

**CG-7**  
**RGB Color Frame Grabber**

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# Communications Regulations

## FCC Statement

This equipment has been tested and found to comply with the limits for a Class B digital device in accordance with the specifications in Part 15 of FCC rules. See instructions if interference to radio or television reception is suspected.

## Radio and Television Interference

The equipment described in this manual generates, uses, and can radiate radio frequency energy. If it is not installed and used properly, it may cause interference with radio and television reception. This equipment has been tested and found to comply with the limits for a Class B digital device in accordance with the specifications in Part 15 of FCC rules. These specifications are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation.

You can determine whether your computer system is causing interference by turning it off. If the interference stops, it was probably caused by the computer or one of the peripheral devices.

If your computer does cause interference to radio or television reception, try to correct the interference by using one or more of the following measures:

- Turn the television or radio antenna until the interference stops.

- Move the computer to one side or the other of the television or radio.

- Move the computer farther away from the television or radio.

- Plug the computer into an outlet that is on a different circuit from the television or radio.

If necessary, consult Scion or an experienced radio/television technician for additional suggestions. You may find the following booklet helpful: *Interference Handbook* (stock number 004-000-00493-1). This booklet, prepared by the Federal Communications Commission, is available from the U.S. Government Printing Office, Washington, DC 20402.

Changes or modifications to this product not authorized by Scion Corporation could void the FCC Certification and negate your authority to operate the product.

# Getting Started

## Introduction

The CG-7 frame grabber that you have just received is a high-quality instrument suitable for use in a variety of scientific and industrial imaging applications such as video microscopy, autoradiography, and automatic process inspection. The primary function of the CG-7 is to capture RGB video frames from NTSC (or PAL) video sources or monochrome video frames from RS-170 (or CCIR) video sources such as CCD cameras. The CG-7 is supplied with Scion Image, a version of the popular image acquisition and analysis software package, NIH Image, developed at the National Institutes of Health. Scion Image is a slightly extended version of NIH Image that supports the additional features of the CG-7 as well as other Scion imaging boards. The CG-7 also comes with a Photoshop module for use with other software packages that support the Photoshop interface.

The CG-7 has numerous features, besides an exceptionally clear and sharp picture, that are particularly useful for demanding scientific use. The CG-7 is capable of a real-time video display rate of 30 frames per second in color and monochrome on the Macintosh monitor. It is also capable of capturing frame sequences to Macintosh system memory at 30 fps. The CG-7 can capture real-time RGB or monochrome images and can output video stream or frame buffer contents in RGB or monochrome. It can capture high resolution frames through horizontal over sampling and vertical interpolation to create 1280 x 960 (NTSC) or 1536 x 1152 (PAL) images. The CG-7 allows software control of the range of digitization of the video signal for each channel, which provides an analog offset and gain capability. Frame capture can be controlled by an external trigger signal. The CG-7 has two RS-232 serial ports, four digital input lines and four digital output lines that allow the monitoring and controlling of external events such as external shutter control. There are also two digital to analog converter outputs that may be used for process control applications. The CG-7 is also software switchable between NTSC and PAL video signals. Finally, the CG-7 has two dedicated open drain outputs that may be used with Scion Image to control several on-chip integrating cameras and activate the remote print function of video printers.

Please take a few moments to read through this manual before you begin using your CG-7 as it should answer some of the questions that you may have concerning your new frame grabber. Please contact us at Scion Corporation should you encounter difficulty at any time, or if you have any questions.

## Contents

You have received in addition to your CG-7 frame grabber: a CD-ROM, and an installation sheet. You may also have received a cable to connect a video source to the frame grabber board. All cables are optional.

The CD-ROM contains a short Read Me file, this manual, a compressed self-extracting archive containing the Scion Image application program along with complete documentation, and the Scion Series 7 Photoshop module. Should any items be missing, please contact Scion Corporation so that we can rush you the missing items.

## **System Requirements**

The CG-7 can be installed in any Macintosh with a full-sized PCI slot. This includes all currently shipping PCI Macintoshes - the Power Macintosh 7200, 7600, 8500, and 9500.

Any standard RGB NTSC (or PAL) or monochrome RS-170 (or CCIR) video source can be used with the CG-7. The NTSC (PAL) standard is a specification for color video signals and the RS-170 (CCIR) standard is a specification for monochrome video signals. The CG-7 board does not come standard with a cable. An optional cable can be purchased from Scion Corporation. The CG-7 cannot be directly connected to a composite color (NTSC or PAL) video signal. The color information in a composite color video signal will produce an unacceptable interference pattern in captured frames.

The CG-7 is designed for use primarily with RGB NTSC (or PAL) color cameras or monochrome RS-170 (or CCIR) CCD cameras. The CG-7 does not perform time-base correction on the incoming video signal. This means that the CG-7 may have sync difficulties with some consumer quality VCR's and camcorders that exhibit large time-base errors.

Optimal display performance will result when the CG-7 is used with a PCI display card. This will allow real-time video display of 24 bit color images using DMA data transfer. Use of motherboard video display may limit the maximum display window size when using the CG-7's DMA mode, or may require displaying images in less than 24 bit depth. Full size images may always be displayed in non-DMA mode, though this will result in a reduced frame rate.

# Installation

## CG-7 Circuit Board

Installing the CG-7 in your Macintosh is an easy process that should only take a couple of minutes. The first step is to remove the cover from your Macintosh. If a PCI card retainer is present, swing it aside so that the PCI slots are accessible. If you are unsure of the proper method for removing the cover from your particular Macintosh, consult your Macintosh user's manual. Once the PCI slots are exposed, select the PCI slot that you wish to use and, if necessary, remove the cover from the opening in the rear of the Macintosh case that corresponds to the slot.

At this point, make sure that you have discharged all static electricity from your body. A good way to discharge static electricity is to touch the Macintosh power supply. Remove the CG-7 frame grabber from its static shielding bag. Holding the CG-7 by its top edge, align the rear edge of the circuit board with the card guide corresponding to the selected slot. At the same time, align the CG-7's connector bracket with the slot opening. When the circuit board is aligned, carefully lower the CG-7 into the slot until the edge connector on the bottom of the board rests against the PCI connector. Check to insure that the board and the connector are appropriately aligned. Then press firmly on the top edge on the circuit board until the board mates with the connector. If excessive force is required to mate the connectors, remove the CG-7 from the Macintosh and try again. Once the CG-7 is inserted in the PCI slot, replace the PCI card retainer, if present, then replace the cover of your Macintosh.

## RGB Cable

If you bought the RGB cable then insert the fifteen pin connector of supplied RGB cable into the fifteen pin connector of the CG-7. The fifteen pin connector of the CG-7 is the upper of the two connectors at the rear of the CG-7 circuit board. When the connectors are mated, tighten the two screws on the cable connector. Connect the four BNC ends labeled R IN, G IN, B IN, S IN of the cable to the red, green, blue, and sync outputs of your camera. The connectors labeled R OUT, G OUT, B OUT, and S OUT may be connected to an external monitor or video printer. If you wish to connect a monochrome camera to the CG-7, use the red input and output connectors

## Scion Image Software

To install the Scion Image software package, insert the Scion CD-ROM and double click the Scion Image folder. To decompress the archive, double click on the archive icon and follow the directions. The archive will decompress into a Scion Image folder containing the program as well as documentation, sample macros, and convolution kernels.

There are four Adobe PDF documents describing the Scion Image package. 'NIH Image Manual' is the user's manual for the standard version of NIH Image. 'NIH Image Engineering' is a brief introduction to some of the technical aspects of imaging. 'Inside NIH Image' describes some of the structure of the standard Image program and discusses ways to modify it for custom applications. All of these documents apply to Scion Image as well. The final document, 'Mods to NIH Image' describes the extensions to the standard Image that are available in Scion Image and how to use them.

# Using the CG-7

## Introduction

Once the CG-7 circuit board has been installed, the supplied RGB cable connected to the CG-7 and your camera, and the Scion Image archive copied to your hard disk and decompressed, you are ready to begin using your CG-7. This section will describe some of the capturing capabilities of the CG-7 and Scion Image – such as color capturing, grayscale capturing, hi-res capturing, frame averaging, grabbing frame sequences, outputting images, and using the external trigger.

Once the Scion Image software has been started, by double clicking on the program icon, the Scion Image menus and windows will be presented. The commands that deal with the CG-7 and image capturing, such as basic color and grayscale capturing, hi-res capturing, frame averaging, capture of frame sequences, and outputting images, are contained in the 'Special' menu and the 'Stacks' menu.

## Color Capturing

Capturing color with the CG-7 takes a few steps to configure in the Scion Image software. The 'Video Control' dialog box under the 'Special' menu needs to be opened. 'Capture Color Images' needs to be enabled, this will allow the CG-7 to acquire color images. The 'Separate Sync' should be enabled when capturing color, this instructs the CG-7 to look for video sync information on the sync channel of the four source cable. The 'PAL CG-7' should be checked if you are connected to a PAL CCD camera. In this dialog box you can also change other various parameters of capture. 'Use External Trigger' enables the CG-7's external trigger capability. The 'Offset' and 'Gain' fields allow you to adjust the range of digitization of the CG-7's three analog to digital converters. By selecting R for red, G for green or B for blue, you can adjust the 'Offset' and 'Gain' for that particular source. The 'All' selection will show the average of R, G and B for the 'Gain' and 'Offset'. When the 'Gain' or 'Offset' is changed for this selection, all of the sources (R, G and B) will be adjusted based on each of their settings. Settings can be saved by choosing 'Record Preferences' in the 'File' menu.

When the 'Start Capturing' command, under the 'Special' menu, is selected, the program will continuously capture and display video frames. You may stop the continuous capture process at any time by either choosing the menu command again (which has changed to 'Stop Capturing') or by clicking in the 'Camera' window with any of the tools except the magnifying glass or the grabber. Once the capturing process has stopped, the captured frame is available for analysis or saving to disk.

## Grayscale Capturing

Grayscale capture with the CG-7 is as simple as color capture. The monochrome CCD camera can be hooked up to any of the four sources on the RGB cable. In the 'Video Control' dialog box make sure that the 'Capture Color Images' box is not checked. This will prevent the CG-7 from capturing color images. 'Separate Sync' must also not be checked. The 'PAL CG-7' should be checked if you are connected to a PAL CCD camera. The correct 'Channel' must be chosen for what source you have the camera connected to. The 'Offset' and 'Gain' will adjust the range of digitization of the CG-7 for the selected 'Channel'.

## **DMA Data Transfer**

Normally, the CG-7 operates by capturing a frame to its internal frame buffer, and having the frame transferred to the screen by the computer's processor. It is possible by this method to display grayscale images in real-time and 24 bit color images at a rate of anywhere from 5 to 15 frames per second depending on your computer configuration. It is possible to increase the display rate using Direct Memory Access data transfer.

In DMA data transfer, the CG-7 directly sends the frame to the video display circuitry with no intervention from the computer processor. This mode is turned on by the 'DMA Enable' check box in the 'Video Control' dialog box. If your monitor is connected to a PCI video card, DMA mode should allow real-time display on your monitor for all screen resolution and display settings. If your monitor is connected to the video connector of your computer's motherboard, then your display circuitry may not be fast enough to keep up with the CG-7. If your displayed image is scrambled then try reducing the size of the 'Camera' window, or try setting your display to a lower depth, say from millions to thousands of colors. Even if you make your window size smaller in DMA mode, a full-size image is always captured to the CG-7's onboard frame buffer and is available once live capturing is completed. Turning DMA mode off will always allow a full-size live capture, though at a lower frame rate.

## **Capture High Resolution Images**

'Capture High Resolution Image' is found in the 'Multi Frame Operations' dialog box from the 'Special' menu. This command will use horizontal oversampling and vertical interpolation to produce a single color or grayscale frame. The size of the captured image will be 1280 x 960 for NTSC and 1536 x 1152 for PAL. If you have a monitor that does not have this kind of resolution then use the grabber (hand) tool to scroll the image around.

## **Frame Averaging**

The 'Averaging Options' found in the 'Multi Frame Operations' command is useful for reducing random video noise. This command is found under the 'Special' menu. The number of frames to average can be specified, though if more than 128 frames are specified, there is a possibility of overflow in the arithmetic buffer. Frames can also be integrated (summed) using the 'Integration Options', with the results scaled to the range 0 to 255.

The 'On-chip' allows the use of integrating cameras. The specified number of frames will be integrated on the imaging sensor of the camera and the resultant image will then be captured by the CG-7. Please contact Scion for a complete list of currently supported integrating cameras. Optional cables will be required for all integrating cameras.

## **Sequence Capture**

The 'Make Movie' command is found under the 'Stacks' menu. It is used for capturing sequences of frames. Before the command is invoked, a region of interest must be drawn in the 'Camera' window using the rectangular selection tool. When the command is invoked, a dialog box will appear. This box will request the number of frames in the sequence and the time interval between frames in the sequence. When both values have been specified, the software will instruct the CG-7 to capture the specified number of frames at the specified time interval. After the command has completed, the sequence will be presented on-screen as a stack of frames.

## **Outputting Images**

At any time, when using the Scion Image software, an image window may be sent to the CG-7 for outputting by choosing the 'Print Video' command under the 'Special' menu. Choosing this command causes the image in the window to be copied to the CG-7's frame buffer, at which point the image will be converted into an RGB NTSC (PAL) video signal. An error message will be displayed if the selected image is greater than 640 x 480 (768 x 576) pixels, the maximum size of an image that can be output with the CG-7. If the CG-7 is connected to the print enable input of a compatible video printer, using one of the optional cables, the 'Print Video' command will cause the video printer to print.

The 'Print Video' command can be used to output a selected region of interest (ROI), instead of the entire image window. If a region of interest is selected, using the ROI tool, only the region of interest will be output by the CG-7. Note that an error will be generated, and an error message displayed, if the selected region of interest is larger than 640 x 480 (768 x 576) pixels, the maximum image size that the CG-7 can handle.

When a selected region of interest is smaller than 640 x 480 (768 x 576) pixels, or for that matter the entire image is smaller than 640 x 480 (768 x 576), the outputted image will be centered in the NTSC (PAL) video field. When the outputted image does not fill the entire video field, there will be a border around the image. This border will be set to Scion Image's current background color. The background color may be adjusted by changing the color of the eraser tool.

If 'Video Pass Through' is checked in the 'Video Control' dialog box then live video will be sent to the video out of the CG-7. If connected to an external RGB monitor, the preview will be live.

## **External Triggering**

The CG-7 has an external trigger capability that allows the synchronization of frame capture to external events. The external trigger feature is enabled in the 'Video Control' dialog box as discussed above. When this feature is enabled, the CG-7 will wait for a trigger event on its external trigger input before capturing a frame. A trigger event is defined as a falling TTL edge (that is, a transition from 5 volts to 0 volts). The trigger input is pin 9 of the 15 pin video connector. Once the trigger event has occurred, this input must be brought back to 5 volts before another trigger event can be recognized.

## Questions and Answers

Q: Why do I see a cross-hatched interference pattern in the captured image?

A: You are probably trying to capture images from a composite color (NTSC or PAL) camera. The CG-7 is designed to capture color images from an RGB video source. Composite color video has color information modulated on the grayscale portion of the video signal. This color information causes the distortion pattern in the captured image.

Q: I am trying to do a color capturing in Scion Image. I have an RGB camera connected to the CG-7 with the RGB cable, but I seem to be having difficulty getting the CG-7 to sync to the camera. What could be causing this?

A: You need to have the 'Separate Sync' box selected in the 'Video Control' dialog box. This dialog box is found under the 'Special' menu. Separate sync tells the CG-7 to look for sync information on the sync input of the RGB cable.

Q: When I try to capture a sequence of frames at video rate with Scion Image, the software tells me that the sequence is actually captured at a slower rate. Why can't I capture in real-time?

A: If your Macintosh is busy with some background task when you try to acquire a sequence of frames, it may not be able to capture real-time. Situations that may slow sequence acquisition include network activity such as AppleShare. Try turning off such background tasks while you are capturing sequences.

Q: Why is the image scrambled in DMA mode?

A: You probably are using your computer's onboard video display circuitry and it cannot keep up with the CG-7's data transfers. Try setting your display to a smaller number of colors or making your camera window smaller. Also, a PCI display card will allow real-time display of full-size color images.

Q: How can I capture images from a monochrome camera with the Scion CG-7?

A: Connect the monochrome camera to any of the sources of the supplied four source cable. Go to the 'Video Control' and uncheck the 'Capture Color Images' box. Also make sure that the 'Separate Sync' box is empty. Choose the 'Channel' to which the monochrome camera is connected to.

## Optional Cables

The CG-7 comes with a Cab-RGB-CG7 cable which has RGB and Sync inputs and outputs. A number of additional cables are available for connecting to other sorts of cameras and devices:

Cab-RGBAux-CG7 - This cable has RGB in via four BNC connectors, RGB out via four BNC connectors, an integration line to connect to Dage cameras, an external trigger line, and a remote line for video printers.

Cab-Dage330S-CG7 - This cable contains a 9-pin connector for RGB input from the Dage DC330 color camera, a 9-pin connector for gating and serial control to the DC330, RGB and Sync outputs, an external trigger line, and a remote line for video printers.

Cab-SVHS-Adp – This adapts any BNC terminated cable to an SVHS connector.

Cab-Cohu-Adp – This adapts the Cab-RGBAux-CG7 integration cable for Cohu 491X cameras.

Optional cables are available direct from Scion. We can also manufacture custom cables for use with video sources with non-standard connectors.

# Software Support

## Scion Image

Scion Image is an image processing and analysis program for the PC. It can acquire, display, edit, enhance, analyze, print, and animate images. It reads and writes TIFF and BMP files, providing compatibility with many other applications, including programs for scanning, processing, editing, publishing, and analyzing images. It supports many standard image processing functions, including contrast enhancement, density profiling, smoothing, sharpening, edge detection, median filtering, and spatial convolution with user defined kernels up to 63x63. Scion Image also incorporates a Pascal-like macro programming language, providing the ability to automate complex, and frequently repetitive, processing tasks.

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# Specifications

## Imaging

Digitizing Speed:	1/30 (1/25) second
Pixel Depth:	8 or 24 bits
Image Resolution:	640 x 480 (768 x 576) pixels normal mode 1280 x 960 (1536 x 1152) oversampling mode
Pixel Aspect Ratio:	1 to 1

## DMA Display

Display Depths:	24, 16, 15, 8 bits
Maximum Transfer Speed:	132 Mb/s peak
Field Control:	both, even, or odd

## Capturing

Capture Mode: field or frame  
Initial Field: even or odd

## Memory

Frame Buffers (24 bit):	2
Frame Buffers (8 bit):	6
Input Look-up Tables:	1
Output Look-up Tables:	1
DMA Look-up Tables:	1

## Video Inputs

Video Input Level:	1 volt peak to peak
Video Signal Type:	NTSC (PAL) RGB, or RS-170 (CCIR) monochrome
Input Sources:	1 RGB or 4 monochrome
Input Resistance:	75 ohms
Video Gain Factor:	3.75
Digitizing Range, Bottom:	0 to 5 volts per channel
Digitizing Range, Top:	0 to 5 volts per channel

## Video Output

Video Output Level:	1.0 volts peak to peak
Video Signal Type:	NTSC (PAL) RGB, or RS-170 (CCIR) monochrome
Output Sources:	1 RGB or 3 monochrome
Output Resistance:	75 ohms

## I/O

Digital Inputs:	4 TTL level
Digital Outputs:	4 TTL level

Analog Outputs: 2, 0 to 10 volts  
Auxillary Outputs: 2, open drain  
Serial Ports: 2, RS-232C  
External Trigger: 1, falling edge triggered

## **Connectors**

Video Connector: 15 pin HD D shell  
Utility Connector: 26 pin HD D shell

## **General**

Installation: 1 PCI slot (full size)  
Operating Conditions : 0 to 70° C  
Power: 15 watts maximum

# Warranty and Support

## Limited Warranty

Scion Corporation ("Scion") warrants this CG-7 against defects in materials and workmanship for a period of one (1) year from the date of original purchase. If you discover a defect, Scion will, at its option, repair, replace, or refund the purchase price of this CG-7 to you, provided you return it during the warranty period, with transportation charges prepaid, to Scion. Each CG-7 returned for warranty service must bear a Return Materials Authorization number, which may be obtained from Scion, on the outside of the shipping box.

This warranty does not apply if the product has been damaged by accident, misuse, or misapplication; if the product has been modified without the written permission of Scion; or if the CG-7 serial number has been removed or defaced.

THE WARRANTY AND REMEDIES SET FORTH ABOVE ARE EXCLUSIVE AND IN LIEU OF ALL OTHERS, WHETHER ORAL OR WRITTEN, EXPRESS OR IMPLIED. SCION SPECIFICALLY DISCLAIMS ANY AND ALL IMPLIED WARRANTIES, INCLUDING, WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. NO SCION DEALER, AGENT, OR EMPLOYEE IS AUTHORIZED TO MAKE ANY MODIFICATION, EXTENSION, OR ADDITION TO THIS WARRANTY.

Scion is not responsible for special, incidental, or consequential damages resulting from any breach of warranty, or under any other legal theory, including but not limited to lost profits, downtime, goodwill, and damage to or replacement of equipment and property.

Some states do not allow the exclusion or limitation of incidental or consequential damages or exclusions of implied warranties, so the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights, and you may also have other rights that vary from state to state.

## Money-Back Guarantee

You may return your CG-7 to Scion Corporation, within 30 days of the date of invoice, for a full refund of the purchase price. All returns must be in as new condition and be returned with all supplied accessories in the original shipping box. All returns must bear a Return Materials Authorization number, which may be obtained from Scion, on the outside of the shipping box.

If payment has already been made at the time you return your CG-7, a cash refund will be made within 30 days of Scion's receipt of the CG-7. If payment has not been made at the time Scion receives your CG-7, a credit memo will be issued against the outstanding invoice within 15 days of Scion's receipt of the CG-7.

## Service Information

Should you determine that your CG-7 requires service, it should be returned directly to Scion Corporation for repair. Before returning your CG-7, call Scion for a Return Materials Authorization number. This number should be printed on the outside of the

shipping carton. Carefully pack the CG-7 in its original shipping materials and include a short note describing the problem. You are responsible for all shipping costs to Scion and for insuring the returned unit. Scion will commit its best efforts to repairing your unit within 5 days of receipt of the unit at our factory.

If your CG-7 is under warranty, it will be repaired or replaced at no charge. Scion will pay for shipping your CG-7 back to you by ground transportation. You may, at your cost, request faster transportation. If your CG-7 is not under warranty, there will be a minimum repair charge of \$150. If the repair cost is greater than \$150, you will be called to approve the necessary work. You must provide, in advance, appropriate payment information (e.g., approved purchase order, credit card number) for non-warranty repair work.