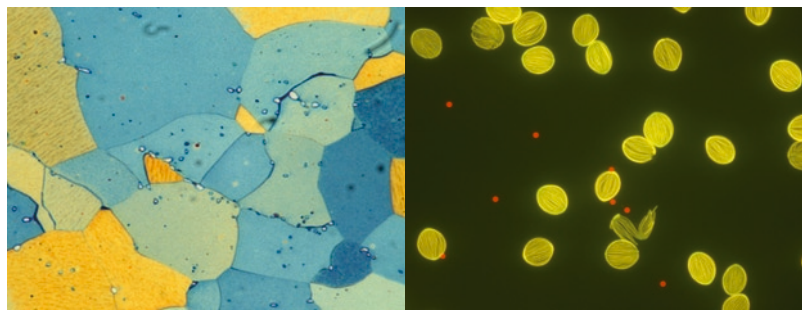
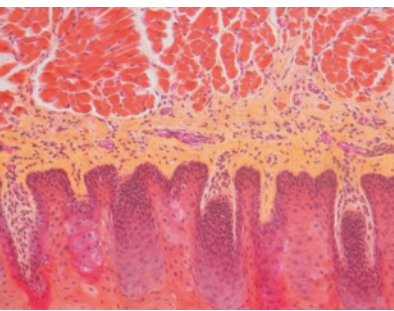


## ProgRes® C14<sup>plus</sup>

Proven Image Quality and Precision in True Color



### Versatile Camera for Highest Requirements

The ProgRes® C14<sup>plus</sup> is a multi-purpose camera to handle most demanding imaging tasks. Its modern 1.4 megapixel CCD sensor allows for a smooth and expedited workflow through fast frame rates.

Achieve first-class results in image presentation and evaluation: using Microscanning technology, the camera generates images up to 12.5 megapixel with even the tiniest details rendered accurately.

For high-grade image analysis or documentation, active sensor cooling and analog gain provide ideal prerequisites, warranting high sensitivity and broad dynamic range.

### Colors Rendered Without Interpolation Effects

The ProgRes® C14<sup>plus</sup> provides genuine color reproduction in proper detail – a feature you can rely on. Its patented Color-Co-Site-Sampling records the color information of your specimens exactly in three color channels for an absolutely real color image.

### Easy to connect

Equipped with IEEE1394 Firewire™ and G-Mount, the camera conveniently connects to any computer and microscope. The CapturePro image acquisition software included in delivery offers comprehensive functionality and intuitive operation.

### Versatile Application

The ProgRes® C14<sup>plus</sup> is suited for all contrast methods in light microscopy. Microscanning provides express overview images and high-resolution detail images – captured with identical optics setting in stereo microscopy or macroscopy.

### Benefits

- True color images without interpolation
- Perfect image quality and highest image resolution
- High sensitivity
- Ease of operation with comprehensive functionality
- Safe investment

# ProgRes® C14<sup>plus</sup>

Proven Image Quality and Precision in True Color

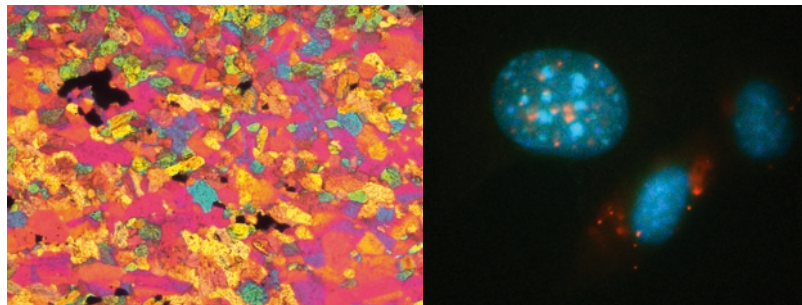
## Specifications

CCD sensor	2/3" 1.4 Megapixel Color CCD, active area: 8.8 mm × 6.6 mm	
Sensor resolution	1360 × 1024 pixel	
Pixel size	6.45 µm × 6.45 µm	
A/D conversion	3 × 14 Bit RGB	
Pixel clock	12 MHz   24.5 MHz	
Dynamic range	69 dB   67 dB (measured at 10 ms exposure)	
Max. exposure	600 s	
Analog gain	1× ... 8×	
Frame rate	32 fps (at image size 680 × 512)	
Image resolution	1360 × 1024 (Progressive Scan & CCSS) 2720 × 2048 (Microscanning & CCSS) 4080 × 3072 (Microscanning & CCSS)	453 × 340 and 272 × 204 (Binning) 680 × 512 and 340 × 256 (HFRM) <i>CCSS = Color-Co-Site-Sampling</i>
Cooling	Peltier, fan, hermetically sealed sensor	
Digital interface	IEEE1394a Firewire™	
Optical connection	C-Mount (0.63× TV adapter recommended)	
Trigger	Trigger-In and Trigger-Out for synchronization with external devices	
Tripod thread	Dual thread 3/8" and 1/4"	
Voltage supply	8 ... 33 VDC (via IEEE1394 connector)	
Power consumption	8 W	
Ambient conditions	Temperature: +5 °C ... +35 °C Humidity: 5 % ... 80 %, not condensing	
Dimensions (L × W × H)	145 mm × 93 mm × 123 mm	
Weight	800 g	
Capture software	ProgRes® CapturePro (TWAIN & Stand-Alone)	
Computer requirements	PC: Microsoft Windows® 2000/XP/Vista Mac: Apple Macintosh® OS X 10.4 or higher 3 GHz CPU, 1 GB RAM, 64 MB graphics IEEE1394 Firewire™ (OHCI compliant)	

It is our policy to constantly improve the design and specifications. Accordingly, the details represented herein cannot be regarded as final and binding.

### Fields of Application

- Life science
- Genetics
- Microbiology
- Pathology
- Cell biology
- Pharmacy
- Material science
- Metallography
- Mineralogy
- Chemistry
- Macrophotography
- Forensics



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## Why ProgRes C14?



The ProgRes C14 technical data speak for themselves: up to 12 Megapixels programmable resolution, cooled CCD, 14bits AD conversion, 66dB dynamic range, IEEE1394a FireWire interface, MS Windows and Apple Macintosh support, ... but let's go a little bit into detail:

### Contents:

1.	FireWire & Connectivity .....	1
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## 1. FireWire & Connectivity

*That's what the others provide:*

Most digital cameras feature proprietary interfaces or need framegrabber boards. Those technologies provide acceptable data transfer rates but at the same time poor computer connectivity. Working with one camera in connection with several PCs thus makes it necessary to purchase several PCI boards or to move the board from one PC to another. Often you need two cables for data and power.

*That's what makes the ProgRes C14 special:*



The ProgRes C14's OHCI compliant IEEE1394 FireWire interface provides a „plug and play“ performance. One single FireWire cable transfers data and supplies power for the ProgRes camera. Many Windows PCs feature FireWire as a standard interface and standard FireWire PCI boards are available for low prices, even as PC cards for notebooks. All Macintosh computers feature FireWire interfaces as standard, the Apple PowerBooks even with power supply.

More: for macro-photography the ProgRes C14 features a flash sync jack and two documented interfaces for external control and data transfer are also available.

*Benefits for the user: one single cable = most easy connectivity, flexibility, mobility.*

## 2. Microscanning (also known as „Pixelshifting“) and Programmable Resolution

*That's what the others provide:*

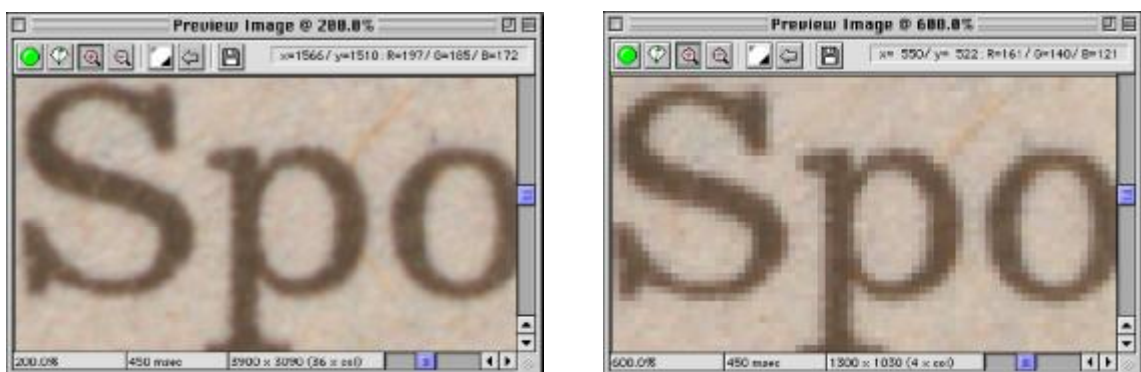
Fixed chip cameras limit the image resolution to the sensor used. A small sensor with a low pixel number has a low resolution and output image sizes. To increase the image output size you can „increase“ resolution by interpolation. By interpolation no new optical image information is generated, you only blow up the data, interpolation errors may generate artifacts. Details that have not been optically recorded remain lost. Alternatives: Increasing the chip size. Problem: by increasing chip size (i.e. area, not necessarily pixel number) production defects will increase exponentially and thus waste and thus costs. Next guess: Keeping chip size small but increase pixel number. Problem: a small sensor with a high pixel number has limited light sensitivity only - resulting in low SNR and thus limited image quality.

*That's what makes the ProgRes C14 special:*

The Microscanning technique used in the ProgRes cameras successfully for more than ten years (!!) increases the optical resolution of small sized sensors without loss of sensitivity. The user can set the camera's resolution to fit his needs: low resolution for emails, quick snapshots, poor microscope optics or high magnification microscope lenses - high resolution for detailed images appropriate for image analysis, documentation, high quality optics, low magnification microscope lenses.

The images below show a part of a photographed newspaper (lens: Rodenstock Apo-Rodagon 50mm, f8, distance approx. 600mm, showing a detail 5mm wide). Left image is captured in max. resolution (36-Shot, 12.1MPix) shown @200% screen enlargement, in comparison to the right image with standard resolution (1.3MPix) shown @600% screen enlargement.

Taking into account Multi-Shot modes and the binning modes the ProgRes C14 provides in total 9 resolutions ranging from 260x206 pixels up to 3900x3090 pixels. This is unrivalled in its class of 1.3MPix CCD digital cameras.



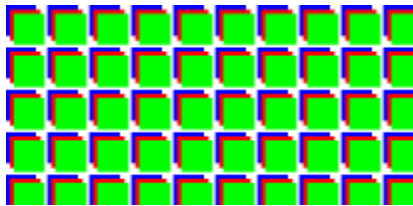
The only drawback to mention is, that the resolution-enhancing Microscanning technique can only be used with still objects or absolutely non-moving specimen.

*Benefits for the user: adaptable resolution from 1.3 up to 12.1 Megapixels not interpolated.*

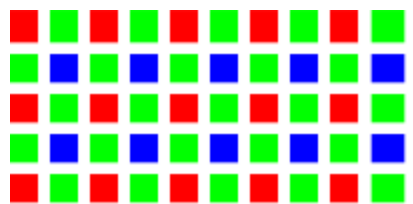
### 3. Microscanning (also known as „Pixelshifting“) and Color-Co-Site-Sampling

*That's what the others provide:*

CCD sensors cannot recognize colors. They can detect only differences in brightness. For recording color images digital photography offers two options. First of all, you can compose every shade of color from the three basic colors red, green and blue (RGB).



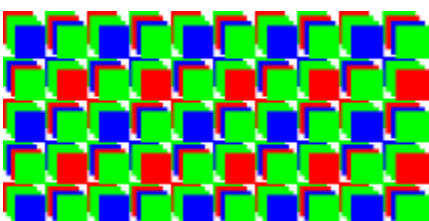
Option 1: Color filter wheels. Cameras with colored filter wheels capture three images of the same object, each time placing a red, green or blue color filter in front of the sensor. The final color image is composed from those three monochrome images. Advantage: the full sensor resolution is used. Major drawback: you cannot capture moving objects.



Option 2: On-Chip color mosaic masks. This type of cameras features CCD sensors where tiny red, green and blue color filters are placed directly on the individual pixels. Most commonly used is the „Bayer pattern“ where rows of alternating red and green pixels rows of alternating blue and green pixels (see illus. on the left). Drawback: you need at least three monochrome pixels for composing one full color pixel, what is done automatically by the camera software. So actually the resolution should be only one third of the full sensor resolution. Usually the full sensor resolution in full color is restored by interpolation algorithms. This sometimes may result in false color rendition or artifacts such as color moirés when capturing certain, fine structured objects. The main advantage of this technique: this is the only possible way to capture color images from moving objects and thus well established in digital photography.

*That's what makes the ProgRes C14 special:*

**1-Shot mode:** The ProgRes C14 camera is equipped with an on-chip color mask and thus enables the user to capture moving objects - freezing movement with minimum exposure time of 1/4000s if necessary. This we call 1-Shot technique. Full color information for each of the sensor's pixels is calculated by a very sophisticated interpolation algorithm. Here we can count on our experience with "eyelike" digital camera backs for professional studio photography, where demands for perfect color rendition are very high.



**Multi-Shot modes:** Microscanning provides additional advantages by overcoming problems that may arise with interpolation. Let's have this explained with the 4-Shot mode as an example: in the ProgRes camera's 4-Shot mode four images of the object are captured. In between of each of the four captures the complete CCD sensor with its color mask is moved or shifted a pixel's step by step in a square pattern. Thus one image point, that is captured e.g. by a green pixel in the first image, will be captured successively by a red, green and blue pixel in the subsequent three images.

The final image is then combined from four single images laid on top of each other. The major advantage is, that by this technique you are recording full RGB color information for each of the sensor's pixels and thus do not need to interpolate two of three colors. In comparison to the 1-Shot mode you could say that in principle you use full color pixels instead of one-color monochrome pixels (with the need of subsequent interpolation). The other Multi-Shot

modes 16-Shot and 36-Shot work the same way, regarding the recording of color information - only the resolution is different. These techniques we call Color-Co-Site-Sampling.

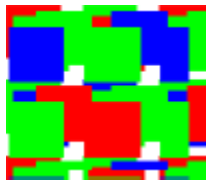
The 9-Shot mode is a compromise between 1-Shot and 36-Shot: The final image is composed of 9 single images, where interpolation and Microscanning are combined. The result is a high-resolution and high-contrast image that takes less time than the 36-Shot mode but lacks the fine details you will record with the 36-Shot mode. It is suited for poorly structured objects or specimens.

Again, the only drawback is, that the color enhancing Microscanning technique cannot be used with moving objects or specimen.

*The benefits for the user: Exact color reproduction thereby avoiding interpolation induced artifacts such as color moiré.*

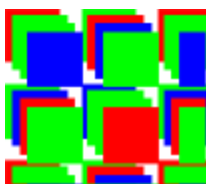
#### 4. Microscanning and Scanner Calibration

*That's what the others provide:*



Few digital cameras feature kind of Microscanning technique using piezoelectric elements for shifting the sensor. As you might guess the shifting must be performed very precisely, i.e. with a precision of approx. 0.5 microns. This is an important prerequisite for combining the individual Multi-Shot images to the final hi-res image. Responsible for the shifting of the sensor are piezoelectric elements. These elements react to an applied voltage by a slight deformation which then is used for the shifting. The trick is to apply the right voltage to produce a certain displacement of the sensor. The trouble with such elements is, that they are susceptible for ambient conditions such as temperature and humidity. Thus the displacement can slightly differ from debit when the scanner is operated under ambient conditions very different from the conditions the scanner has been calibrated for. This will normally result in visible defects in the final compound image. Under normal conditions the manufacturer's calibration will work fine.

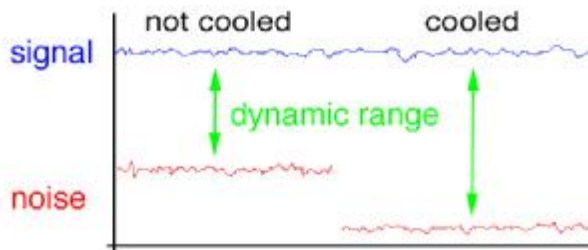
*That's what makes the ProgRes C14 special:*



The ProgRes C14 camera features a calibration procedure for the Microscanning technique. This can be utilized in case the user should notice loss in image quality when operating the camera in Multi-Shot mode under „extreme“ ambient conditions. With all cameras a calibration slide is supplied. Simply put it under the microscope, set focus and exposure, press two buttons in the camera software and that's it. The calibration is done automatically by the camera and the calibration data will be memorized. Remember that normally you do not need to re-calibrate the camera but you are able to perform the calibration by yourself if it becomes necessary.

*The benefits for the user: Perfect operation of the piezo-driven scanner for perfect images.*

## 5. Cooling and Sensor Capsuling

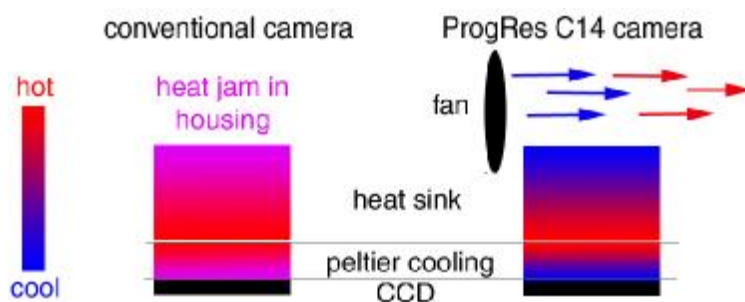


An effective sensor cooling is essential to reduce noise and thus increase image quality, to improve the dynamic range and to allow for long integration times.

*That's what the others provide:*

Most cooled CCD cameras feature an electric cooling mechanism. Heat is removed from the CCD sensor by a peltier device. One side of the peltier device is cooled while the other heats up. The heat from the hot side is abducted to a heat sink. The heat sink itself in result becomes more and more hot, the heat usually is abducted by the air surrounding the heat sink and by the camera's housing. When the housing heats up too much and no hot air from inside is exchanged by cooler outside air, a heat jam may occur. Another possible by-product of cooling: the cooling below ambient temperature makes the CCD sensor susceptible to condensation of air humidity.

*That's what makes the ProgRes C14 special:*



The ProgRes C14 uses electric cooling by a peltier device and heat sink in combination with an additional fan. The fan is used to remove heat more effectively from the heat sink by continuously replacing the warm air in the housing by colder air from the housing's surroundings.

A CCD cooling of approx. 10°C to 15°C below ambient temperature is achieved this way. In addition to this 2-fold cooling mechanism the ProgRes is designed in such a way, that electronic components generating heat (e.g. interface electronics) are separated from the sensor. The overall power consumption of the sensor electronics has been kept as low as possible which also reduces heat generation to a minimum. In total, the ProgRes C14 is cooled more effectively than digital cameras with comparable peltier cooling mechanisms, thereby resulting in a typical dynamic range of 66dB.

The image on the left compares the standard peltier cooling mechanisms. In conventional cameras, where no fan is used, heat may be trapped in the camera's housing resulting in ineffective CCD cooling. In the ProgRes C14 a fan removes heat from heatsink and housing.

Sensor capsuling: The condensation problem is solved by sealing the complete CCD sensor and filling the sensor capsule with a dried, protective gas. Thus no condensation can occur. The sensor capsuling has another great advantage: the CCD sensor is completely protected from dust and other pollution from external sources. The IR cut-off filter, which is integrated part of the sensor capsule, is placed well in front of the CCD surface and thus additionally protects

from image flaws caused by dust that sometimes and occasionally seems to be magnetically attracted to optical devices.

*The benefits for the user: An effective cooling results in high dynamics, low noise, long exposure times and the sensor capsule protects the CCD sensor from dust and condensation.*

## 6. AD-Conversion Methods

*That's what the others provide:*

AD-conversion in most cameras takes place in interface boards inside the computers. This keeps the camera small, but there is a long way for the analogue image data signal from the sensor to the digitizer board and thus much chance that noise will disturb the signal.

*That's what makes the ProgRes C14 special:*

The AD-conversion takes place in the ProgRes C14 camera itself, near the sensor. By this means electronic noise and other electromagnetic interferences are kept to an absolute minimum.

*The benefits for the user: AD conversion in the camera head reduces noise thereby improving dynamics.*

## 7. Automatic Exposure Metering

The ProgRes C14 features an automatic exposure metering tool that evaluates the image area's exposure and sets the exposure time accordingly. The automatic function achieves excellent results under most imaging and illumination conditions. The automatic exposure function is especially worthwhile for fluorescence applications where there is no time to set the exposure time manually by trial and error. A simple click on a button does the measuring and setting of the correct exposure time automatically.

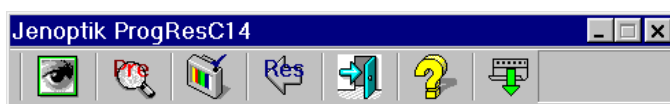
## 8. Software

*That's what the others provide:*

Few cameras are delivered with specialized software, some only with software for a certain computer operating system, some provide highly sophisticated and expensive features, others lack of basic image processing functionalities.

*That's what makes the ProgRes C14 special:*

Just a few keywords for a start: ProFile, TWAIN, Photoshop, Windows, Macintosh, automated functions, aiding tools, AOI, calibrations, gradation, color, ...



The ProgRes C14 camera software comes for Microsoft Windows 98/98SE/NT4.0/2000 as a native TWAIN plugin, support for XP will follow soon. For Apple Macintosh OS 9 and better currently a stand-alone application is avail-

able, a Adobe Photoshop plugin will follow in the beginning of 2002, OS X support is in preparation. This guarantees that the ProgRes C14 camera software can be run on nearly all relevant computer configurations. The TWAIN plugin concept makes it possible to integrate the camera software in most available third party image analysis, processing and archiving software.

The ProgRes C14 camera software controls the camera and provides many useful functions:

- ü pretty fast live image, that makes microscope control as easy as with a video camera,
- ü focussing aid,
- ü definition of a area of interest,
- ü easy whitebalancing by a mouse-click,
- ü gradation curves and color balance,
- ü sophisticated color and scanner calibration tools,
- ü white shading for compensating lens vignetting,
- ü black shading (also known as black reference image) for compensating pixel anomalies and allowing for integration times up to 10 minutes (!) in connection with the cooling mechanism,
- ü future software upgrades and improvements will be free for download on our website,
- ü ...

A software development kit (SDK) for integrating the ProgRes camera software seamlessly in other applications is also available.



NEW! ProFile: In cooperation with dhs Dietermann & Heuser Solutions GmbH, Germany, we now offer an easy to operate image database named „ProFile“ together with our camera software. ProFile comes as a fully functional 14 day evaluation version, that can be fully licensed within or after the evaluation period by phone, email....

ProFile basically is an modular image database where the user can import, modify and file images, text and information from various sources. A TWAIN module connects the ProgRes C14 camera to the ProFile image database. Based on an MS Access database structure ProFile is flexible, programmable and easy to handle (“drag & drop”). The modular concept of ProFile makes possible to supplement other modules from dhs for professional image analysis, automated reporting, measurement, and much more applications. Due to the modular concept the user need to purchase only the applications he really needs for simplifying his work.

*The benefits for the user: A comfortable software for easy capturing perfect images.*

## 9. Direct comparison with two outstanding competitors

ZEISS axiocam:

- + monochrome version available
- + full integration in motorised ZEISS microscopes
- poor connectivity due fiber optic cable and proprietary interface board with external power supply
- ineffective cooling system, camera can get real hot
- „microscanning“ cannot be calibrated by user
- camera software rather uncomfortable
- camera software axiovision expensive
- no comparable Apple Macintosh version

NIKON DXM1200:

- + full integration in motorised NIKON microscopes
- + straightforward software
  
- poor connectivity due proprietary interface board with external power supply
- no cooling
- highest resolution achieved with 9-Shot only; poor image quality is to be expected
- no calibration possible; visible artifacts (pattern) when capturing homogeneous objects (!) according to trustable sources of information
- no service/support by NIKON/Japan; camera defects are compensated for by price reductions
- no Apple Macintosh version; MS Windows NT/2000?

**Therefore ProgRes C14 is your Camera of Choice  
for Scientific Digital Imaging!**

