BLI Comparative Lab Test Report

SEPTEMBER 2016

Canon imagePROGRAF PRO-4000 vs. Epson SureColor SC-P9000

Canon imagePROGRAF PRO-4000

Epson SureColor SC-P9000

Advantage ✔	Canon imagePROGRAF PRO-4000	Epson SureColor SC-P9000
Colour Image Quality	✔	
Black Image Quality	✔	
Print Productivity	✔	
Ink Consumption	✔	
Device Feature Set	✔	
Print Driver Feature Set	=	=
Printhead Reliability / Cleaning Routines	=	=

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TEST OBJECTIVE

Buyers Laboratory LLC (BLI) was commissioned by Canon Europe to conduct confidential document imaging device performance testing on the Canon imagePROGRAF PRO-4000 and the Epson SureColor SC-P9000, and produce a report comparing the relative strengths and weaknesses of the two products in terms of image quality, productivity, ink consumption, device feature set, driver functionality, plus printhead stability and cleaning routines. All testing was performed in BLI's test facility in Wokingham, UK.

EXECUTIVE SUMMARY

The Canon imagePROGRAF PRO-4000 gave an outstanding performance in BLI's testing, delivering higher productivity, with a clear speed advantage in all modes tested, superior image quality, lower ink consumption and a stronger device feature set when compared with the Epson SureColor SC-P9000. The Epson model does have some advantages—including smaller (but variable) ink-drop sizes and lower power consumption while printing, but not in the standby mode in which the devices will likely spend more time. A significant productivity-enhancing advantage for the Canon model is its hot-swap ink tank design, which lets users replace empty ink cartridges while the device is still actively printing. In contrast, when the Epson SC-P9000 runs out of ink, printing has to stop for the cartridge to be replaced, which leads to some operator downtime. Moreover, the Canon device's single printhead is user-replaceable (the Epson model's printhead is service-replaceable), which helps to maximize uptime. Both models' printheads performed reliably throughout the evaluation, with neither experiencing any problems with nozzle clogging when powered off over a weekend.

As would be expected of two models aimed at the Graphic Arts (GA) marketplace, both units delivered excellent image quality overall. The Epson model delivered higher optical density for yellow, whilst the Canon model delivered much higher magenta and black optical density, and cyan density was comparable. The Epson SC-P9000's colour gamut was 9.3% larger on Photo quality paper. The Canon unit had the overall advantage in image quality thanks to its crisper text, more vibrant colours, excellent fine detailing in light and dark contrast areas and more natural-looking skin tones when compared with the Epson unit.

The test included an ink consumption evaluation, in which BLI assessed ink consumption with three different document types in Standard/Quality mode on proofing, matte coated and semi-gloss paper. In all of BLI's ink consumption print runs, the Canon imagePROGRAF PRO-4000 used significantly less ink in terms of net weight than the Epson SureColor SC-P9000.

The Canon PRO-4000 has a stronger device feature set, which includes higher memory capacity, a 320-GB hard drive (only offered as an option to Epson users), lower rated power consumption in standby mode and the option to install a dual-roll unit, giving users the extra flexibility of switching between different media types or sizes without having to reload the media each time. The Epson SC-P9000 delivers smaller (but variable) ink-drop sizes and lower advertised power consumption while printing. However, only the Epson model offers the option of attaching an X-Rite Spectrophotometer (which Epson calls a SpectroProofer) to provide more precise colour management control. While the Canon PRO-4000 does not offer this as an option, the device comes with standard calibration features which allow users to calibrate the printer not only with the manufacturer's own-brand of genuine paper, but also with other media brands, as well as letting administrators control colour remotely across the whole PRO-1000/2000/4000 series to ensure colour consistency.

Both models offer a comparable feature-rich driver set; the Canon model offers a greater number of media profiles (although both let users build a library of custom media profiles), a flexible layout nesting option to save on paper, and security watermark options. Canon's Color imageRUNNER Enlargement Copy Mode allows users to integrate with a smaller-format MFP to produce enlarged poster-size copies, although this functionality is matched by Epson's CopyFactory utility. ICC profile settings and built-in colour adjustment settings are available with both drivers, with the Epson driver offering a handy thumbnail preview for users to check the effects on their image as they make their changes.

In summary, with its superior productivity, more efficient use of ink and excellent overall image quality the Canon imagePROGRAF PRO-4000 is judged to be the stronger performer in BLI's evaluation.

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Image Quality

Advantage ✔	Canon imagePROGRAF PRO-4000	Epson SureColor SC-P9000
Text	✔	
Fine Lines	✔	
1x1 Pixel Grid	✔	
Halftone Range	=	=
Halftone Fill	=	=
Solid Density	✔	
Colour Drift across FOGRA39		✔
Consistency of three skin tones	=	=
Consistency of neutral grey	=	=
Colour Gamut		✔
Business Graphics	✔	
Photographic Images	✔	

+, — and ○ represent positive, negative and neutral attributes, respectively.

○ Image quality testing was done with Canon's own Semi-gloss Photo 280gsm media and Epson's own Semi-gloss Photo 250gsm media, with quality set to Highest (1200 dpi) on the Canon model, and the Epson model set to Max Quality Level 5 (2880 x 1440 dpi).

○ As would be expected of two models aimed at the Graphic Arts (GA) marketplace, both units delivered an exceptionally high standard of output in colour appropriate for their poster and photo printing target markets, with only slight differences in some respects.

+ The Canon imagePROGRAF PRO-4000 and the Epson SureColor SC-P9000 displayed clear formation of fonts in colour mode down to the smallest 3-point size. Canon's serif and sans serif fonts were judged very good as they were crisper than those from the Epson device, which were not as sharp, and rated good.

+ Both devices delivered very good vertical and horizontal fine lines down to 0.1-pt. size but the Epson device showed a significant amount of stair-stepping in diagonal lines compared with a barely discernible amount of stair-stepping in output from the Canon model.

+ The Canon model delivered far smoother, well-formed circles than those produced by the Epson model, which exhibited some stair-stepping and pixellation.

+ The Canon PRO-4000 produced the 1x1 pixel grid in CMY with no quality issues. Although the Epson model delivered consistent coverage across the 1x1 pixel grid, its dot laydown was less well defined and was rated good as opposed to very good for the Canon model.

— During BLI's colour drift analysis, in which the FOGRA39 media wedge is submitted to print before and after productivity and ink consumption tests, and measured using EFI Colour Verifier software, the Epson device delivered a lower mean Delta E drift of 1.4 than the Canon unit's mean Delta E, which was 2.9. (The PRO-4000 tested is a pre-production model with pre-matured mechanical structure, so results with production devices may differ.)

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○ Both models delivered colour halftone output across the full range—from the 10% to the 100% dot-fill levels—with distinct transitions between all levels.

○ Both models delivered an equally impressive range of halftone fills in colour mode, which were smooth and consistent throughout.

\+ The Canon unit delivered a much higher optical density for magenta, and it had a higher optical density for black (an important attribute for the photography market).

○ Optical density for cyan was comparable with both models.

— The Epson model delivered a higher optical density for yellow.

○ When evaluating the consistency with which different skin tones were delivered, the Canon model displayed slightly greater variance with the first skin shade test (with a Delta E of 0.8 compared with 0.2 for the Epson model), however there would be no meaningful real-world difference that's discernible to the naked eye.

○ Neutral grey consistency was maintained well by both models, with equally low variance across the page indicated by low Delta E values, at which the degree of drift would not be discernible to the naked eye.

— The Epson device's colour gamut was 9.3% larger than that achieved by the Canon model when printed on semi-gloss photo media in highest quality settings, with a CIE volume of 879,597 compared with a CIE volume of 804,574 for the Canon model.

\+ The Canon model had the advantage with its business graphics output which was judged to be brighter, with smoother and finer lines, whereas lines were less well defined on the Epson model's output.

\+ BLI analysed a range of colour and greyscale regions in photographic images output by both devices and judged the Canon model to have the outright advantage for its vibrant colours and excellent fine detailing in light and dark contrast areas. In contrast, the Epson model's output exhibited less bright colours and suffered from a loss of integrity in dark contrast areas.

\+ The Canon model exhibited very good, natural-looking skin tones in photographic images; while the Epson unit produced skin tones that were flat and pale in comparison.

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Print Productivity

Advantage ✔	Canon imagePROGRAF PRO-4000	Epson SureColor SC-P9000
First Page Out from Ready State (Tested in all modes)	✔	
A1 Throughput Speed Portrait (Tested in all modes)	✔	
A1 Throughput Speed Retail Poster (Tested in all modes)	✔	
A0 Throughput Speed Portrait (Tested in all modes)	✔	
A0 Throughput Speed Retail Poster (Tested in all modes)	✔	

+ When printing a high-resolution portrait, the Canon model delivered faster first-page-out times than the Epson model from the ready state in all modes; it was 23.9% faster than that of the Epson device in Standard/Speed, 22.3 % faster in High/Quality and 29.8% faster in Highest/Max Quality.

+ When printing a medium-resolution signage retail poster, the Canon model easily surpassed the Epson model in terms of speed, with faster (46.6% in Standard/Speed, 45.1% in High/Quality and 33.4% in Highest/Max Quality) first-page-out times from ready state in all modes.

+ In BLI's A1 throughput speed evaluation, the Canon PRO-4000 displayed a clear speed advantage over the Epson model when printing five pages of a single-page A1-size high-resolution portrait test document in three quality modes; its per-page speed was 28.3% faster in Standard/Speed mode, 23.9% faster in High/Quality mode and 30.5% faster in Highest/Max Quality mode.

+ When printing five pages of a single-page A1-size medium-resolution retail poster test document, the Canon model again outperformed the Epson model, with per-page times that were 53.4% faster in Standard/Speed mode, 45.1% faster in High/Quality mode and 35.0% faster in Highest/Max Quality mode.

+ In BLI's A0 throughput speed evaluation, the Canon PRO-4000 displayed a clear speed advantage over the Epson model when printing five pages of a single-page A0-size high-resolution portrait test document in three quality modes; its per-page speed was 8.6% faster in Standard/Speed mode, 19.0% faster in High/Quality mode and 25.7% faster in Highest/Max Quality mode.

+ When printing five pages of a single-page A0-size medium-resolution retail poster test document, the Canon model again outperformed the Epson model, with per-page times that were 45.8% faster in Standard/Speed mode, 42.9% faster in High/Quality mode and 31.1% faster in Highest/Max Quality mode.

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Ink Consumption

BLI analysts observed that, owing to the vagaries of inkjet technology (for example, head flushing and calibration routines can occur at any time during testing), the same test can produce different results at different times. Although BLI makes every effort to ensure that devices are tested on a level playing field, the test results should be regarded as an indicator of likely performance and not as a prediction of actual ink consumption in a real-world environment.

Average weight of ink used (grams)	Canon imagePROGRAF PRO-4000	Epson SureColor SC-P9000
PACKAGING PROOF (Standard/Speed Mode)	146.0 g	274.4 g
RETAIL POSTER (Standard/Quality Mode)	123.0 g	201.4 g
STUDIO PORTRAIT (Standard/Speed Mode)	139.6 g	201.1 g

+ In all of the BLI Packaging Proof ink consumption print runs using Standard/Quality mode on glossy proofing paper, the Canon PRO-4000 used significantly less ink in terms of net weight than did the Epson SureColor SC-P9000.

+ In all of the BLI Retail Poster print runs using Standard/Quality mode on matte coated media, the Canon PRO-4000 used significantly less ink in terms of net weight than the Epson SureColor SC-P9000 did.

+ In all of the BLI Studio Portrait ink consumption print runs using Standard/Quality mode on semi-gloss photo media, the Canon PRO-4000 used significantly less ink in terms of net weight than did the Epson SureColor SC-P9000.

Device Feature Set

+ The Epson SureColor SC-P9000 employs eleven inks, four of which are different shades of black, whilst the Canon PRO-4000 employs twelve inks, including two black and two grey inks. The fact that the Canon inks are replaceable during operation helps to reduce downtime.

+ The Canon model's printhead contains over five times more nozzles per colour than the Epson unit's single printhead. The Canon printhead is user-replaceable, whereas Epson's is only service-replaceable.

— The Canon unit's ink delivery system dispenses a slightly larger drop size than the Epson ink delivery system.

+ The Epson starter ink cartridge capacity (110 ml) is less generous than that of the Canon model (190 ml). Replacement cartridges come in comparable sizes (160/330/700 ml for Canon, 150/350/700 ml for Epson).

+ In addition to high-speed USB and Gigabit connectivity (matched by Epson), the Canon also offers a wireless interface (not matched by Epson).

— Epson offers an inline spectrophotometer as an option, for automated colour management and verification—an option that's not offered with the Canon model.

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+ However, Canon users can use the PRO-4000's standard calibration features which allow users to calibrate the printer not only with the manufacturer's own-brand of genuine paper, but other media brands as well, while administrators can control colour and monitor the calibration status across the whole PRO-1000/2000/4000 series via Canon's free Device Management Console utility to ensure colour consistency.

○ Both models offer borderless printing.

+ The Canon model has a larger standard memory capacity (3 GB) than the Epson unit which has a 1-GB memory.

+ The Canon model has a standard 320-GB hard drive, which allows for the storage of commonly used documents and aids spooling workflow; the Epson device offers a 320-GB hard drive, but only as an option.

+ Canon offers the option of a 'Multi-function' dual-roll system for those who need to be able to switch flexibly between different media types or sizes; this option is not offered by Epson.

— The Canon model has a higher advertised peak energy value (112W) than the Epson model (75W).

+ However, the Canon PRO-4000's energy consumption in standby mode (where it will likely spend a large amount of time) is just 1.8W compared with 19W for the Epson device.

○ The Canon model includes a plug-in for Microsoft Office, which provides a wizard that enables users to create posters from Word, Excel or PowerPoint, avoiding the need for complex resizing. This feature is also offered on the Epson model.

+ The Canon model includes PosterArtist Lite, Canon's software for creating posters and signage in simple steps. The full version of Canon PosterArtist, available as an option, offers more advanced features such as auto design, variable data printing, in-application editing features, plus additional templates, photos and clip art. Epson offers CopyFactory as an extra-cost option, which enables poster and banner creation on Epson large-format printers.

+ The Canon device includes a media mismatch option, which places on hold jobs that can't be printed due to incorrect media being loaded, while jobs that can be completed are printed; the held jobs are printed once the required paper is loaded. The Epson device offers a paper size check setting which, if enabled, means it will stop printing altogether, should it detect an issue.

○ Canon offers a Print Studio PRO plug-in which offers support for a variety of software options designed to appeal to specific segments of the Graphic Arts market such as photography and fine art display. These include a print plug-in for Photoshop, which, according to Canon, allows users to print 16-bit files directly from Adobe RGB with a wide gamut and clear tonal gradation, and a plug-in for DPP (Digital Photo Professional) that includes a 'Digital Lens Optimizer' to improve photographic image quality and enhance depth of field; Adobe Lightroom is also supported. Print Studio Pro has additional functions allowing users to add text to the photos; choose black and white photo mode, and save favourite settings among others. Epson's Print Layout is a plug in for Photoshop, Lightroom and Nikon View NX-I, which lets users perform more advanced colour management, layout and print photos, optimize black-and-white photos and save media types and sizes for future use.

○ Canon's Accounting Manager, accessed via the Status Monitor, offers comprehensive accounting management for all print jobs. Users enter the actual costs for individual inks and media types, and the cost per job is calculated automatically and displayed. For each job, the media type, area, ink used and total print time are listed, and more detailed cost and consumption information can be obtained by double-clicking on an individual job name or by highlighting a range of different jobs. Job cost information can then be saved in .CSV format and opened in Excel. Epson offers similar accounting management and tracking capabilities via its LFP Accounting Tool software, which is available to download for free from Epson's website.

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Driver Feature Set

+ The Canon driver includes 51 media profiles versus 47 for the Epson driver, although both units permit users to build a library of custom media profiles

+ The Canon driver includes a watermark capability; the Epson driver does not.

+ The Canon driver also includes a Thicken Fine Lines image enhancement option, which is not available with the Epson model.

+ Both the Canon and Epson drivers offer N-up printing (up to 16 and 4, respectively).

— Poster printing capability (2 x 2) is offered by the Canon model, but Epson users can select a further option for 4 x 4 poster printing.

— Although the Canon driver offers page-stamping (date, time, user-name and page number), a wider range of page stamping options is available with the Epson driver, including a free text comments field for users to add personal observations.

○ The Canon driver includes a utility, Colour imageRUNNER Enlargement Copy Mode, which allows users to integrate a Canon MFP or other scanner with the PRO-4000. Documents scanned by the Canon MFP are automatically routed to a hot folder, which is monitored by the PRO-4000 driver. Users can also set up other scanners to route files directly to the hot folder. The image is then resized and printed, offering a fast, easy-to-use poster creation tool for office users. Epson's CopyFactory Utility offers similar functionality, but was not evaluated by BLI.

○ The Canon model's device status monitor can be accessed directly from the first tab of the driver, but Epson users must perform an extra click to access device status via an icon on the Utility tab.

○ The Canon driver features a wide selection of simple colour adjustment options, which include brightness and contrast, as well as a sliding scale of adjustments for cyan, magenta, yellow and black. The Epson driver has similar adjustment options for cyan, magenta and yellow (but no black), along with brightness, contrast and saturation.

— The print driver for the Epson model provides a handy thumbnail preview for users to check the effects on their image as they make colour adjustments.

○ The Canon driver includes advanced colour-matching capabilities, including the selection of ICC profiles and rendering intents based on different elements in the document. The Epson Color Calibration Utility offers 'Paper Preset Management', which offers users the ability to create, install and export media ICC profiles, and the optional spectrophotometer provides colour management control.

○ The Canon and Epson drivers both include a unidirectional print selection.

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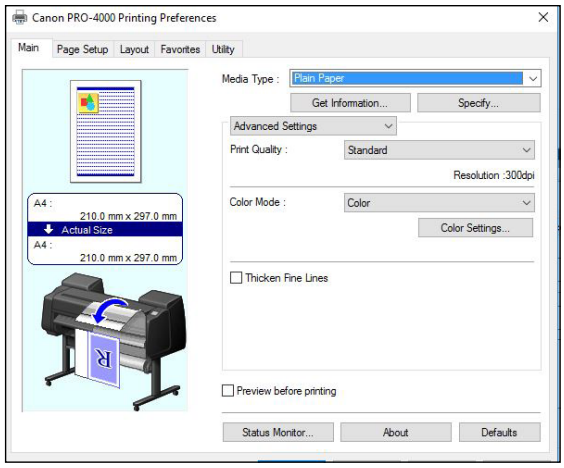
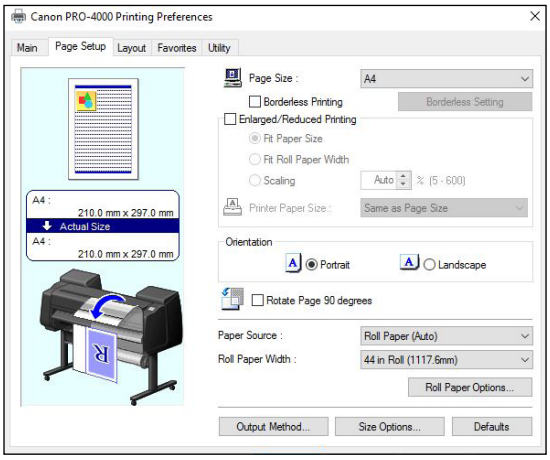
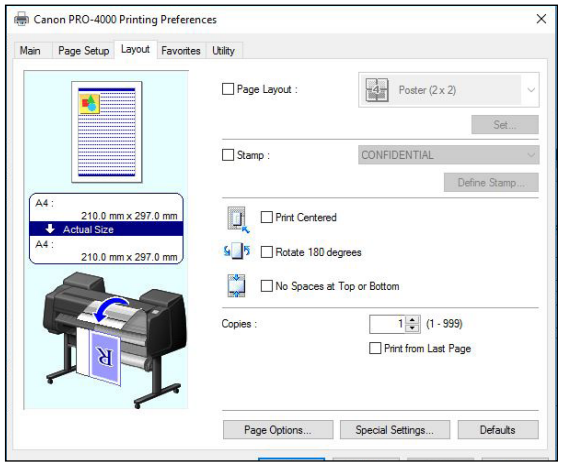


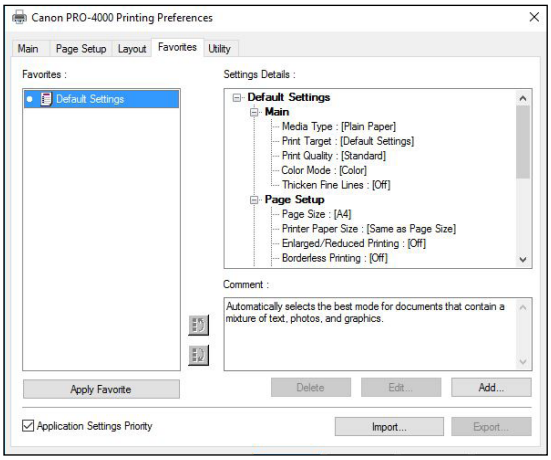
Canon imagePROGRAF PRO-4000 Print Driver Main Tab



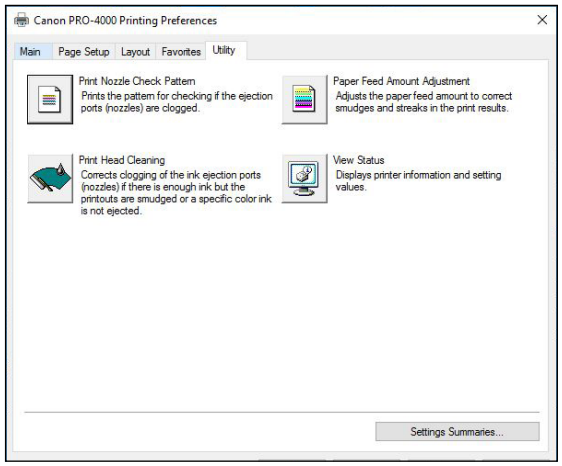
Canon imagePROGRAF PRO-4000 Print Driver Page Setup Tab



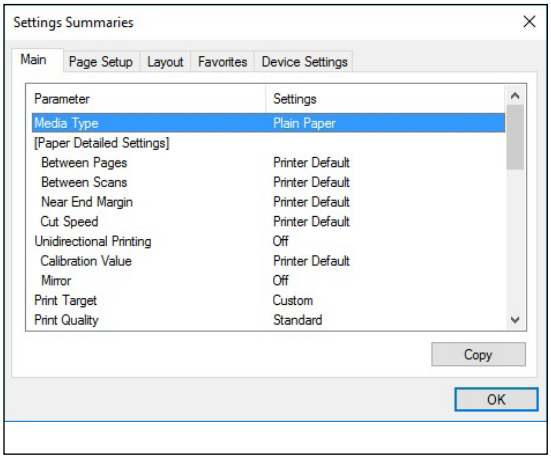
Canon imagePROGRAF PRO-4000 Print Driver Layout Tab



Canon imagePROGRAF PRO-4000 Print Driver Favourites Tab



Canon imagePROGRAF PRO-4000 Print Driver Utility



Canon imagePROGRAF PRO-4000 Settings Summaries

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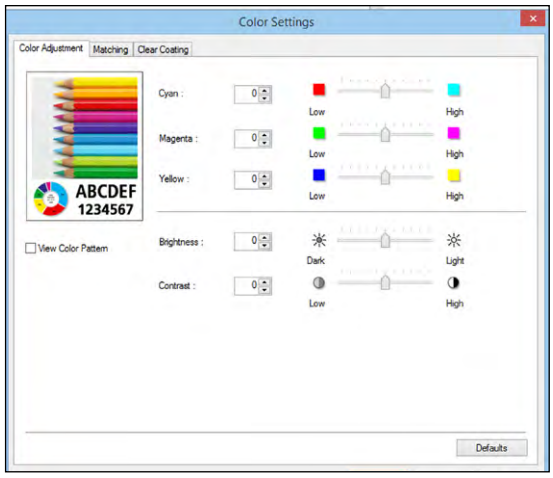
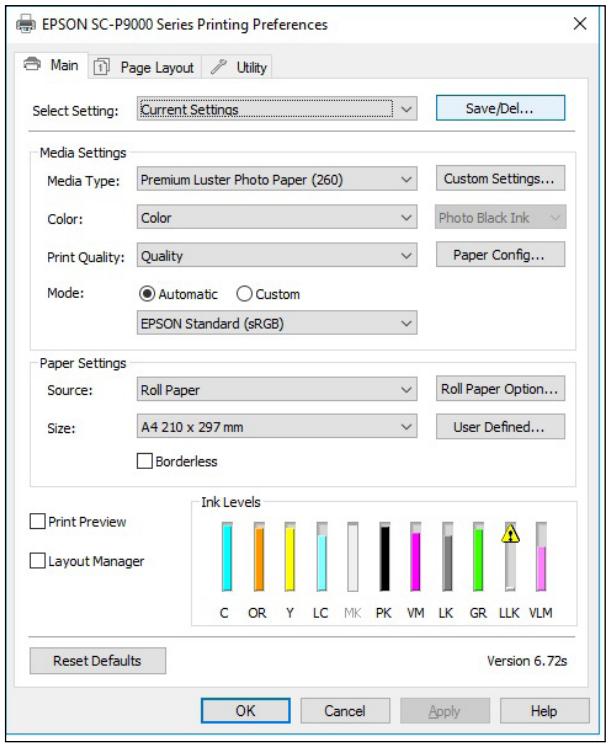
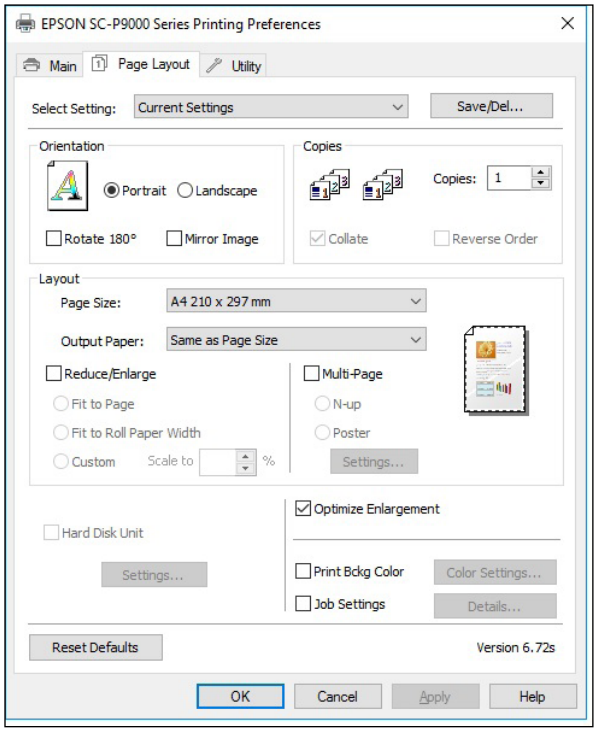


Canon imagePROGRAF PRO-4000 Print Driver Colour Adjustment Tab



Epson SureColor SC-P9000 Print Driver Main Tab



Epson SureColor SC-P9000 Print Driver Page Layout Tab

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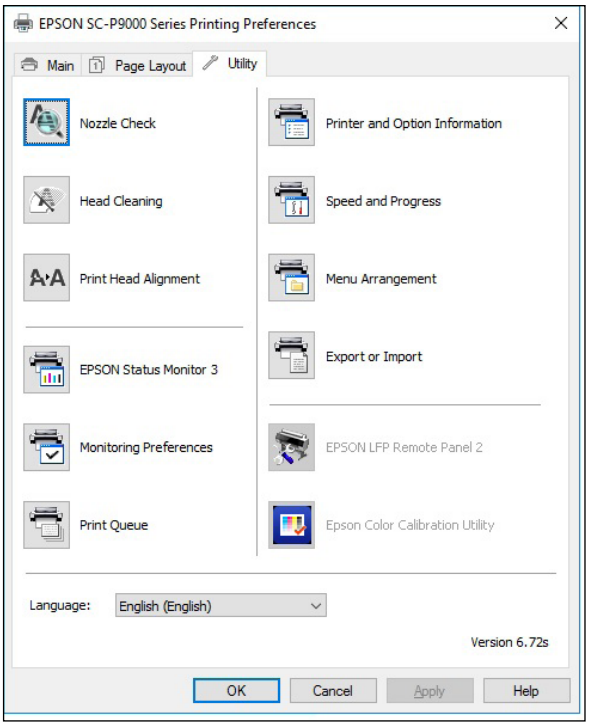
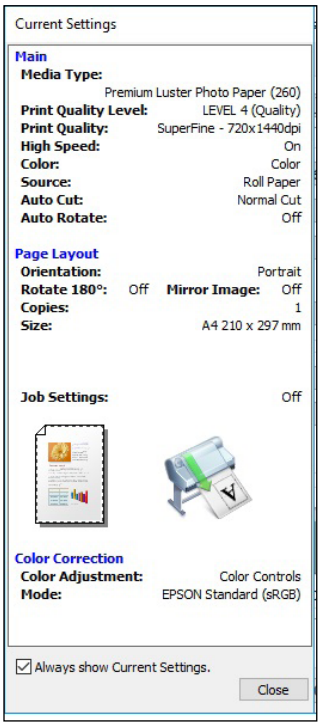


Epson SureColor SC-P9000 Print Driver Utility Tab



Epson SureColor SC-P9000 Print Driver Current Settings

Printhead Reliability / Cleaning Routines

○ Both models offer various choices of settings for performing nozzle checks at the control panel. The Canon PRO-4000 has an Auto nozzle check setting, which is the default setting. In addition, it offers settings at the control panel to perform a check after one page, after 10 pages or to disable it entirely. Nozzle checks can be performed on the Epson model either at the control panel or via the driver. If the Auto Nozzle Check option is enabled, there are three choices of settings for nozzle checks: Periodic (the default mode), On (performs a check at each job) or Off (the machine performs a check under specific conditions, such as after initial ink charging).

○ When a clogged nozzle is detected on the Canon unit, it pauses during operation and automatically runs a cleaning cycle to maintain image quality and consistency; it resumes printing once the cleaning cycle is completed, with no user intervention required. When a clogged nozzle is detected on the Epson device, the machine can run a cleaning cycle immediately without the user having to print a nozzle check pattern, with the number of automatic cleaning cycles set in the driver (a choice of one—the default—to three).

○ When the two devices were powered off completely over a weekend, the Canon model had no issues with nozzles clogging. When a nozzle check pattern was requested, it printed with perfect accuracy every time. Similarly, the Epson SC-P9000 did not suffer any issues with nozzles clogging and printed a flawless nozzle check pattern upon request.

+ As the Epson SureColor SC-P9000 has both matte black and photo black inks which share the same printhead, users must choose to switch between them for a specific job at the control panel (or this can be done auto-

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matically via the Auto Black Change setting in the printer driver)—a process which takes about two minutes to complete and uses an indeterminate amount of ink.

+ A standard cleaning cycle performed on the Canon model takes approximately 4 minutes, 30 seconds on average to complete, whilst on the Epson model, a Standard clean cycle takes approximately 7 minutes.

SUPPORTING TEST DATA

Colour Throughput Time – A1 High Resolution Portrait Printing

Canon imagePROGRAF PRO-4000 (time in seconds)			Epson SureColor SC-P9000 (time in seconds)		
Standard	High	Highest	Speed (Level 2)	Quality (Level 4)	Max Quality (Level 5)
271.36	420.00	616.73	378.76	552.15	886.98

A single-page A1 portrait TIFF file was printed as a 5-page job using the device driver set to the glossy paper/colour setting. Both devices were loaded with 36" rolls. The time indicated is the average speed per page in seconds (based on timing from the cutting of the first page to the cutting of the final page and dividing by four to exclude the initial processing time).

Colour Throughput Time – A1 Medium Resolution Signage Retail Poster Printing

Canon imagePROGRAF PRO-4000 (time in seconds)			Epson SureColor SC-P9000 (time in seconds)		
Standard	High	Highest	Speed (Level 2)	Quality (Level 4)	Max Quality (Level 5)
125.70	238.73	333.89	269.55	434.91	513.45

A single-page A1 retail sale JPEG file was printed as a 5-page job using the device driver set to the matte coated paper/colour setting. Both devices were loaded with 36" rolls. The time indicated is the average speed per page in seconds (based on timing the cutting of the first page to the cutting of the final page and dividing by four to exclude the initial processing time).

Colour Throughput Time – A0 Medium-Resolution Signage Retail Poster Printing

Canon imagePROGRAF PRO-4000 (time in seconds)			Epson SureColor SC-P9000 (time in seconds)		
Standard	High	Highest	Speed (Level 2)	Quality (Level 4)	Max Quality (Level 5)
229.79	432.99	620.26	424.09	758.66	900.59

A single-page A0 retail sale JPEG file was printed as a 5-page job using the device driver set to the matte coated paper/colour setting. Both devices were loaded with 36" rolls. The time indicated is the average speed per page (based on timing the cutting of the first page to the cutting of the final page and dividing by four to exclude the initial processing time).

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A1 First-Page-Out Time from Ready State – High-Resolution Portrait Printing

	Canon imagePROGRAF PRO-4000 (time in seconds)			Epson SureColor SC-P9000 (time in seconds)		
	Standard	High	Highest	Speed (Level 2)	Quality (Level 4)	Max Quality (Level 5)
Time Before Printing Commences	26.82	28.97	28.86	30.41	30.18	30.37
First Print Out	269.24	415.47	603.83	353.94	534.57	859.72

First-page-out times are achieved by sending an A1 high resolution portrait TIFF file to print, timed from release to page out with the Canon driver set to the plain paper setting and the Epson driver set to plain paper, black mode. Both devices were loaded with 24" rolls.

A1 First-Page-Out Time from Ready State – Medium-Resolution Signage Retail Poster Printing

	Canon imagePROGRAF PRO-4000 (time in seconds)			Epson SureColor SC-P9000 (time in seconds)		
	Standard	High	Highest	Speed (Level 2)	Quality (Level 4)	Max Quality (Level 5)
Time Before Printing Commences	24.54	22.84	24.28	30.39	30.47	31.67
First Print Out	129.72	230.26	335.17	242.71	419.03	503.21

First-page-out times are achieved by sending an A1 medium resolution signage retail poster PDF file to print, timed from release to page out with the Canon driver set to the plain paper setting and the Epson driver set to plain paper, black mode. Both devices were loaded with 24" rolls.

Colour Print Quality

Colour Optical Density Evaluation

Canon imagePROGRAF PRO-4000: Semi-Glossy Photo Paper						
	Highest (2400 x 1200 dpi)					
	1	2	3	4	Max.	Min.
Cyan	1.78	1.79	1.70	1.71	1.79	1.70
Magenta	1.69	1.71	1.69	1.70	1.71	1.69
Yellow	1.32	1.32	1.31	1.31	1.32	1.31
Black	2.70	2.69	2.69	2.66	2.70	2.66

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Epson SureColor SC-P9000: Semi-Glossy Photo Paper						
	Max Quality Level 5 (2880 x 1440 dpi)					
	1	2	3	4	Max.	Min.
Cyan	1.77	1.78	1.78	1.77	1.78	1.77
Magenta	1.07	1.07	1.07	1.08	1.08	1.07
Yellow	1.45	1.45	1.45	1.45	1.45	1.45
Black	2.61	2.60	2.60	2.58	2.61	2.58

Note: Colour density readings were assessed by printing a BLI test file on proofing paper in high-quality colour settings (with Colour Correction set to Off on the Canon device and Colour Adjustment set to Off on the Epson device) and measuring the density of 100% dot fills using an XRite 508 densitometer.

Skin Tone and Neutral Grey Consistency

Skin Tone 1 (C=6, M=15,Y=16,K=0)		
	Canon imagePROGRAF PRO-4000	Epson SureColor SC-P9000
Colour block		
2	0.2	0.2
3	0.3	0.1
4	0.5	0.3
5	0.3	0.2
6	0.4	0.2
7	0.1	0.2
8	0.4	0.1
9	0.9	0.2
Max. Delta E Variance	0.8	0.2

Skin Tone 2 (C=30, M=63,Y=75,K=0)		
	Canon imagePROGRAF PRO-4000	Epson SureColor SC-P9000
Colour block		
2	0.3	0.1
3	0.5	0.3
4	0.3	0.4
5	0.7	0.3
6	0.3	0.3
7	0.8	0.2
8	0.7	0.2
9	0.7	0.3
Max. Delta E Variance	0.5	0.3

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Skin Tone 3 (C=19, M=33,Y=50,K=0)		
	Canon imagePROGRAF PRO-4000	Epson SureColor SC-P9000
Colour block		
2	0.4	0.5
3	0.7	0.3
4	0.9	0.2
5	0.7	0.6
6	0.5	0.6
7	0.4	0.2
8	0.5	0.6
9	0.5	0.4
Max. Delta E Variance	0.5	0.4

Neutral Grey		
	Canon imagePROGRAF PRO-4000	Epson SureColor SC-P9000
Colour block		
2	0.8	0.4
3	0.3	0.1
4	0.4	0.2
5	0.3	0.4
6	0.6	0.1
7	0.3	0.1
8	0.4	0.4
9	0.3	0.2
Max. Delta E Variance	0.8	0.4

Note: Skin tone and neutral grey consistency measurements are based on nine readings taken from a BLI proprietary PDF test target file comprising four A1-sized solid coverage documents of three skin tones and a neutral grey with the Highest/Max Quality print quality setting selected in the driver and the target printed on the manufacturer's own brand of proofing semi-gloss media. Colour differences across the A1 image were measured comparing eight locations to that of the colour measured at the top left of the page, using an EFI ES1000 colour spectrophotometer and Gretag MacBeth EyeOne Share colour comparison software.

FOGRA 39 DRIFT TEST: comparison of FOGRA39 colour patches before and after ink consumption test.

	Canon imagePROGRAF PRO-4000	Epson SureColor SC-P9000
Delta E Drift	2.9	1.4

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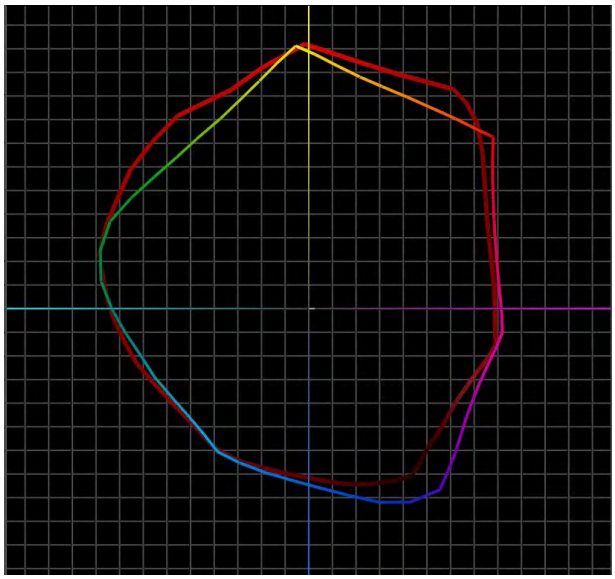
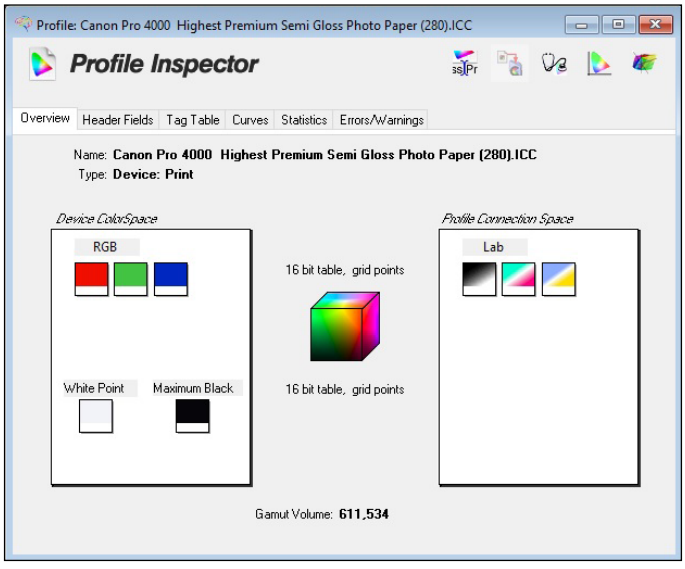
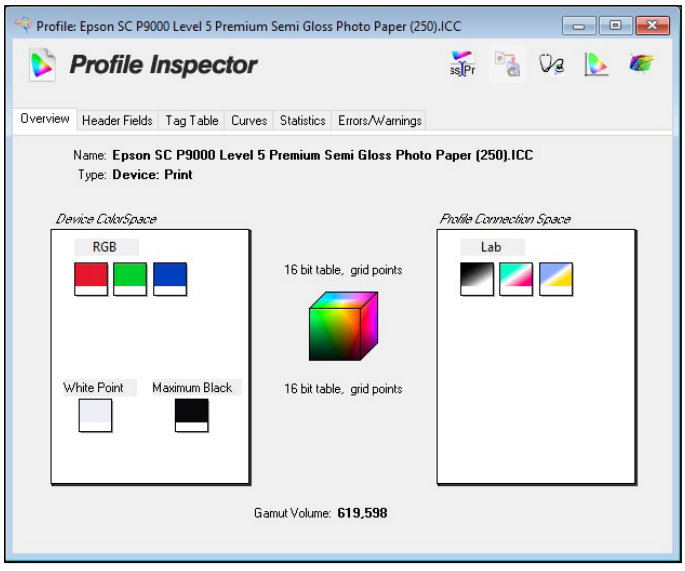
Colour Gamut Comparison

Media Type/Settings	Canon image PROGRAF PRO-4000	Epson SureColor SC-P9000	Canon % larger/smaller +/- than Epson
Photo Paper Highest/Max Quality	804,574	879,597	-8.5%



Canon imagePROGRAF PRO-4000 colour gamut (shown chromatically) on Semi-Gloss photo paper in Highest quality settings and with Colour Correction disabled versus Epson SureColor SC-P9000 colour gamut (red) on Semi-Gloss photo paper in Max Quality Level 5 settings with Colour Adjustment disabled.





Colour gamut profiles for the Canon imagePROGRAF PRO-4000 (left) and Epson SureColor SC-P9000 (right) on photo paper in highest quality mode.

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Device Feature Set

	Canon imagePROGRAF PRO-4000	Advantage		Epson SureColor SC-P9000
Max. print resolution	2400 x 1200 dpi		✔	2880 x 1440 dpi
Number of ink cartridges	12	✔		11
Ink tanks replaceable during operation	Yes	✔		No
Ink-drop size	4 picoliter		✔	Minimum 3.5 picoliter (variable)
Starter cartridge total capacity	2,280 (12 x 190 ml)	✔		1,100 (10x 110 ml)
Ink cartridge capacity	160 ml, 330 ml and 700 ml			150 ml, 350 ml and 700 ml
Number of nozzles	18,432 (1,536 per colour)	✔		3,600 (360 per colour)
Number of printheads	1			1
Line accuracy	+/-0.1% or less	✔		+/-0.2%
Minimum line width	INA			INA
Minimum print margins	Borderless			Borderless
Borderless (0 mm) printing	Yes			Yes
Maximum outside diameter of roll paper	170 mm	✔		150 mm
Maximum printable paper roll length	18 m			Limited by application, OS and driver/RIP used
Maximum cut-sheet media length	1.6 m			INA
Maximum media thickness	0.8 mm (roll), 0.8 mm (cut sheet)			0.5 mm (roll), 1.5 mm (cut sheet)
Maximum media width	44 inches			44 inches
Media loading	Front/top			Front/top
Optional media handling	Roll holder set (supports 2" and 3" media cores)			Roll media adapter (supports 2" and 3" media cores)
Standard RAM	3 GB	✔		1 GB
Maximum RAM	3 GB	✔		1 GB
Hard drive	Standard 320-GB	✔		Optional 320-GB
Interface	10/100/1000Base-T/TX Ethernet, USB 2.0 High Speed, Wireless 802.11b/g/n	✔		100Base-TX/10Base-T Ethernet, USB 2.0 High Speed
PDL	SG (Standard Graphic) Raster			Epson ESC/P-R
Dual-Roll	Optional	✔		No
Net weight (unpacked)	123 kg			131 kg
Power consumption when in standby	1.8 W	✔		19 W
Power consumption when active	112 W		✔	75 W
Acoustic pressure	Operation: 47 dB (A) or less; Standby: INA			Operation: Less than 48 dB (A); Standby: 35dB
Option to integrate with a spectrophotometer?	No		✔	Yes (Epson SpectroProofer)

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Driver Feature Set

	Canon imagePROGRAF PRO-4000	Advantage		Epson SureColor SC-P9000
Speed settings	Up to 5 depending on media settings			Up to 5 depending on media settings
Economy mode	Yes (Fast setting)			Yes (Level 1 setting)
Predefined profiles	4 (Under Easy Settings)		✔	5
Overview of profile settings provided	Yes (Favourites only)			Yes
Media profiles	51	✔		47
IQ optimized for options	Yes			Yes
Watermark	Yes	✔		No
Sharpen text	No		✔	Edge smoothing
Thicken fine lines	Yes	✔		No
Mirror image	Yes			Yes
Multi-up printing	Yes, 2 to 16	✔		Yes, 2 to 4
Poster print mode	Yes (2 by 2)		✔	Yes (4 by 4)
Page stamping	Yes (Date, Time, Name, Page Number)		✔	Yes (Date, Time, Document/User/Printer Name, Media Type, Print Quality Level, Print Quality Resolution, Colour Mode, High Speed, Finest Detail, Edge Smoothing, Colour Adjustment and Value, Mode, Colour Density)
Image rotation	Yes, auto 180 degrees			Yes, auto 180 degrees
Option to preview before print	Yes			Yes
Link to device web server from driver	No (there is a link to Status Monitor)			No (there is a link to Status Monitor 3)
CMYK balance adjustment	Yes			Yes
Brightness adjustment	Yes			Yes
Contrast adjustment	Yes			Yes
Saturation adjustment	No		✔	Yes
Advanced colour management options	Yes			Yes
Enlargement Copy Mode	Yes			Yes
Free Layout Capability	Yes	✔		No
MS Office Plug-in	Yes			Yes
Adobe Photoshop Plug-in	Yes*			Yes**
Accounting Capability	Yes			Yes
Disable automatic cutter	Yes			Yes
Unidirectional printing selection option	Yes			Yes

* Canon's imagePROGRAF PRO-4000 supports Canon's Print Studio PRO plug-in which lets users print from industry-standard editing and graphics software such as Adobe Lightroom, Adobe Photoshop and Canon Digital Photo Professional. It also comes bundled with PosterArtist Lite software.

** The Epson SC-P9000 supports Epson Print Layout, available to download from Epson's website, which is a plug-in for Adobe Lightroom, Adobe Photoshop and Nikon View NX-i.

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Ink Consumption

Table 1: Amount of Ink in each Canon imagePROGRAF PRO-4000 Cartridge (grams)

	PM	R	C	PG	MK	PK	B	CO	G	Y	M	PC
Weight of cartridge prior to installation	945.9	944.4	941.2	931.0	956.3	935.5	937.5	937.1	937.2	944.4	951.6	938.7
Weight of cartridge at end of life	201.3	201.3	201.3	201.3	201.3	201.3	201.3	201.3	201.3	201.3	201.3	201.3
Net weight of ink	744.6	743.1	739.9	729.7	755.0	734.2	736.2	735.8	735.9	743.1	750.3	737.4
Total ink weight across 12 cartridges												8,885.2

Table 2: Amount of Ink in each Epson SureColor SC-P9000 Cartridge (grams)

	C	OR	Y	LC	MK	PK	VM	LK	G	LLK	VLM
Weight of cartridge prior to installation	955.8	938.6	917.4	807.3	996.6	945.6	865.4	770.5	914.1	447.0	717.1
Weight of cartridge at end of life	351.5	351.5	351.5	351.5	351.5	351.5	351.5	351.5	351.5	351.5	351.5
Net weight of ink	604.3	587.1	565.9	455.8	645.1	594.1	513.9	419.0	562.6	95.5	365.6
Total ink weight across 11 cartridges											5,408.9

Table 3: Ink Used in Three 50-Page Runs of Packaging Proof Test Document (Standard Mode) on the Canon imagePROGRAF PRO-4000 (grams)

	PM	R	C	PG	MK	PK	B	CO	G	Y	M	PC
Test Run 1 Net weight of ink used	9.25	7.0	11.4	7.3	7.7	36.9	6.5	9.3	33.2	11.6	11.8	8.2
Test Run 2 Net weight of ink used	11.1	9.8	11.4	4.8	4.0	37.8	8.9	3.8	33.2	10.9	11.8	4.2
Test Run 3 Net weight of ink used	10.8	4.4	3.7	7.1	6.9	30.2	5.5	6.7	27.7	9.6	8.2	5.3
Average amount of ink used across three runs	10.4	7.1	8.8	6.4	6.2	35.0	7.0	6.6	31.4	10.7	10.6	5.9
Total average ink weight across 11 cartridges												146.0

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Table 4: Ink Used in Three 50-Page Runs of Packaging Proof Test Document (Quality Mode) on the Epson SureColor SC-P9000 (grams)

	C	OR	Y	LC	MK	PK	VM	LK	G	LLK	VLM
Test Run 1 Net weight of ink used	14.0	12.6	18.0	32.9	0	27.9	17.9	59.6	12.5	52.1	52.8
Test Run 2 Net weight of ink used	5.4	4.2	11.2	26.0	0	20.1	9.9	52.0	4.9	43.4	44.1
Test Run 3 Net weight of ink used	13.8	12.2	32.2	33.7	0	29.3	18.3	61.5	12.9	35.6	52.4
Average amount of ink used across three runs	11.1	9.7	20.5	30.9	0	25.8	15.4	57.7	10.1	43.7	49.8
Total average ink weight across 11 cartridges											274.4

Table 5: Ink Used in Three 50-Page Runs of Retail Poster Test Document (Standard mode) on the Canon imagePROGRAF PRO-4000 (grams)

	PM	R	C	PG	MK	PK	B	CO	G	Y	M	PC
Test Run 1 Net weight of ink used	13.2	4.8	4.0	21.6	10.2	3.8	4.6	3.6	15.1	8.8	7.5	4.8
Test Run 2 Net weight of ink used	13.5	6.1	3.6	23.4	9.5	3.5	0	3.6	14.6	7.4	7.3	6.1
Test Run 3 Net weight of ink used	16.9	6.5	3.7	24.5	10.3	3.1	6.2	3.7	17.8	8.4	8.8	6.5
Average amount of ink used across three runs	14.5	5.8	3.8	23.2	10.0	3.5	3.6	3.6	15.8	8.2	7.9	5.8
Total average ink weight across 12 cartridges												105.7

Table 6: Ink Used in Three 50-Page Runs of Retail Poster Test Document (Quality mode) on the Epson SureColor SC-P9000 (grams)

	C	OR	Y	LC	MK	PK	VM	LK	G	LLK	VLM
Test Run 1 Net weight of ink used	8.3	11.3	17.0	17.7	0	0.5	29.1	4.9	11.5	67.6	42.3
Test Run 2 Net weight of ink used	0	11.3	0	17.8	0.5	8.3	29.7	15.2	11.2	68.1	42.6
Test Run 3 Net weight of ink used	3.3	11.1	7.1	17.3	0.4	0	28.7	14.6	11.0	66.1	41.3
Average amount of ink used across three runs	3.5	11.2	7.2	17.6	0.3	0.3	29.2	11.6	11.2	67.3	42.1
Total average ink weight across 11 cartridges											201.4

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Table 7: Ink Used in Three 50-Page Runs of Studio Portrait Test Document (Standard mode) on the Canon imagePROGRAF PRO-4000 (grams)

	PM	R	C	PG	MK	PK	B	CO	G	Y	M	PC
Test Run 1 Net weight of ink used	10.8	3.8	4.0	35.1	5.0	15.3	4.4	4.0	36.2	5.2	3.9	7.1
Test Run 2 Net weight of ink used	15.3	4.8	4.2	37.1	4.7	13.7	5.4	4.8	39.2	9.9	4.7	9.8
Test Run 3 Net weight of ink used	10.3	3.7	3.6	36.0	3.7	14.1	2.2	3.1	34.7	8.1	2.7	8.2
Average amount of ink used across three runs	12.1	4.1	3.9	36.1	4.5	14.4	4.0	4.0	36.7	7.7	3.8	8.4
Total average ink weight across 12 cartridges												**139.6**

Table 8: Ink Used in three 50-page Runs of Studio Portrait Test Document (Quality mode) on the Epson SureColor SC-P9000 (grams)

	C	OR	Y	LC	MK	PK	VM	LK	G	LLK	VLM
Test Run 1 Net weight of ink used	2.6	3.7	7.4	23.3	0	1	4.6	23.7	10.1	87.6	31.9
Test Run 2 Net weight of ink used	7.8	5.5	8.3	24.1	0	11.5	9.1	0	11.5	87.3	32.7
Test Run 3 Net weight of ink used	3.4	4.2	7.9	23.8	0	7.3	4.9	28.2	10.6	87.3	32.1
Average amount of ink used across three runs	4.6	4.5	7.9	23.7	0.0	6.6	6.2	17.3	10.7	87.4	32.2
Total average ink weight across 11 cartridges											**201.1**

Ink Consumption Test Methodology Overview

Buyers Lab's ink consumption analysis was conducted using three document types (proof, retail poster and photo). The Packaging Proof document was formatted as a PDF, the Retail Poster as a JPG file and the Studio Portrait was formatted as a TIFF file and all were sized at ISO A1.

The Canon imagePROGRAF PRO-4000 was installed in BLI's lab with the latest level of firmware (as of April 2016) and connected to a Windows 7 workstation using a 1000BaseT TCP/IP connection. The device was left in default configuration throughout testing. The Canon GARO driver was used for all testing and was left in default colour setting configuration. The Packaging Proof document was printed on 255 gsm glossy proofing media in Standard mode. The Retail Poster was printed on matte coated media in Standard mode, and the Studio Portrait photo was printed on 280 gsm semi-gloss photo media in Standard Mode.

The Epson SureColor SC-P9000 was installed in BLI's lab with the latest level of firmware (as of March 2016) and connected to a Windows 7 workstation using a 100BaseT TCP/IP connection. The device was left in default configuration throughout testing. The Epson ESC/P driver was used for all testing and was left in default colour setting, with media selection set to plain paper and the image set to print at actual size. The Packaging Proof document was printed on 255 gsm glossy proofing media in

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Quality mode. The Retail Poster was printed on matte coated in Quality mode, and the Studio Portrait photo was printed on 280 gsm semi-gloss photo media in Quality Mode

Before installing the ink cartridges, BLI technicians weighed and recorded the weight of each with all packaging removed. At the end of each 50-print test run, the cartridges were weighed again and the resulting weight of ink used for the test run calculated for each colour. To ensure that the sub-tank on the Canon model did not affect results, a procedure was followed to ensure that the sub-tank level was at its maximum before the print run commenced and again after the print run was completed, thereby ensuring that ink replenishment of the sub-tanks was taken into account for each print run.

For the Canon imagePROGRAF PRO-4000 and Epson SureColor SC-P9000: one cartridge was then run to exhaustion and the weight of the empty cartridge was recorded.

Before installing the ink cartridges, BLI technicians weighed and recorded the weight of each with all packaging removed. At the end of each 50-print test run, the cartridges were weighed again and the resulting weight of ink used for the test run calculated for each colour. To ensure that the sub-tank on the Canon model did not affect results, a procedure was followed to ensure that the sub-tank level was at its maximum before the print run commenced and again after the print run was completed, thereby ensuring that ink replenishment of the sub-tanks was taken into account for each print run.

Test Environment

Testing was conducted in BLI's European test lab, in an atmospherically controlled environment monitored by a 24/7 Dickson Temperature/RH chart recorder, ensuring that typical office conditions were maintained. All paper used in testing was allowed to acclimatize inside the facility for a minimum of 12 hours before being used.

Test Equipment

BLI's dedicated test network in Europe, consisting of Windows 2008 servers, Windows 10 workstations, 10/100/1000BaseTX network switches and CAT5e/6 cabling.

Test Procedures

The test methods and procedures employed by BLI in its lab testing include BLI's proprietary procedures and industry-standard test procedures. In addition to a number of proprietary test documents, BLI uses industry standard files including a BLI test file and an ASTM monochrome test document for evaluating black image quality. In addition to a visual observation, colour print quality and gamut size are evaluated using a profile software tool from Colour Confidence that was read using an EFI ES-1000 colour spectrophotometer and analysed using Chromix ColorThink Pro 3.0 software. Density of black and colour output was measured using an X-Rite 508 densitometer.

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