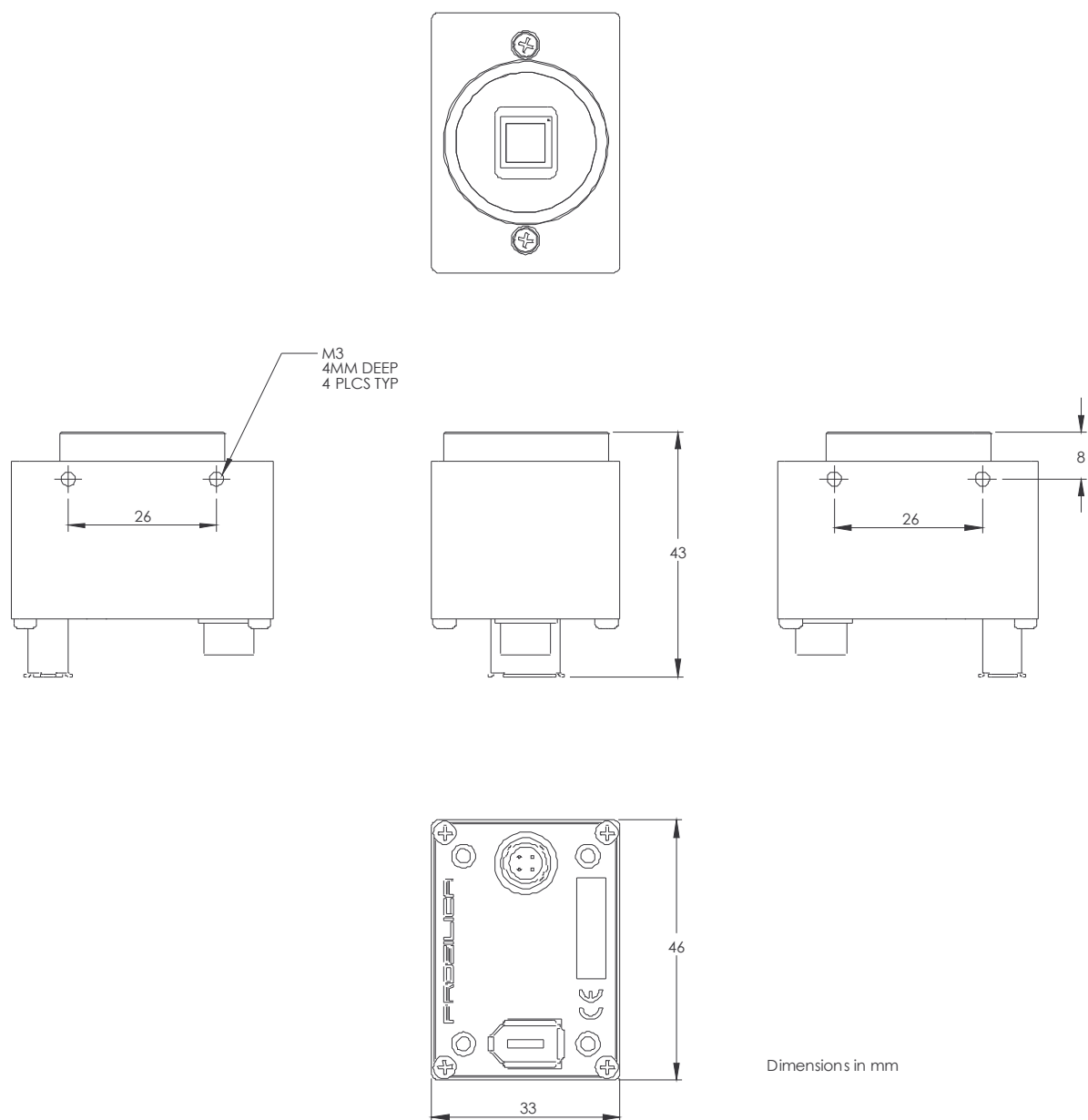


Figure 1: EC750 and EC750C Mechanical

Connections

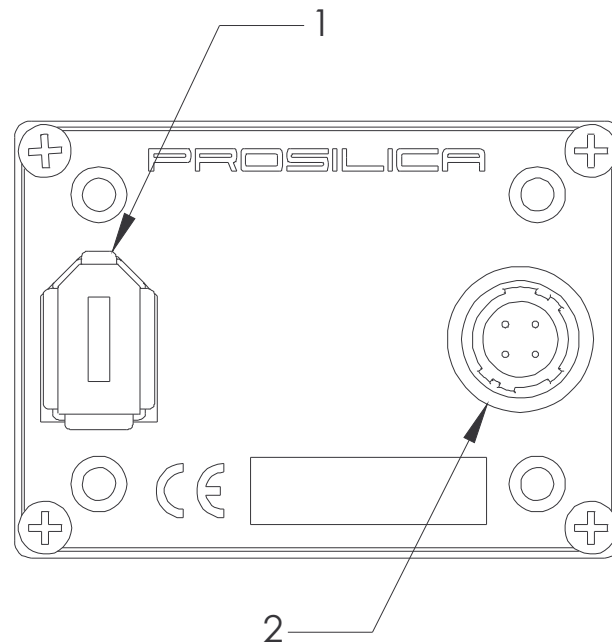


Figure 2: Camera Back for EC750 and EC750C

Item 1: IEEE 1394A (FIREWIRE™) PORT

This port will work with all commercially available 6 pin 1394A cabling. Contact Prosilica if screw captivation is required.

Item 2: Trigger I/O PORT

The Trigger I/O port uses a Hirose HR10A-7R-4PB connector on the camera side. The mating cable connector is Hirose HR10A-7P-4S. This connector can be purchased from Prosilica or from <http://www.digikey.com>.

Figure 3 shows the pin out, internal trigger circuitry, and an example of how a user would configure their cabling and circuitry to work with the EC750 camera. As indicated, the Trigger Input and Sync-Out are optically isolated. Contact Prosilica to purchase compatible trigger cables if required.



DO NOT EXCEED VOLTAGE AND CURRENT RATINGS OF THE INDICATED OPTOCOUPLER.

TRIGGER INPUT

This input signal allows the camera to be synchronized to some external event. The camera can be programmed to trigger on the rising or falling edge of this signal. The camera can also be programmed to capture an image at some programmable delay time after the trigger event. See the 1394-DCAM Reference Manual for a detailed description of this signal.

Sync-Out

The Sync-Out signal can be configured as follows:

Exposing	Corresponds to when camera is integrating light.	Sync-Out default
Trigger Ready	Indicates when the camera will accept a trigger signal.	
Trigger Input	A relay of the trigger input.	
Programmable	Signal can be programmed from host system.	

See the 1394-DCAM Reference Manual for a detailed description of these signals.

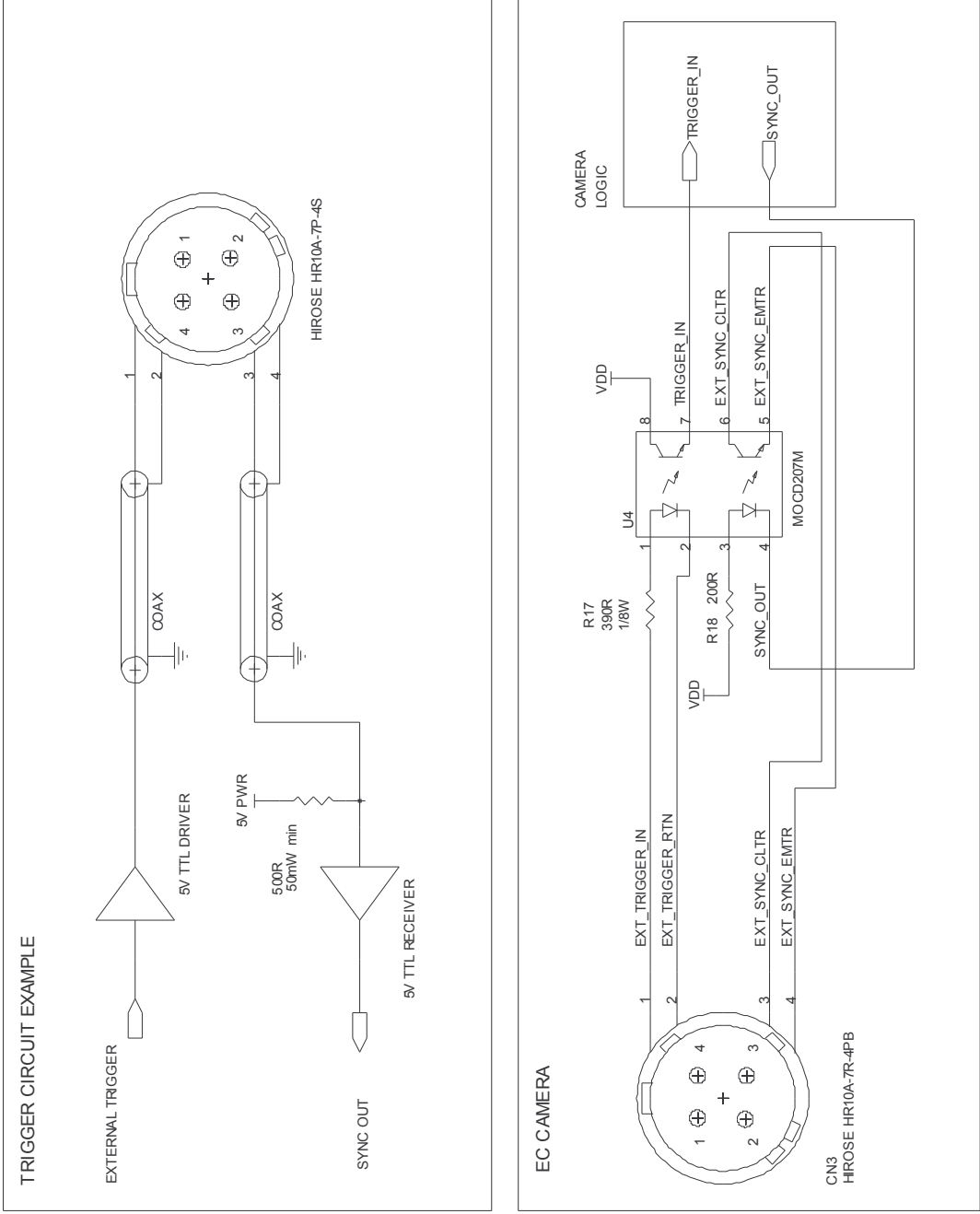


Figure 3: Trigger Circuit for EC750 and EC750C.

Cleaning the Sensor



DO NOT CONTACT CLEAN SENSOR UNLESS ABSOLUTELY NECESSARY.

Identifying Debris

Debris on the image sensor or optical components will appear as a darkened area or smudge on the image that does not move as the camera is moved. Do not confuse this with a pixel defect which will appear as a distinct point.

Locating Debris

Before attempting to clean the image sensor, it is important to first determine that the problem is due to debris on the sensor window. To do this you should be viewing a uniform image, such as a piece of paper, with the camera. Debris will appear as a dark spot or dark region that does not move as the camera is moved. To determine that the debris is not on the camera lens, rotate the lens independent of the camera. If the spot moves as the lens moves, then the object is on the lens -not on the image sensor- and therefore cleaning is not required. If the camera has an IR filter, then rotate the IR filter. If the object moves then the particle is on the IR filter not the sensor. If this is the case remove the IR filter carefully using a small flat head screw driver. Clean both sides of the IR filter using the same techniques as explained below for the sensor window.



DO NOT TOUCH ANY OPTICS WITH FINGERS. OIL FROM FINGERS CAN DAMAGE FRAGILE OPTICAL COATINGS.

Cleaning with Air

If it is determined that debris is on the sensor window, then remove the camera lens, and blow the sensor window directly with clean compressed air. If canned air is used, do not shake or tilt the can prior to blowing the sensor. View a live image with the camera after blowing. If the debris is still there, repeat this process. Repeat the process a number of times with increased intensity until it is determined that the particulate cannot be dislodged. If this is the case then proceed to the contact cleaning technique.

Contact Cleaning

Only use this method as a last resort. Use 99% laboratory quality isopropyl alcohol and clean cotton swabs. Dampen the swab in the alcohol and gently wipe the sensor in a single stroke. Do not reuse the same swab. Do not wipe the sensor if the sensor and swab are both dry. You must wipe the sensor quickly after immersion in the alcohol, or glue from the swab will contaminate the sensor window. Repeat this process until the debris is gone. If this process fails to remove the debris, then contact Prosilica.

Camera Installation

IEEE 1394 Computer Interface

Verify that the IEEE 1394 interface used with the camera is OHCI compliant. This is a commonly available product, but can also be purchased with the camera (Prosilica P/N 02-3000A)

If the IEEE 1394 port is a 4 pin socket, such as on a laptop computer, then this is a non-powered 1394 connection. If this is the case then an adapter is required, such as a hub, to provide power to the required 6 pin 1394 connection.

If the IEEE 1394 port is a 9 pin bilingual socket, then a 9 pin to 6 pin cable is required to adapt to the Prosilica camera.

IEEE 1394 Cabling

The 1394 camera sockets are 1394A 6 pin. These sockets accept signals as well as power. Verify that the cable and 1394 interface can supply power to the 6 pin connector.

The 1394A standard specifies a maximum cable length of 4.5m although longer cables are available. Contact Prosilica if longer cables are required.

Prosilica also provides a bracket and cables which are screw captivated.

Other Cabling

The camera can be triggered through the Trigger I/O connector. The compatible cable connector is specified in the Connections section of this document. Contact Prosilica to purchase compatible cabling.

Installing ProViewer for Testing

Unplug the camera 1394 connection prior to installing software.

The latest ProViewer software can be downloaded from <http://www.prosilica.com/support.htm>.

Run the ProViewer Installer. This will install the Prosilica Digital Camera drivers as well as the Prosilica Viewer application program.

Plug in the Prosilica camera via the 1394 port. Run the Prosilica Viewer Application. The camera should now be imaging. If not, see the Trouble Shooting section of this document.

Trouble Shooting

Check the Basics

- Is power available? The camera will get warm to the touch after a few minutes of operation. If not, the camera is not getting power. Verify the connections and cabling.
 - Cameras draw power from the Firewire Port.
 - 4-pin to 6-pin Firewire cables cannot source power. If your host computer has a 4-pin Firewire port, you must use a hub or adapter to supply power over the Firewire cable.

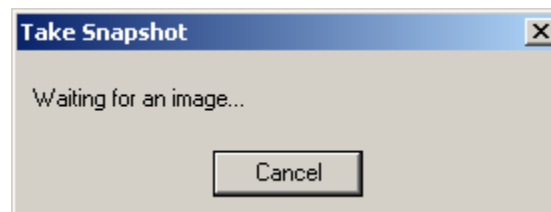
Test the Camera with the Prosilica Viewer

Download and install the Prosilica Viewer (from <http://www.prosilica.com/support.htm>).

- Can the Viewer find the camera? From the *Camera* menu, select *Open Camera*. Is the list empty? If so, proceed to **Driver Issues**.



- Is the image black? If so, check the optics. Check that lens iris is fully open. Check exposure time - in room lighting, an exposure time of 30ms should be adequate to see an image. If image is still black, contact Prosilica.
- Is the image white? From the *Camera* menu, select *Snapshot*. Did the snapshot complete?



- If the camera is in external trigger mode, a snapshot will not complete until a hardware trigger is received. We suggest you reset the camera controls: choose the *Factory Setup* configuration channel (under *Memory* in the *Controls* dialog).
 - Image data may fail to arrive at the computer if there is a problem with the driver. If you suspect a driver problem, proceed to **Driver Issues**.
 - Some Firewire ports built into motherboards cannot run at high data rates. In this case, you will need an OHCI Firewire card plugged into a PCI slot. We always recommend OHCI Firewire cards with TI chips.
- Is the image white, but you successfully took a white snapshot in the test above? Do you have a lens? Check your exposure time, offset, and gain controls. We suggest you reset the camera controls: choose the *Factory Setup* configuration channel (under *Memory* in the *Controls* dialog).

- Is the frame rate slower than expected for the current settings? If you are using Windows XP and Service Pack 2 or later, the Firewire drivers built into Windows will run at $\frac{1}{4}$ speed if any IEEE 1394B hardware is present. In this case, the solution is described by *Windows XP SP2 fix for 1394B* support notes (http://www.prosilica.com/support/support_notes.htm).
 - All cameras with a fiber optic interface are IEEE 1394B, therefore they have this problem on Windows XP Service Pack 2.
 - Your OHCI card (or hub, if present) may be an IEEE 1394B device.
- Does the image occasionally freeze? Test the camera with an alternate Firewire cable and card. If the problem persists, contact Prosilica.
 - An intermittent connection will result in the loss of image data, but you likely will not notice a problem when using the camera controls.
 - Some poorly designed OHCI chips do not perform well at high data rates. We always recommend OHCI cards containing TI chips.

Driver Issues

- Are you running Windows 2000 or Windows XP? Older versions of Windows are not supported.
- Does the camera show up in Windows *Device Manager* when the camera is connected, and disappears when the camera is disconnected? If Windows' built-in Firewire driver cannot see the camera, it will not be listed in *Device Manager*. There are two possibilities:
 - Check the driver for your Firewire card (the *OHCI 1394 Bus host controller*). Look at the driver properties. If the *Driver Provider* is not Microsoft, it has been replaced by an incompatible third-party driver. In this case, reinstall the Microsoft driver.
 - Some camera vendors replace Microsoft's OHCI driver with their own non-standard OHCI driver.
 - Some OHCI card vendors and some motherboard vendors provide non-standard OHCI drivers, usually to support IEEE 1394B ports.
 - There is a hardware fault somewhere between the OHCI Firewire card and the camera. The most likely candidates are the cable or power supply.

Camera Will Not Trigger

Check cabling and connections. See Figure 3 of this document. Use Prosilica Viewer program in trigger mode to eliminate possible software issues.