

BERTL

HIGHLY RECOMMENDED

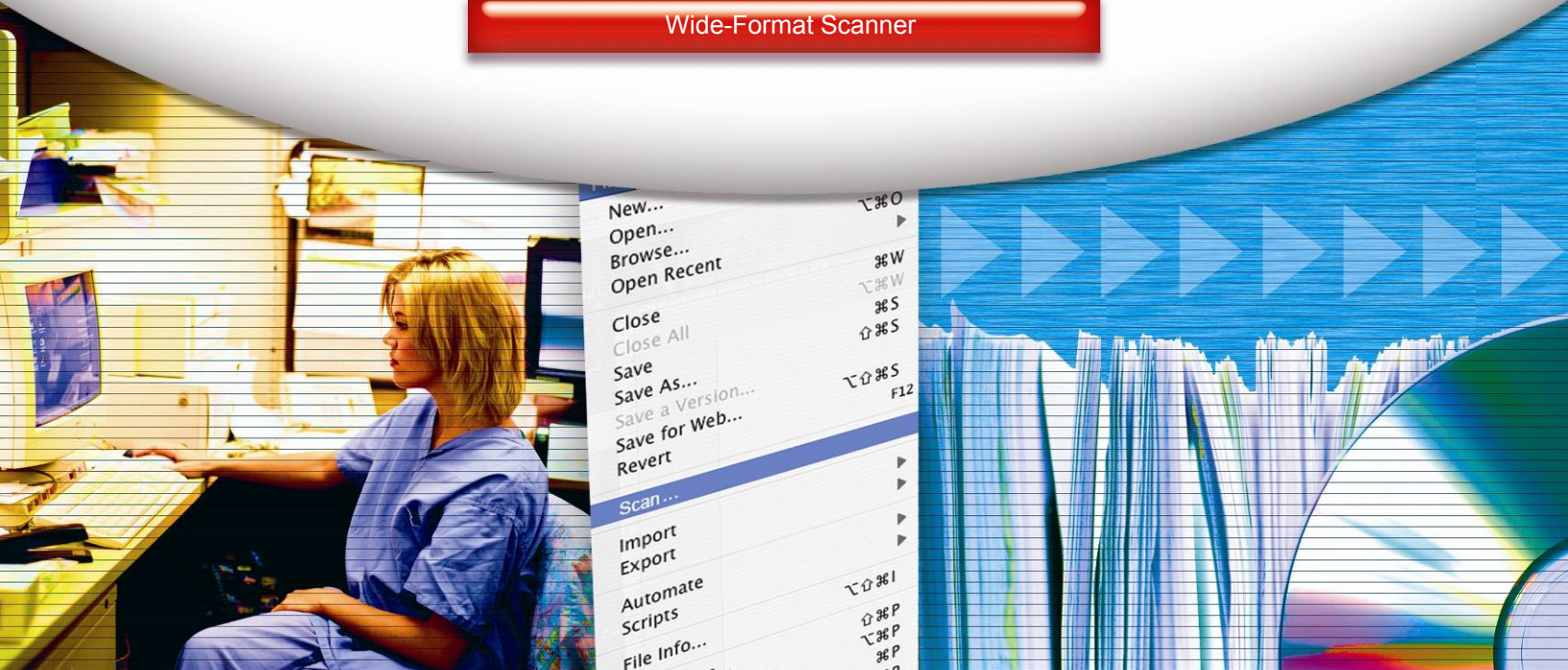


Graphtec CS610



4.5–9 ips monochrome; 1.5–3 ips color

Wide-Format Scanner

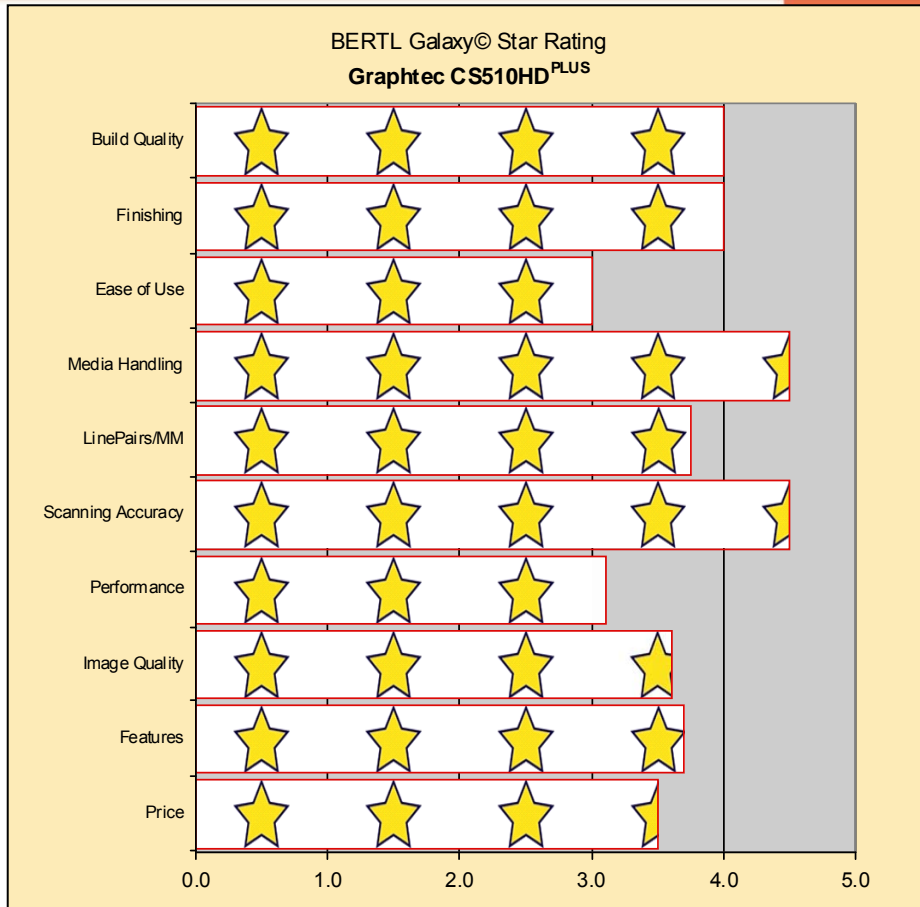


100% INDEPENDENT ANALYSIS

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WIDE-FORMAT



ABOUT BERTL'S GALAXY© STAR RATING

BERTL understands how difficult it is to choose one office-imaging device over another and strives to make this an easier choice for the consumer. That said, how does a consumer decide between two or more devices that carry the same BERTL 3-, 4-, or 5 star rating?

Category Criteria:

Build Quality: An analysis of the construction quality of the major components that the user must interact with on a regular basis (e.g., paper tray, access covers, suppliers, etc.)

Finish: The productivity penalty (punch, staple, booklets) based on tests and finishing specifications and effectiveness based on a sliding scale benchmark when compared to that of other finishing systems found on other devices.

Ease of Use: Ease of maintenance (adding paper, toner, misfeeds, cleaning) and ease of using the documentation, help, control panel, print drivers, and client utilities analysis when compared to a sliding scale benchmark on the ease of use of other devices.

Media Handling: Throughput specifications and evaluations based on a sliding scale benchmark when compared with the handling of special media (e.g., oversize, thick, or coated stock) found on other devices.

Line Pairs/mm: A measure of how many lines the scanner can resolved over an inch or mm. The higher the better.

Scanning Accuracy: A measure of both the horizontal and vertical scanning precision and color accuracy if applicable.

Performance: A overall performance index performed over a variety of different modes. E.g. Black& White performance, color performance, graytone performance etc..

Image Quality: The quality of business color images (text, dot, line, halftone, and solid quality) based on tests and a subjective rating on the quality of continuous tones (photos) when compared to a sliding scale benchmark based on the continuous tone quality of other devices.

Features: The feature set compared to a sliding scale benchmark based on the feature set found on other devices.

Price: MSRP of a system configured with network printing, copying, scanning, and media trays/rolls (wide format) configuration.

Graphtec Corporation released the Graphtec CS610HD^{PLUS} in December 2004 as a full color and monochrome solution for large-format scanning and copying. It is a 42" wide, high-speed scanner. The CS610HD^{PLUS} is part of a family of three different 42" wide scanners all based on the same scanning technology and positioned with different prices and specifications to serve specific industry needs.

The CS610HD^{PLUS} is a high-end performance color scanner for the reprographic, graphic arts, photographic, corporate graphics, and GIS market.

GRAPHTEC HISTORY

Graphtec Corporation was established as Watanabe Instruments in Tokyo in 1949. The company was formed in order to specialize in the design and manufacture of analog recording instruments, and released its first product, an EO-type pen oscillograph, in 1952. Graphtec rapidly became an industry leader, both in Japan and around the world.

The company was quick to venture into new fields, and introduced its first plotter in 1961. With the growth of computing in the 1960s, Graphtec branched out into computer-aided design (CAD), and today offers a wide range of computer input devices, such as digitizers and wide-format scanners, and output devices such as pen plotters, direct imaging plotters, cutting plotters for the sign and apparel industries, thermal printers, thermal-transfer printers, and inkjet printers.

In 1991 Graphtec was awarded ISO9001 Quality Management System Approval Certificate.

GRAPHTEC CS610HD^{PLUS}

The CS610 HD^{PLUS} BERTL tested is in the high end of the 42" wide line of scanners and comes in two versions: a *Base* version and *Pro* version. Both versions share the same hardware platform and can easily be upgraded in the field by a trained IT professional. The main differences between the two versions are the color scanning speed, maximum resolution, and price. All other features are identical.

The CS610HD^{PLUS} includes the scanner, scanner stand, Scanning Master 21+ scanner software, and three-year on-site warranty in the United States and Canada, and a parts and labor warranty elsewhere in the world.

The CS610HD^{PLUS}'s three-year on-site warranty is the longest we have seen provided by wide-format scanner vendors.

Device Features Summary

List Price	\$19,995 (Base version)/ \$20,995 (Pro version)
Monochrome Speed	4.5.0 ips* at 200 dpi (Base version)/ 9.0 ips* (Pro version) at 200 dpi
Color Speed	1.5 ips at 200 dpi (Base version)/3.0 ips (Pro version) at 200 dpi
Scanning Method	42-bit CIS technology
Maximum Resolution	800 dpi (Base version)/ 9,600 dpi (Pro version)
Document Size	Paper width up to 42"/ 1,067mm; unlimited scan length
Maximum Media Thickness	Up to 0.8"/20 mm
Interface	Ethernet/USB 2.0

Note: Price includes the scanner, scanner stand, and Scanning Master 21+ Scanning software, plus a three-year on-site warranty in the United States.

** ips = inches per second.*

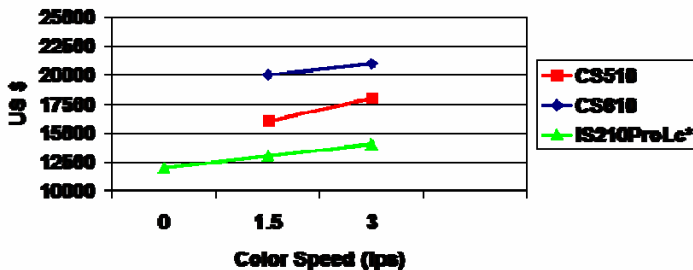


GRAPHTEC FAMILY OF SCANNERS

The CS610HD^{PLUS} is part of a family of three 42" wide color scanners all based on the same hardware platform that consists of the CS610HD^{PLUS}, CS510HD^{PLUS} and IS210HD^{PLUS}.

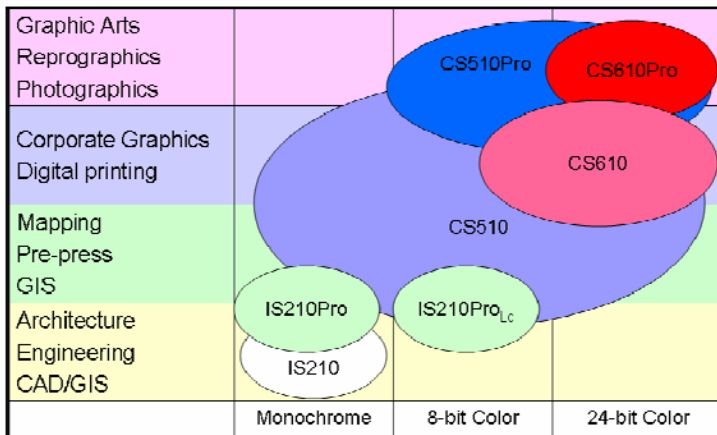
Graphtec spun off the CS510HD^{PLUS} and IS210HD^{PLUS}. The CS510HD^{PLUS} and IS210HD^{PLUS} are based on the same CS610HD^{PLUS} hardware platform, but have different specifications, prices, and target markets.

Graphtec CS610 & 42" scanner family



The Graphtec CS610HD^{PLUS} family of scanners. The CS510HD^{PLUS} has the same specifications as the CS610HD^{PLUS}, but it cannot handle thick originals. There is no upgrade path from a CS510HD^{PLUS} to a CS610HD^{PLUS} scanner. Graphtec rates the IS210ProLeC⁺ at 3 ips for 8-bit color scanning, and it can be upgraded to the CS510HD^{PLUS} scanner.

In the United States and Canada, Graphtec scanners include the **Scanning Master 21+** scanning software. This software is Graphtec's own scanning software and supports professional scan-to-file operations and viewing.



Graphtec's scanner-family positioning.

According to Graphtec some of the CS610HD^{PLUS} scanner's advantages include:

- 600 dpi true optical resolution
- Automatic adjustment for media up to 0.8" thick

- Compact design
- Contact Image Sensor (CIS) Technology
- "Instant-on" scanner ready technology

GRAPHTEC UPGRADE POLICY

Graphtec has a liberal upgrade policy and customers can freely download and install new software updates directly from Graphtec's Web site at: http://www.graphteccorp.com/imaging/cs600/cs600_support.html. For firmware upgrades, you should contact the local distributor. In addition, the Download section also provides free software such as the company's Microsoft Windows Vista-compatible TWAIN32 driver.

WHAT BERTL TESTED

BERTL tested the CS610HD^{PLUS} Base/Pro model with the stand and the Scanning Master 21+ scanning software. The price for the tested equipment was \$20,995 for the Pro version and \$19,995 for the Base version.

BERTL uses its own standardized test procedure to test all wide-format scanners, ensuring uniform and independent treatment of wide-format scanners across scanner manufacturers.

GETTING SET UP

The scanner arrives in two cardboard crates containing the scanner and the scanner stand. The scanner stand is easy to assemble, even if you're alone on the job. The assembly instructions are clear and easy to follow. The hardest part was to assemble the document basket, but if you carefully follow the instructions it's quickly finished. The next most difficult part of the assembly process was placing the scanner on the stand. Weighing in at less than 80 lbs. it can be done by one person, but it's easier for two people to lift the scanner and secure it to the stand. Once assembled, you connect the scanner to the computer using either USB2 or Ethernet interfaces.

In order to get the scanner running, you need to install the two software components: the scanner driver and the scanning Master 21+ scanning software.

The user then loads the CD that contains the drivers for the scanner, and turns on the scanner. The Microsoft Windows "Found New Hardware Wizard" starts automatically and selects the correct software driver. Once the CS610HD^{PLUS} scanner is loaded, the user installs the Scanning Master 21+ scanner software using the same CD located in the directory English\OPS112\Setup.exe. When the setup program terminates, Scanning Master21+ is added to the Programs menu in the Windows' Start menu.

If you need to use the TWAIN driver interface to capture scanned image from other applications, you can install the TWAIN driver as well. The TWAIN driver is also located on the same CD as the other software and can be found in the directory: **English/OPS115/Setup.exe**. Install the same way as the Scanning Master 21+ software.

After proper installation, there are two applications in the Windows Start menu under the Scanning Master21+: Scanner Adjust for basic scanner and color calibration, and the Scanner Master21+ application for scan-to-file operations.

WHAT WE LIKED

- The installation procedure is complete and easy to follow. It can be performed by anyone in an organization who has average experience in installing new software and hardware on a computer workstation.
- Instructions for assembly and installation are easy to follow with plenty of drawings and instructions provided.
- Typical scanner assembly time is 10 to 15 minutes.
- Typical software installation time is 10 minutes for the scanner drivers and scanning software.
- Easy and automated firmware upgrade procedure.

WHAT WE WOULD LIKE TO SEE

- BERTL would like to see an application install manager for installing all the software packages in one coherent operation.

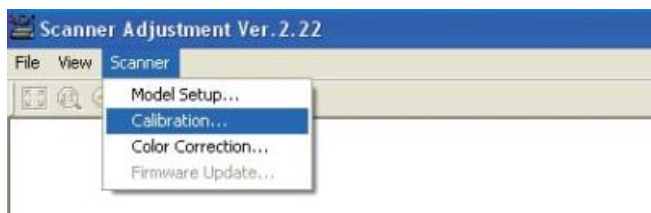
SCANNER CALIBRATION

After you install the software, you must still walk through a series of scanner calibrations in order to insure that the scanner delivers optimal scanning quality. Calibration is straightforward and consists of a three-step procedure using the supplied basic calibrations sheet and the color calibration sheet:

- Model Setup
- Basic Calibration
- Color Calibration

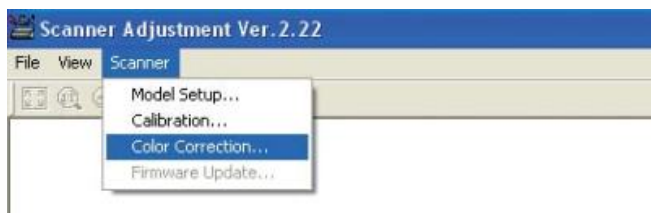
Before beginning calibration, clean the transparent contact plates located inside the scanner and the surface of the document scanning table. Any dust or dirt on these surfaces may affect the calibration results and the resulting image quality. Also check that the calibration sheet is free of dust or dirt.

You start the scanner adjustment program and setup the correct scanner model:

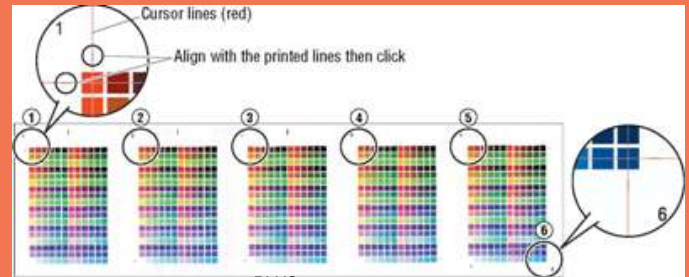


Next, continue with the basic calibration sheet with specifically set black and white points for the scanner. The calibration process takes about five minutes and is fully automated.

After the basic calibration, the last step to perform is the actually color calibration.



The color calibration procedure scans a special color chart developed by Graphtec that contains several hundred color patches in five sections—one section for each CIS sensor in the scanner. The purpose is to generate the correct response for each color patch and to level out the different sensitivity in each of the five individual CIS sensors in order to eliminate differences between camera boundaries. Differences can show up in the image, unless color calibration is done properly.

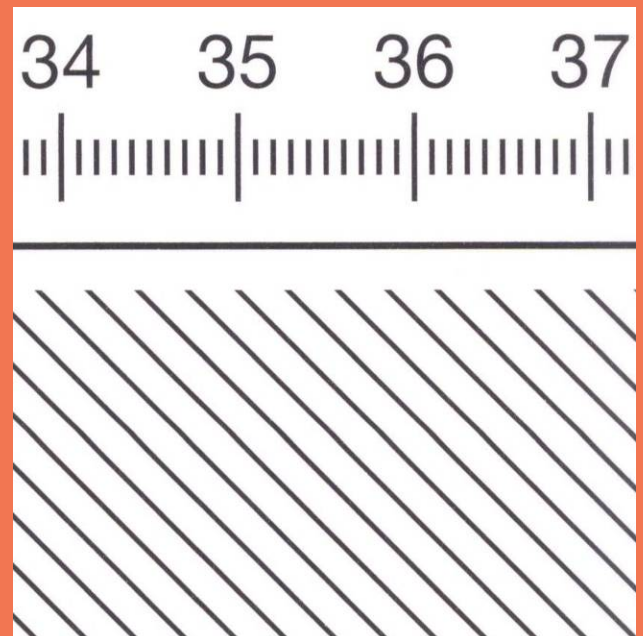


Graphtec CS610HD^{PLUS} color calibration sheet. For each of the five CIS sensors there is a unique set of color patches to ensure an even response across camera boundaries.

After color calibration, you must identify the start of each of these five patches, plus the lower-right corner patch. Although an easy task to do, we were surprised that the Graphtec scanner adjustment application did not automatically do it. It would have made the highly automated process even more automated. The CS610HD^{PLUS} scanner calibrates to the sRGB color standard.

After the scanning calibration process, we ran our stitching test chart to detect horizontal and vertical stitching problems. We didn't observe any horizontal or vertical stitching problems.

The picture below shows a perfect horizontal and vertical alignment between cameras. The 45° angled lines are used for vertical alignment. When vertical alignment is not done properly, it shows up as jagged angle lines. A horizontal stitching problem shows up when the horizontal line is not straight.



Stitching test chart. We did not observe any horizontal or vertical stitching problems.

The whole calibration procedure process took about 10 minutes to complete.

WHAT WE LIKED

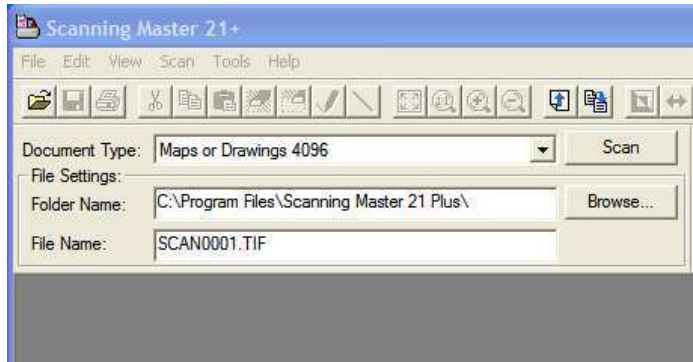
- The calibration procedure is well documented and easy to perform.
- Typical calibration time is 10 minutes.
- A scanner operator does not need to understand the various calibration steps, and as such, calibration can be performed by an operator who does not have specific knowledge of color calibration.

WHAT WE WOULD LIKE TO SEE

- BERTL would like the calibration to be more fully automated. For example it should automatically find the six patch coordinates, instead of the operator.
- We would also like that the scanner model to be automatically recognized by the scanning software.
- Instead of having to feed two calibrations sheet into the scanner, BERTL would like to see a single calibration sheet to do the job.
- BERTL would like the scanner to automatically detect the need for color calibration when it detects degradation in scanning quality, or dust and dirt on the mechanism.

SCANNING MASTER 21+

The Scanning Master 21+ version 6.31 is Graphtec's own scanning software that is used to drive all of the company's scanners. The first thing you need to do is to open the software and then select "Model Setup" in order to choose the right scanner model. Then you are ready to make your first scan. Scanning Master 21+ supports two basic ways to scan. You can simply press the Scan button, while more experienced scanner operators can use the professional interface.



For the less experienced user, begin simply by selecting three options:

- Document Type
- Folder Name
- File Name

Document type is a pre-selection of standard document types:

- Black and White
- Clear Mylar
- Dark Blue print
- Graphics
- Light Blue print
- Maps and drawings
- Maps and Drawings 4096
- Map and Drawings Full Color
- Photo 256
- Photo 4096
- Photo Full color

Simply select which document type most closely matches your document. Select the Destination Folder name and your actual file name, press the Scan button, and you are done.

In the main screen, you can select general options such as default file format, unit of measurement (inch/mm), display setting and general setup.

You can choose your preferred file format as the default setting. You can select between:

- TIFF

- JPEG
- BMP
- CAD Overlay
- CALS Group 4
- PCX,
- Sun Raster
- Intergraph

Some of the file formats are black and white only and do not work with color scans.

You may find that you need to tweak the default document-type settings a little bit as you gain in experience with the CS610HD^{PLUS} scanner.



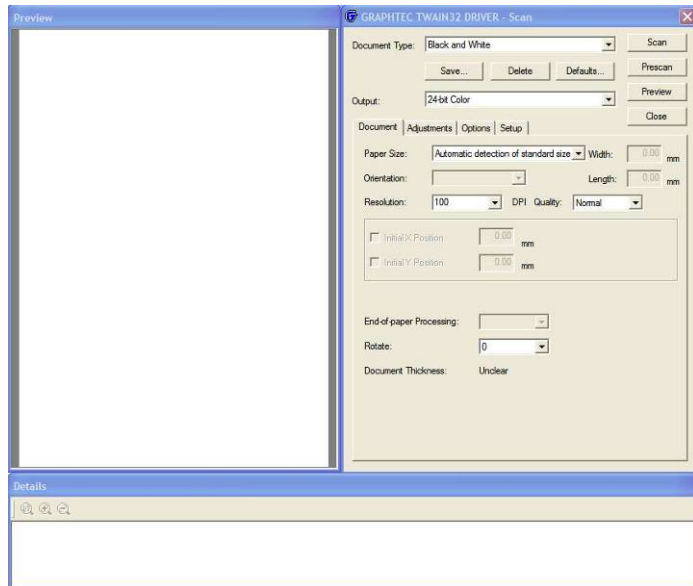
POWER-SAVE MODE

The CS610HD^{PLUS} scanner complied with the previous ENERGY STAR[®] 2002 rating specifications. However, due to a lower energy requirement in the latest ENERGY STAR[®] rating, the CS610HD^{PLUS} lost its rating in the beginning of 2007. Despite this, the CS610HD^{PLUS} still implements a low-power saving mode of only 6 watts or less.

SCANNING MASTER 21+: FOR THE EXPERIENCED OPERATOR

This software provides the experienced operator with more control over scanning. From the Scan / Scan pull-down you see three new windows:

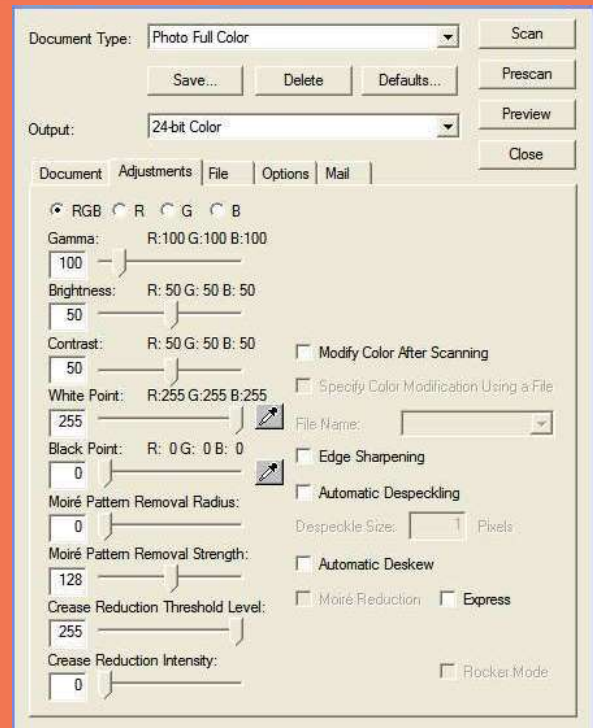
- Preview window
- Details window
- Control window



The software provides the experienced operator with three scan dialog boxes that provide more control over scanned images.

The three windows can be individually sized and moved around. We recommend that you resize the Details windows to three-times the current default size so you can see all the details.

The **Preview** window shows the whole image while scanning. The actual size changes as you change the document settings for width and height. The **Details** window shows the scan in 1:1 and a detail view of the image while scanning. Usually the default size is too small for practical use and you most likely will need to make it bigger for a better detail viewing. Finally, the **Control** window lets you fine-tune all scanning parameters and set up batch scanning.



The Control window provides full control over the scanning process.

In the Control window you can change all the default settings for the document type or create new ones. For example, select Photo Full Color, select the Adjustment tab and change the Gamma to 1.5. Now press Save and type in a different name, such as Photo Full Color Gamma 1.5, and you have created your own custom type.

The Document tab is where you set most of the scanning parameters.

Paper Size enables you to specify the size of the document to be scanned, and you can choose from among a predefined list of ANSI, ARCH DIN, and ISO standard sizes or create your own unique size by filling in the width and length.

Use Orientation to select between Landscape and Portrait orientations.

Set the Resolution for the desired scanning resolutions.

Finally, under Quality, select between:

- High Quality
- Normal
- High Speed

Pay attention to the quality settings because it significantly can alter the scanned quality of the document.

High quality is the best mode, although it has the slowest scanning speed. Normal mode provides much faster scanning speeds, but it reduces the horizontal resolution. When we performed our line pairs per mm (lp/mm) test, we noticed that the lp/mm horizontal across a scan line was close to half the lp/mm in the vertical direction. This led us to believe that the CS610HD^{PLUS} reduces the horizontal resolution, so when scanning at 400 dpi in normal mode, you are essentially scanning the document at 200 x 400 dpi. Finally, High Speed mode reduces the vertical resolution, so a 400-dpi high-speed scan is essentially performed at 200 x 200 dpi. There is nothing wrong with this approach—you just should be aware of how you exchange scanning quality for scanning speed.

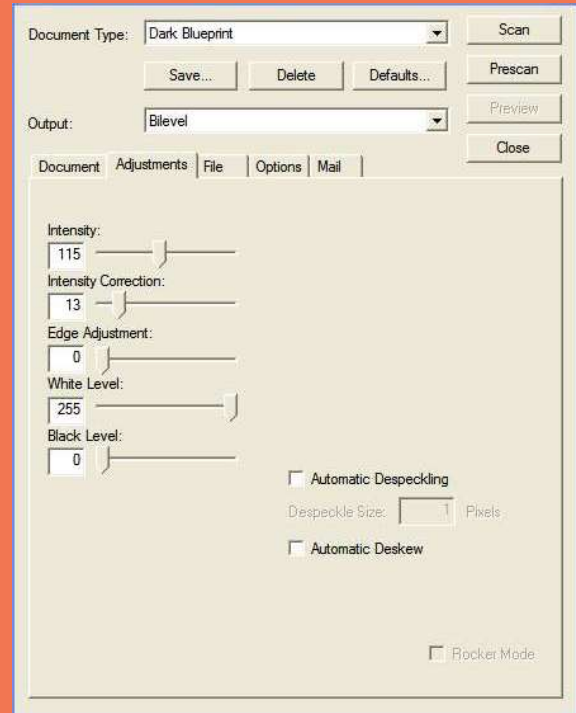
The CS610HD^{PLUS} supports resolutions between 50 to 800 dpi (Base version) 9,600 dpi (Plus version) in steps of 1 dpi increments. It scans at a higher resolution and then scales to the desired output resolution. For example, when set at 500 dpi, the CS610HD^{PLUS} actually scans the image at 600 dpi and then scales it down to a final size of 500 dpi.

You also have some miscellaneous controls such as the ability to resize the document to standard or original size, rotating, mirroring, and reverse polarization (negative image).

The Adjustment tab depends on which scanning mode is selected. For black and white mode, there are seven controls:

- Intensity
- Intensity Correction:
- White Level
- Black Level
- Edge Sharpening
- Automatic Despeckling
- Automatic Deskewing

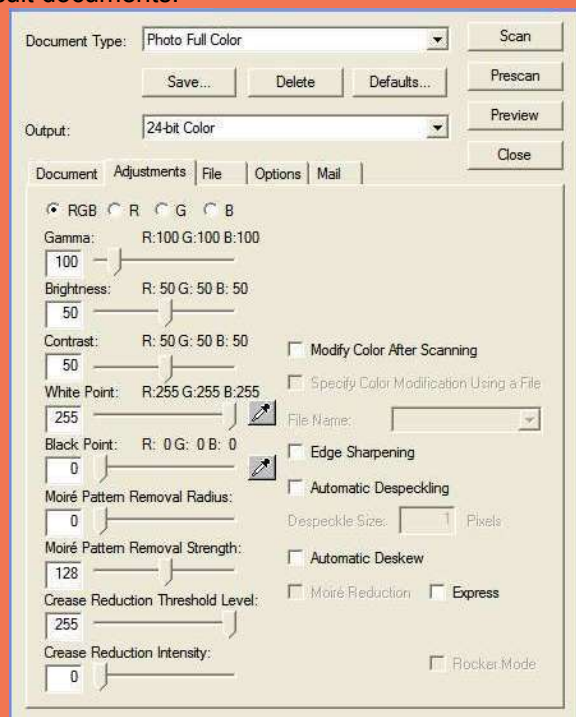
Intensity corrections are for cleaning up faded background or blue prints. An example is shown in the quality-evaluation section of this report.



Black and white adjustments.

When working in color you have more control and can choose to either operate with an individual color or with all three primary colors at the same time.

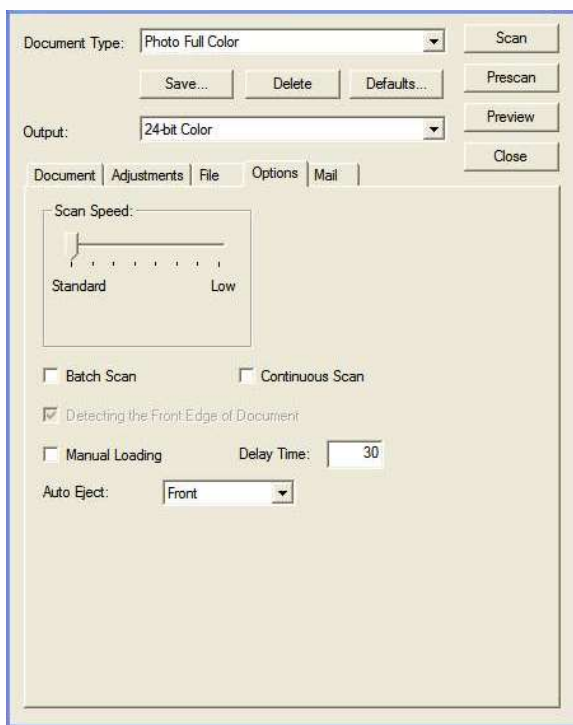
It may take a little while to get used to all the Adjustment parameters and you may only need them for dealing with difficult documents.



Color mode provides more adjustments.

The File Document tab controls the naming the scanned file, file format, auto assignment of name for batch scanning, and finally whether to output directly to the file or to launch the image in a viewer for quality assurance and post-processing.

The Options tab enables users to set up all miscellaneous parameters (settings) and is also used for enabling and disabling batch scanning and scanning speed. Scanning speed adjustments are useful when dealing with delicate and fragile documents that can become damaged if scanned at fast scanning speeds. Users can also specify that the scanner eject the scanned documents, either in the front or back, or let the original remain in the scanner for a possible rescanning.



Scanning options for rarely used settings or for scanning fragile and delicate documents.

SCANNING MASTER 21+ VIEWER

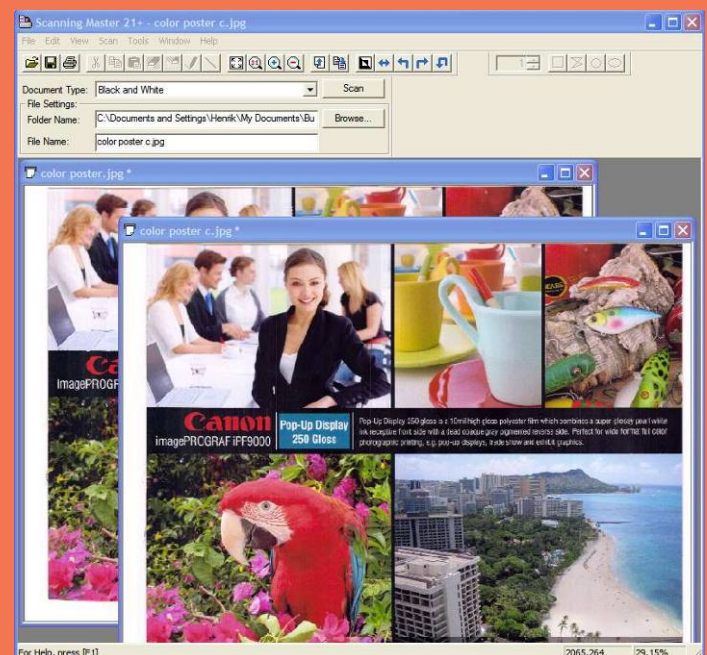
After scanning an image, it opens up in the viewer or you can select File menu/Open to browse for any images supported by the Scanning Master 21+ Viewer.

This built-in viewer is basic and does not offer editing capabilities, except when working with black and white drawings. With them, you can rub out or erase areas and add lines, and draw in freestyle. For more elaborate viewing features, users should purchase one of the many image viewers on the market; however it is nice that it supports multiple file viewing. The viewer supports common viewing features such as rotating, cropping, de-

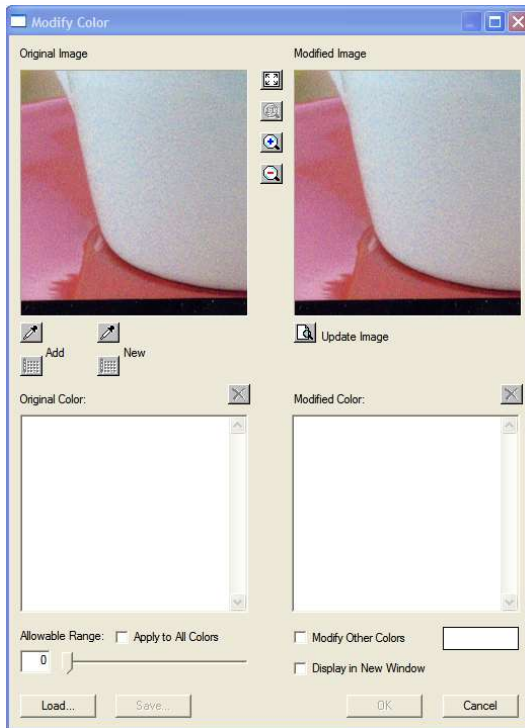
speckling, and de-skewing of images, plus simple measuring tools to measure lengths and angles.

We found that the Viewer does support a magnification window. When you select the Loupe tool and click anywhere in the image, a magnification window pops up showing the image in detail, or you can toggle the zoom and a 1:1 window appears that show the details of the cursor's location.

You can also modify color in a color image. When choosing Modify color, a new window launches, enabling the user to simultaneously scan the original color image and the modified color image, which is a very nice feature for visualizing the effect of any color change. When editing the color you can move and pan around and zoom in/out to see a smaller or larger area at any given time.



The Scanning Master 21+ viewer provides viewing of multiple files.



Although not the same as Adobe Photoshop, Scanning Master 21+ Scanning Software does provide minor color manipulation of images.

WHAT WE LIKED

- Scanning Master 21+ Scanning Software is a professional scanning tool that gets the job done.
- Scanning Master 21+ supports both inexperienced and experienced operators with different dialog boxes.
- Scanning Master 21+ supports viewing of multiple images.
- BERTL liked Scanning Master 21+'s 1:1 Zoom window and Loupe tool.
- BERTL liked Scanning Master 21+'s black and white tool for simple erasing and drawing.

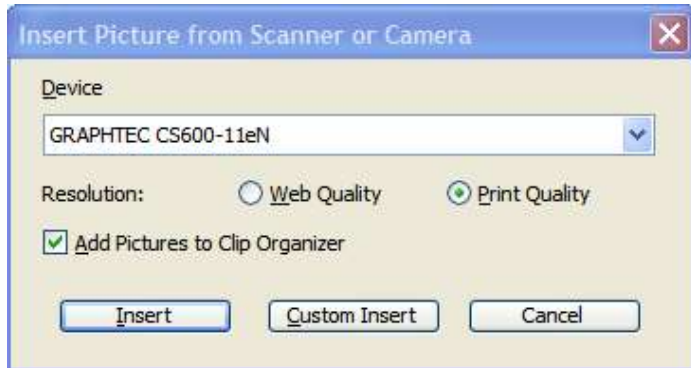
WHAT WE WOULD LIKE TO SEE

- BERTL would like to see Scanning Master 21+'s dialog boxes better organized.
- Would like the Scanning Master 21+'s software to automatically find the right connected scanner model.
- Pixel-level precision cropping and alignment of the image.
- Support of multiple-page TIFF file format.
- Support of mark-up text and simple erasing tool for color images.
- Support of indexing features for image archiving.
- Support for more than a maximum skewing angle of 7.1°.

TWAIN SCANNING

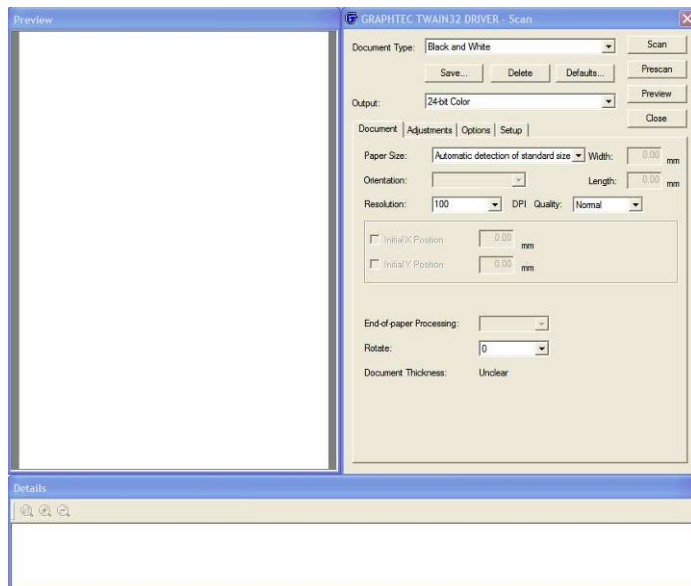
Users can also scan into another application other than Scanning Master 21+ via the industry standard TWAIN driver. However, certain features are available with the fully featured Scanning Master 21+ software that are not available with the TWAIN driver.

To launch the TWAIN driver, navigate to the Control panel and select Scanner or Camera, or use Microsoft Word and choose Insert / Picture / From Scanner or Camera.



Insert Picture from Scanner or Camera dialog box.

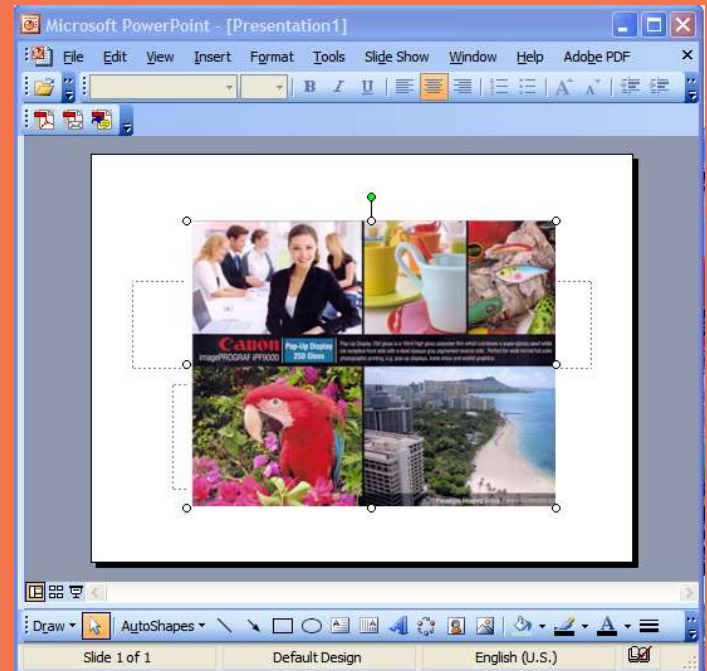
Select the quality as either Web or Print and select the Custom Insert button.



Notice the similarity with the Scanning Master 21+ application.

Now, an interface that is almost the same as the Scanning Master 21+ interface is launched. The same three windows are provided: Scan, Preview, and Details, all of which may be individually sized and moved.

Select the appropriate scanner parameters, press the Scan button, and the image is scanned directly into Microsoft PowerPoint.



The final result obtained by using the TWAIN driver from Microsoft PowerPoint.

WHAT WE LIKED

- BERTL recommends the use of the TWAIN driver for access to the scanner from other applications. Although not nearly as feature-rich as the provided Scanning Master 21+ scanner software, it's sufficient for most needs.

WHAT WE WOULD LIKE TO SEE

- BERTL does not have any recommendations for improvement in this category.

CONSUMABLES



BERTL found it easy to repair the Graphtec scanner, with plenty of room for replacement of circuit boards.

Like any other peripheral, a scanner also has consumable parts, although they're insignificant compared to wide-format printers' consumables. With scanners, there are typically three pieces that you should know about: replacement lamps, the white background plate, and the scanner glass plate. The CS610HD^{PLUS} uses LED lights that have a lifetime of approximately 50,000 hours, so that they are not really of any concern. The remaining items usually require a technician to replace because of the integrated and compact nature of all the scanning components. But, if your luck runs out and you need to perform repairs, then the CS610HD^{PLUS} scanner is easy to open, and the majority of all circuit-board and power-supply components are easily accessible from the front cover. BERTL estimated that a typical time for repair is around 20 minutes.

UPGRADE CARD

The CS610HD^{PLUS} can be upgraded from the Base to the Pro version in the field. However, it requires uploading of new firmware and inserting a Pro version chip into the scanner. To be safe, you should let a qualified technician do the job, but if you are used to "getting your hands dirty," then you should be able to complete the job.

WHAT WE LIKED

- BERTL likes the scanner's use of long-life LEDs for illumination.

WHAT WE WOULD LIKE TO SEE

- Would like it to be easier to replace consumables in the scanner.
- BERTL would like to see a smarter and easier way of upgrading the scanner in the field. In this industry, we have seen the use of a SmartCard and/or special firmware downloads do the trick.

SCANNER ACCURACY

BERTL performed a series of quality tests on the scanners. We used our Applied Image (QA-1) test chart for evaluating the scanner's horizontal and vertical accuracy. Instead of measuring the accuracy between two end points, we instead only measured a random selection of 6" width. Our test results indicated that:

CS610HD ^{PLUS}	Accuracy %
Horizontal	0.03
Vertical	0.17

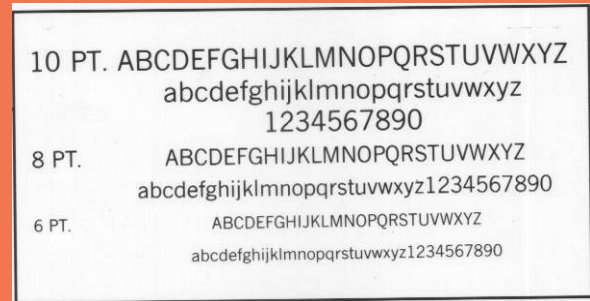
This horizontal result is excellent and is within the vendor's claimed accuracy of 0.1%. The vertical accuracy was above the specification of 0.1%.

The CS610HD^{PLUS} scanner supports adjustment of the vertical precision and you do that by typing in what a known distance is, and then it adjusts it for precision. Initially we measured a vertical accuracy of 0.28% without adjustment and 0.17% after adjustment.

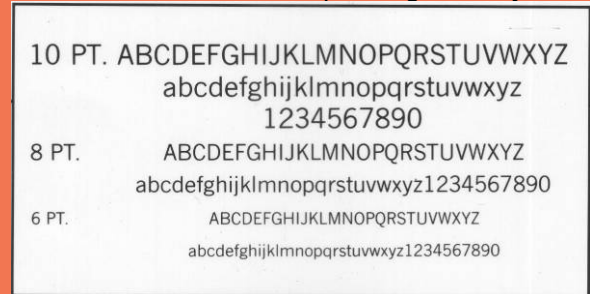
TEXT SHARPNESS

Text sharpness is another test where we look at the impact of scanning small text size at low, medium, and high resolutions. As the results show, the CS610HD^{PLUS} in high-quality scan mode has no problem scanning small text characters at low resolutions. We also did the test in Normal scan mode and saw that the clarity of the text was reduced. Based on similar findings with our line pairs/mm test, we concluded that the CS610HD^{PLUS} scanner in Normal mode reduces the horizontal resolution in order to gain faster scanning speed.

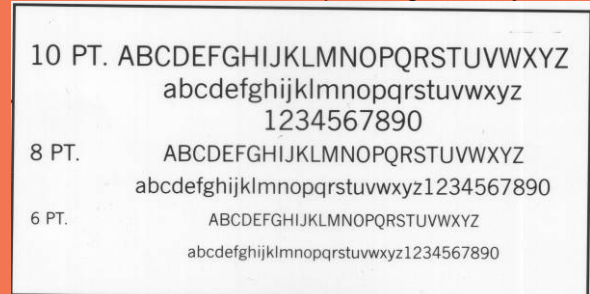
BERTL recommends that you consider the impact of high-quality versus normal scanning mode. If you wish to capture images with the highest and most detailed precision, then you should use the High Quality mode (only available with the Pro version). If it is less important to capture the smallest details, use Normal mode. In general, we find that you should avoid the High-speed mode because it sacrifices too much scanning quality for performance.



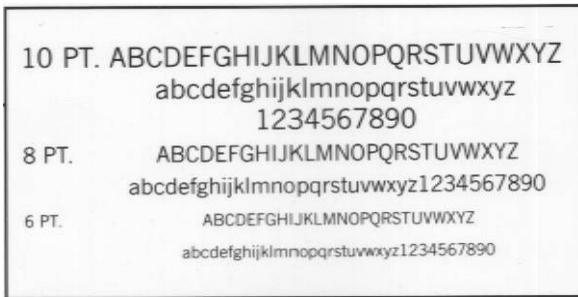
Small text scanned at 200 dpi in High Quality mode.



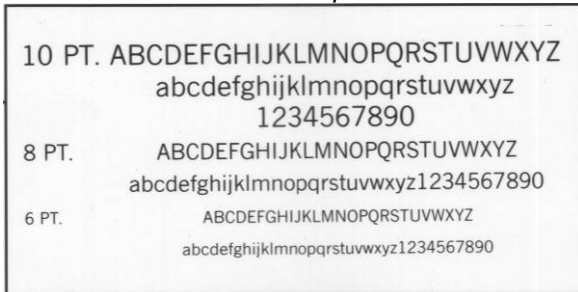
Small text scanned at 400 dpi in High Quality mode.



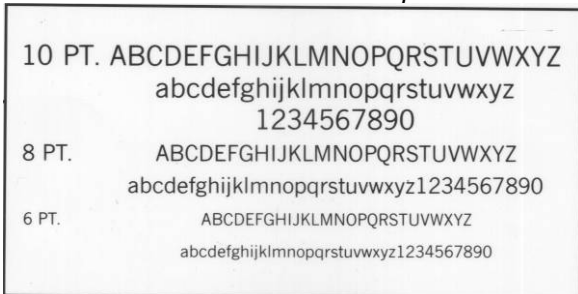
Small text scanned at 600 dpi in High Quality mode.



Small text scanned at 200 dpi in Normal mode.



Small text scanned at 400 dpi in Normal mode.



Small text scanned at 600 dpi in Normal mode.

WHAT WE RECOMMEND

- BERTL recommends you consider your need for high-quality versus normal scanning quality. If you want to capture images with the highest and most detailed precision, then you should use the High Quality mode (only available with the Pro version). If it is less important that you capture the smallest details, you should use Normal mode. Finally you should avoid the High-speed mode because it sacrifices too much scanning quality for performance.

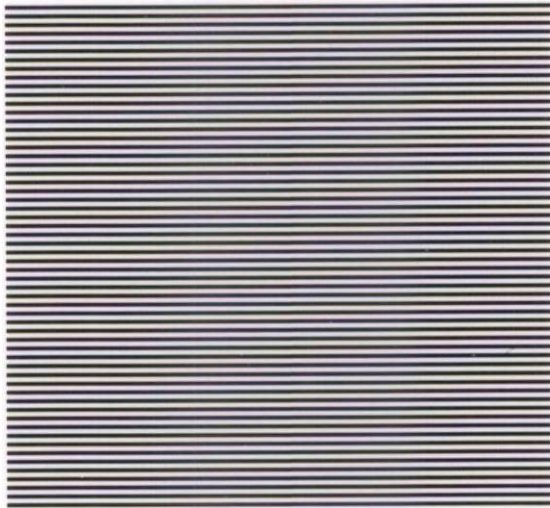
WHAT WE LIKED

- BERTL liked the scanner's horizontal accuracy, which we attributed to the higher geometrical accuracy of CIS technology-based scanners.

WHAT WE WOULD LIKE TO SEE

- BERTL would like to see a more precise vertical precision adjustment that can get the vertical precision within specification.

COLOR FRINGING



The Color Fringing test checks how well the RGB channel is aligned. We do this by scanning the Grayscale Applied image test chart (QA-1) in color at the optical resolution and see if there is any visible color-fringing problem.

As can be seen above, there is barely a visible fringing problem.

CS610HD ^{PLUS}	Color Fringing
Test Result	Barely

COLOR ACCURACY



For our Color Accuracy test, we used the well known ANSI IT8 test chart that is used to calibrate many color devices.

We scanned the test chart at 300 dpi using the sRGB color space and a Gamma of 2.2 (default of sRGB). We

then read each patch and compared them with the reference patches of true color value and determined the ΔE value indicating how accurately the scanned colors match the reference chart. The color-accuracy score for the CS610HD^{PLUS} is excellent, and we attribute this to the Graphtec Color adjustment calibration procedure.

CS610HD ^{PLUS}	ANSI IT8.7 Color Matching	
Test Result	$\Delta E=4.1$	Average
	$\Delta E=12.4$	Worst Case
	$\Delta E=8.3$	95%

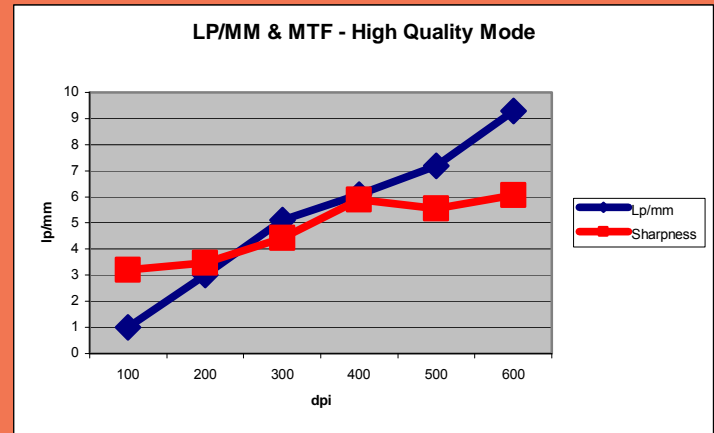
LINE PAIR PER MM RESOLUTION

Optical resolution is a physical characteristic of a scanner system and it describes the ability of a system to distinguish, detect, and record physical details. However, there is more to the story than just the sensor in a scanner system, so when considering scanning quality, we also have to consider the optical system, mirrors, CCDs, glass plate, and the scanner's illumination system. Furthermore, when scanning is not performed at the highest optical resolution, we must consider how the scanner performs the actual scaling to the selected scanning resolution. All of these factors introduce errors and reduce scanning quality; therefore optical resolutions are an *indicator* of scan quality not a measure of it.

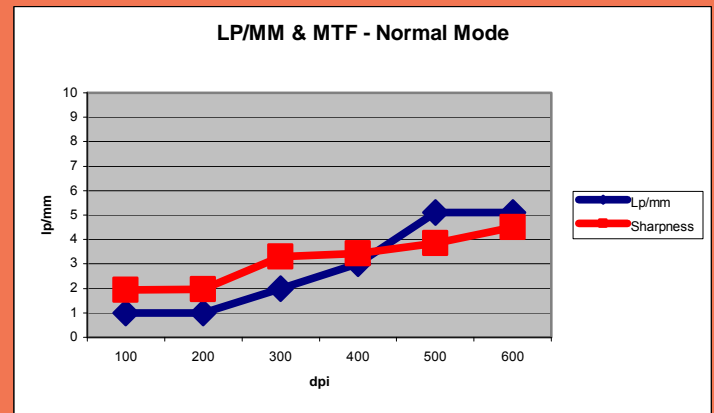
We use a line pairs per mm (lp/mm) test as a way to measure spatial resolution. With the lp/mm measure, all quality factors, such as lenses, optical system, scaling, and image processing, are taken into account, making the use of lp/mm a better way to measure scanning quality. In connection with lp/mm, we also like to measure how well a scanner maintains rapid change in the image and if it maintains the sharpness instead of just blurring rapid transition in the image. We use the 50% point of the Contrast Transfer function to measure the sharpness of the scanner.

The chart to the right shows the result of the lp/mm test for resolutions between 100 to 600 dpi in steps of 100 dpi. As expected, we see that with lower resolutions, the lp/mm goes down, but the curve keeps up fairly well, so that it maintains lp/mm at lower resolutions. We also note that the lp/mm peaks at the optical resolution at 9.3 lp/mm. This result is good, and is what to expect for a 600 dpi optical resolution scanner. When the scanning resolution is decreased, so are the lp/mm.

Because most scanner users scan between 200 to 400 dpi, the CS610HD^{PLUS} performs at the same level as other scanners in that range, even though other vendors' scanners are of the same or slightly lower optical resolution.



An lp/mm at 9.3 lp/mm at optical resolution in High Quality mode is what to expect from a 600 dpi optical resolution scanner.

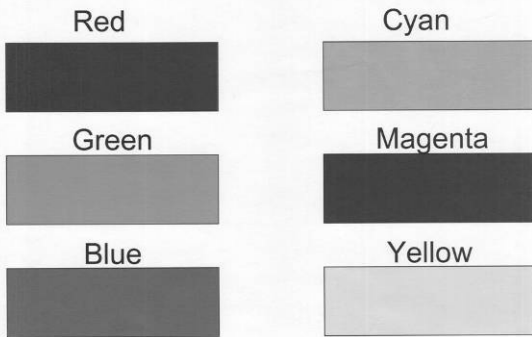


Notice that nearly half the lp/mm at 5.1 lp/mm at optical resolution is in normal mode. BERTL concludes that the CS610HD^{PLUS} is reducing horizontal resolution when scanning in Normal mode.

CS610HD ^{PLUS} – High Quality	LP/MM
Test Result - Peak	9.3
Test Result – Average 200 - 400 dpi	4.6

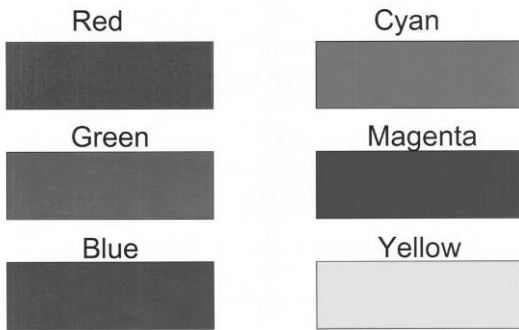
PANCHROMATIC TEST

Panchromatic



CS610HD^{PLUS} Grayscale scanning of a color test chart.

Panchromatic



Correct Panchromatic interpretation of color image.

This test is designed to check if the scanner can scan panchromatic correctly. If a scanner has a dedicated panchromatic line sensor, or the grayscale response is formed by combining the red, blue, and green channels, the test reveals a correct response. If, on the other hand, the scanner uses the green color channel to get the grayscale response, it will not detect color that does not reflect with the green color. The result above shows that the CS610HD^{PLUS} is using the Green channel to scan Grayscale images.

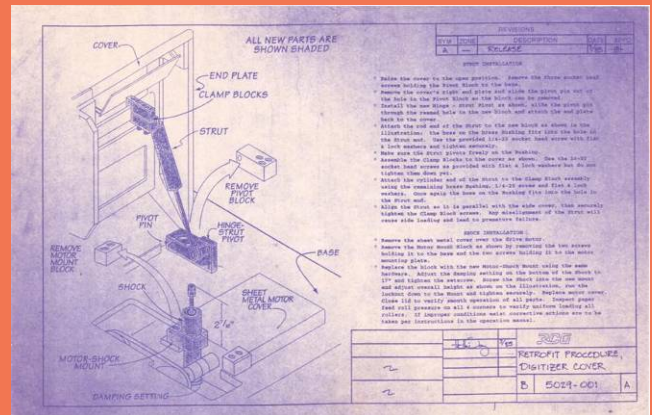
ADAPTIVE THRESHOLDING

Adaptive thresholding is a scanning technology that cleans up engineering blueprints and other deteriorated drawings. We test the scanner's ability to *clean* up the drawings both in terms of the cleaning-up result, but also how easy it is to find the best settings for this process.

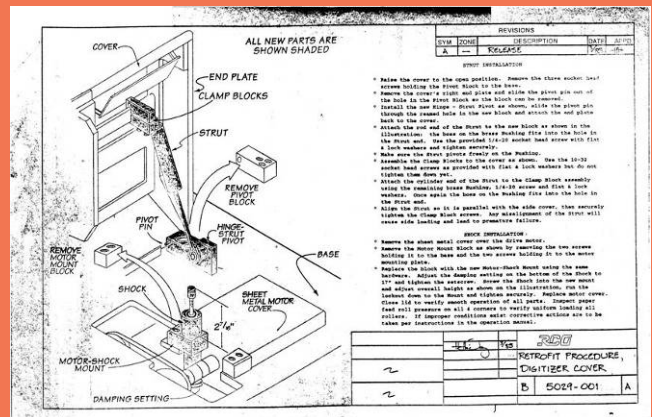
With Adaptive Thresholding, scoring is based on a subjective scale from:

- **Best** – The best available in the industry in terms of clean up and ease of use.
- **Good** – Good clean-up result, better than average and easy to use.
- **Average** – Average clean-up result and average ease of use.
- **Poor** – The clean up result is poor, and it is difficult find the best setting.
- **N.A.** – Adaptive clean up is not available.

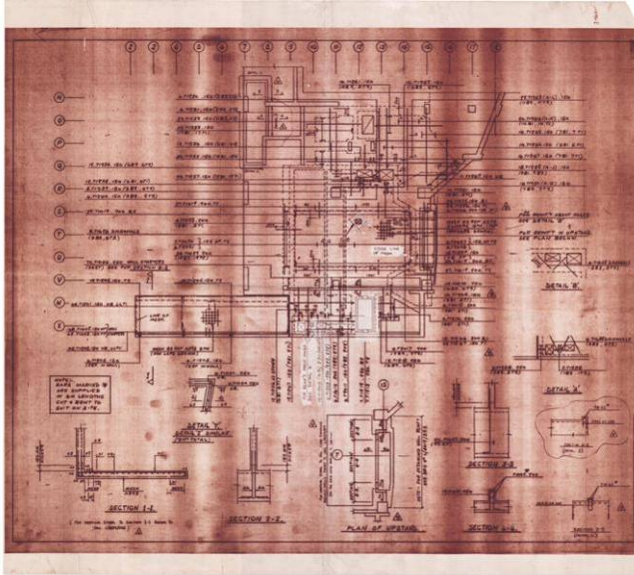
CS610HD ^{PLUS}	Adaptive Thresholding
Test Result	Average



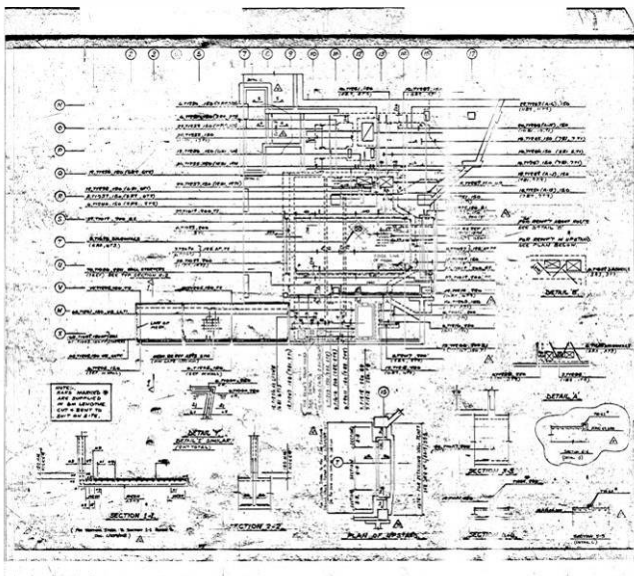
Original scanned in color.



After adaptive scanning.



Original scanned in color.



With adaptive thresholding.

SCAN SPEED TESTS

We performed a series of scanner speed tests for black and white, grayscale, and color scanning. For each test, we measured the scanning speed between 100 to 600 dpi resolutions in steps of 100 dpi. This test range represents more than 95% of all wide-format scanners in use and is therefore representative for a real-user environment. Our test drawing size is architectural E-size (36" X 48") for both black and white and grayscale performance testing, and for color performance testing we used a 36" X 24" color drawing.

For the performance test, we used a desktop computer running Microsoft Windows XP/2 with 2 GB of memory and a 3 GHz Pentium 4 processor with 120 GB hard disk, and connected to the scanner via the USB 2 interface. The test is performed using the supplied scanner software. While this computer is not the fastest available, it represents a typical computer used by a typical scanner customer.

BERTL measured the scanning time by starting a regular stop watch at the time we pressed the scan button and stopped it when the scanning application finished scanning the image into the destination file. We call this test the "observed scanning speed" for a drawing. For black and white drawings, we use TIFF Group 4 compression, while for grayscale and color scanning, we used TIFF uncompressed file format. The error in measuring time by hand is approximately 1 second, which indicates that black and white performance tests can show great variation at up to 25% error for less than 300 dpi scans; at higher resolution, the relative errors converge to less than 5%.

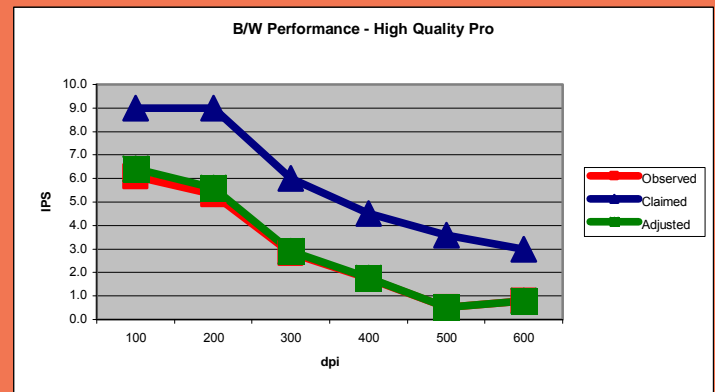
For each scan timed, BERTL also measured the reaction time from the time we pressed the scan button to the time the scanner actually started scanning, and then we measured the end time at the completion of the scan. The reaction time is in the range of less than a 1/2 second in black and white and grayscale, and approximately 2 seconds in color scanning.

We then graphed the results with both the observed time and the adjusted time, which is the observed time minus the reaction time. This performance is more true to the actual true speed of the scanner. Finally, we graph the scanner manufacturer's claimed speed time. All measures are in inches per seconds (ips).

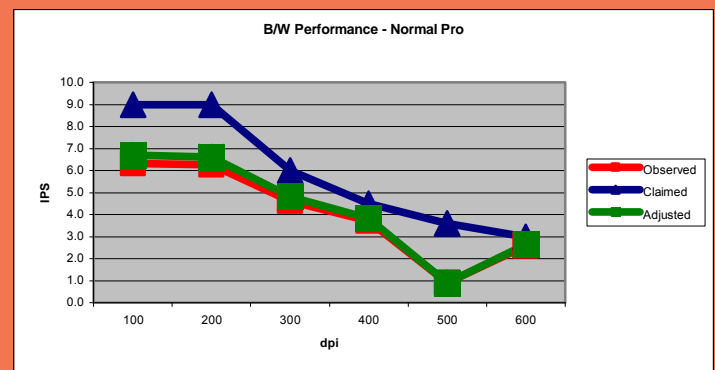
BERTL cautions against the absolute interpretation of the performance result because the actual result depends heavily on the computer in use and the scanner interface.

BLACK AND WHITE PERFORMANCE

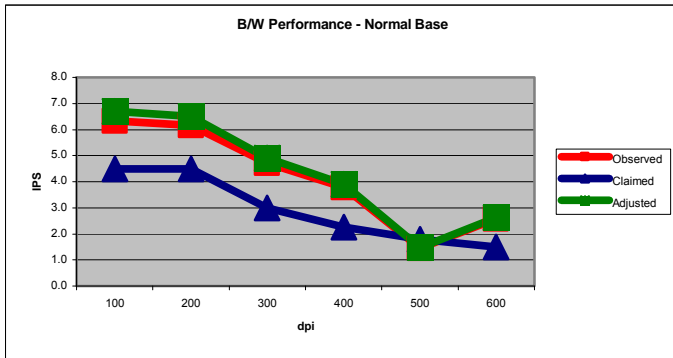
The black and white performance after adjustment is below the manufacturer's claimed speed. Note, however, that the observed speed is roughly one-third to half the claimed performance. The scanner reaction time is low and we don't see any differences between the observed and adjusted scan time. We do notice a dip in performance at 500 dpi. The reason is that the scanner is actually scanning at 600 dpi and then rescaling the image to a 500 dpi size. For scanning in normal mode, the scan performance is higher but still below the claimed scanning speed.



Black and white scanning performance in High Quality mode.



Black and white scanning performance in Normal mode.

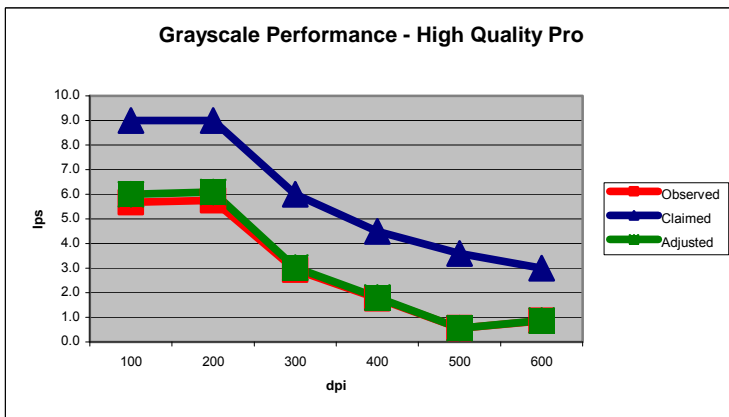


Black and white scanning performance in Normal mode.

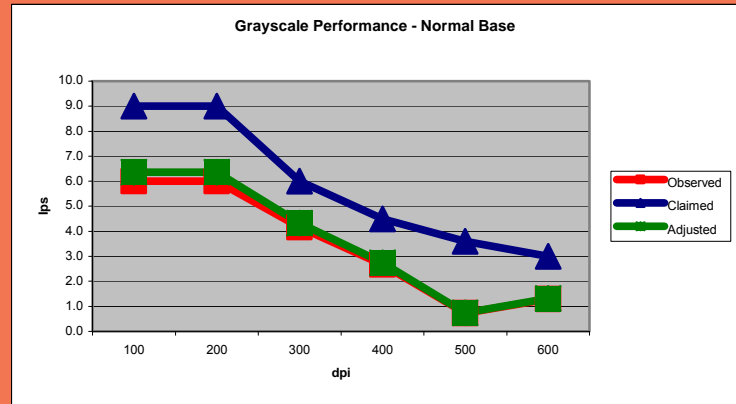
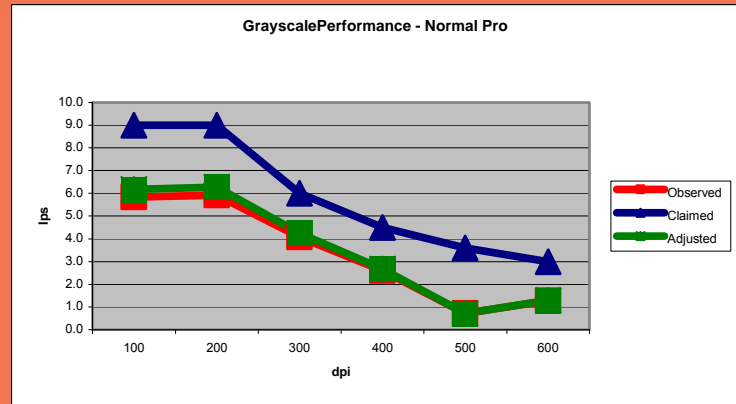
The CS610HD^{PLUS} Base scanner actually performed better than the rated maximum speed of 4.5 ips and at the same speed as the CS610HD^{PLUS} Pro version. We are not sure why, although we tested the CS610HD^{PLUS} Base by downgrading the CS610HD^{PLUS} Pro model.

GRAYSCALE PERFORMANCE

Technically speaking, the scanner speed in grayscale and black and white should be identical. However, we measured some difference due to the larger size of image data that must be transferred to the computer. The scanning performance is almost the same speed as with black and white. In normal mode, we do see an increase in performance, but, in our view, the extra speed is not worth the decrease in scanning quality. Last, we see that despite the lower performance claim, the CS610HD^{PLUS} Base version performed at the same level as the CS610HD^{PLUS} Pro version.



Grayscale scanning performance.



Grayscale scanning performance.

COLOR PERFORMANCE

We noticed that due to an average of a 2–2.5 second delay, there is a difference between the Adjusted and Observed speed. Also, we noticed that when scanning in color, the scanner often pauses during scanning. This is due to an interface and computer bottleneck, as the interface and computer cannot handle the amount of image data being transferred between the scanner and the computer. The only way the scanner can cope with this situation is to stop scanning and wait for the computer to consume the data. Once the data is consumed by the computer, the scanner starts scanning again. This is one of the reasons why it's very hard to get the most out of your color scanner, and is also why BERTL recommends that it's better to buy a powerful and high-performance computer to drive your scanner.

Although all measured results fall below the claimed speed, the overall performance of the CS610HD^{PLUS} scanner is good. In Normal mode, the CS610HD^{PLUS} scanner is 50% faster, although, as we have mentioned, BERTL does not believe it is worth opting for the extra speed at the expense of image quality.

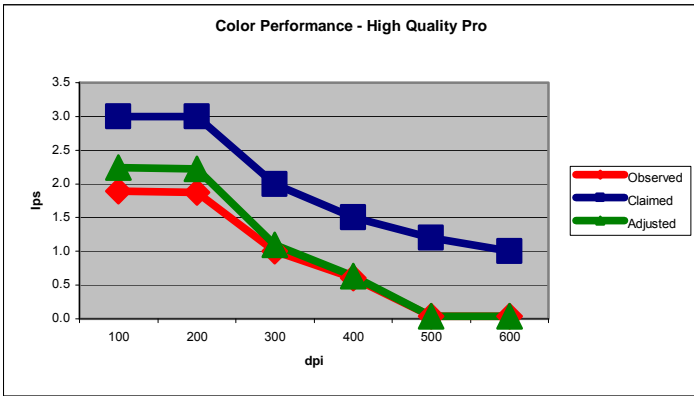
PERFORMANCE CONCLUSION

Although the CS610HD^{PLUS} falls short on its claimed speed for black and white, grayscale, and color scanning, it actually delivers a very good performance compared to other scanners on the market.

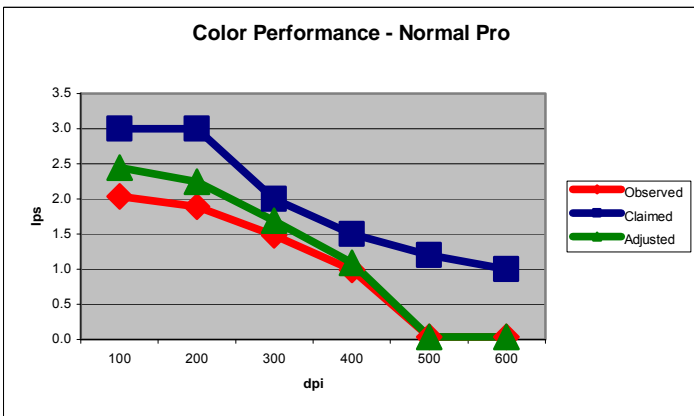
To assess realistic black and white performance, you must take into account the scanner reaction time that for the CS610HD^{PLUS} scanner is approximately 2-2.5 seconds. For grayscale and black and white scanning, this reaction time has no impact, and for color scanning it's negligible above 300 dpi. Also, the higher the scanning resolution, the less impact the reaction time has.

WHAT WE RECOMMEND

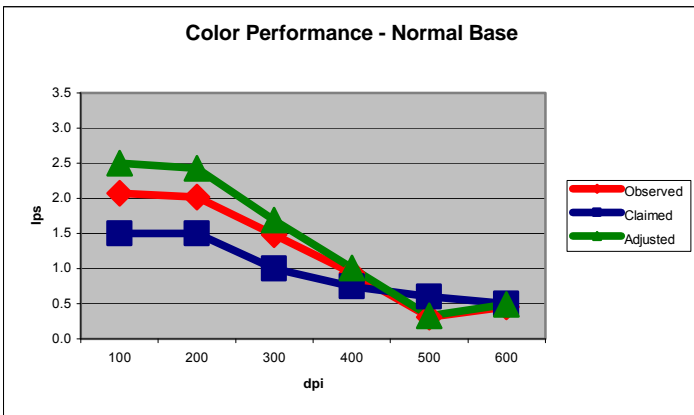
- BERTL recommends that you strongly consider investing in a top-of-the-line computer with high performance to get the most out of your scanner.
- If you need more speed, the Plus upgrade for an additional \$1,000 is a worthwhile investment because you get access to the high-quality scanning mode.



High quality Pro version color scanning performance.



Normal quality Pro version color scanning performance.



Normal mode Base version color scanning performance.

Surprisingly the CS610HD^{PLUS} Base version in normal mode performed at the same level as the CS610HD^{PLUS} Pro version.

CS610 Pro	Score	Range
Feature Score		
Scanning software	3	0..5
Image feature	4	0..5
Previewing	3	0..3
Automated 8-bit color scanning	4	0..5
Thick media handling	2	0..2
Easy replacement of consumables	2.5	0..5
Sub Total	18.5	0..25

Quality Score		
Scanner accuracy	5	0..5
No color fringing	4	0..5
Color accuracy	4.2	0..5
Lp/mm	3.75	0..5
Panchromatic	0	0..2.5
Adaptive quality	3	0..5
Sub Total	19.95	0..30

Performance Score		
Black and white performance - Claimed	3	0..5
Graytone performance - Claimed	3	0..5
Color performance - Claimed	5	0..5
Black and white performance - Observed	2	0..5
Graytone performance - Observed	2	0..5
Color performance - Observed	3.5	0..5
Sub Total	18.5	0..30

Total Score 56.95 0.85

Price Factor Adjusted 17.995

Value Price Index 316

RECOMMENDATIONS

The CS610HD^{PLUS} with the Scanning Master 21+ software is a fully featured wide-format scanning solution that provides high-end scanning quality, with excellent black and white scanning performance and fast color scanning performance.

This wide-format scanner is priced in the higher end. However, one of its biggest advantages is that the CS610HD^{PLUS} comes standard with a three-year on-site warranty in Canada and the United States. However, if you don't need thick-media scanning capability, BERTL recommends that you look at the CS510HD^{PLUS} scanner. The CS510HD^{PLUS} scanner has the same specifications, except that it lacks thick media handling, and is priced \$3,000–\$4,000 less than the CS610HD^{PLUS} scanner.

Overall, the Graphtec CS610HD^{PLUS} scanner is a feature-rich, reliable and high-quality scanner with a color-capture accuracy that is among the best in the industry. It's fast in black and white and grayscale scanning modes, and relatively fast in color mode. With a fast computer, users should be able to fully realize the potential of its color performance. It's best used as a high-end wide-format scanner.

CS610 Base	Score	Range
Feature Score		
Scanning software	3	0..5
Image feature	4	0..5
Previewing	3	0..3
Automated 8-bit color scanning	4	0..5
Thick media handling	2	0..2
Easy replacement of consumables	2.5	0..5
Sub Total	18.5	0..25

Quality Score		
Scanner accuracy	5	0..5
No color fringing	4	0..5
Color accuracy	4.2	0..5
Lp/mm	3.75	0..5
Panchromatic	0	0..2.5
Adaptive quality	3	0..5
Sub Total	19.95	0..30

Performance Score		
Black and white performance - Claimed	1	0..5
Graytone performance - Claimed	1	0..5
Color performance - Claimed	3.5	0..5
Black and white performance - Observed	2	0..5
Graytone performance - Observed	0	0..5
Color performance - Observed	4	0..5
Sub Total	11.5	0..30

Total Score 49.95 0.85

Price Factor Adjusted 16.995

Value Price Index 294

The CS610HD^{PLUS} represents the some of the best value for your money. Its combination of three-year onsite warranty, pricing, a 42"-wide scanning capability, fast black and white and mid-range color scanning speed makes this scanner a good choice. It operates smoothly, and with the scanner's high reliability, it should provide trouble-free operation for years. The scanner is therefore a recommended choice for the reprographic, graphic arts, photographic, corporate graphic, and GIS markets.

PROs	CONS
Highly productive, fast black and white scanning speed, and mid-range color scanning speed.	In our view, the Normal mode sacrifices too much scanning quality.
High color-capture and geometrical accuracy.	Scanning performance does not match the vendor's specification; however, some of this is due to computer bottleneck.
Feature-rich and mature software.	The Scanning Master21+ software could be more logical and intuitive.
Three-year on-site warranty	

WHAT WE LIKED

- The installation procedure is complete and easy to follow. It can be performed by anyone in an organization who has average experience in installing new software and hardware on a computer workstation.
- Instructions for assembly and installation are easy to follow with plenty of drawings and instructions provided.
- Typical scanner assembly time is 10 to 15 minutes.
- Typical software installation time is 10 minutes for the scanner drivers and scanning software.
- Easy and automated firmware upgrade procedure.
- The calibration procedure is well documented and easy to perform.
- Typical calibration time is 10 minutes.
- A scanner operator does not need to understand the various calibration steps, and as such, calibration can be performed by an operator who does not have specific knowledge of color calibration.
- Scanning Master 21+ Scanning Software is a professional scanning tool that gets the job done.
- Scanning Master 21+ supports both inexperienced and experienced operators with different dialog boxes.
- Scanning Master 21+ supports viewing of multiple images.
- BERTL liked Scanning Master 21+'s 1:1 Zoom window and Loupe tool.
- BERTL liked Scanning Master 21+'s black and white tool for simple erasing and drawing.
- BERTL recommends the use of the TWAIN driver for access to the scanner from other applications. Although not nearly as feature-rich as the provided Scanning Master 21+ scanner software, it's sufficient for most needs.
- BERTL likes the scanner's use of long-life LEDs for illumination.
- BERTL liked the scanner's horizontal accuracy, which we attributed to the higher geometrical accuracy of CIS technology-based scanners.

WHAT WE WOULD LIKE TO SEE

- BERTL would like to see an application install manager for installing all the software packages in one coherent operation.
- BERTL would like the calibration to be more fully automated. For example it should automatically find the six patch coordinates, instead of the operator.
- We would also like that the scanner model to be automatically recognized by the scanning software.
- Instead of having to feed two calibrations sheet into the scanner, BERTL would like to see a single calibration sheet to do the job.
- BERTL would like the scanner to automatically detect the need for color calibration when it detects degradation in scanning quality, or dust and dirt on the mechanism.
- BERTL would like to see Scanning Master 21+'s dialog boxes better organized.
- Would like the Scanning Master 21+'s software to automatically find the right connected scanner model.
- Pixel-level precision cropping and alignment of the image.
- Support of multiple-page TIFF file format.
- Support of mark-up text and simple erasing tool for color images.
- Support of indexing features for image archiving.
- Support for more than a maximum skewing angle of 7.1°.
- Would like it to be easier to replace consumables in the scanner.
- BERTL would like to see a smarter and easier way of upgrading the scanner in the field. In this industry, we have seen the use of a SmartCard and/or special firmware downloads do the trick.
- BERTL would like to see a more precise vertical precision adjustment that can get the vertical precision within specification.

Summary

About BERTL

The success of an organization depends on its ability to manage its information and assets. An effective workflow process requires the complex integration of information, devices, software, and people.

IT managers, office managers, and other knowledge management professionals need to know what digital imaging devices would best serve their specialized workflow processes.

BERTL's services are designed around this real-world framework, delivering business consumers the independent analysis and insight needed to make critical decisions about digital imaging's role in their organization.

Independent Analysis and Insight

BERTL's reports, comparative data, and strategic guides look at digital imaging through the eyes of the business user. The research examines not only the technical features, but also vertical market applications, and business benefits. The impact on worker productivity is a primary concern.

BERTL is 100-percent independent. It receives no funding from manufacturers and all product evaluations and reports are published at BERTL's own expense for its subscribers. Business users worldwide trust BERTL for objective, unbiased analysis of digital imaging systems.

BERTL Services

Reports and Star Ratings

BERTL analysts provide detailed reports on the technical and practical benefits of thousands of color and monochrome workgroup, office, graphic arts, and production devices.

Product Specifications

DataCheck Gen II provides the most current competitive data on printers, copiers, MFPs, fax devices, wide format printers, scanners, and more.

News, Interviews, and Analysis

The ITchat online magazine provides insight into the dynamics and trends of the digital imaging marketplace through interviews, feature articles, and software reviews.

BERTL Awards

BERTL analysts recognize the leading devices and software solutions in the annual BERTL's Best awards. BERTL also honors the performance of manufacturers in the annual Readers' Choice selections.

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