KEYPOINT INTELLIGENCE *Buyers Lab*

KPI Comparative Lab Test Report

MAY 2018

Canon imagePROGRAF TX-4000
vs. HP DesignJet T1700dr

Advantage ✔	Canon imagePROGRAF TX-4000	HP DesignJet T1700dr
Colour Image Quality	✔	
Black Image Quality	✔	
Print Productivity	✔	
Banner Printing	✔	
Poster Printing	✔	
Direct Print Submission Functionality	=	=
Ink Consumption	✔	
Device Feature Set	✔	
Print Driver Feature Set	✔	

TEST OBJECTIVE

Keypoint Intelligence – Buyers Lab was commissioned by Canon Europe to conduct confidential document imaging device performance testing on the Canon imagePROGRAF TX-4000 and the HP DesignJet T1700dr, and produce a report comparing the relative strengths and weaknesses of the two 44-inch large-format devices in the areas of image quality, productivity, banner and poster printing, direct print submission functionality, device feature set, driver functionality, and ink consumption. All testing was performed in Buyers Lab's European test facility in Wokingham, UK.

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Executive Summary

Designed to meet the demands for high productivity and exceptional image quality of both the high-end Computer-Aided Design (CAD) inkjet market and entry-level LED plotter market, the 5-colour Canon imagePROGRAF TX-4000 proved to be more than capable of fulfilling these requirements. With its superior productivity, top-class image quality, lower ink consumption across all three tests, and richer driver and device feature sets, the Canon unit outperformed the 6-colour HP DesignJet T1700dr in the majority of categories evaluated. The unit's productivity, in particular, was outstanding, whether printing after a weekend of non-use, from a ready state, or printing Buyers Lab's jobstream (which replicates a typical mixed workflow for a large-format unit). Buyers Lab technicians observed that the speed advantage of the Canon model became more pronounced as the quality level was increased, which enables Canon users to achieve optimum image quality without sacrificing productivity. Both models offer a dual-roll design—a productivity boost for environments where users need to print regularly on different media types or sizes—and while the time to switch between rolls was comparable for both models, the Canon TX-4000 bested the HP competitor in Buyers Lab's dual-roll job stream evaluation. One key productivity-boosting advantage for the Canon model is its hot-swap ink tank design, which enables users to replace empty inks while the device is actively printing. In contrast, when the HP T1700dr runs out of ink, printing has to stop for a cartridge to be replaced, which leads to some operator downtime.

In terms of image quality, both models delivered high-quality results when printing technical documents and graphics—results that would easily satisfy any Architectural, Engineering and Construction (AEC), Geographical Information Systems (GIS) or CAD customer requirements. Yet the Canon model had a clear overall advantage, producing larger colour gamuts, impressive pin-sharp text, smoother circles and brighter colours in photographic output versus the HP T1700dr. Neither model produced very natural-looking skin tones, which were yellowish on output from both. The Canon TX-4000 also outperformed the HP unit in Buyers Lab's ink consumption testing, using less ink than the HP device did with all three test documents used. Moreover, Canon's ink tank capacities are higher than the competitor's, and will likely require less frequent replacement.

Both models offer strong device feature sets, which include a 500-GB hard drive as standard to aid with job processing and job storage, and robust security tools to protect company information and prevent unauthorised access to the device. While the HP T1700dr has a higher standard and maximum memory capacity and lower rated energy consumption while printing, the Canon TX-4000 offers a host of other benefits to give it the overall advantage, such as a unidirectional print feature (which eliminated the banding noted in the poster test in Fast mode), a high-capacity stacker (that's capable of collating 100 A0-sized CAD prints), more media profiles, and a flexible layout nesting option to save on paper. (The HP model offers a similar feature but lacks the same flexibility and control over image placement.) Both models support direct printing of JPEG, TIFF and PDF files from a USB flash drive providing convenience to mobile workers; HP users can email their jobs directly to the printer for instant printing, while Canon users can print via the Canon Print Service mobile app (Android currently supported, with iOS support to follow in 2018).

In conclusion, based on its superior image quality, faster productivity across the board, stronger feature sets and more efficient ink consumption, Buyers Lab judges the Canon imagePROGRAF TX-4000 as clearly the stronger performer in its large-format production evaluation.

Colour Image Quality

Advantage ✔	Canon imagePROGRAF TX-4000	HP DesignJet T1700dr
Text	✔	
Fine Lines	=	=
Halftone Range	=	=
Halftone Fill	=	=
Solid Density	✔	
AEC Graphics	✔	
GIS Graphics	=	=
Business Graphics	✔	
Photographic Images	✔	
Colour Gamut (Plain Paper, Fast)	✔	
Colour Gamut (Plain Paper, Standard/Normal)	✔	
Colour Gamut (Plain Paper, High/Best Quality)	✔	
Colour Gamut (Matte Coated Paper, High/Best Quality)	✔	

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

○ Buyers Lab's image quality test evaluation was conducted using Canon Standard Plain Paper 2 and HP Universal Bond.

+ The Canon TX-4000 delivered superior optical densities for cyan, magenta and yellow in Standard/Normal and High/Best modes, while the HP T1700dr delivered higher optical densities for composite black. In Fast mode, the Canon unit produced the higher optical density for composite black and the HP device had the higher result for magenta, while results for cyan and yellow were comparable.

+ In Buyers Lab's colour gamut assessment conducted in Fast mode, the Canon TX-4000 delivered a 35.8% larger colour gamut, with a CIE volume of 200,598 versus a CIE volume of 147,761 for the HP model.

+ The Canon model produced an impressive 100.3% larger colour gamut in Standard/Normal mode, with a CIE volume of 332,964 versus a CIE volume of 166,241 for the HP device.

+ Similarly, in High/Best quality settings, the Canon TX-4000 delivered a 100.2% larger colour gamut than the HP T1700dr, with a CIE volume of 343,545 versus a CIE volume of 171,562 for the HP model.

+ When printing on matte coated paper in High/Best quality mode, the Canon model delivered a 47.7% larger colour gamut than that of the HP unit, with a CIE volume of 410,918 compared with a CIE volume of 278,251 for the HP unit.

+ Both models produced dark Arial sans serif text that was fully formed and legible down to the smallest (3-pt.) type size, but the Canon TX-4000 had the advantage as its characters displayed no bleed in all modes, while the HP unit's san serif text exhibited some bleed in Fast and Normal modes. Serif characters produced by the Canon model, again, displayed no bleed and were fully formed, crisp and legible down to the 5-pt. size in Fast

and Standard modes, and 3-pt. size in High quality mode. Times Roman text was legible down to the 5-pt. level in all modes for the HP T1700dr, but characters produced in Fast mode were less distinct as they exhibited slight ink bleed.

○ Fine lines produced by both devices remained visible and intact down to the 0.1-pt. level, and were rated very good in all modes except Fast, where the HP model's lines suffered from some ink bleed, and the Canon unit's horizontal lines lacked sharpness.

+ The Canon TX-4000 produced clean, smooth and fully formed 0.1-pt. circles that were rated very good in Fast and High modes and excellent in Standard mode. Circles produced by the HP T1700dr were fully formed at 0.1-pt but rated only good in Fast and Normal modes as they suffered from some ink bleed, while in Best mode, they were smoother and rated very good.

○ Both models produced the 1x1 pixel grid in CMY with no quality issues, and coverage was consistently very good across all colours.

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

○ Both models produced very good, consistently smooth colour halftone fills in all modes.

+ When evaluating Architectural, Engineering and Construction (AEC) graphics in all modes, the Canon and HP models' output exhibited an excellent level of detail, but the Canon model delivered more distinct fine lines and sharper text formation when viewed under magnification.

○ When evaluating Geographic Information Systems (GIS) graphics in Standard/Normal and High/Best modes, both units produced very good detail and showed an equally good depth of field—a critical factor in delivering a realistic three-dimensional rendering of topographical features—the Canon TX-4000's output displayed richer saturation in High/Best quality mode whereas colours were muted on the HP model's output.

+ Colour business graphics produced by the Canon TX-4000 exhibited slightly smoother transitions from light to dark areas and sharper fine details than those produced by the HP device.

+ When comparing photographic images in Fast mode, the Canon TX-4000 delivered finer detailing and brighter colours than the HP unit. In Standard/Normal and High/Best modes, both models delivered superb detailing in dark and light contrast areas with good saturation, but colours were consistently brighter and there was greater depth in the Canon unit's output.

○ Skin tones produced by both models were slightly yellow in all modes.

+ Overall, Buyers Lab technicians judged the Canon TX-4000 as the superior performer in the colour image quality evaluation. It delivered pin-sharp crisp text with no ink bleed, unlike with some of the HP model's output, smoother circles, and brighter, more saturated colours as well as larger colour gamuts under all test conditions. In terms of optical density, the HP T1700dr delivered higher composite black optical density in Standard/Normal and High/Best modes, while the TX-4000 had the advantage with CMY solid density. Importantly, as befitting the needs of their target market, both models produced excellent detailing in GIS graphics with equally very good depth of field, but the Canon model had a slight advantage in AEC drawings with crisper fine lines and text.

Black Image Quality

Advantage ✔	Canon imagePROGRAF TX-4000	HP DesignJet T1700dr
Text	✔	
Fine Lines	✔	
Halftone Range	=	=
Halftone Fill	=	=
Solid density	=	=
AEC Graphics	✔	
Business Graphics	✔	
Photographic Images	✔	

○ When printing in monochrome in Fast mode, the Canon TX-4000 produced darker solids with higher optical densities than the HP unit; in Standard/Normal mode, both models' optical densities were comparable, while in High/Best mode, the HP T1700dr delivered higher optical densities.

+ Black serif fonts produced by the Canon TX-4000 unit were dark, crisp and legible down to the smallest 3-pt. level in High quality mode, and 4-pt. level in Fast and Standard modes, while sans serif characters were pin sharp and legible at the 3-pt. size in all modes. There was no ink bleed visible on text produced by the TX-4000. In contrast, the HP device delivered fully formed black serif fonts legible down to the 5-pt. level in Fast and Normal modes, and 4-pt. level in Best quality mode, but with some ink bleed and overspray evident. The HP model's sans serif fonts were dark and legible at the 3-pt. size in all quality modes, but displayed some ink bleed.

+ In Buyers Lab's line art reproduction test, both models' fine lines were intact at the 0.1-pt. level in all modes and were rated very good for the Canon device and good for the HP unit, as they were less distinct. White-on-black fine lines produced by both models were intact at the 0.25-pt. level in all quality modes, and were rated very good for the Canon TX-4000 across the board, but only fair for the HP T1700dr in Fast and Normal modes and good in Best mode as they were indistinct.

+ Circles produced by both models were fully formed at 0.1-pt, but the Canon TX-4000 delivered far smoother circles (which were rated very good in all modes) than those produced by the HP unit, which were rated good in all modes as they were slightly jagged.

+ Both models produced the 1x1 pixel grid in black with no quality issues, except for the HP T1700dr's grid in Fast mode, which was slightly inconsistent; the Canon model's grids displayed smooth and uniform coverage and were rated very good (in Fast and Standard modes) and excellent in High mode, versus a rating of good (in Fast mode) and very good (in Normal and Best modes) for the HP unit.

○ Both models delivered comparable 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 very smooth greyscale coverage that was rated excellent in Fast mode and very good in Standard/Normal and Best/High quality modes.

+ When evaluating AEC graphics in black in all modes, both models delivered very good detailing, but the Canon TX-4000 had a slight advantage with crisper text and more distinct fine lines when viewed under magnification. While output from the HP model appeared bolder, it displayed slight ink bleed in all modes, but only when viewed under magnification.

+ Monochrome business graphics were produced more accurately by the Canon model, as some fine lines and circles were slightly less distinct in the output produced by the HP unit, but only when viewed under magnification.

+ Both models produced smooth greyscale photographic images in all modes. In Fast mode, there was a slight sepia tone on output from the Canon model, while the HP unit delivered better neutral grey tones. Images displayed very good fine detailing in light contrast areas, however the Canon unit produced better detailing in dark contrast areas in Fast and Standard/Normal modes, as well as more image depth.

+ In Buyers Lab's monochrome image quality assessment, the Canon TX-4000 produced better quality overall, delivering superior text and fine lines (with no ink bleed), sharper business graphics and better fine detailing in photographic images. Neither model had an overall advantage in producing solid black optical density. In addition, both delivered very good detailing in AEC graphics, a full halftone range and smooth greyscale coverage.

Print Productivity

Advantage ✔	Canon imagePROGRAF TX-4000	HP DesignJet T1700dr
First Page Out From Weekend Non-Use	✔	
First Page Out From Ready State	✔	
Throughput Speed (Fastest mode)	✔	
Throughput Speed (Default mode)	✔	
Throughput Speed (Highest-quality mode)	✔	
Job Stream	✔	
Dual-roll Job Stream	✔	

+ The Canon TX-4000 delivered a much faster (by 51.2%) first-page-out time of 89.35 seconds after a weekend of non-use, compared with 183.04 seconds for the HP T1700dr. Start-up time before printing commenced was, again, faster for the Canon model at 58.10 seconds, compared with 148.79 seconds for the HP unit.

+ The Canon device delivered a 12.7% faster first-page-out time of 45.59 seconds from its ready state, compared with 52.20 seconds for the HP device. Although start-up time before printing commenced was slower for the Canon model—21.95 seconds versus 18.38 seconds— the Canon TX-4000 is the faster device overall when combining both measurements.

+ When printing Buyers Lab's job stream, designed to simulate a typical mixed workflow for a large-format unit, the Canon TX-4000 delivered a far superior performance in High/Best quality mode, running 60.7% faster than the HP model. In the other tested modes, it was also faster—by 34.5% in Fast mode and 54.8% in Standard/Normal mode.

+ As both models offer a dual-roll design, Buyers Lab conducted a second job stream test in Fast mode to assess roll switching efficiency by printing the same files, but alternating them between the two rolls. The Canon TX-4000 completed the dual-roll job stream in 762.86 seconds—24.8% faster than the 1,013.90 seconds taken by the HP T1700dr.

○ Buyers Lab technicians observed that, although Canon's faster speed gave it the overall edge when printing to dual rolls, the actual time taken to switch between rolls (around 22 seconds) was similar for both models.

+ When printing Buyers Lab's 12-page DWF test file in colour, the Canon unit was 36.2% faster in Fast mode, 54.7% faster in Standard/Normal mode, and 69.4% faster in High/Best quality mode.

+ Similarly, when printing Buyers Lab's 12-page DWF test file in monochrome, the Canon unit was 34.3% faster than the HP model in Fast mode, 54.9% faster in Standard/Normal mode, and 69.0% faster in High/Best quality mode.

+ In Buyers Lab's single-page A0-size test, the Canon TX-4000 delivered a first-page-out time (117.55 seconds) that was 24.8% faster than that of the HP unit (156.38 seconds). The Canon model was also 38.3% faster than the HP T1700dr when printing five A0-size pages (523.25 seconds versus 848.04 seconds).

+ The Canon model's unique sub ink tank system provides a further boost to productivity. When the HP T1700dr model runs out of ink, printing will stop until the cartridge is replaced, which leads to operator downtime. In contrast, when the Canon TX-4000 requires cartridge replacement it continues to print drawing ink from its sub tank, and while the cartridges is replaced no downtime is incurred. For added convenience, the control panel alerts users to replace ink and also provides purchasing information.

○ Both models will stop and alert the operator when media is depleted. Once a new roll is installed, each resumes printing at the beginning of the interrupted page, rather than printing the portion of the page that remained before running out, thereby wasting less ink and paper.

Banner Printing

	Canon imagePROGRAF TX-4000	HP DesignJet T1700dr
Image Quality	✔	
Productivity	✔	

+ The Canon TX-4000 successfully printed Buyers Lab's 36" x 105" banner (a 4,955-KB PDF file) in Fast mode, taking 6.06 seconds to generate a preview at the workstation, and an additional 2 minutes, 0.41 seconds from preview to final paper. In contrast, the HP DesignJet T1700dr could not complete a preview image, failing after 43.21 seconds, and was incapable of printing the banner.

Poster Printing

Advantage ✔	Canon imagePROGRAF TX-4000	HP DesignJet T1700dr
Image Quality (Fast mode)	✔	
Image Quality (Standard/Normal mode)	✔	
Image Quality (High/Best mode)	=	=
Productivity (Fast mode)	✔	
Productivity (Standard/Normal mode)	✔	
Productivity (High/Best mode)	✔	

+ When printing Buyers Lab's Poster test target in Fast mode at 300 dpi, the Canon TX-4000 took 37.88 seconds to complete the job, while the HP T1700dr took 44.46 seconds. Slight banding was evident with both models, but only in the dark areas. When unidirectional printing (not supported on the HP model) was selected in the Canon print driver, banding was eliminated, and the time to print the banner slowed to 56.74 seconds.

+ When printing a poster in Standard/Normal mode, the Canon model took 1 minute, 0.52 seconds. The HP unit took 1 minute, 34.94 seconds. Both models' output showed no banding.

+ When printing the poster in High quality mode (600 dpi), the Canon model took 1 minute, 43.26 seconds, which is 62.0% faster than the 4 minutes, 31.86 seconds taken by the HP model to print the poster in Best mode.

O At these High/Best quality settings, image quality was equally good on output from both models, with vibrant, saturated colours and good definition of fine details.

Direct Print Submission Functionality

Advantage ✔	Canon imagePROGRAF TX-4000	HP DesignJet T1700dr
First Page Out From Weekend Non-Use	=	=
First Page Out From Ready State	=	=

◯ Available as a free download from Canon's website, the 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. Via the utility, users can preview print layouts and select print settings without the need to open up the driver properties. For added convenience, users can modify and print multiple files simultaneously.
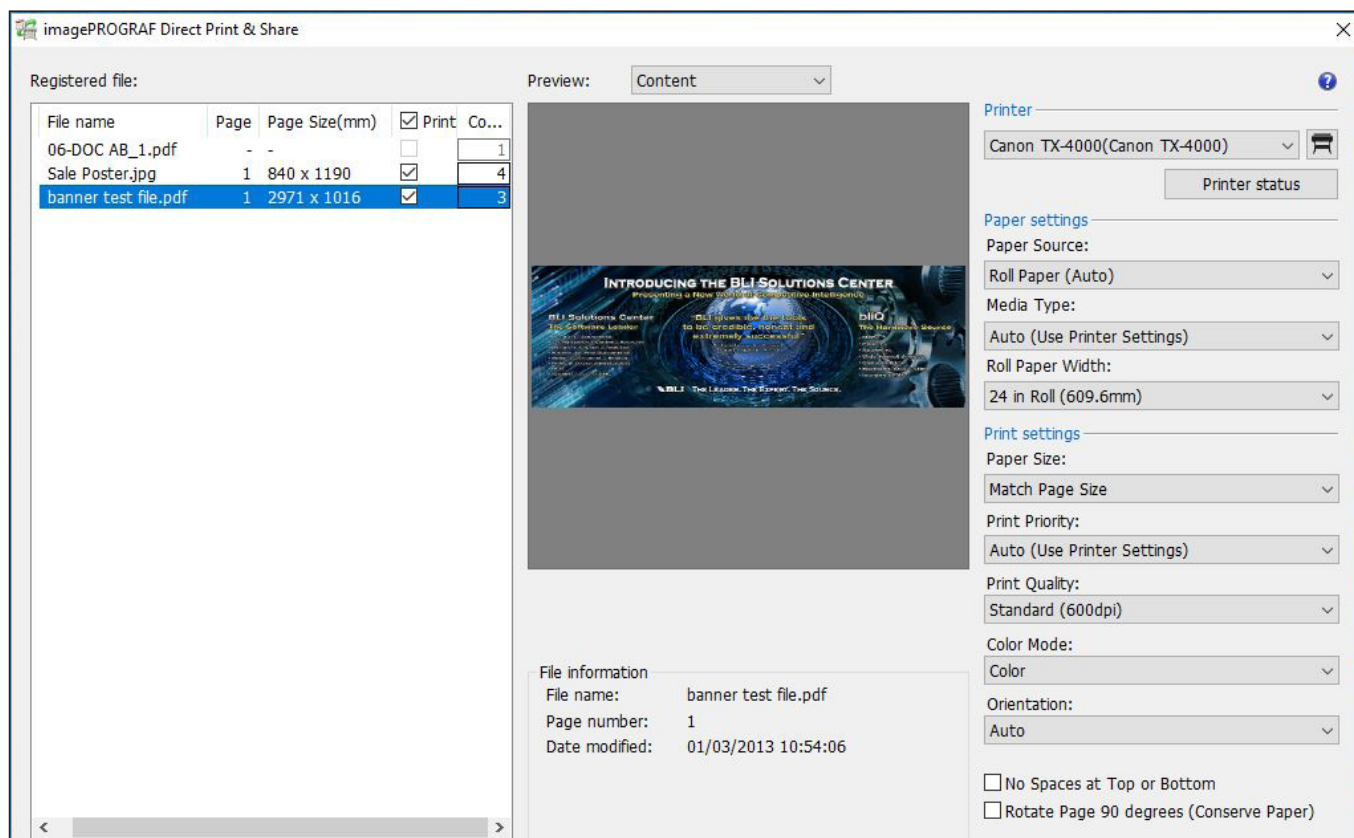
Canon's imagePROGRAF Direct Print & Share utility gives users an image preview.

○ The imagePROGRAF Direct Print & Share utility supports "Shortcut Print" functionality, enabling users to create a desktop shortcut that includes commonly used print settings. Akin to a hot folder workflow, files are automatically printed with the predefined settings when users drag-and-drop the files to the desktop icon. Multiple desktop icons can be created for different print settings or combinations of print settings.
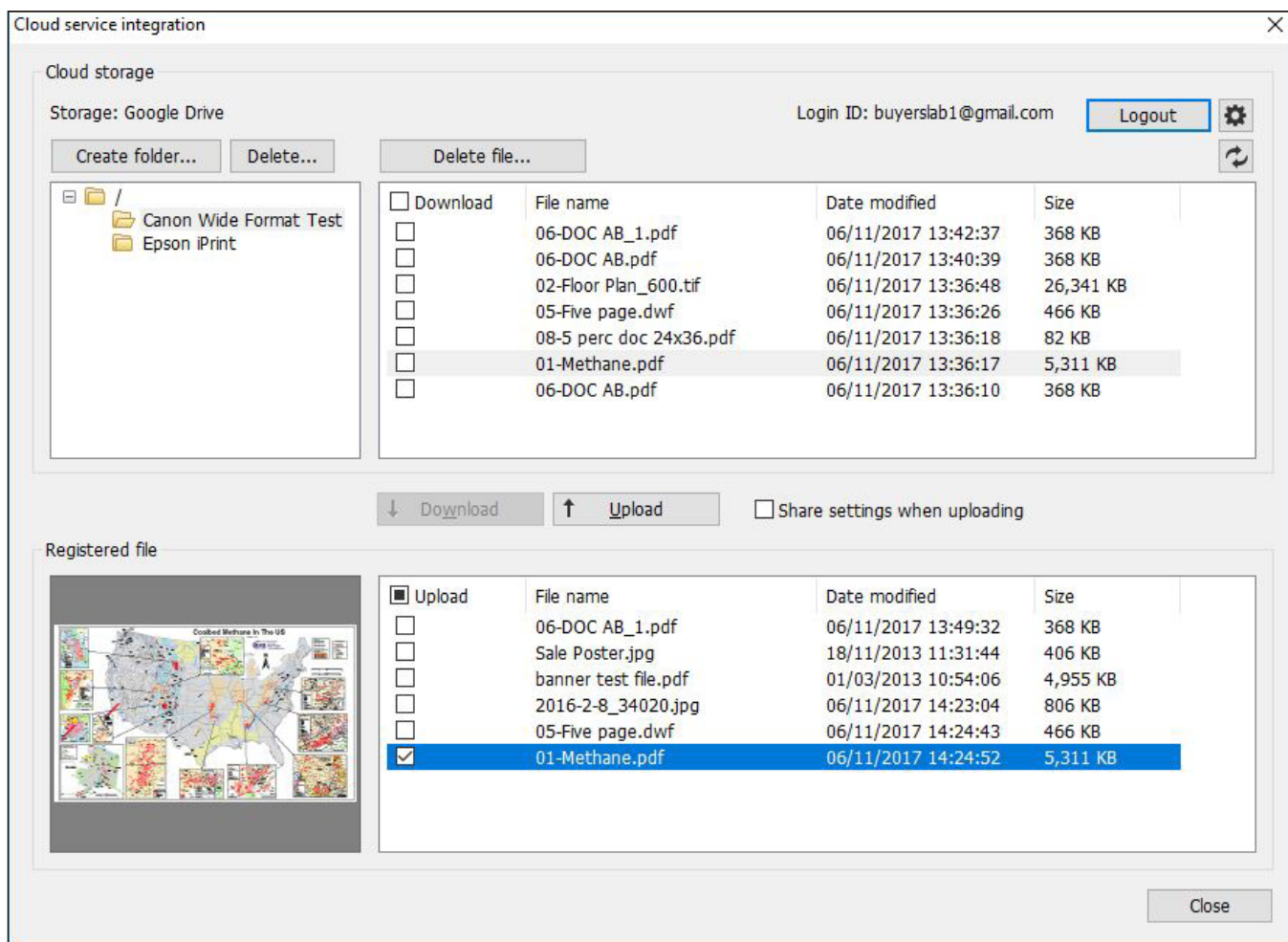
Retrieving files from Google Cloud using imagePROGRAF Direct Print & Share.

○ Users can download stored files from Google Drive and AutoCAD 360 cloud storage services for printing via the imagePROGRAF Direct Print & Share utility. Files can be uploaded directly to cloud storage as well. For added convenience and collaboration, the utility offers the option of sharing 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.
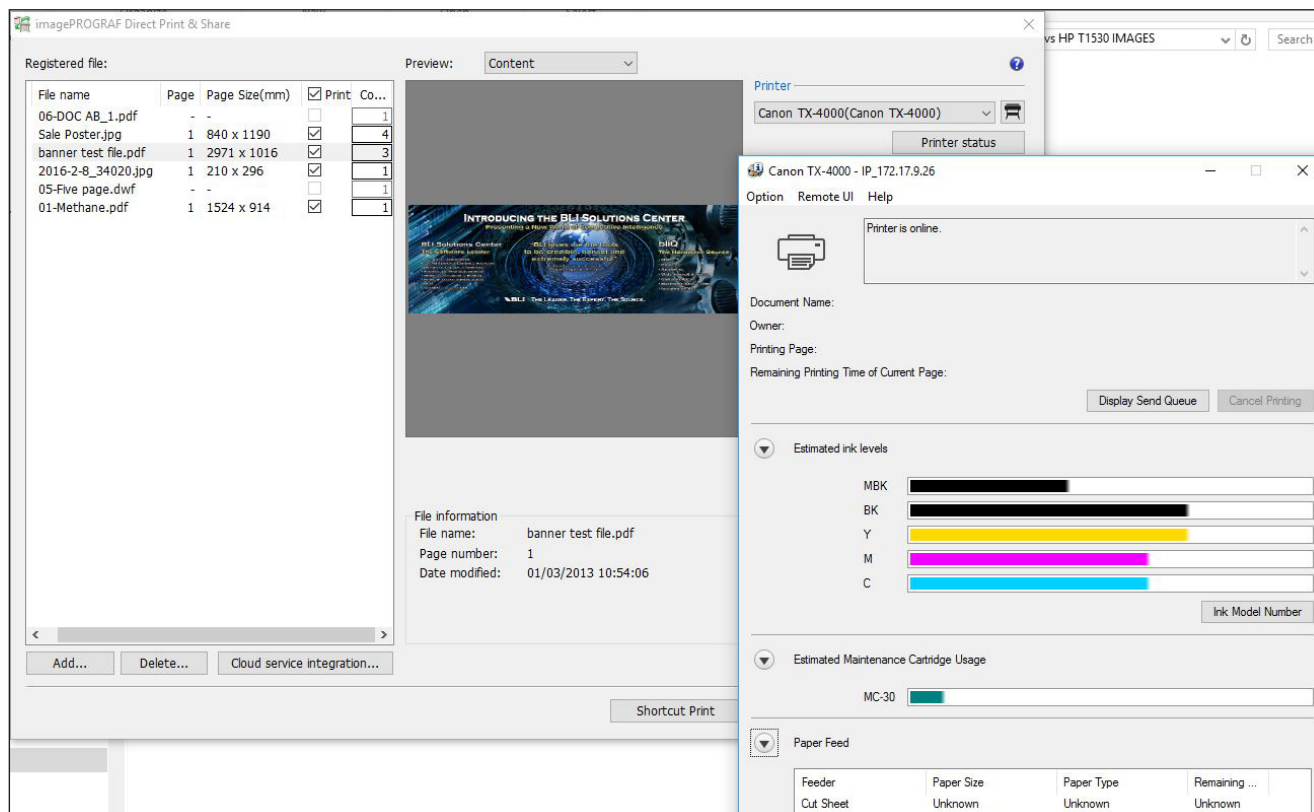
Users can view device status information via the utility.

○ 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. Here, users can 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.
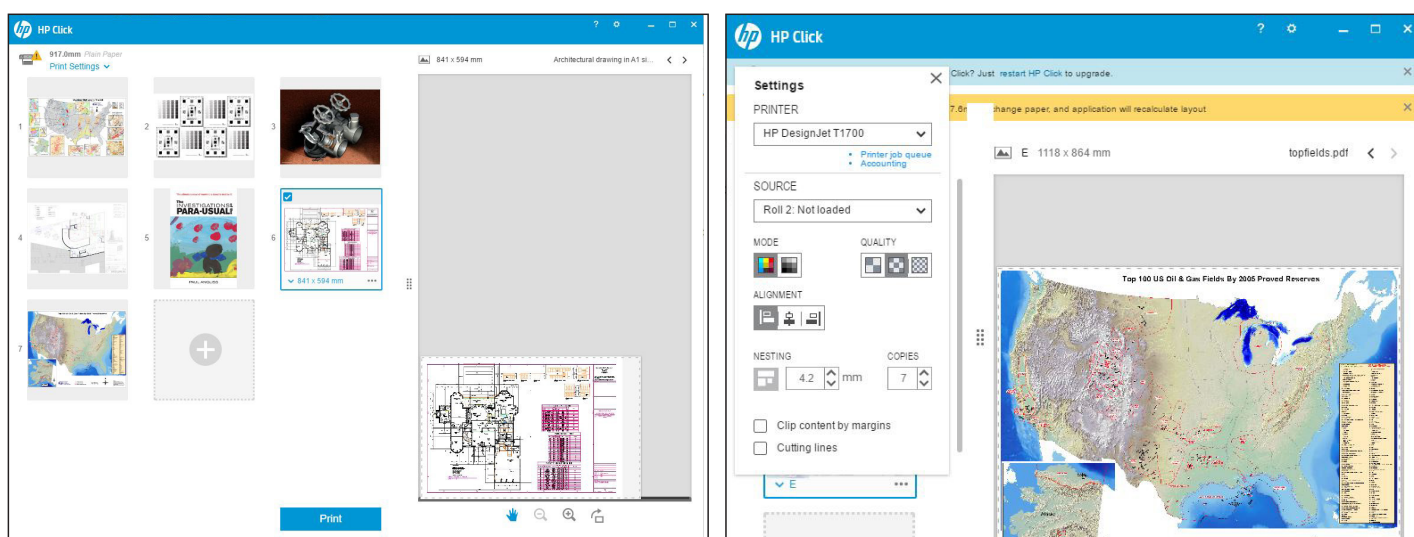
Via HP Click, users can select basic print settings, preview images, manipulate images as well as utilize the automatic nesting feature to reduce paper waste.

○ The HP T1700dr 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. Unlike the Canon device, it does not support any mobile print app solutions for printing via smartphones and tablets, although users can print from their iOS smart devices via Apple AirPrint.

○ The Canon TX large-format series supports Canon Print Service, a mobile print app for Android users (with support for Apple iPad devices to follow this year), which is a productivity boost in environments where workers are travelling between sites or working remotely.

Ink Consumption

Overall Weight of Ink Used (in Grams)

	Canon imagePROGRAF TX-4000	HP DesignJet T1700dr
Cottage Architectural Plan	29.6	46.2
ISO Poster	81.6	101.3
GIS Map	82.8	107.9

Results are averaged across three sets of 50-page A0 printing in Standard/Normal mode.

+ When producing 50 prints of a Cottage Architectural Plan in Standard/Normal mode, the Canon unit used 35.9% less ink than the HP T1700dr.

+ When printing an ISO Poster in Standard/Normal mode, the Canon unit used 19.4% less ink than the HP T1700dr.

+ When printing a GIS Map in Standard/Normal mode, the Canon TX-4000 used 23.3% less ink than the HP device.

Device Feature Set

+ The total capacity of the Canon TX-4000's starter ink cartridges is 970 ml, which is higher than the 240 ml total starter ink volume available with the HP model.

+ Canon's replacement ink cartridge capacities are 160 ml, 330 ml and 700 ml for all colours, whereas the HP model offers only 130 ml and 300 ml for all colours, and as a consequence they will need replacing less frequently than will the HP device.

+ Canon's ink cartridges are replaceable during operation, which helps reduce downtime for Canon users. HP's cartridges cannot be replaced during operation.

+ If the Canon device detects that printhead nozzles are becoming clogged and there are no alternative nozzles available to compensate, a cleaning routine will begin automatically. The HP unit requires this task be performed manually, although technicians did not encounter any nozzle clogging issues with either device.

○ Both units utilize user-replaceable printheads, which take less than five minutes to replace on both.

○ Both models offer USB 2.0 and Gigabit Ethernet connectivity.

○ Both also offer easy and quick roll paper loading with auto paper feed—once the user loads paper on to the device, alignment and width adjustments are automatically carried out without further user intervention.

○ The Canon device includes a media mismatch option, which places jobs on hold that can't be printed due to the required media not being loaded, while jobs that can be completed will automatically print, and 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 control panel's "Paper mismatch action" allows users either to put the job on hold or print it; all jobs that are slated for the paper types that are already loaded will be printed without delay.

○ The Canon TX-4000 offers user-friendly media loading options at the front (however, if the stacker is attached, it will need to be removed first in order to gain access to the rolls). The HP device only allows media rolls to be loaded from the top rear and back of the device, which can be cumbersome if the device is positioned against a wall.

○ For maximum convenience and minimum downtime, both models offer an optional dual-roll unit which gives users the added flexibility of switching between different media types or sizes without reloading media each time a second roll is required.

+ The TX-4000'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 option is not available for the HP device.

— The Canon model offers a standard, non-upgradable (virtual) RAM capacity of 128 GB (2 GB physical RAM), while the HP unit has a standard non-upgradable (virtual) RAM capacity of 128 GB (based on 4 GB DDR3 RAM).

○ A standard 500-GB hard drive is built in to both devices, which allows for the storage of commonly used documents and aids spooling workflow.

+ The Canon TX-4000 supports borderless printing regardless of what roll media type is being used, whilst the HP model does not support this feature.

+ Both models support up to 0.8 mm media thickness for roll paper, but the Canon TX-4000 supports 170 mm as the outside diameter of the roll, while the HP T1700dr supports 135 mm in diameter.

○ The Canon TX-4000 comes with robust security features, including newly added hard drive encryption and protocol locking to prevent unauthorised access to the device; it also supports SNMP v3 (secure network protocol) and IPsec which provide further security by authenticating and encrypting data over the network. The HP T1700dr features a new self-encrypting hard drive that is only readable by the printer itself even if removed from the device. For additional device security, HP Secure Boot ensures BIOS protection, while the Whitelisting feature allows only approved firmware to be installed and run on the device; the model is also compatible with HP JetAdvantage Security Manager to further safeguard use.

○ Both models come with a simple catch bin/basket to collect output from media rolls; the HP catch basket is attached to the device, while the Canon catch basket can be wheeled up and attached to the main unit, and easily moved when detached.

+ The Canon TX-4000 also offers stacking capability, with the Canon TX-4000's stacker capable of collating up to 100 A0-sized CAD prints. This feature is not available with the HP unit.

— The HP model is much lighter with a net weight of 74 kg versus 114 kg for the Canon unit.

O Both models offer a colour touchscreen user interface, which are similarly responsive and intuitive to navigate.

— The Canon TX-4000's power consumption while printing is slightly higher—107 watts versus 100 watts—than that of the HP model.

— Rated noise emissions are higher for the Canon model (51 dB) compared to the HP device (45 dB) while the devices are printing.

Driver Feature Set

+ The Canon TX-4000 has five speed settings (Fast 300, Standard 600, Fast 600, High 600 and 1200), which are matched by three settings on the HP device (Fast, Normal and Best Quality), although not all speed settings are available with all media types on the Canon model.

○ Both the Canon imagePROGRAF Printer Driver and the HP's HPGL/2 driver provide a useful overview of the settings for predefined profiles.

+ Six predefined profiles are available with the Canon driver, while the HP driver offers five.

+ The Canon driver supports multi-up (2 to 16) printing, while the HP driver does not support multi-up printing.

+ The Canon driver offers a 2 by 2 poster mode, while the HP model does not offer support for poster printing.

+ The Canon driver offers page stamping (Date, Time, Name and Page Number), while the HP unit does not support this feature.

○ The Canon imagePROGRAF Printer Driver offers a broad range of built-in adjustments for CMY balance, brightness and contrast, while the HP T1700dr's HPGL/2 driver also offers CMY balance and brightness adjustments. The Canon driver's advanced colour-matching selections include the ability to match ICC profiles and select the rendering intent based on different elements in the document.

— The HP driver provides a handy thumbnail preview for users to check the effects on the image as they make colour adjustments, which is not available in the Canon driver.

+ The Canon driver offers the option of unidirectional printing, even in Fast mode. With the printhead travelling in only one direction to create the desired image, this helps to avoid any banding across output. The HP driver does not offer this feature.

+ Both 64-bit and 32-bit versions of the Canon driver now include the Color imageRUNNER Enlargement Copy Mode utility. This enables users to integrate a Canon small-format MFP device with the TX-4000, whereby documents scanned at the MFP are automatically routed to a hot folder that is monitored by the TX-4000 driver. The image is then resized and printed, offering a fast, easy-to-use poster creation tool for office users. There is no equivalent functionality in the HP driver.

+ The Canon driver includes the Free Layout nesting tool (also available as a download via the Printer Driver Extra Kit) that enables files—even those created with different applications—to be scaled, resized, or grouped together as a single job from the printer driver. Images can be dragged and dropped to the desired locations and printed together on a single page, helping to save on paper. The HP unit offers a similar nesting feature, which can be activated directly on the control panel or from the print driver utility. However, unlike the Canon tool, it does not allow users to have precise control over the positioning of jobs, rather it will randomly position jobs to print across the width of a page, either in the order jobs were sent or in 'optimized' layout order.

+ The Canon model also offers a plug-in for printing from Microsoft Office applications, which includes useful tools for automatic media resizing, nesting and borderless printing. HP offers no equivalent software.

○ 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. HP offers similar accounting management and tracking capabilities via the Accounting tab on its embedded web server page, or via the HP DesignJet Excel Accounting tool, which is available as a free download.
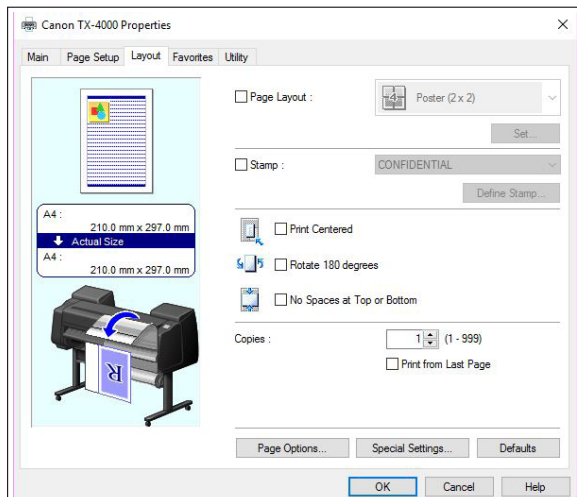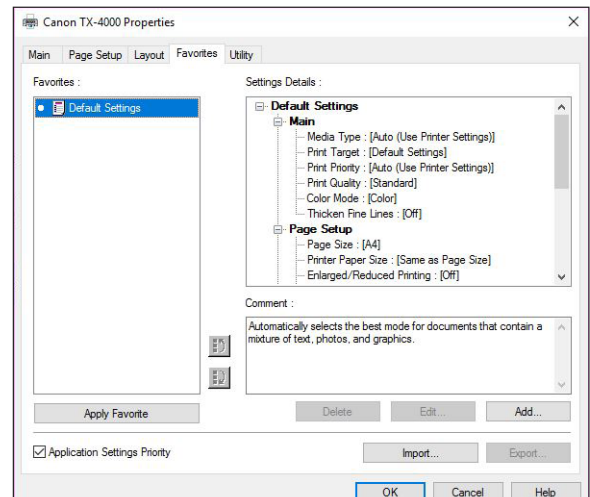
Test Models' Print Driver Screenshots
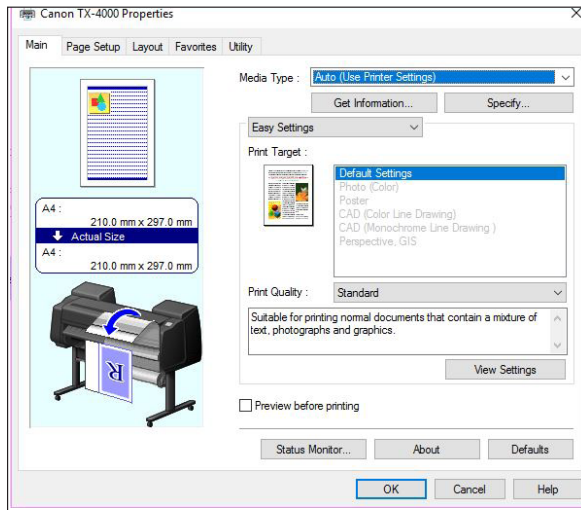
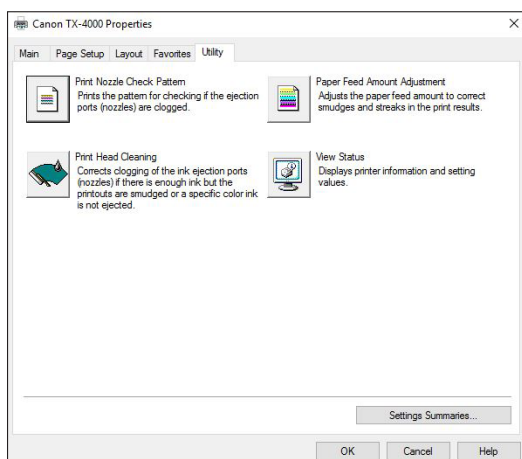Canon imagePROGRAF TX-4000 Print Driver Main Tab
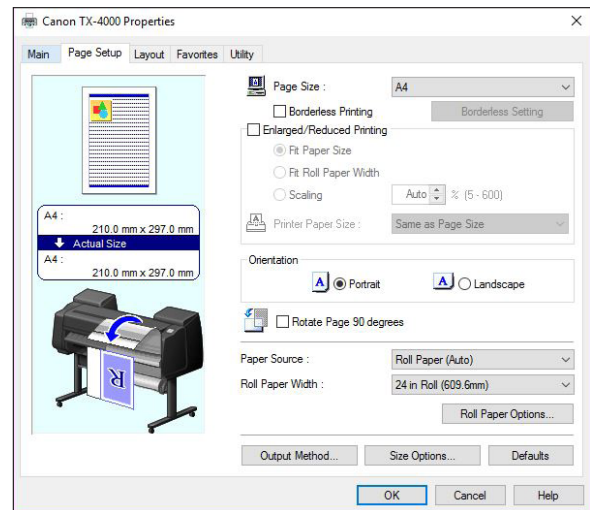
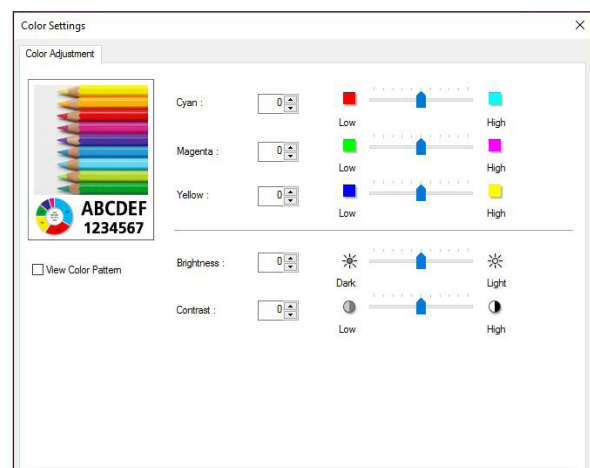Canon imagePROGRAF TX-4000 Print Driver Page Setup Tab

Canon imagePROGRAF TX-4000 Print Driver Layout Tab

Canon imagePROGRAF TX-4000 Print Driver Favourites Tab

Canon imagePROGRAF TX-4000 Utility Tab

Canon imagePROGRAF TX-4000 Print Driver Colour Adjustment Tab
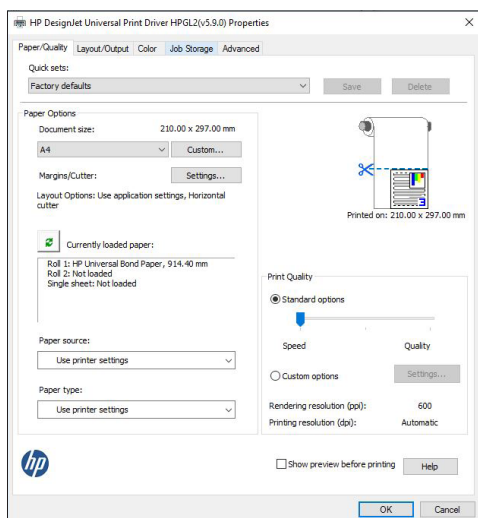
HP DesignJet T1700dr Print Driver Paper/Quality Tab
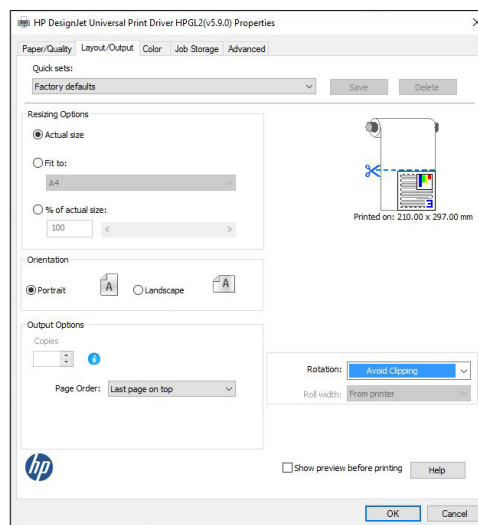
HP DesignJet T1700dr Print Driver Layout/Output Tab

HP DesignJet T1700dr Print Driver Colour Tab

HP DesignJet T1700dr Colour Adjustment Settings

HP DesignJet T1700dr Print Driver Advanced Tab

HP DesignJet T1700dr Print Driver Advanced Lightness and Colour Balance Adjustments Tab

SUPPORTING TEST DATA

Print Productivity

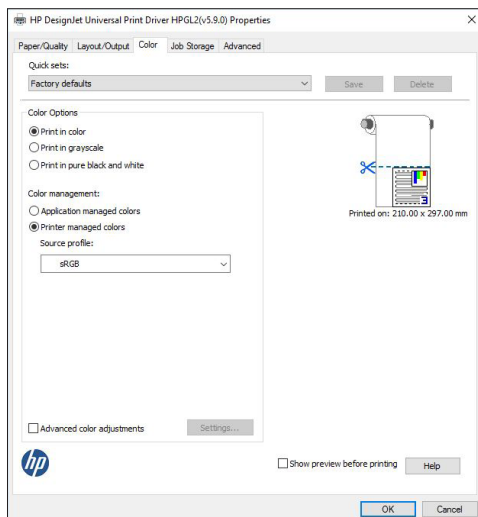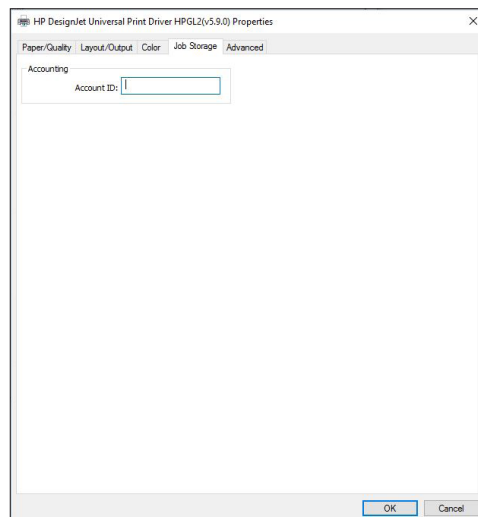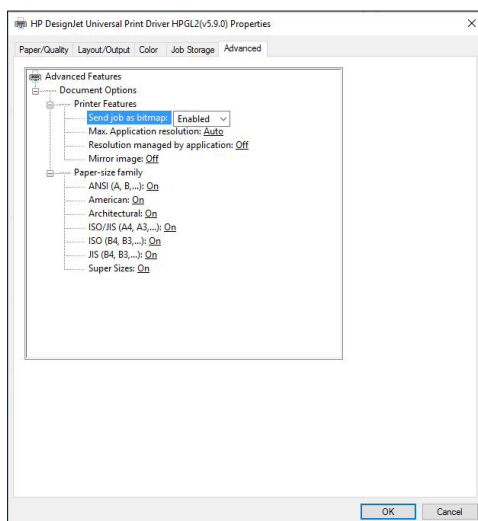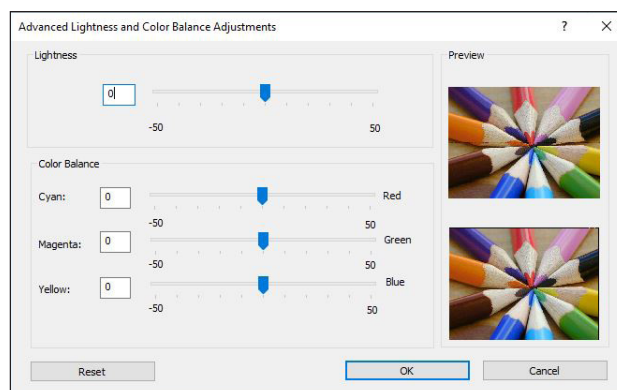### Job Stream Productivity (in Seconds)

Mixed File Types, Same Size, Single Roll

Canon imagePROGRAF TX-4000		HP DesignJet T1700dr	
Fast	593.83	Fast	906.50
Standard	914.85	Normal	2,024.15
High	1,844.69	Best	4,698.90

Buyers Lab's job stream consists of nine files, including PDF, TIFF and DWF files totalling 19 pages, all at Arch D-size, ensuring that the files are set to fit to page. This test replicates the type of traffic a typical wide-format device might experience in a real-world, multi-user environment. All of the files are submitted to the controller in a specific order and sent to the printer as a group, at which time the stopwatch begins; timing ends when the last page of the last file exits the device. Both devices were loaded with 44-inch rolls, with each file set to auto-rotate to save media.

Mixed File Types, Same Size, Dual Roll

Canon imagePROGRAF TX-4000		HP DesignJet T1700dr	
Fast	762.86	Fast	1,013.90

Buyers Lab's dual-roll job stream consists of nine files, including PDF, TIFF and DWF files totalling 19 pages, all at Arch D-size, ensuring the files are set to fit to page. This test replicates the type of traffic a typical wide-format device might experience in a real-world, multi-user environment. All of the files are submitted to the controller in a specific order and sent to the printer as a group, sending alternate jobs to different rolls, at which time the stopwatch begins; timing ends when the last page exits the device. Both devices were loaded with 44-inch rolls, with each file set to auto-rotate to save media.

Colour Productivity (in Seconds)

Canon imagePROGRAF TX-4000		HP DesignJet T1700dr	
Fast	337.95	Fast	529.50
Standard	578.90	Normal	1,279.04
High	1,063.65	Best	3,471.18

The 12-page DWF test file was printed using the device driver set to the plain paper/colour setting. Both devices were loaded with 44-inch rolls. The actual time indicated is the time it took to RIP, image and deliver all pages of the test document to the collection bin.

Monochrome Productivity (in Seconds)

Canon imagePROGRAF TX-4000		HP DesignJet T1700dr	
Fast	347.76	Fast	529.34
Standard	581.16	Normal	1,288.06
High	1,069.90	Best	3,454.62

The 12-page DWF test file was printed with the Canon driver set to the plain paper/monochrome setting and the HP driver set to plain paper, black mode. Both devices were loaded with 44-inch rolls. The actual time indicated is the time it took to RIP, image and deliver all pages of the test document to the collection bin.

First-Page-Out Productivity after a Weekend of Non-Use (in Seconds)

	Canon imagePROGRAF TX-4000	HP DesignJet T1700dr
Time Before Printing Commences	58.10	148.79
First Page Out	89.35	183.04

First-Page-Out Productivity from Ready State (in Seconds)

	Canon imagePROGRAF TX-4000	HP DesignJet T1700dr
Time Before Printing Commences	21.95	18.38
First Page Out	45.59	52.20

First-page-out times are achieved by sending an Arch D-size PDF file to print, timed from release to page out with the Canon driver set to the plain paper/monochrome setting and the HP driver set to plain paper, black mode. Both devices were loaded with 44-inch rolls.

A0 First-Page-Out and Throughput Productivity (in Seconds)

	Canon imagePROGRAF TX-4000	HP DesignJet T1700dr
First Page Out	117.55	156.38
Five Pages Out	523.25	848.04

The single-page A0-size PDF test file was printed using the device driver with the plain paper/colour setting in default speed mode. The actual time indicated is the time it took to RIP, image and deliver five pages of the test document to the collection bin.

Colour Print Quality

Colour Optical Density Evaluation

Canon imagePROGRAF TX-4000						
	Fast		Standard		High	
	50%	100%	50%	100%	50%	100%
Cyan	0.47	1.03	0.54	1.29	0.56	1.33
Magenta	0.40	0.86	0.46	1.20	0.47	1.23
Yellow	0.42	0.85	0.48	1.05	0.49	1.08
Black	0.48	1.54	0.56	1.47	0.58	1.45

HP DesignJet T1700dr						
	Fast		Normal		Best	
	50%	100%	50%	100%	50%	100%
Cyan	0.63	1.03	0.56	1.06	0.58	1.06
Magenta	0.51	0.95	0.43	0.95	0.45	0.97
Yellow	0.33	0.85	0.37	0.86	0.36	0.89
Black	0.61	1.44	0.53	1.50	0.52	1.51

Note: Colour density readings were assessed by printing a Buyers Lab proprietary PDF test target file on Canon Standard Plain Paper 2 and HP Universal Bond in default colour settings at all quality settings available, and measuring the density of 100% dot fill and 50% dot fill using an XRite eXact^{Xp} densitometer.

Colour Gamut Comparisons

Media Type/Settings	Canon imagePROGRAF TX-4000	HP DesignJet T1700dr
Plain Paper Fast	200,598	147,761
Plain Paper Standard/Normal	332,964	166,241
Plain Paper High/Best	343,545	171,562
Matte Coated High/Best	410,918	278,251
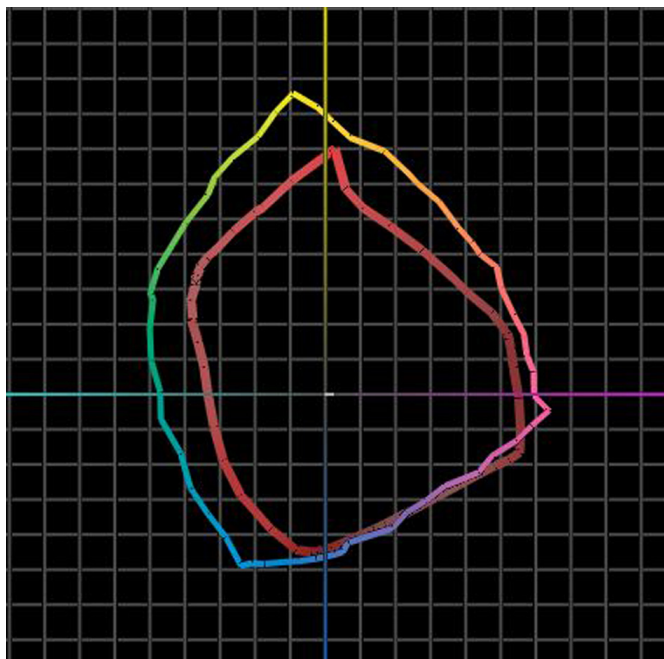
Canon imagePROGRAF TX-4000 colour gamut on Canon Standard Plain Paper 2 in Fast settings (shown chromatically) versus HP DesignJet T1700dr colour gamut (shown in red) on HP Universal Bond paper in Fast settings.
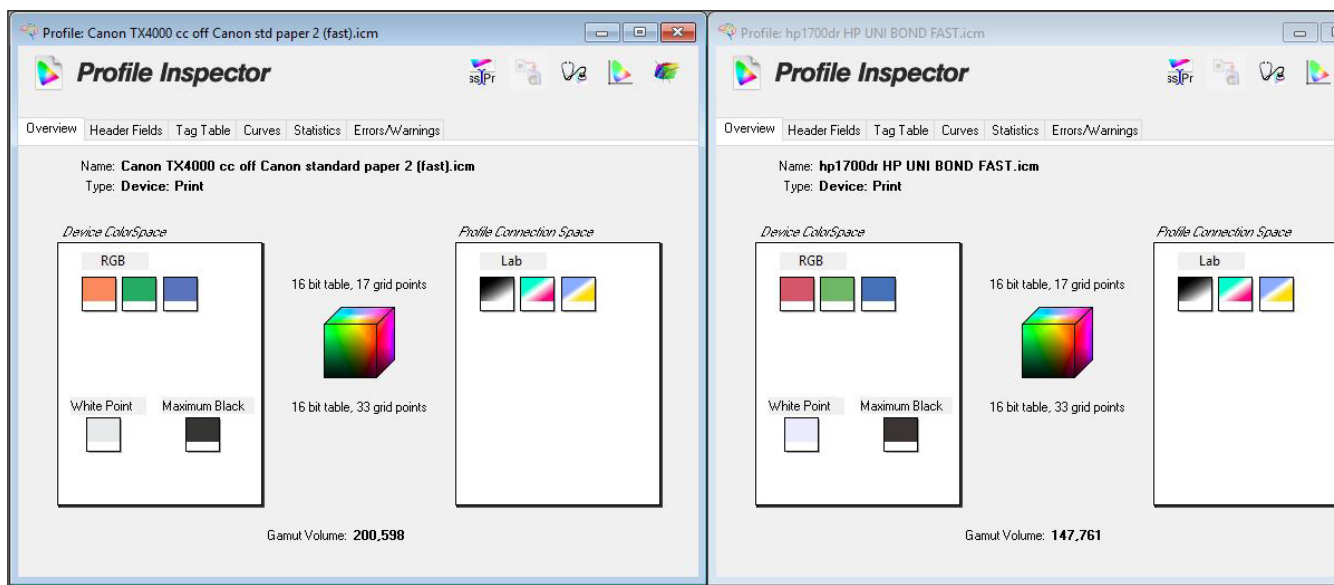
Colour gamut profile for Canon imagePROGRAF TX-4000 (left) and HP DesignJet T1700dr (right) in Fast mode.
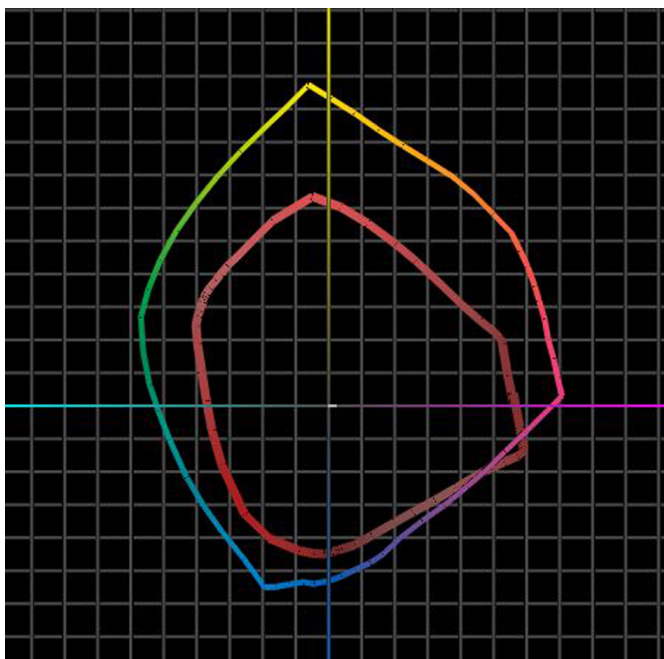
Canon imagePROGRAF TX-4000 colour gamut on Canon Standard Plain Paper 2 in Standard settings (shown chromatically) versus HP DesignJet T1700dr colour gamut (shown in red) on HP Universal Bond paper in Normal settings.

Colour gamut profile for Canon imagePROGRAF TX-4000 (left) and HP DesignJet T1700dr (right) in Standard/Normal modes.

Canon imagePROGRAF TX-4000 colour gamut on Canon Standard Plain Paper 2 in High settings (shown chromatically) versus HP DesignJet T1700dr colour gamut (shown in red) on HP Universal Bond paper in Best settings.
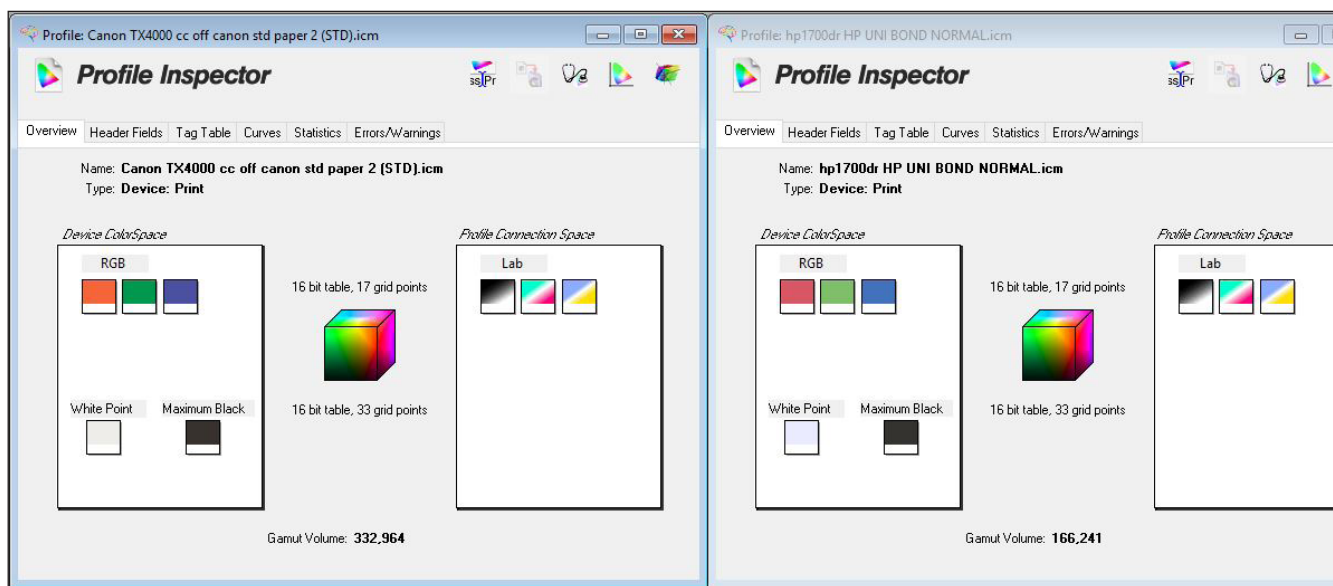

Colour gamut profile for Canon imagePROGRAF TX-4000 (left) and HP DesignJet T1700dr (right) in High/Best Quality modes.
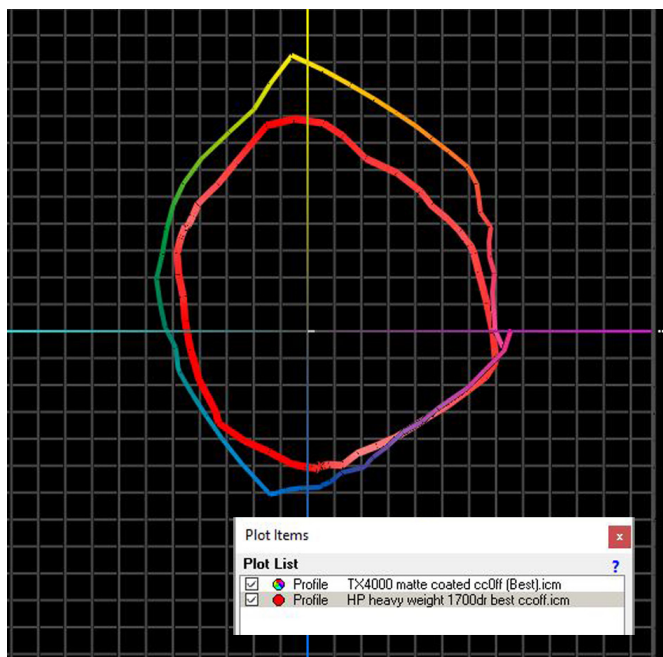
Canon imagePROGRAF TX-4000 colour gamut on matte coated paper in High quality settings (shown chromatically) versus HP DesignJet T1700dr colour gamut (shown in red) on matte coated paper in Best settings.
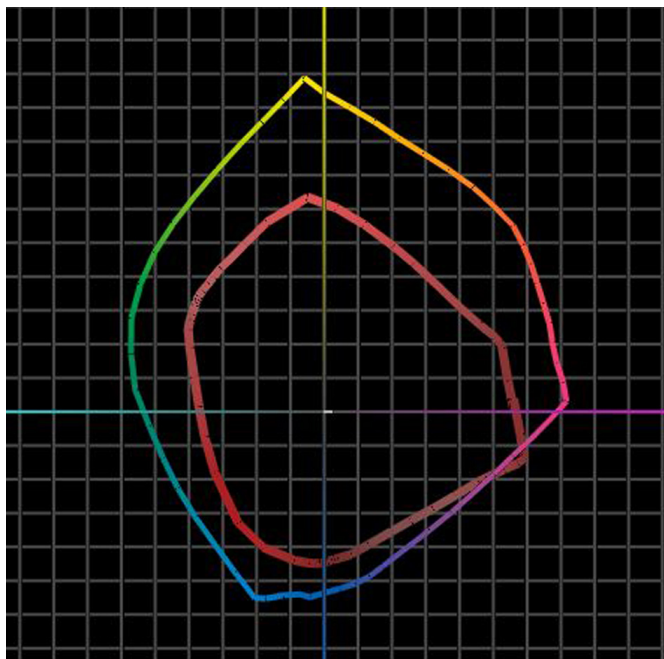

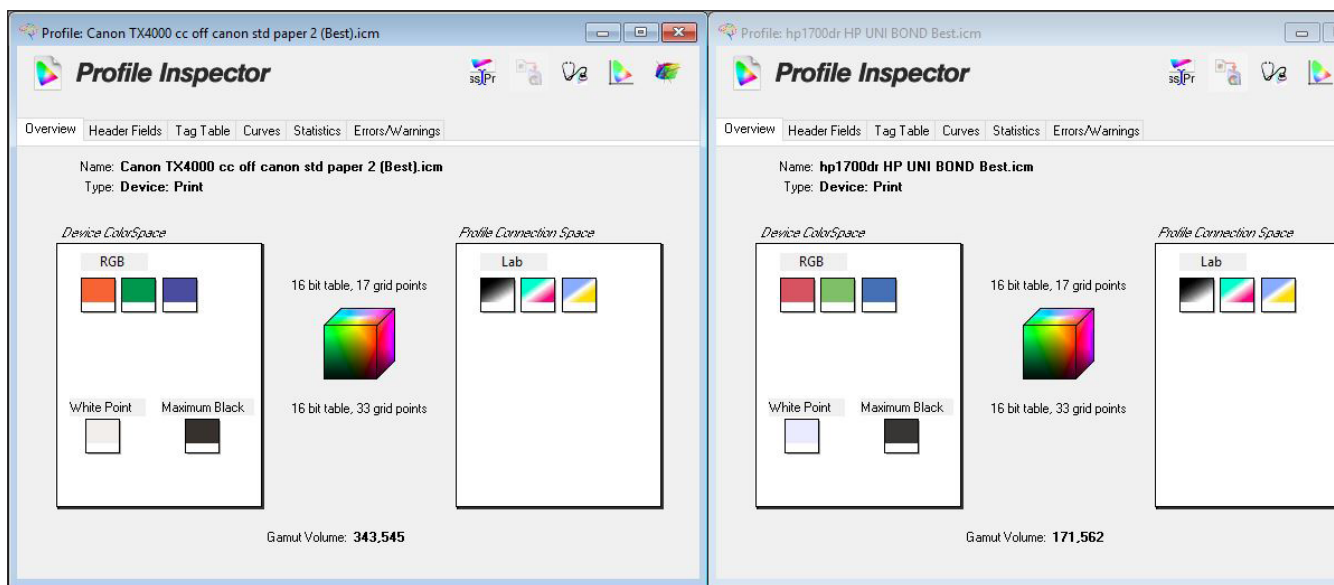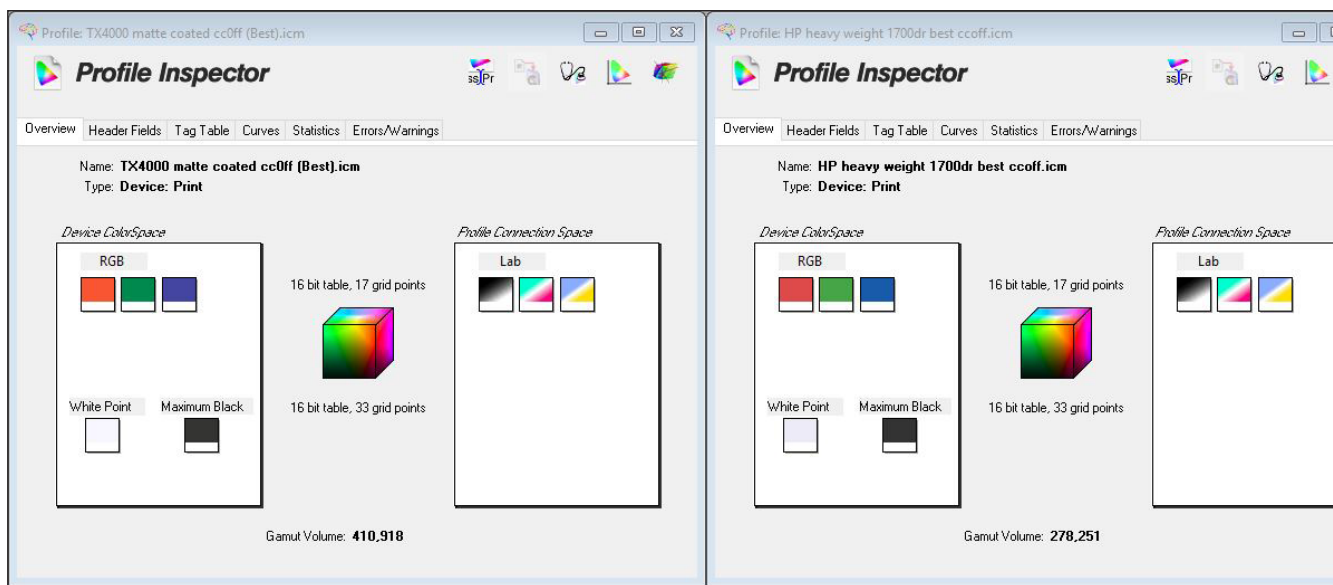**Colour gamut profile for Canon imagePROGRAF TX-4000 (left) and HP DesignJet T1700dr (right) on matte coated paper in High/Best Quality modes.**

Black Print Quality

Black Optical Density Evaluation

	Canon imagePROGRAF TX-4000			HP DesignJet T1700dr		
Density Block						
	Fast	Standard	High	Fast	Normal	Best
1	1.54	1.50	1.46	1.45	1.51	1.51
2	1.54	1.51	1.46	1.47	1.51	1.51
3	1.53	1.52	1.46	1.46	1.48	1.51
4	1.55	1.52	1.46	1.47	1.50	1.49

Note: Solid black density measurements are based on four readings taken from a Buyers Lab proprietary PDF test target file corresponding to four different 100% solid black locations on the output. The output was assessed at all quality settings available, with the Canon driver set to plain paper/monochrome setting and the HP driver set to plain paper, black mode. Density was measured using an XRite eXact^{Xp} densitometer.

Device Feature Set

	Canon imagePROGRAF TX-4000	Advantage		HP DesignJet T1700dr
Max. image resolution	2400 x 1200 dpi			2400 x 1200 dpi
Number of inks	5		✔	6
Ink tanks replaceable during operation	Yes	✔		No
Ink-drop size	5 picoliter	✔		6 picoliter
Ink capacity out of the box	970 ml (330 ml MBk; 160 ml CMYK)	✔		240 ml (40 ml x 6)
Ink cartridge capacity	160/330/700 ml (CMYK, MBk)	✔		130/300 ml (CMY, MBk, G, PBk)
Number of nozzles	MBK: 5,120 nozzles; other colours: 2,560 nozzles each; 15,360 nozzles in total	✔		2,112 nozzles per colour
Number of printheads	1 (User-replaceable)			3 (2 colours per printhead; user-replaceable)
Line accuracy	+/-0.1% or less			+/-0.1%
Minimum line width	0.02 mm			0.02 mm
Minimum print margins	3 mm			3 mm
Borderless (0 mm) printing	Yes (Roll only)	✔		No
Maximum outside diameter of roll paper	170 mm	✔		135 mm
Maximum printable paper roll length	18 m		✔	91 m
Maximum cut-sheet media length	1.6 m			1.6 m

	Canon imagePROGRAF TX-4000	Advantage		HP DesignJet T1700dr
Maximum media thickness for roll paper	0.8 mm			0.8 mm
Maximum media width	44 inches			44 inches
Media loading	Top and Front			Top Rear and Rear
Roll paper	Optional Multifunction Roll System (with Auto Take-Up)	✔		Optional dual
Optional media handling	Roll holder set			Roll feed spindle
Standard/Maximum RAM	128 GB virtual (2 GB physical RAM)		✔	128 GB virtual (based on 4 GB DDR3 RAM)
Hard drive Capacity	500-GB (Standard)			500-GB (Standard)
Interface	10/100/1000Base-T/TX Ethernet, USB 2.0			Gigabit Ethernet, 10/100/1000Base-T Ethernet (802.3, 802.3u, 802.3ab); USB
PDL	HPGL/2, HP RTL, PDF, JPEG			HP-PCL3GUI, HPGL/2, TIFF, JPEG, URF, CALS G4
Net weight (unpacked)	114 kg	✔		74 kg
Power consumption when in standby	INA			24 W
Power consumption when active	107 W	✔		100 W
Acoustic pressure	Operation: 51 dB (A) or less; Standby: 35 dB (A) or less	✔		Operation: 45 dB (A); Standby: 32 dB (A)
Acoustic power	INA			Operation: 6.1 Bels

Driver Feature Set

	Canon imagePROGRAF TX-4000	Advantage		HP DesignJet T1700dr
Economy mode	Yes			Yes
Speed settings	5 (Fast 300, Standard 600, Fast 600, High 600 and 1200)	✔		3 (Fast, Normal and Best)
Predefined profiles	6 (Default, Photo (colour), Poster, CAD (colour line drawing), CAD (mono line drawing) and Perspective GIS)	✔		5 (Default, CAD, GIS, Photo and B/W Photo)
Overview of profile settings provided	Yes			Yes
Media profiles	53 + 10 user customizable special options	✔		36
IQ optimized for print profiles	Yes			Yes

	Canon imagePROGRAF TX-4000	Advantage		HP DesignJet T1700dr
Watermark	Yes	✔		No
Sharpen text	Yes			Yes (Max. Detail setting)
Thicken fine lines	Yes			Yes (Max. Detail setting)
Mirror image	Yes			Yes
Multi-up printing	Yes, 2 to 16	✔		No
Poster print mode	Yes (2 by 2)	✔		No
Page stamping	Yes (Date, Time, Name, Page Number)	✔		Not supported
Image rotation	Yes, 90 degrees and auto 180 degrees	✔		Yes, auto rotate and 90 degrees
Option to preview before print	Yes			Yes
CMYK balance adjustment	Yes (CMY)			Yes (CMY)
Brightness adjustment	Yes			Yes
Contrast adjustment	Yes			Yes
Saturation adjustment	No			No
Advanced colour management options	Yes			Yes
Enlargement Copy Mode	Yes	✔		No
Free Layout Capability	Yes (flexible placement)	✔		Yes (automatic placement)
MS Office Plug-in	Yes	✔		No
Accounting Capability	Yes			Yes
Disable automatic cutter	Yes			Yes
Unidirectional printing selection option	Yes	✔		No

The Canon imagePROGRAF TX-4000 comes bundled with PosterArtist Lite.

Ink Consumption

Table 1: Amount of Ink in each Canon imagePROGRAF TX-4000 Cartridge (in Grams)

	Matte Black	Black	Yellow	Magenta	Cyan
Weight of cartridge prior to installation	952.9	777.6	805.8	786.2	785.2
Weight of cartridge at end of life	205.5	205.5	205.5	205.5	205.5
Net weight of ink	747.4	572.1	600.3	580.7	579.7
Total ink weight across five cartridges					3,080.2

Table 2: Amount of Ink in each HP DesignJet T1700dr Cartridge (in Grams)

	Grey	Photo Black	Matte Black	Yellow	Magenta	Cyan
Weight of cartridge prior to installation	185.0	186.1	187.4	191.8	190.3	190.0
Weight of cartridge at end of life	70.9	70.9	70.9	70.9	70.9	70.9
Net weight of ink	114.1	115.2	116.5	120.9	119.4	119.1
Total ink weight across six cartridges						705.2

Table 3: Ink Used in Three 50-Page Runs of Cottage Architectural Plan Test Document (Standard Mode) on the Canon imagePROGRAF TX-4000 (in Grams)

	Matte Black	Black	Yellow	Magenta	Cyan
Test Run 1 Net weight of ink used	16.0	3.1	3.8	4.3	2.2
Test Run 2 Net weight of ink used	16.6	3.3	4.7	4.4	3.0
Test Run 3 Net weight of ink used	14.9	3.5	3.9	3.5	1.8
Average amount of ink used across three runs	15.8	3.3	4.1	4.1	2.3
Total ink weight across five cartridges for 50-page run (based on averages)					29.6

Table 4: Ink Used in Three 50-Page Runs of Cottage Architectural Plan Test Document (Normal Mode) on the HP DesignJet T1700dr (in Grams)

	Grey	Photo Black	Matte Black	Yellow	Magenta	Cyan
Test Run 1 Net weight of ink used	0.8	11.1	19.4	1.8	4.0	8.0
Test Run 2 Net weight of ink used	0.7	12.4	21.3	1.7	4.2	8.8
Test Run 3 Net weight of ink used	0.8	11.0	19.2	1.5	3.7	7.9
Average amount of ink used across three runs	0.8	11.5	20.0	1.7	4.0	8.2
Total ink weight across six cartridges for 50-page run (based on averages)						46.2

Table 5: Ink Used in Three 50-Page Runs of ISO Poster Test Document (Standard Mode) on the Canon imagePROGRAF TX-4000 (in Grams)

	Matte Black	Black	Yellow	Magenta	Cyan
Test Run 1 Net weight of ink used	20.5	2.6	2.0	21.5	33.1
Test Run 2 Net weight of ink used	19.5	3.8	5.1	27.3	27.2
Test Run 3 Net weight of ink used	18.9	3.0	3.1	25.6	31.9
Average amount of ink used across three runs	19.6	3.1	3.4	24.8	30.7
Total ink weight across five cartridges for 50-page run (based on averages)					81.6

Table 6: Ink Used in Three 50-Page Runs of ISO Poster Test Document (Normal Mode) on the HP DesignJet T1700dr (in Grams)

	Grey	Photo Black	Matte Black	Yellow	Magenta	Cyan
Test Run 1 Net weight of ink used	3.8	9.4	11.8	6.8	19.5	49.8
Test Run 2 Net weight of ink used	4.0	9.5	11.9	7.0	19.5	50.1
Test Run 3 Net weight of ink used	3.7	9.2	11.7	6.8	19.4	49.7
Average amount of ink used across three runs	3.8	9.4	11.8	6.9	19.5	49.9
Total ink weight across six cartridges for 50-page run (based on averages)						101.3

Table 7: Ink Used in Three 50-Page Runs of GIS Map Test Document (Standard Mode) on the Canon imagePROGRAF TX-4000 (in Grams)

	Matte Black	Black	Yellow	Magenta	Cyan
Test Run 1 Net weight of ink used	25.0	3.4	14.2	15.9	24.8
Test Run 2 Net weight of ink used	24.8	3.7	13.4	16.9	23.8
Test Run 3 Net weight of ink used	24.0	3.5	13.3	16.3	25.5
Average amount of ink used across three runs	24.6	3.5	13.6	16.4	24.7
Total ink weight across five cartridges for 50-page run (based on averages)					82.8

Table 8: Ink Used in Three 50-page Runs of GIS Map Test Document (Normal Mode) on the HP DesignJet T1700dr (in Grams)

	Grey	Photo Black	Matte Black	Yellow	Magenta	Cyan
Test Run 1 Net weight of ink used	37.1	5.9	11.2	13.6	13.1	29.9
Test Run 2 Net weight of ink used	36.4	5.9	7.4	13.4	13.0	29.9
Test Run 3 Net weight of ink used	36.8	5.8	7.6	13.4	13.1	30.0
Average amount of ink used across three runs	36.8	5.9	8.7	13.5	13.1	29.9
Total ink weight across six cartridges for 50-page run (based on averages)						107.9

Ink Consumption Test Methodology Overview

Buyers Lab's ink consumption analysis was conducted using three document types (Cottage Architectural Plan, ISO Poster and GIS map). Each document was formatted as a PDF (except for the Cottage Architectural Plan, which was formatted as a DWG TrueView Drawing) and sized at ISO A0.

The Canon imagePROGRAF TX-4000 was installed in Buyers Lab's lab with the latest "01.10" level of firmware (as of October 2017) and connected to a Windows 10 workstation using a 1000BaseT TCP/IP connection. The Canon imagePROGRAF Printer Driver was used for all testing with media selection set to plain paper and the image set to print at actual size. For the Cottage Architectural Plan, print priority settings were set to Line Drawing/Text with quality set to Standard (600 dpi). For the ISO Poster and the GIS map, print priority settings were set to Image with quality set to Standard (600 dpi).

The HP DesignJet T1700dr was installed in Buyers Lab's lab with the latest JGRw_01_17_44.10 level of firmware and connected to a Windows 10 workstation using a 1000BaseT TCP/IP connection. The HPGL/2 driver was used for all testing, with media selection set to plain paper and the image set to print at actual size. For the Cottage Architectural Plan, print priority settings were set to CAD with quality set to Normal. For the ISO Poster, print priority settings were set to Poster with quality set to Normal, and for the GIS map print priority settings were set to Perspective GIS with quality set to Normal.

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 cartridge.

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, consisting of Windows 2008 and Microsoft Exchange servers, Windows 10 workstations, 10/100/1000BaseTX network switches and CAT6 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 eXactXp densitometer.

About Keypoint Intelligence - Buyers Lab

Keypoint Intelligence is a one-stop shop for the digital imaging industry. With our unparalleled tools and unmatched depth of knowledge, we cut through the noise of data to offer clients the unbiased insights and responsive tools they need in those mission-critical moments that define their products and empower their sales.

For over 50 years, Buyers Lab has been the global document imaging industry's resource for unbiased and reliable information, test data, and competitive selling tools. What started out as a consumer-based publication about office equipment has become an all-encompassing industry resource. Buyers Lab evolves in tandem with the ever-changing landscape of document imaging solutions, constantly updating our methods, expanding our offerings, and tracking cutting-edge developments.

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