

KPI Comparative Lab Test Report

JANUARY 2020

Canon imagePROGRAF PRO-4100

vs. HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer

Advantage	Canon imagePROGRAF PRO-4100	HP DesignJet Z9+dr 44 inch Post- Script with V-Trimmer
Image Quality	✓	
Print Productivity	✓	
Banner Printing	✓	
Ink Consumption	✓	
Direct Print Submission Functionality	✓	
Device Feature Set	✓	
Print Driver Feature Set	✓	
Printhead Reliability/Cleaning Routines	✓	

Test Objective

Keypoint Intelligence - Buyers Lab was commissioned by Canon Europe to conduct confidential wide format device performance testing on the Canon imagePROGRAF PRO-4100 and the HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer, and produce a report comparing the relative strengths and weaknesses of the two printers in terms of image quality, productivity, ink consumption, direct print submission functionality, device feature set, driver functionality, and printhead stability and cleaning routines. All testing was performed in Buyers Lab's European test facility in Wokingham, UK.

Executive Summary

Based on its test performance in Buyers Lab's graphic arts evaluation, the Canon imagePROGRAF PRO-4100 had clear advantages in many areas, delivering superior image quality, lower ink consumption in two of the three test scenarios, and faster productivity in all tests. Its speed performance makes the Canon unit the more productive choice for high-resolution environments such as photographic studios in addition to being well suited for medium-resolution work such as signs and posters. Not just fast, it successfully printed Buyers Lab's proprietary banner image, unlike the HP model which couldn't handle the file at all. Image quality produced by both 44-inch printers in the highest quality mode, was entirely congruous with the standard expected of models that are designed for photographic and graphical printing applications. Yet, the Canon PRO-4100 had the overall edge with better fine detailing in highlight and shadow areas, cleaner and crisper fine lines, and a larger colour gamut. Printhead reliability was also in the Canon unit's favour; while both models' printheads performed reliably throughout the evaluation, the PRO-4100 printhead did not experience any nozzle clogging issues when powered off over a weekend, but the HP model's printhead did, and it required a clean cycle to rectify. Canon's latest generation PRO series offer numerous features that boost efficiency, including improved automatic media loading, automatic media identification and tracking abilities without the need to print a media barcode, large ink cartridge capacities for all colours, wireless connectivity, a dual-roll design that operates with auto take-up to facilitate longer unattended workflows, as well as Canon's hallmark hot-swap ink tank design, which lets users replace empty inks while the device is still actively printing. In contrast, when the HP DesignJet Z9+dr runs out of ink, printing has to stop for the cartridge to be replaced, which leads to operator downtime. Both models come with a 500-GB hard drive to aid job storage, support direct printing via a USB flash device, and offer comparably strong mobile print support. In terms of direct print submission functionality, Canon has the overall slight edge with its new Professional Print & Layout utility which offers extensive image adjustment features and flexible layout nesting to help users save on paper. The HP Z9 offers higher memory to aid with job processing, has a dual-roll design (with auto take-up as an optional extra), and comes with an inline XRite i1 spectrophotometer to provide more precise colour management control. While the Canon PRO-4100 does not offer this as an option, the device comes with standard calibration features used for both the manufacturer's own-brand of genuine paper, as well as other media brands. The HP Z9+dr's V-Trimmer functionality enables the unit to trim most supported media, including HP Artist and Professional Matte Canvas and Scrim Banner, and allows borderless output on all sizes and media supported; the Canon PRO-4100 supports borderless output on all media too.

In conclusion, the Canon PRO-4100 is the stronger performer in Buyers Lab's large-format evaluation overall. Not only did it deliver faster productivity and first-class photographic image quality, it handled Buyers Lab's banner test successfully (which the HP failed to output), and its driver and device feature sets are richer, providing many ways to boost productivity and enhance functionality.

Image Quality

Advantage	Canon imagePROGRAF PRO-4100	HP DesignJet Z9+dr 44 inch Post-Script with V-Trimmer
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	=	=
Photographic Images	✓	
Colour Gamut	✓	

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

Buyers Lab's image quality test evaluation was conducted using Canon's Premium Semi-gloss Photo 280gsm media and HP's Premium Instant-Dry Satin Photo 260gsm media, with quality set to Highest on the Canon model and the HP model set to Best.

- + As would be expected of two models aimed at the Graphic Arts (GA) marketplace, both units delivered a very high standard of output in colour appropriate for any poster and photo printing application. However, the Canon PRO-4100 delivered superior quality overall, with finer detailing in dark contrast areas and better depth of field.
- The Canon model produced cleanly formed and pin-sharp fonts in both black and colour that were fully formed down to the 4-pt type size in serif, and 3-pt. level in sans serif with no bleed observed. The HP model also delivered crisp sans serif and serif fonts in colour and in black that were legible to the 3-pt. type size, except for Times in black which was fully formed at the 4-pt. level.
- + The Canon PRO-4100 delivered very good vertical and horizontal fine lines down to 0.1-pt size in both black and colour. Fine lines produced by the HP model were slightly bolder, with no distinction between 0.1-pt. and 0.25-pt. levels, and were rated good.
- + Circles produced by the Canon unit were smooth, clean, and distinct and judged very good at the 0.1-pt. level. The HP Z9 produced dark bold circles at the 0.1-pt. level, which weren't distinguishable from those at the 0.25-pt. level, and rated good.
- + The Canon unit produced excellent CMY and black-on-white 1x1 pixel grids with no quality issues; the HP model delivered very good intact 1x1 pixel grids as well, however the dot formation was inconsistent.
- Both models delivered colour and black 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 impressive range of halftone fills in colour mode, with no banding or graininess issues. Neutral greyscale halftone coverage was equally good from both units.
- The Canon PRO-4100 produced a higher yellow optical density, while the HP unit produced higher cyan, magenta, and black optical densities.
- The production of three different skin tone colours yielded fairly consistent results for both models. Although the HP unit displayed a slightly greater variance with one of the three skin shades, this would not be considered significant enough to be discernible to the naked eye.
- Neutral grey consistency was maintained well by both models, with a low variance across the page indicated by low Delta E values.
- During Buyers Lab'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 Color Verifier software, both models displayed comparably low mean Delta E drifts—2.6 for the Canon unit and 2.9 for the HP device.
- + When printing on photo media in highest quality settings, the Canon PRO-4100 delivered a slightly larger (by 2.3%) colour gamut—787,627 CIE volume versus 769,709 CIE volume for the HP model.
- + Buyers Lab technicians analysed a wide range of colour and greyscale images output by both devices and found them to be of an exceptionally high standard, with equally vibrant colours. However, the Canon PRO-4100 had better fine detailing in light and dark contrast areas, while greyscale images produced on the HP Z9 were slightly darker and therefore suffered from a loss of integrity in dark contrast areas.
- Both models produced very good natural-looking skin tones in photographic images, with good definition in the light contrast areas and smooth tonal transitions.

Print Productivity

Advantage	Canon imagePROGRAF PRO-4100	HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer
First Print Out From Ready State Portrait Printing	✓	
First Print Out From Ready State Retail Poster Printing	✓	
Throughput Speed A1 Portrait Printing	✓	
Throughput Speed A1 Retail Poster	✓	
Throughput Speed A0 Portrait Printing	✓	
Throughput Speed A0 Retail Poster	✓	

Productivity evaluation is based on Standard/Normal and High/Best modes only.

- + When printing a single high-resolution portrait, the Canon PRO-4100 was faster than the HP Z9+dr model in terms of speed of the first-print-out from ready state. In Standard/Normal, the PRO-4100 was 45.9% faster than the HP Z9+dr, and it was 44.2% faster in High/Best mode when compared with the HP model.
- + When printing a single medium-resolution retail poster from ready state, the Canon PRO-4100's speed was faster by 18.6% in Standard/Normal mode, and 21.3% in High/Best mode when compared with the HP device.
- + In Buyers Lab's A1 throughput speed evaluation, the Canon model's per-page speed was 43.1% faster than the HP model when printing five copies of a single-page A1-size high-resolution portrait test document in Standard/Normal mode. In High/Best mode, the PRO-4100's per-page speeds were 41.5% faster when compared with the HP model.
- + When printing five copies of a single-page A1-size medium-resolution retail poster test document, the Canon model's per-page speeds were faster by 35.4% in Standard/Normal mode, and 31.2% in High/Best mode when compared with the HP DesignJet Z9.
- + In Buyers Lab's A0 throughput speed evaluation, the Canon model's per-page speeds were 33.3% faster in Standard/Normal mode, and 35.2% faster in High/Best quality mode than those of the HP model when printing five copies of a single-page A0-size high-resolution portrait test document.
- + When printing five copies of a single-page A0-size medium-resolution retail poster test document, the Canon model delivered output with per-page speeds that were faster by 29.8% in Standard/Normal mode, and 29.5% in High/Best mode when compared with the HP DesignJet Z9+dr.
- Buyers Lab technicians conducted a selection of productivity tests on the HP DesignJet Z9+dr with the onboard V-Trimmer feature enabled. This was to gauge whether the V-Trimmer had an impact on the HP model's speeds compared to its performance without using the V-Trimmer. The results showed there was a slowdown in performance when the V-Trimmer was employed. For example, its per-page speeds increased by 23.37 seconds when printing five copies of a single-page A1-size high-resolution portrait test document with the V-Trimmer employed in Normal mode when compared with its print speed without using the V-Trimmer.

Banner Printing

Advantage	Canon imagePROGRAF PRO-4100	HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer
Image Quality	✓	
Productivity	✓	



Buyers Lab's Banner Test File

- + The Canon PRO-4100 successfully printed Buyers Lab's 36" x 105" banner (a 4,955-KB PDF file) in Fast mode, taking 31.61 seconds to generate a preview at the desktop, and an additional nine minutes, 5.43 seconds from preview to final paper cut. In contrast, the HP Z9 doesn't offer a preview, and it was unable to process the file or print any portion of the banner.

Ink Consumption

Buyers Lab technicians 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 Buyers Lab 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.

Overall Weight of Ink Used (in Grams)

	Canon imagePROGRAF PRO-4100	HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer
Packaging Proof	133.8	223.0
Retail Sales Poster	122.8	87.1
Studio Portrait	157.4	189.8

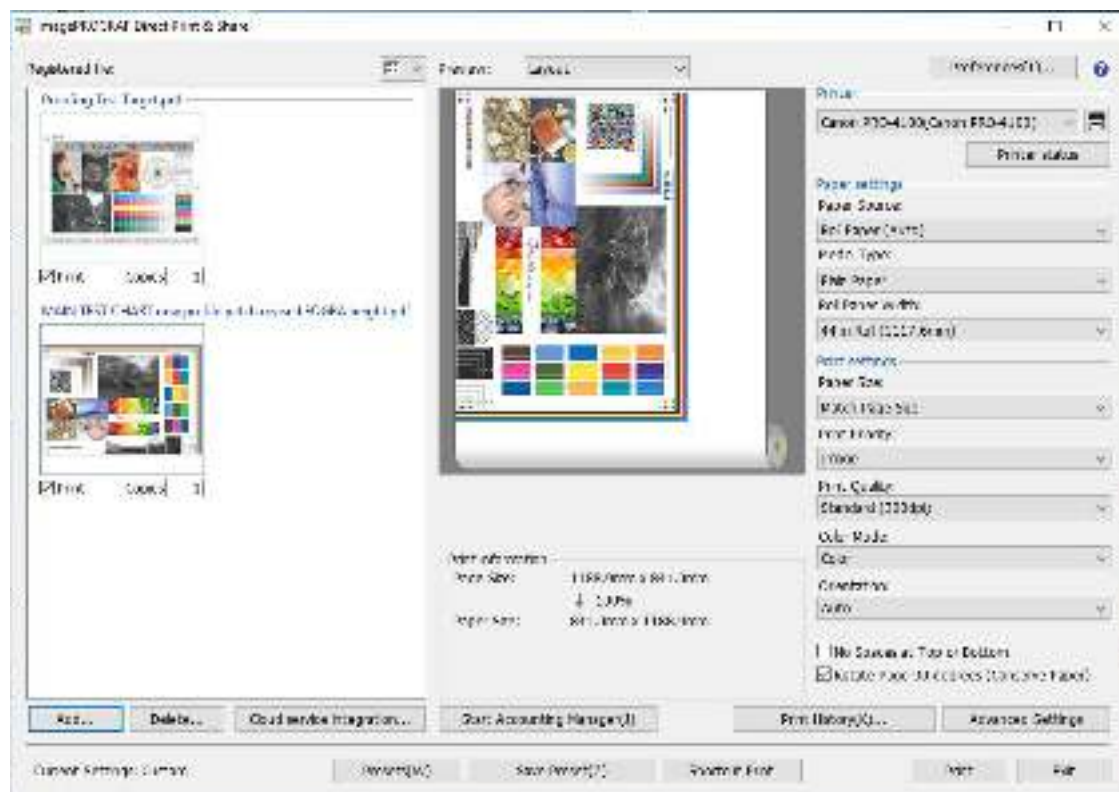
Results are averaged across three sets of 50-page A1 printing in Standard/Normal mode.

- + When printing Buyers Lab's Packaging Proof test target in Standard/Normal mode on proofing media, the Canon PRO-4100 used 40.0% less ink in terms of net weight than the HP Z9.
- + For the same print scenario, the Canon PRO-4100 used 1.5% of its total available ink, while the HP model used 7.3%.
- When printing Buyers Lab's Retail Sales Poster test target in Standard/Normal mode on matte coated media, the Canon unit used 40.9% more ink than the HP DesignJet Z9 did.

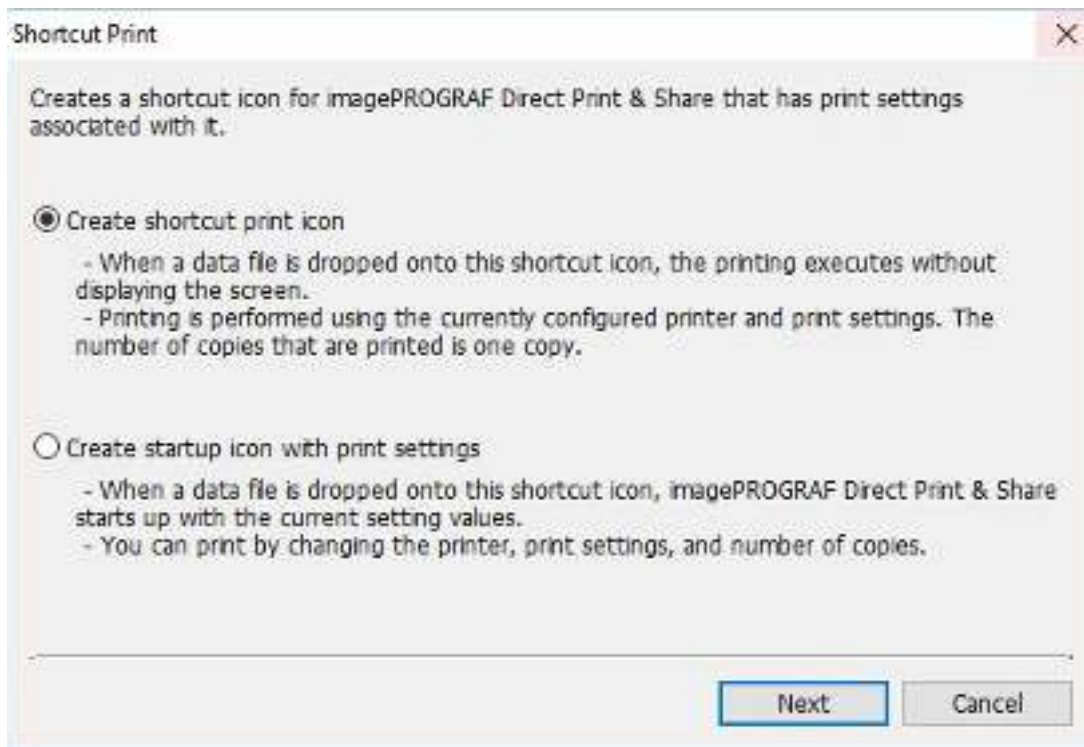
- + For the same print scenario, the Canon PRO-4100 used 1.4% of its total available ink, while the HP model used 2.8%.
- + When printing Buyers Lab's Studio Portrait test target in Standard/Normal mode on semi-gloss photo media, the Canon unit used 17.1% less ink than the HP Z9 did.
- + For the same print scenario, the Canon PRO-4100 used 1.8% of its total available ink, while the HP model used 6.2%.

Direct Print Submission Functionality

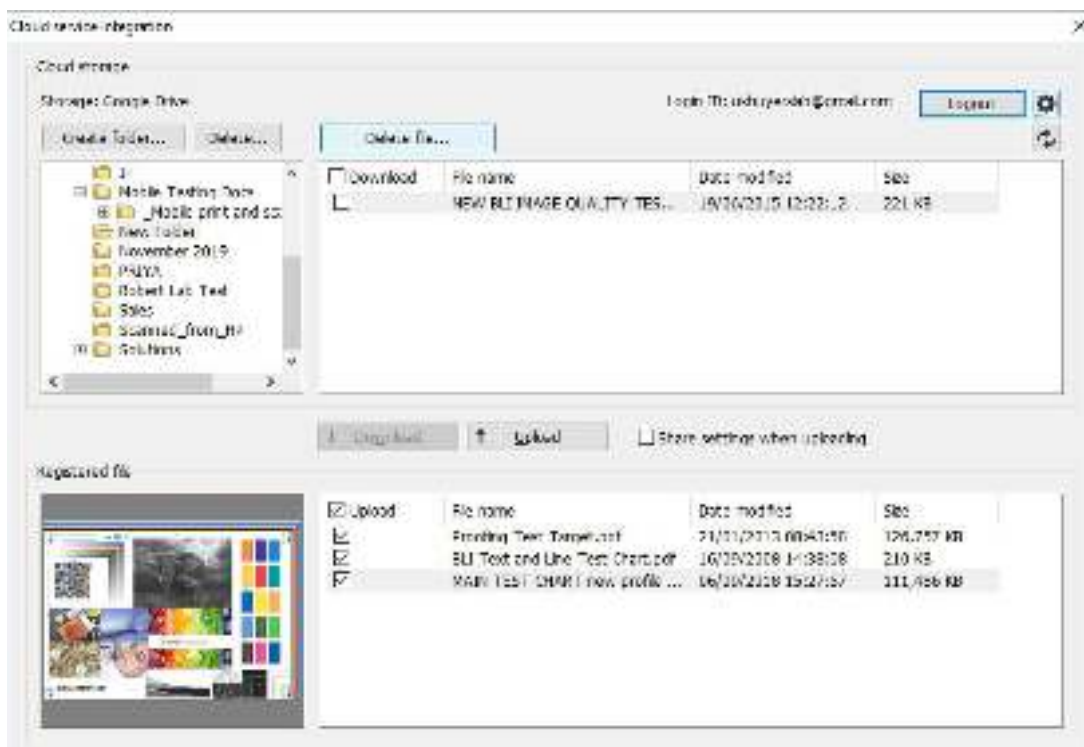
Advantage	Canon imagePROGRAF PRO-4100	HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer
Ease of Use	=	=
Direct Print Submission Functionality	✓	
Mobile App Integration	=	=



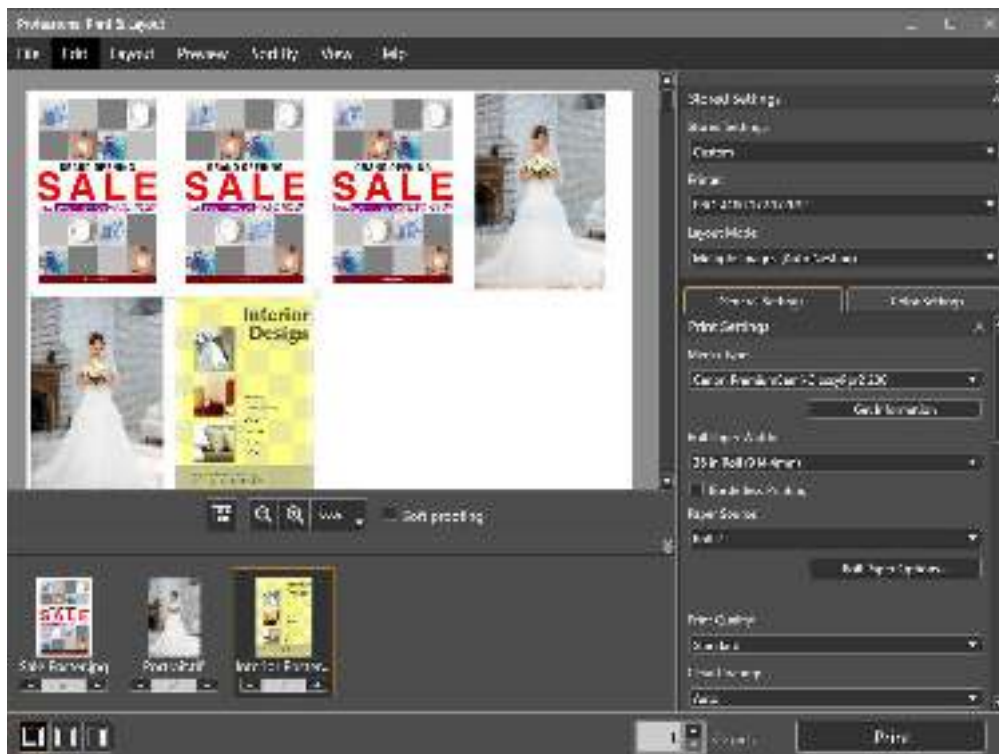
Available as a free download from Canon's website, imagePROGRAF Direct Print & Share utility enables the direct printing of PDF, JPEG, TIFF, and HPGL/2 files without the need for native applications or print drivers. Users can preview print layouts, view thumbnail images of multiple print jobs, and select print settings directly within the utility, as well as modify and print multiple files simultaneously. Additional benefits provided by imagePROGRAF Direct Print & Share include quick and easy printing of jobs selected from the print history log using the same settings as when last printed; the ability to view printer and consumables status via a link to Status Monitor before sending jobs to print; and the option to insert a divider sheet in between jobs when outputting multiple files simultaneously for easier identification.



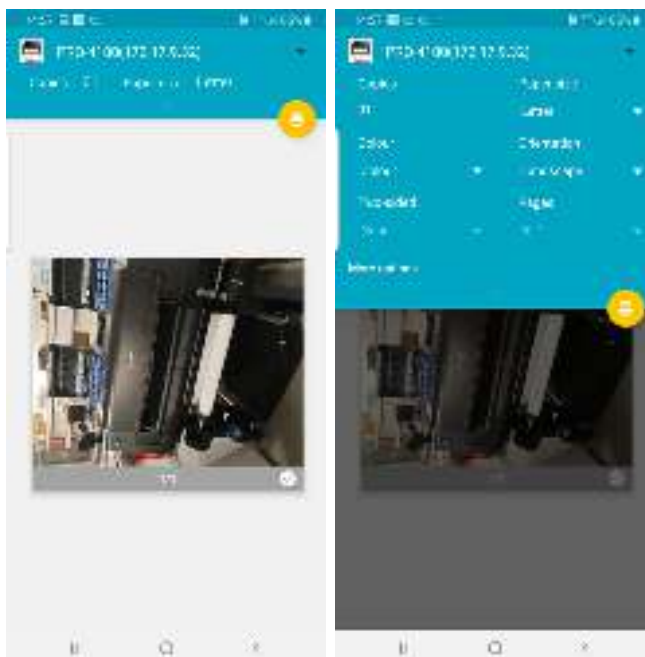
To help standardize and streamline common print workflows, imagePROGRAF Direct Print & Share supports “Shortcut Print” functionality. Akin to a hot folder workflow, users can create desktop shortcuts that allow drag and drop automatic file printing with predefined print settings, including output printer, print quality, paper type, and paper size. Multiple desktop icons can be created that contain different print settings or combinations of print settings. In addition, users can register and save new job presets in the utility to expedite daily routine workflows.



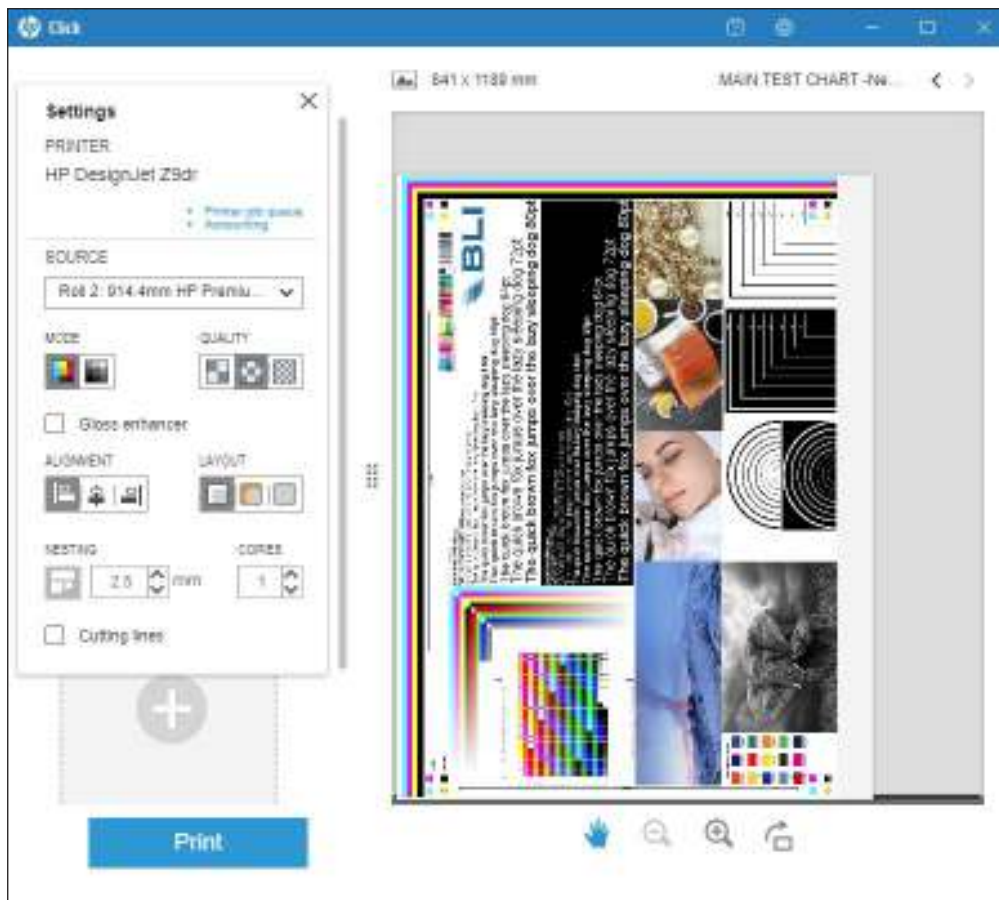
Canon imagePROGRAF Direct Print & Share lets users download stored files from Google Drive and AutoCAD 360 cloud storage services for printing, and enables the uploading of files directly to cloud storage for easier collaboration. For added convenience, the utility offers the option to share files simultaneously with one or more users (via Google Drive only), who will receive an email notification with a link to download the shared file without the need to log in.



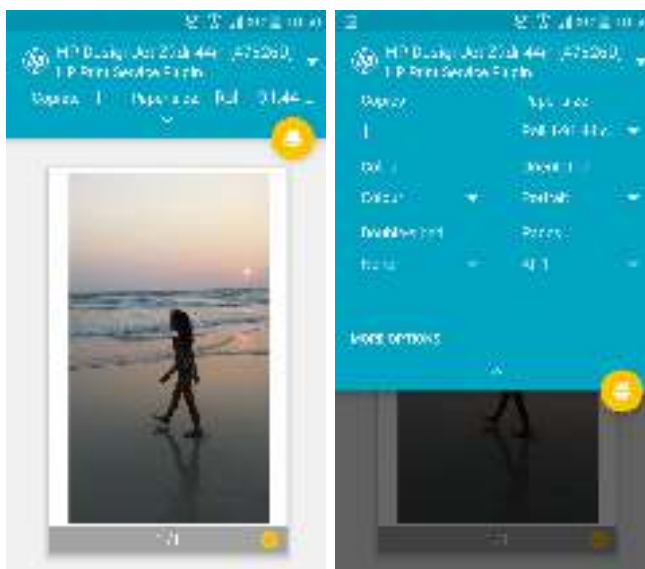
Canon's Professional Print & Layout utility enables files—even those created with different applications—to be scaled, resized, or grouped together as a single job. Not only does it offer an auto nesting feature, but users can drag and drop images to desired locations and print them together on a single page, so paper is used more efficiently. The utility offers previews, soft proofing, and pattern printing, which enables users to check and adjust the colour balance, contrast, or brightness of their image by specifying a variation in instance and viewing the resulting 'pattern' to identify and select the desirable value. A range of job setting adjustments, including colour management, print quality, image rotation, amongst others, can be performed, as well. The utility has a plug-in function 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, as well as 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.



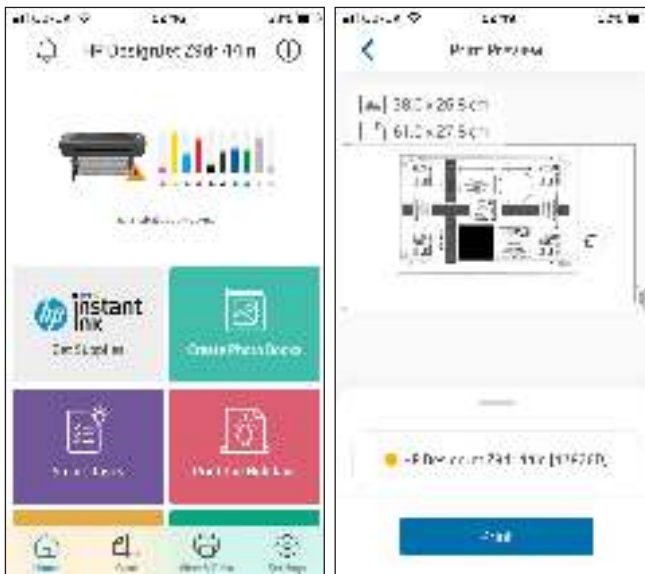
The free Canon Print Service mobile print plugin is an easy way for Android users to print wirelessly to the PRO-4100 and other compatible Canon large-format printers on the same WiFi network; it offers a broad range of print settings, including colour, orientation, and borderless printing and is very straightforward to use. For iPad users, PRO Gallery Print is a free dedicated mobile app for Canon's PRO series, that lets users print JPEG files stored on their iPads, or via photographers' web services such as SmugMug and Zenfolio.



Similar to Canon's utility, HP Click printing software, which is also available as a free download, enables direct printing of PDF, JPEG, TIFF, and HPGL/2 files from the PC desktop, without the need for native applications or print drivers. Users can select basic print settings, preview, resize and align images without the need to open up the driver properties. The utility also has an automatic nesting feature to reduce waste (however, unlike the Canon tool, it does not allow users to have precise control over the positioning of jobs), and with select models (including the HP DesignJet Z9), users can access printer and print job status information via a link to the device's embedded web server.



The HP Mobile Printing service allows users to print directly from an iOS or Android (shown above) smart device to the HP Z9 and other compatible HP large-format devices easily. Mobile devices quickly pair with the printer via a wireless network connection or by Wi-Fi Direct for direct job submission. Android users have an added step, however, of downloading and enabling the free HP Print Service Plugin app, which is available from Google Play, before being able to access the HP Printing service. Users can print a wide selection of file formats such as Microsoft Office documents, as well as PDF, JPEG, and TIFF files, preview images, and perform basic image adjustments. Whether a file is stored locally on the device, in a cloud service account, or sent as an email attachment, the user just needs to open the file and select the Share option, which then allows them to send the job to their preferred HP printer.



Users also have the option of printing from their Apple iOS and Android smartphones and tablets via the HP Smart mobile app. This free mobile printing app lets users scan documents directly to their mobile device; retrieve, print, or upload files to a variety of cloud storage services such as Dropbox, Box, Google Drive and Evernote; and monitor printer status. Basic document editing options are available through the Preview function. In addition, the HP Z9 supports HP ePrint functionality, whereby users are able to send print jobs remotely by email either via a workstation PC or a mobile device; PDF, TIFF, and JPEG files (up to 10 MB) are supported.

Device Feature Set

- + The Canon PRO-4100 employs a 12 ink system that includes two grey and two black inks, as well as Chroma Optimizer for enhanced gloss uniformity. The HP DesignJet Z9+dr utilizes ten inks, including Chromatic Red, Chromatic Blue, Chromatic Green, and (optional) Gloss Enhancer. Canon inks are replaceable during operation, helping to reduce downtime for users, whereas HP's cartridges cannot be replaced on the fly.
- + Canon offers three replacement ink cartridge capacity options—160 ml, 330 ml, and 700 ml—for all colours, whilst the HP Z9+dr only offers 300 ml for all colours.
- The Canon unit's ink delivery system dispenses a 4-picoliter drop size for all colours; the HP DesignJet Z9+dr model dispenses two drop sizes: 7-/3-picoliter dual drop weight (M, C, PBk, CB, and G) and a 6-picoliter drop size for yellow, chromatic red, chromatic green, and matte black.
- Both models utilize user-replaceable printheads, which are similarly straightforward to replace.
- + The Canon PRO-4100 offers improved media loading at the front of the device. Once the media roll holder is locked in place on the unit, the printer automatically feeds and loads the media, making the process easier and quicker, and minimizes user intervention. Built-in sensors allow the machine to automatically detect the media type and size so there's no need to confirm anything on the control panel. For the HP DesignJet Z9+dr, media rolls are loaded at the rear, which makes it a more cumbersome process especially if the basket is open as the operator may need to lean further over the device. If it is positioned against a wall, the operator will have to move it in order to load the second roll, which is located directly underneath the first roll at the rear of the device. The operator must feed the paper edge into the machine until there is an audible beep, after which the printer will load the paper. To complete the process, the operator must confirm the media type on the control panel and then close the roll cover.

- + The Canon printer contains two sensors that are capable of measuring and estimating the remaining length available on the media roll, eliminating the need for the machine to print and read a barcode each time a partially-used roll is loaded and unloaded. This also reduces the risk of media running out halfway through a job as operators will be alerted on the control panel as to whether there is enough media to complete their job. The HP Z9 offers paper tracking capabilities, as well; when removing a partial roll, a media information barcode with remaining roll length and type of paper can be printed on the roll's edge.
- The Canon PRO-4100 supports borderless printing regardless of what media is being used, with a media sensor detecting the edges and automatically adjusting the margin; users can choose free size or three-sided borderless. The HP Z9+dr supports borderless feature only with select media. However, when the V-Trimmer feature is enabled, the HP model supports borderless output on all sizes and media.
- The Canon device includes a media mismatch option which holds jobs that can't be printed due to incorrect media being loaded, while jobs that can be completed are printed; the queued jobs are printed once the required paper is loaded. In the event of a media mismatch on the HP device, users are provided with a warning directly in the print driver before the job is submitted, and a control panel warning appears after it is submitted. The HP Z9 control panel's "Paper mismatch action" setting allows users either to put the job on hold (it will be kept in the printer queue until suitable paper is loaded) or print it anyway; all jobs that are slated for the paper type that is already loaded will print without delay.
- + Both models support Gigabit Ethernet connectivity, but the Canon PRO-4100 also offers a wireless interface (not matched by the HP Z9+dr with V-Trimmer).
- Both devices have USB ports, enabling walk-up users to print from USB flash drives (PDF and JPEG files supported, with TIFF files also supported on HP model) and helps aid document portability.
- The HP Z9+dr 44 inch with V-Trimmer model comes with an inline XRite i1 spectrophotometer as standard, for automated colour management and verification—an option that's not offered with the Canon model.
- However, the Canon PRO-4100 does have a built-in Color Calibration function which uses a multi-sensor to read colour density and automatically calibrate the printer with Canon media, as well as other media brands. Moreover, administrators can control colour and monitor the calibration status across the whole PRO-2100/4100/6100S series via Canon's free Device Management Console utility to ensure colour consistency among all Canon devices. HP users can also track and control colour consistency across multiple devices via HP PrintOS Color Beat functionality, which is part of HP PrintOS, a cloud-based print production management system that includes multiple online and mobile apps to help HP customers better manage their operational environment.
- The Canon model offers a standard, non-upgradable RAM capacity of 3 GB, while the HP unit has a standard non-upgradable RAM capacity of 4 GB (includes virtual memory).
- Both models come with a standard built-in 500-GB hard drive, which allows for the storage of commonly used documents and aids spooling workflow.
- For maximum convenience and minimum downtime, both models offer the advantage of a dual-roll design, giving users the added flexibility of switching between different media types or sizes without having to reload the media each time.

- + The PRO-4100's optional Multifunction Roll System can also act as an auto Take-up-Roll unit with bi-directional rewind, which could be an extremely valuable feature in high-volume production environments, enabling large numbers of prints to be conveniently stored on a single roll. This is also available but as an extra cost option for the HP device.
- The output catch baskets of both models are very simple designs which collect output from media rolls in a somewhat random order.
- While the Canon model is heavier (123 kg versus 98 kg) than the HP Z9+dr unit, it is more compact, with a width of 1,593 mm versus 1,802 mm for the HP Z9+dr.
- The PRO-4100 features a new 4.3-inch touchscreen control panel which is larger and better designed than its predecessor. From the home screen, operators can view printer, paper, and ink status easily. The HP unit's touchscreen is similarly responsive and easy to navigate.
- The Canon PRO-4100's power consumption while printing is slightly higher—112 watts versus 100 watts—than that of the HP model.
- + However, in standby mode (where it may spend more of its time) the Canon model's power consumption is lower (3.6 watts versus HP Z9+dr's 32 watts).

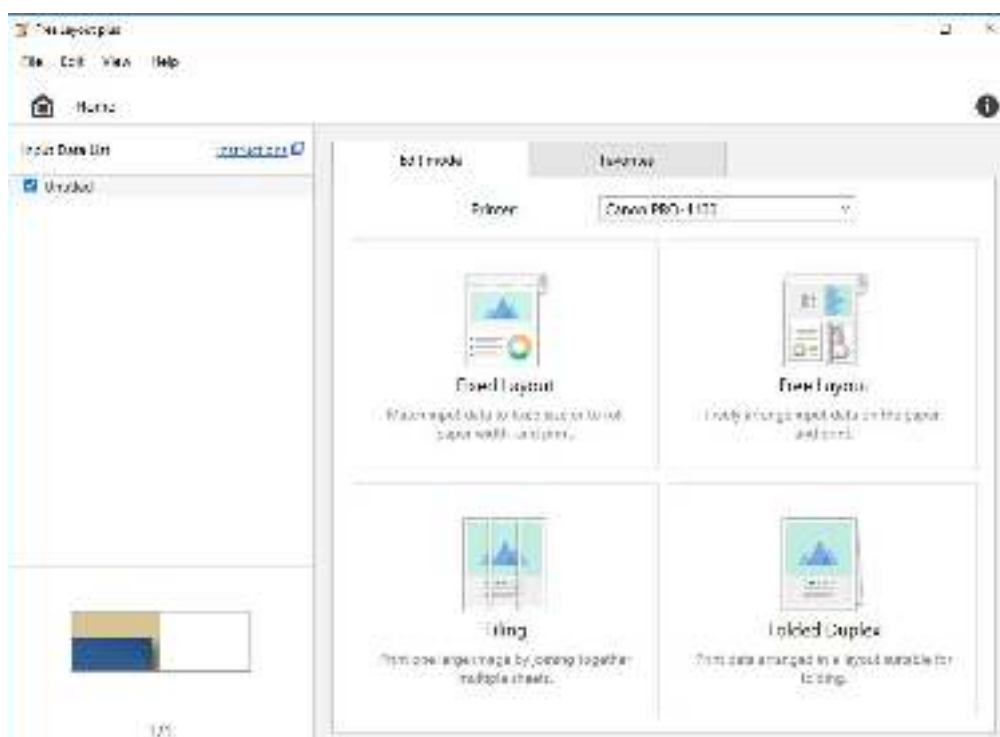
Print Driver Feature Set

- + The Canon PRO-4100 has five speed settings, although not all of them are available with all media types. In contrast, the HP device has three settings (Fast, Normal, and Best).
- + The Canon driver includes 66 media profiles and the ability to create up to 10 custom options, versus 35 for the HP driver, which doesn't have a customization option.
- + The Canon driver includes a watermark capability; the HP driver does not.
- + The Canon driver offers N-up printing (16-up maximum), which is not supported by the HP unit.
- + Poster printing capability (2 x 2) is offered only by the Canon model, as is page-stamping (date, time, user-name and page number); neither feature is available with the HP HPGL/2 driver.
- + The Canon driver offers unidirectional printing, even in Fast mode, which helps to eliminate banding across output because the printhead travels in only one direction to create the desired image. The HP driver does not offer this feature.
- The Canon driver has advanced colour-matching capabilities, including the ability to match colours using ICC profiles and select the rendering intent based on different elements in the document. The HP Color Center Utility offers the HP Easy Profiling feature, which enables users to build custom ICC colour profiles using the on-board spectrophotometer, and embed them in the HP Z9 printer. Users can also re-profile existing media as well as new, third-party media.

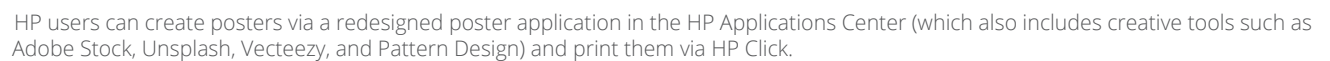
- + The Canon driver includes a utility, Colour imageRUNNER Enlargement Copy Mode, which allows users to integrate a Canon MFP or other scanner with the PRO-4100. Documents scanned by the Canon MFP are automatically routed to a hot folder, which is monitored by the PRO-4100 driver. Users can also set 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.
- + The Canon model offers a plug-in for printing from Microsoft Office applications, which includes useful tools for automatic media resizing, nesting and borderless printing. No such plug-in is available to HP users.



Bundled with the PRO-4100, PosterArtist Lite, Canon's PosterArtist Lite is an easy-to-use poster and signage creation tool. It provides additional templates to create multi-language versions of a poster that includes 900 common expressions in 10 languages and a wide range of pictographic icons. 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.



Within PosterArtist Lite, users can opt to edit their layouts with Canon's Free Layout plus tool before printing. Free Layout plus allows users to customize the arrangement of files so media is utilized as efficiently as possible, and any two pages can be arranged for double-sided printing so that they are orientated correctly when folded after printing.

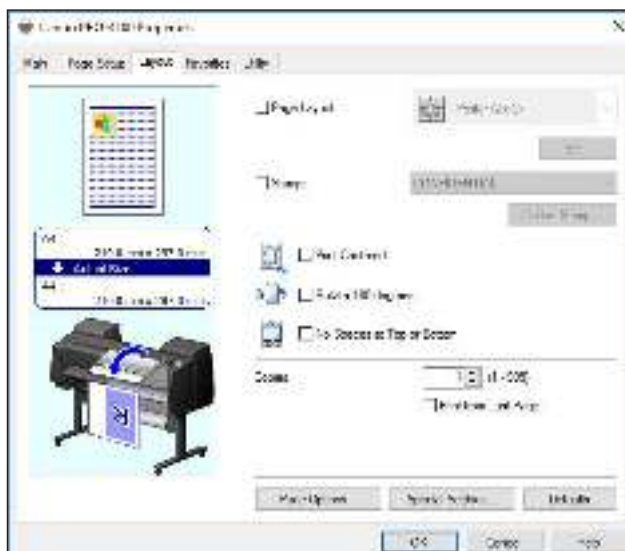
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Available for the PRO series as a free download from Canon's website, Canon Accounting Manager offers comprehensive accounting management for print jobs. Users enter the actual costs for individual inks and media types, and the cost per job is calculated 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.

The HP Click utility offers a Job Accounting option which links to the Z9 printer's web page Accounting section. Here, operators can assign costs against paper usage, job type, inks, or specify a fixed job cost, as well as export accounting reports in CSV format.

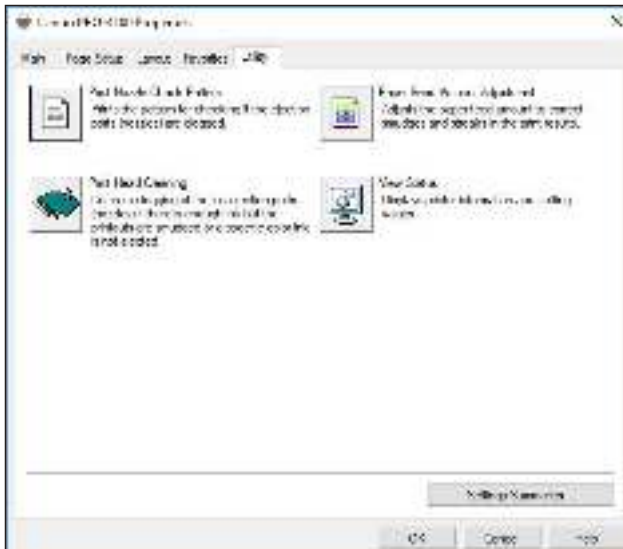
The figure consists of two side-by-side screenshots of the HP DesignJet 1000C software interface. Both windows have a title bar that reads 'HP DesignJet 1000C Page Setup'. The left window is in the 'Main' tab, showing a 'Main Paper' dropdown menu, a 'Print Range' section with 'Print Range' and 'Print Range' buttons, and a 'Print Range' section with 'Print Range' and 'Print Range' buttons. The right window is in the 'Page Setup' tab, showing a 'Page Size' dropdown menu, a 'Print Range' section with 'Print Range' and 'Print Range' buttons, and a 'Print Range' section with 'Print Range' and 'Print Range' buttons.

Canon PRO-4100 Page Setup tab

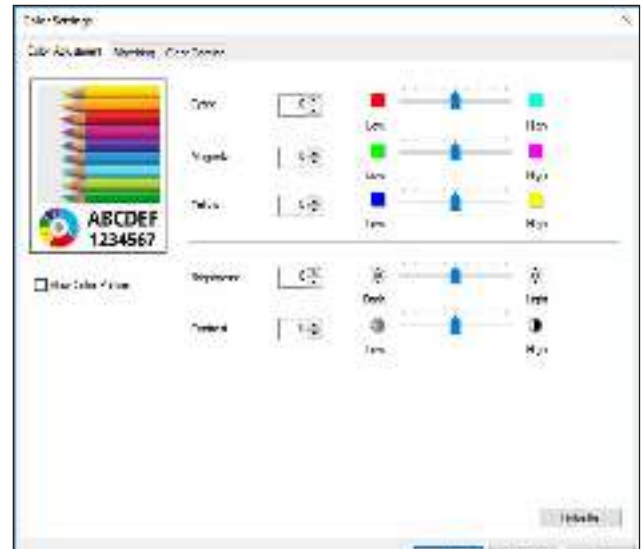


The screenshot shows the Windows XP Control Panel window titled "Control Panel - Display Properties". The "Appearance" tab is active. In the "Visual Style" section, the "Classic" theme is selected. Below it, under "Mouse Settings", the "Page Size" is set to "A4". To the left of the settings is a preview area showing a document page. At the bottom, there are buttons for "Apply", "OK", and "Cancel".

Canon PRO-4100 Favourites tab

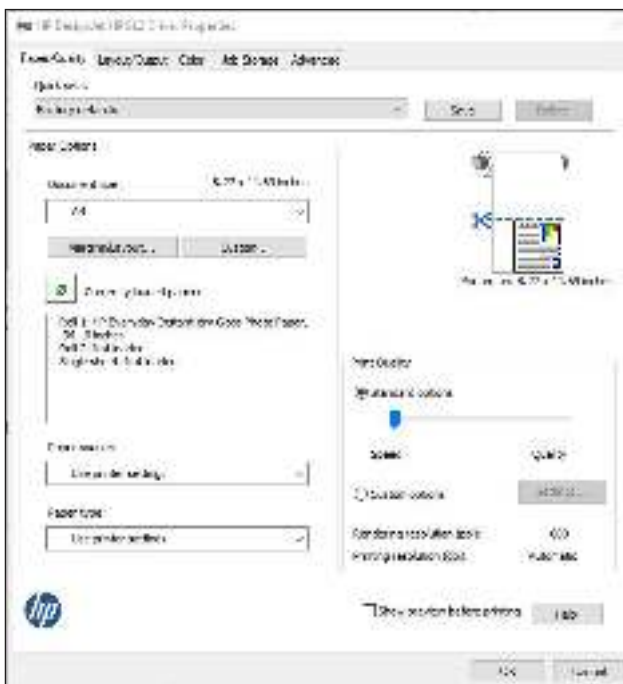


Canon PRO-4100 Utilities tab

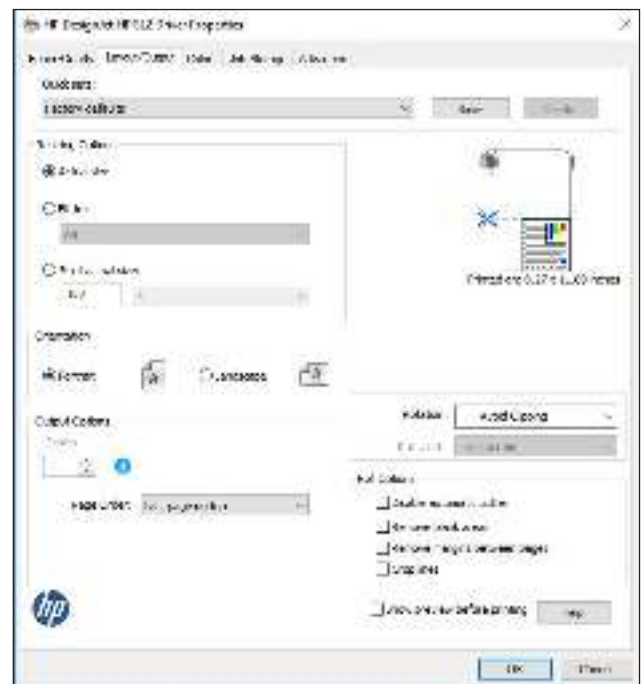


Canon PRO-4100 Colour Adjustment Settings

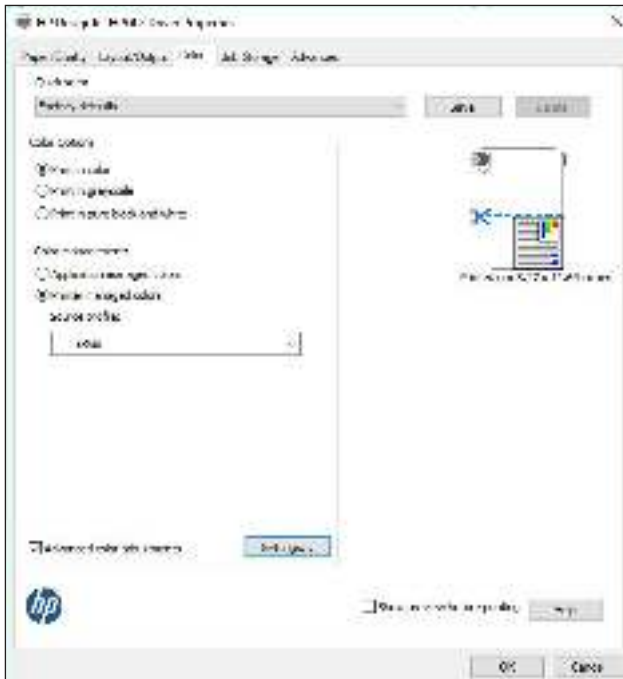
Note: Due to performance issues related to the HP model's HPGL/2 driver (and attributed to the version available at the time of testing), the PCL 3 for Windows with Modern Apps driver was recommended as the replacement. Screenshots of both printer drivers are shown below.



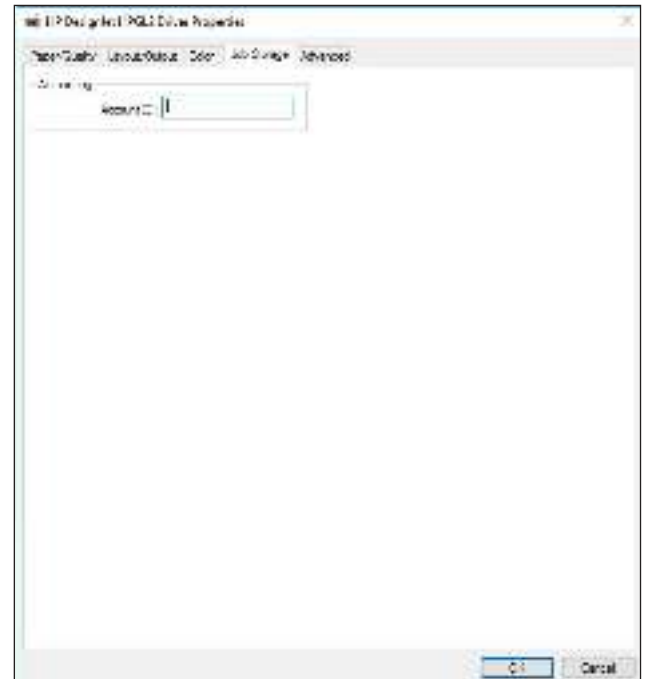
HP DesignJet Z9+dr Paper/Quality Tab (HPGL/2)



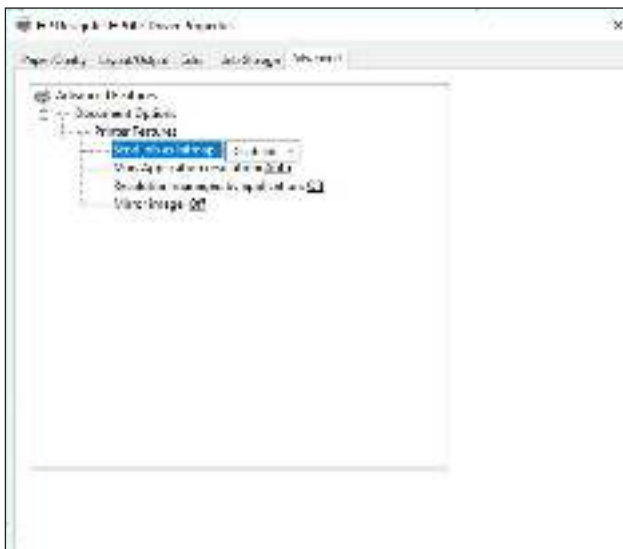
HP DesignJet Z9+dr Layout/Output Tab (HPGL/2)



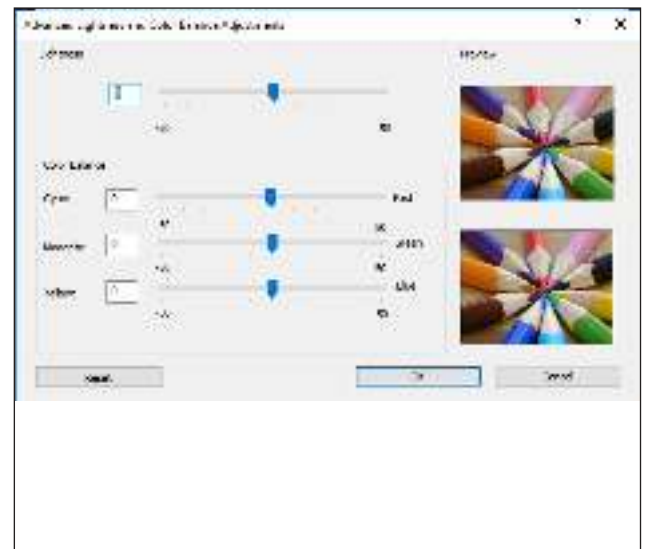
HP DesignJet Z9+dr Colour Tab (HPGL/2)



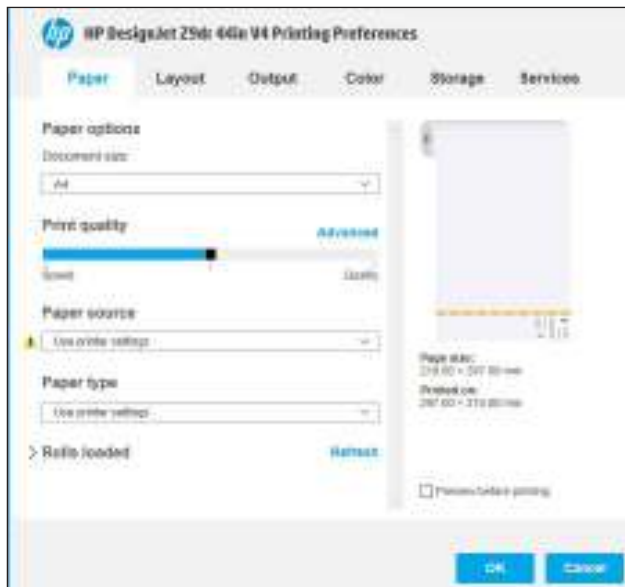
HP DesignJet Z9+dr Job Storage Tab (HPGL/2)



HP DesignJet Z9+dr Advanced Tab (HPGL/2)



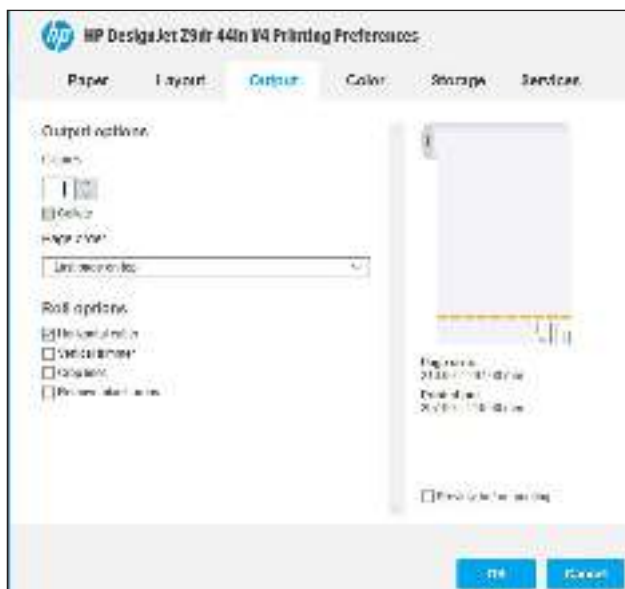
HP DesignJet Z9+dr Advanced Colour Adjustment Settings (HPGL/2)



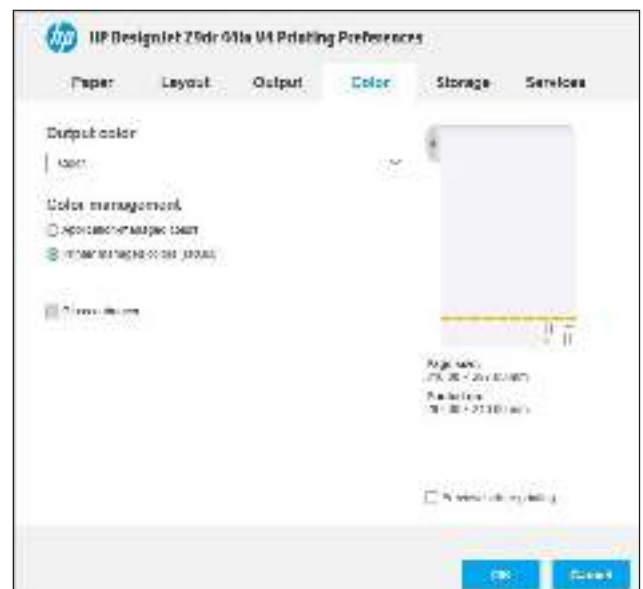
HP DesignJet Z9+dr Paper Tab (PCL 3)



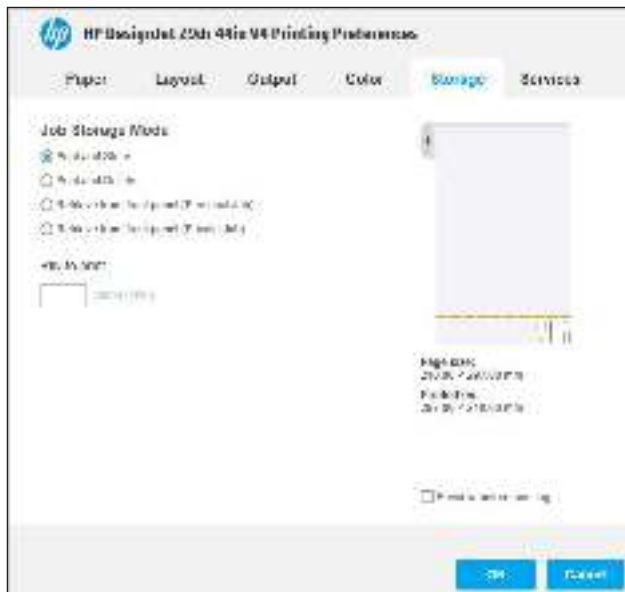
HP DesignJet Z9+dr Layout Tab (PCL 3)



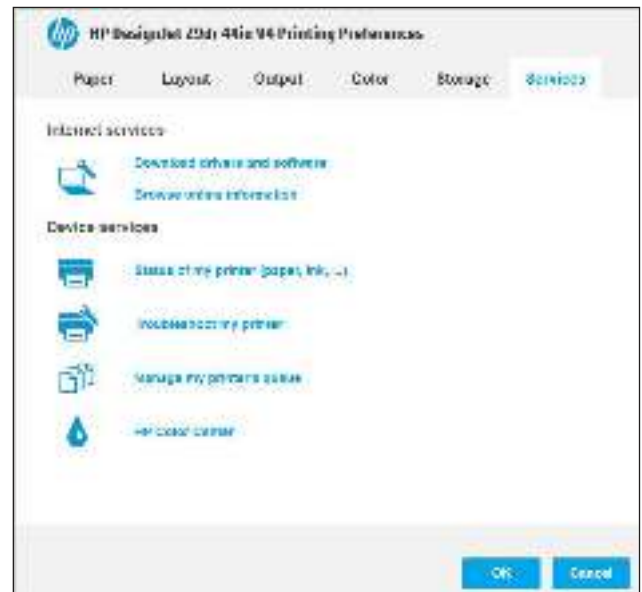
HP DesignJet Z9+dr Output Tab (PCL 3)



HP DesignJet Z9+dr Colour Tab (PCL 3)



HP DesignJet Z9+dr Storage Tab (PCL 3)



HP DesignJet Z9+dr Services Tab (PCL 3)

Printhead Reliability / Cleaning Routines

- The Canon PRO-4100 enables users to run a printhead nozzle check pattern at the control panel. The default setting is an Auto nozzle check, while additional settings include 'after one page', 'after 10 pages' or 'disable'. The HP DesignJet Z9 offers only one option to run a nozzle check pattern – 'Print Diagnostic Image', which can be found in the main Settings menu under the Optimize Print Quality option.
- 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. The HP model does not offer any indication that it conducts automatic printhead maintenance other than when the machine is initializing after being switched on. However, users can initiate a clean printhead maintenance process at the control panel for one or more printheads. The control panel indicates an estimate of both time and the amount of ink consumed, which differs depending on how many printheads are selected.
- + After both devices were turned off over the course of a weekend, upon restarting the following Monday, the Canon model had no problems with clogged nozzles and printed the pattern perfectly after a performing a cleaning. In contrast, the nozzles of the HP unit became clogged over the weekend and required at least one cleaning cycle to resolve the issue, leading to operator downtime.
- + A standard cleaning cycle performed on the Canon model takes approximately four minutes, 27.23 seconds on average to complete, whilst on the HP model, a cleaning cycle lasts twice as long – nine minutes, 25 seconds.

SUPPORTING TEST DATA

Productivity

Colour Throughput Time – A1 High-Resolution Portrait Printing (in Seconds)

Canon imagePROGRAF PRO-4100		HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer		HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer (Enabled)
Standard	High	Normal	Best	Normal
215.59	331.04	379.19	566.17	402.56

A single-page high-resolution A1 portrait was printed as a five-page job using the device driver set to the semi-gloss photo/colour setting. Both devices were loaded with 36" rolls, with each job set to auto-rotate to save media. The time indicated is the average number of 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). (The time for the final four of five pages to print and cut with the addition of the V-Trimmer is reported in the last column.)

Colour Throughput Time – A1 Medium-Resolution Retail Poster Printing (in Seconds)

Canon imagePROGRAF PRO-4100		HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer		HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer (Enabled)
Standard	High	Normal	Best	Normal
106.08	196.54	164.29	285.74	174.47

A single-page medium-resolution A1 retail sales poster was printed as a five-page job using the device driver set to the matte coated/colour setting. Both devices were loaded with 36" rolls, with each job set to auto-rotate to save media. The time indicated is the average number of 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). (The time for the final four of five pages to print and cut with the addition of the V-Trimmer is reported in the last column.)

Colour Throughput Time – A0 High-Resolution Portrait Printing (in Seconds)

Canon imagePROGRAF PRO-4100		HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer	
Standard	High	Normal	Best
428.62	667.16	642.87	1,030.88

A single-page high-resolution A0 portrait was printed as a five-page job using the device driver set to the semi-gloss photo/colour setting. Both devices were loaded with 36" rolls, with each job set to auto-rotate to save media. The time indicated is the average number of 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 – A0 Medium-Resolution Retail Poster Printing (in Seconds)

Canon imagePROGRAF PRO-4100		HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer	
Standard	High	Normal	Best
214.41	404.38	305.48	573.26

A single-page medium-resolution A0 retail sales poster was printed as a five-page job using the device driver set to the matte coated/colour setting. Both devices were loaded with 36" rolls, with each job set to auto-rotate to save media. The time indicated is the average number of 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).

First-Print-Out Time from Ready State – High-Resolution Portrait Printing (in Seconds)

	Canon imagePROGRAF PRO-4100		HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer		HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer (Enabled)
	Standard	High	Normal	Best	Normal
Time Before Printing Commences	27.74	26.72	74.47	81.16	106.97
First Print Out Time	225.81	338.69	417.77	607.16	452.66

First-page-out times are determined by sending an A1 high-resolution portrait PDF file to print, timed from job release to page out, with both Canon and HP drivers set to semi-gloss photo media. Both devices were loaded with 36" rolls.

First-Print-Out Time from Ready State – Medium-Resolution Retail Poster Printing (in Seconds)

	Canon imagePROGRAF PRO-4100		HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer		HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer (Enabled)
	Standard	High	Normal	Best	Normal
Time Before Printing Commences	23.83	24.34	20.81	26.85	46.97
First Print Out Time	115.05	206.02	141.39	261.85	144.25

First-print-out times are achieved by sending an A1 medium-resolution retail sales poster PDF file to print, timed from job release to page out with both Canon and HP drivers set to matte coated media. Both devices were loaded with 36" rolls.

Colour Print Quality

Colour Optical Density Evaluation

Canon imagePROGRAF PRO-4100						
Highest						
	1	2	3	4	Max.	Min.
Cyan	2.21	2.21	2.22	2.21	2.22	2.21
Magenta	1.89	1.89	1.91	1.89	1.91	1.89
Yellow	1.30	1.30	1.30	1.29	1.30	1.29
Black	1.73	1.70	1.72	1.69	1.73	1.69

HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer						
Best						
	1	2	3	4	Max.	Min.
Cyan	2.28	2.30	2.29	2.29	2.30	2.28
Magenta	1.91	1.93	1.93	1.92	1.93	1.91
Yellow	1.23	1.23	1.23	1.23	1.23	1.23
Black	2.00	1.98	1.98	1.99	2.00	1.98

Note: Colour density readings were assessed by printing a Buyers Lab test file on proofing paper in high-quality colour settings and measuring the density of 100% dot fill using an XRite exact[®] densitometer.

Skin Tone and Neutral Grey Consistency

	Skin Tone 1 (Formula: C=6, M=15, Y=16, K=0)	
	Canon imagePROGRAF PRO-4100	HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer
Colour block		
2	0.2	0.2
3	0.2	0.3
4	0.3	0.2
5	0.2	0.3
6	0.2	0.2
7	0.3	0.6
8	0.2	0.5
9	0.3	0.6
Max. Delta E Variance	0.2	0.5

	Skin Tone 2 (Formula: C=30, M=63,Y=75,K=0)	
	Canon imagePROGRAF PRO-4100	HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer
Colour block		
2	0.4	0.3
3	0.4	0.2
4	0.3	0.3
5	0.3	0.5
6	0.3	0.3
7	0.3	0.2
8	0.2	0.4
9	0.3	0.3
Max. Delta E Variance	0.2	0.3

	Skin Tone 3 (Formula: C=19, M=33,Y=50,K=0)	
	Canon imagePROGRAF PRO-4100	HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer
Colour block		
2	0.2	0.3
3	0.2	0.2
4	0.2	0.3
5	0.3	0.2
6	0.2	0.3
7	0.3	0.1
8	0.4	0.3
9	0.3	0.3
Max. Delta E Variance	0.2	0.2

	Neutral Grey	
	Canon imagePROGRAF PRO-4100	HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer
Colour block		
2	0.3	0.3
3	0.1	0.2
4	0.6	0.3
5	0.5	0.4
6	0.4	0.3
7	0.3	0.1
8	0.4	0.1
9	0.5	0.3
Max. Delta E Variance	0.5	0.3

Note: Skin tone and neutral grey consistency measurements are based on nine readings taken from a Buyers Lab proprietary PDF test target file comprising four A1-sized solid coverage documents of three skin tones and a neutral grey with the High/Best 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.

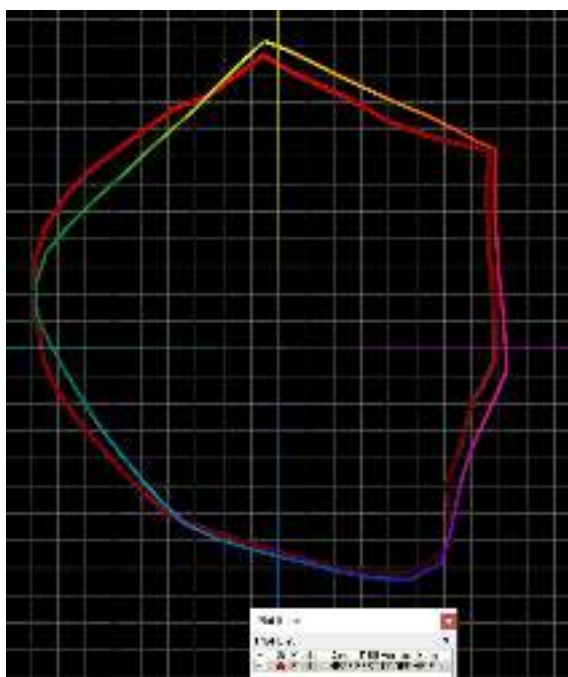
FOGRA 39 Drift Test

Comparison of FOGRA39 colour patches before and after ink consumption test

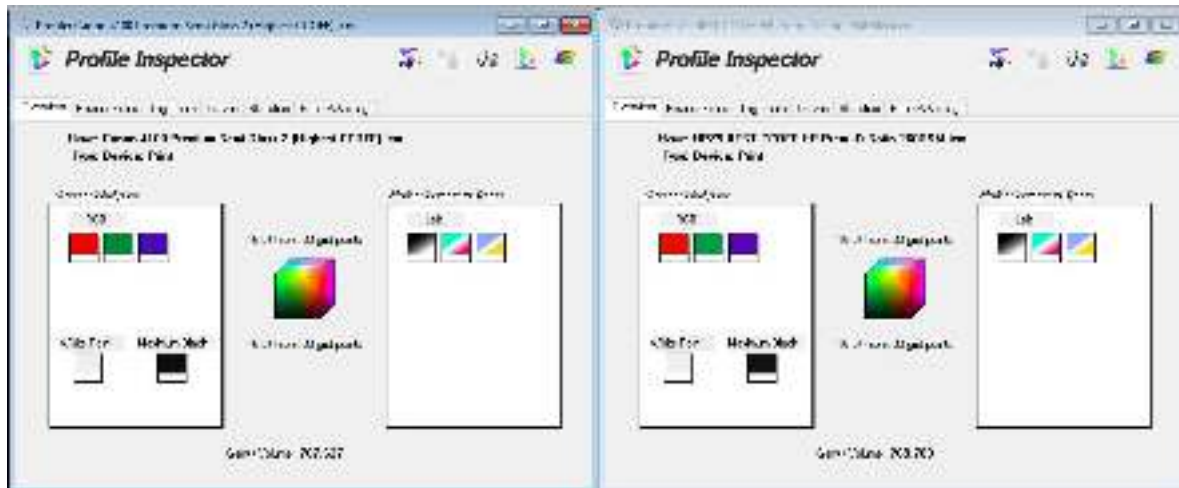
	Canon imagePROGRAF PRO-4100	HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer
Delta E Drift	2.6	2.9

Colour Gamut Comparison

Media Type/Settings	Canon imagePROGRAF PRO-4100	HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer	Canon % larger/smaller (-) than HP
Photo Paper Highest/Best	787,627	769,709	2.3



Canon imagePROGRAF PRO-4100 colour gamut (shown chromatically) on photo paper in Highest mode with colour correction disabled versus HP DesignJet Z9+dr 44 inch with V-Trimmer colour gamut (red) on photo paper in Best quality mode with Colour Adjustment disabled.



Colour gamut profile for Canon imagePROGRAF PRO-4100 (left) and HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer (right) on gloss photo paper in highest-quality mode.

Device Feature Set

	Canon imagePROGRAF PRO-4100	Advantage	HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer
Max. print resolution	2400 x 1200 dpi		2400 x 1200 dpi
Number of inks	12 (PBK, MBK, C, M, Y, PC, PM, GY, PGY, R, B, CO)	✓	10 (unit was tested with optional Gloss Enhancer ink)
Ink tanks replaceable during operation	Yes	✓	No
Ink-drop size	Minimum 4 picoliter		7/3 pl dual-drop weight (M, C, PBk, CB, G); 6 pl (Y, CR, MBk, CG)
Starter cartridge ink capacity	1,920 ml (160 ml bundled starter ink)		INA
Ink cartridge capacity	160 ml, 330 ml, and 700 ml (all colours)	✓	300 ml (all colours)
Number of nozzles	18,432 nozzles in total (1,536 per colour)		2,400 nozzle-per-inch HDNA print-heads
Number of printheads	1		5 Universal
Printhead replacement	User replaceable		User replaceable
Line accuracy	+/-0.1% or less		+/-0.1%
Minimum line width	INA		0.02 mm (PDF addressable at 1200 dpi)
Minimum print margins	Roll paper: Borderless or 3 mm (all sides); Cut sheet: 3 mm (Top, Side), 20 mm (Bottom)		Roll paper: Borderless (all media when using V-Trimmer) or 5 mm (all sides); Cut sheet: 5 mm (Top, Side), 17 mm (Bottom)
Borderless (0 mm) printing	Yes all sizes and media supported		Yes (with select media); V-Trimmer enables borderless output on all sizes and media supported
Maximum outside diameter of roll paper	170 mm	✓	136 mm
Maximum printable paper roll length	18 m (varies according to the OS, RIP, and application used)		INA
Maximum printable cut-sheet media length	1.6 m		INA

Maximum media thickness	Roll/cut: 0.07-0.8 mm			0.8 mm
Maximum media width	44 inches			44 inches
Media loading	Front	✓		Rear
Roll paper	Optional Multifunction Roll System (dual roll and/or bi-directional auto Take up configuration)			Dual roll (optional take up unit)
Optional media handling	Roll holder set (supports 2" and 3" media cores)			Roll holder adapter (supports 3" media core)
Standard RAM	3 GB		✓	128 GB with 4 GB physical memory
Maximum RAM	3 GB		✓	128 GB with 4 GB physical memory
Hard drive	Standard 500-GB			Standard 500-GB
Interface	10/100Base-TX/1000Base-T/TX, USB 2.0 Hi-Speed, Wireless LAN: 802.2.11 b/g/n	✓		10/100/1000Base-T Ethernet (802.3, 802.3u, 802.3ab), USB Type-A host port
PDL	SG Raster			Adobe PostScript 3, Adobe PDF 1.7, TIFF, JPEG, CALS G4, HPGL/2, HP-RTL
Net weight (unpacked) and size	123 kg / 1,593 mm			98 kg / 1,802mm
Power consumption when in standby	3.6 W or less	✓		< 32 W
Power consumption when active	112 W or less		✓	< 100 W
Acoustic pressure	INA			Operation: 42-45 dB (A) or less; Standby: 33 dB (A) or less
Acoustic power	INA			Operation: 6.0-6.3 Bels or less; Standby: 5.1 Bels
Option to integrate with a spectrophotometer?	No		✓	Standard embedded X-Rite i1 In-line spectrophotometer

INA – Information not available

Driver Feature Set

	Canon imagePROGRAF PRO-4100	Advantage (compared with HP's HPGL/2)		HP DesignJet Z9+dr 44 inch with V-Trimmer (HPGL/2)**	HP DesignJet Z9+dr 44 inch PostScript with V-Trimmer (PCL 3 for Windows Modern Apps)**
Speed settings	Up to five depending on media settings	✓		3 (Fast, Normal, Best)	3 (Fast, Normal, Best)
Economy mode	No		✓	Yes (Fast setting)	Yes (Fast setting)
Predefined profiles	4 (Under Easy Settings: Default, Photo Color, Photo Monochrome, and Poster)		✓	5 (Default, CAD, GIS, Photo, and Black and White Photo)	None
Overview of profile settings provided	Yes			Yes	No
Media profiles	66 + 10 user customizable special options	✓		35	45
IQ optimized for various types of output	Yes			Yes	Yes
Watermark	Yes	✓		No	No
Sharpen text	No		✓	Yes (called Max Detail)	Yes (called Max Detail)

Thicken fine lines	Yes			Yes (called Max Detail)	Yes (called Max Detail)
Mirror image	Yes			Yes	No
Multi-up printing	Yes, 2 to 16	✓		No	No
Poster print mode	Yes (2 by 2)	✓		No	No
Page stamping	Yes (Under Layout and Page Options: Date, Time, User Name, Page Number)	✓		No	No
Image rotation	Yes, 90 degrees and 180 degrees	✓		Yes, auto, 90 degrees	Yes, auto, 90, 180 and 270 degrees
Option to preview before print	Yes			Yes	Yes
Link to device web server from driver	Yes (via link to Status Monitor)	✓		No	No (there is a link to HP DesignJet Utility)
CMYK balance adjustment	Yes (CMY only)			Yes (CMY only)	No
Brightness adjustment	Yes			Yes	No
Contrast adjustment	Yes	✓		No	No
Saturation adjustment	No			No	No
Advanced colour management options	Yes			Yes	No
Enlargement Copy Mode	Yes			INA	INA
Free Layout Capability	Yes (flexible placement)	✓		Yes (automatic nesting via HP Click)	Yes (automatic nesting via HP Click)
MS Office Plug-in	Yes	✓		No	No
Adobe Photoshop Plug-in	Yes*			INA	INA
Accounting Capability	Yes (Canon Accounting)			Yes (HP Click)	Yes (HP Click)
Disable automatic cutter	Yes			Yes	Yes
Unidirectional printing selection option	Yes	✓		No	No
Integration with MFP	Yes			INA	INA

* The Canon PRO-4100 comes bundled with PosterArtist Lite and supports Canon's latest Professional Print & Layout (PPL) workflow software, which is designed to accentuate details in highlight areas and make in-focus areas stand out. It can be used as a standalone RIP or as an export module from industry-standard editing and graphics software such as Adobe Photoshop, Adobe Lightroom, as well as Canon Digital Photo Professional.

** Note KPI usually tests HP large-format models using the HPGL/2 driver, however due to the model not performing as expected, Buyers Lab technicians were advised by an HP reseller to use the PCL 3 for Windows Modern Apps driver. The issues were eliminated once the driver was switched, and so the faults are attributed to the version of the HPGL/2 driver available at the time of testing. For the purposes of the report, the driver feature set section includes both the HPGL/2 and the (more limited) PCL 3 for Windows Modern Apps features, while the Canon PRO 4100's driver is compared and rated against the HPGL/2 driver in the understanding that the HPGL/2's bugs will be rectified in future versions.

Ink Consumption

Table 1: Approximate Amount of Ink in each Canon imagePROGRAF PRO-4100 700-ml Cartridge (in Grams)

	PM	R	C	PGY	MBK	PBK	B	CO	GY	Y	M	PC
Weight of cartridge prior to installation	947.3	947.3	947.3	947.3	947.3	947.3	947.3	947.3	947.3	947.3	947.3	947.3
Weight of cartridge at end of life	200.9	200.9	200.9	200.9	200.9	200.9	200.9	200.9	200.9	200.9	200.9	200.9
Net weight of ink	746.4	746.4	746.4	746.4	746.4	746.4	746.4	746.4	746.4	746.4	746.4	746.4
Total ink weight across 12 cartridges												8,956.8

Table 2: Amount of Ink in each HP DesignJet Z9+dr 44-inch PostScript with V-Trimmer 300-ml Cartridge (in Grams)

	M	Y	C	CR	PK	MK	CB	CG	GY	GE
Weight of cartridge prior to installation	416.1	416.7	413.6	418.2	418.7	420.0	414.3	424.2	413.8	413.8
Weight of cartridge at end of life	111.3	111.3	111.3	111.3	111.3	111.3	111.3	111.3	111.3	111.3
Net weight of ink	304.8	305.4	302.3	306.9	307.4	308.7	303.0	312.9	302.5	302.5
Total ink weight across ten cartridges										3,056.4

Table 3: Ink Used in Three 50-Page Runs of Packaging Proof Test Document (Standard Mode) on the Canon PRO-4100 (in Grams)

	PM	R	C	PGY	MBK	PBK	B	CO	GY	Y	M	PC
Test Run 1 Net weight of ink used	11.2	5.3	5.8	6.2	4.6	32.4	5.9	5.4	28.2	10.2	7.0	5.8
Test Run 2 Net weight of ink used	11.4	6.1	6.1	4.7	6.4	38.4	5.2	5.9	30.4	10.6	5.9	4.3
Test Run 3 Net weight of ink used	11.8	5.2	6.6	6.5	6.2	37.4	5.3	5.6	28.6	11.5	7.5	5.4
Average amount of ink used across three runs	11.5	5.5	6.2	5.8	5.7	36.1	5.5	5.6	29.1	10.8	6.8	5.2
Total ink weight across 12 cartridges for 50-page run (based on averages)												133.8

Table 4: Ink Used in Three 50-Page Runs of Packaging Proof Test Document (Normal Mode) on the HP DesignJet Z9+dr 44-inch PostScript with V-Trimmer (in Grams)

	M	Y	C	CR	PK	MK	CB	CG	GY	GE
Test Run 1 Net weight of ink used	15.0	19.4	7.5	11.0	42.1	3.7	5.5	7.3	16.3	91.1
Test Run 2 Net weight of ink used	15.8	20.2	7.7	11.8	43.1	3.7	5.8	7.1	16.5	92.6
Test Run 3 Net weight of ink used	15.7	20.0	8.2	11.3	43.9	4.1	5.8	7.6	17.0	92.3
Average amount of ink used across three runs	15.5	19.9	7.8	11.4	43.0	3.8	5.7	7.3	16.6	92.0
Total ink weight across ten cartridges for 50-page run (based on averages)										223.0

Table 5: Ink Used in Three 50-Page Runs of Retail Sales Poster Test Document (Standard Mode) on the Canon PRO-4100 (in Grams)

	PM	R	C	PGY	MBK	PBK	B	CO	GY	Y	M	PC
Test Run 1 Net weight of ink used	12.7	21.4	4.0	20.5	8.0	5.3	5.6	3.1	9.6	7.3	3.6	9.9
Test Run 2 Net weight of ink used	15.3	23.2	6.0	22.3	7.4	7.2	5.8	7.4	15.7	6.9	6.8	5.9
Test Run 3 Net weight of ink used	15.7	18.7	7.5	24.0	7.6	7.3	6.5	6.7	11.8	8.7	6.2	6.6
Average amount of ink used across three runs	14.6	21.1	5.8	22.3	7.7	6.6	6.0	5.7	12.4	7.6	5.5	7.5
Total ink weight across 12 cartridges for 50-page run (based on averages)												122.8

Table 6: Ink Used in Three 50-Page Runs of Retail Sales Poster Test Document (Normal Mode) on the HP DesignJet Z9+dr 44-inch PostScript with V-Trimmer (in Grams)

	M	Y	C	CR	PK	MK	CB	CG	GY	GE
Test Run 1 Net weight of ink used	8.3	3.9	4.7	26.2	13.6	4.8	2.1	1.6	20.4	1.3
Test Run 2 Net weight of ink used	8.4	4.4	5.2	26.3	14.0	4.9	2.4	1.8	20.3	1.7
Test Run 3 Net weight of ink used	8.3	3.7	4.7	25.4	13.3	4.6	2.1	1.5	19.8	1.4
Average amount of ink used across three runs	8.3	4.0	4.9	26.0	13.6	4.8	2.2	1.6	20.2	1.5
Total ink weight across ten cartridges for 50-page run (based on averages)										87.1

Table 7: Ink Used in Three 50-Page Runs of Studio Portrait Test Document (Standard Mode) on the Canon PRO-4100 (in Grams)

	PM	R	C	PGY	MBK	PBK	B	CO	GY	Y	M	PC
Test Run 1 Net weight of ink used	8.7	8.2	9.0	30.5	10.6	10.8	8.7	8.9	26.7	9.8	9.1	8.8
Test Run 2 Net weight of ink used	13.7	9.3	9.1	31.8	9.4	12.9	9.3	9.8	28.6	10.8	8.7	9
Test Run 3 Net weight of ink used	11.1	10.1	10.7	25.6	11.6	12.8	9.4	10.1	26.5	12.3	10	9.6
Average amount of ink used across three runs	11.2	9.2	9.6	29.3	10.5	12.2	9.1	9.6	27.3	11.0	9.3	9.1
Total ink weight across 12 cartridges for 50-page run (based on averages)												157.4

Table 8: Ink Used in Three 50-Page Runs of Studio Portrait Test Document (Normal Mode) on the HP DesignJet Z9+dr 44-inch PostScript with V-Trimmer (in Grams)

	M	Y	C	CR	PK	MK	CB	CG	GY	GE
Test Run 1 Net weight of ink used	7.9	12.9	6.7	9.0	18.6	3.6	3.9	5.7	46.7	60.2
Test Run 2 Net weight of ink used	8.0	12.7	6.6	9.2	18.6	3.9	4.2	5.7	45.4	86.9
Test Run 3 Net weight of ink used	7.6	12.3	6.2	8.5	17.9	3.3	3.9	2.7	44.7	86.1
Average amount of ink used across three runs	7.8	12.6	6.5	8.9	18.4	3.6	4.0	4.7	45.6	77.7
Total ink weight across ten cartridges for 50-page run (based on averages)										189.8

Ink Consumption Test Methodology Overview

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

The Canon imagePROGRAF PRO-4100 was installed in Buyers Lab's lab with the latest 01.05 level of firmware (as of November 2019) and connected to a Windows 10 workstation using a 1000BaseT TCP/IP connection. The device was left in default configuration throughout testing. The Canon imageRUNNER Printer Driver was used for all testing and was left in default colour setting configuration. The Packaging Proof document was printed on Canon 255gsm proofing media in Standard mode. The Retail Poster was printed on 140gsm matte coated media in Standard mode, and the Studio Portrait photo was printed on 280gsm semi-gloss photo media in Standard mode.

The HP DesignJet Z9+dr 44-inch PostScript with V-Trimmer was installed in Buyers Lab's lab with the latest "JGR6_03_18_26.7" level of firmware (as of August 2018) and connected to a Windows 10 workstation using a 1000BaseT TCP/IP connection. The device was left in default configuration throughout testing. The PCL 3 driver for Windows Modern Apps was used for all testing and was left in default colour setting. The Packaging Proof document was printed on HP proofing media in Normal mode. The Retail Poster was printed on matte coated media in Normal mode, and the Studio Portrait photo was printed on HP gloss photo media in Normal Mode.

Before installing the ink cartridges, Buyers Lab 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 both models, one cartridge was then run to exhaustion and the weight of the empty cartridge was recorded and used as the empty weight for each colour.

Test Environment

Products were tested in Buyers Lab's environmentally controlled UK test lab, which replicates typical office conditions.

Test Equipment

Buyers Lab's dedicated test network in Europe, consisting of Windows 2012 servers and Windows 10 Professional workstations, 10/100/1000BaseTX network switches and CAT5e/6 cabling.

Test Procedures

The test methods and procedures employed by Buyers Lab in its lab testing include Buyers Lab's proprietary procedures and industry-standard test procedures. In addition to a number of proprietary test documents, Buyers Lab uses industry standard files including a Buyers Lab 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 XRite i1 profile software and an i1 Pro colour spectrophotometer, and analysed using XRite i1i0 Advanced Scanning Table. Density of black and colour output was measured using an XRite exact^{xp} densitometer.

About Keypoint Intelligence - Buyers Lab

Keypoint Intelligence is a one-stop shop for the digital imaging industry. With our unparalleled services and unmatched depth of knowledge, we cut through the noise of data to offer clients the independent insights and responsive tools they need.

For over 50 years, Buyers Lab has been the global document imaging industry's resource for unbiased and reliable research, test data, and competitive information services. In addition to publishing the industry's most comprehensive and accurate test reports, each representing months of hands-on testing in our U.S. and UK laboratories, we have been the leading organization for extensive specifications/pricing databases on MFPs, printers, scanners, and software. Buyers Lab also provides consulting services and a range of private testing services that include document imaging device beta and pre-launch testing, performance certification testing, consumables testing (toner, ink, fusers, and photoconductors), solutions evaluations, and media runnability testing.

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