

# Designjet T1100- and T610-series Printers: Image Quality



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Technical and business graphics users depend on prints to convey critical information with accuracy and readability. Line and text must always be sharp and clearly-readable, and this is especially important when they are printed on colored or gray backgrounds. Gray area fills are commonly used in these applications for annotations and for highlighting information, and the perception of a high quality print depends upon these features being printed in true neutral tones without color casts and with minimal artifacts from metamerism and banding.

HP Designjet T1100- and T610 series printers are designed to deliver fast, high-quality prints on plain, coated, and glossy papers. HP 72 Vivera inks and HP 72 Printheads produce rich, saturated colors, very fine lines and crisp text, and true neutral grays. HP's Professional Color Technologies assure consistent and accurate color print-to-print and printer-to-printer and emulate the colors produced by HP Designjet 500-, 800-, and 1000-series printers.

## HP 72 Vivera inks

HP 72 Vivera inks are specifically formulated to deliver vivid colors, neutral grays, and crisp lines and text on plain, matte, and glossy media. HP 72 Vivera inks support the high productivity of HP Designjet T1100- and T610-series printers by drying quickly to give smudge-resistant output that is ready to handle immediately after printing.

HP 72 Vivera inks offer an excellent match to colors used in popular applications such as AutoCAD<sup>®</sup>, and Designjet T1100ps printers produce a colorimetric match to 62% of PANTONE<sup>®</sup> colors.<sup>1</sup>

HP 72 Vivera inks include five (5) dye-based inks (Cyan, Magenta, Yellow, Photo Black, Gray) and a pigment-based Matte Black. HP 72 Vivera inks are available in 69-ml and 130-ml Ink Cartridges except for Matte Black, which is available in 130 ml only.

HP offers more than 20 Original HP media for HP Designjet T1100- and T610-series printers. These media include bond, coated, heavyweight coated, tracing, and high-gloss and semi-gloss papers that were designed and tested together with HP 72 Vivera inks to ensure high image quality and produce consistent, professional results.

Figure 1. Six HP 72 Vivera inks and three HP 72 Printheads



## HP 72 Printheads

HP Designjet T1100- and T610-series printers use three HP 72 Printheads for a total of 6,336 nozzles in a 22.35-mm (0.88-inch) print swath. Each HP 72 Printhead delivers two colors of ink (Gray/Photo Black, Matte Black/Yellow, and Magenta/Cyan) with 1,056 nozzles per color.

When it is necessary, the user can remove and install an HP 72 Printhead in about a minute without the expense, printer down-time, and inconvenience of a service call.

<sup>1</sup> Measured on HP Universal High Gloss Photo Paper.

## HP Three-black Ink Set

The HP Three-black ink set for the HP Designjet T1100- and T610-series printers consists of dye-based HP 72 Vivera Gray and Photo Black inks and a pigment-based Matte Black ink.

HP 72 Vivera Gray and Photo Black inks are used on all media for text, graphics, and images; HP 72 Vivera Matte Black ink is used together with HP 72 Gray and Photo Black inks on matte media to produce high optical density for sharp lines and crisp text.

Using HP 72 Vivera Matte Black ink, HP 72 Printheads produce fine black lines as narrow as 0.067mm (vertical) and 0.0454mm (horizontal) on HP Matte Film.<sup>2</sup>

The HP 72 Three-black ink set offers technical and business graphics users important benefits compared to printing composite grays with mixtures of color inks:

- Architectural and technical drawings often contain continuous-tone monochrome renderings and have text and lines printed within gray panels for emphasis. The appearance of the print is significantly enhanced by ensuring grays are printed without color casts and show minimum metamerism under changing light conditions.

Using the HP 72 Three-black ink set, HP Designjet T1100- and T610-series printers print neutral grays using only gray, photo black, and matte black inks.<sup>3</sup> Because no color inks are used, gray area fills are neutral, free of color casts, and show very little metamerism.

- Gray inks offer more accurate color and true neutral gray. Prints have smooth area fills, more depth, and more subtle contrast from the most vivid color to the softest tones. Gray inks also reduce image grain and improve highlight and shadow detail in both color and monochrome images.
- Compared to printing grays with color inks, HP's Three-black ink set and HP Designjet T1100- and T610-series printers produce gray lines, text, and area fills that are less sensitive to variations in the inkjet writing system. For example, consider the following points:
  - Composite grays typically depend on the use of four ink colors: cyan, magenta, yellow, and black. In 6-ink systems, light cyan and light magenta are used in the lighter tones to reduce image grain.  
To print a gray pixel, each color must produce a dot with a specific size, and dot must be precisely positioned relative to the others. Any change in dot position and overlap, dot size, dot optical density, or the amount of white (unprinted) area in a pixel will affect the hue and optical density.
  - Media advance errors in multi-pass printing can introduce visible color bands in composite gray area fills due to small errors in relative dot positions between one swath and the next.

## Professional Color Technologies

HP Designjet T1100- and T610-series printers use a suite of HP Professional Color Technologies to provide crisp black text, sharp lines, and consistent and accurate color in prints for technical graphics and business communications.

### Black Fortification

Black fortification produces high black optical density and ensures sharp edges on black lines and text when printing matte black ink on plain paper and matte media. In this process, a small amount of dye-based HP 72 Gray or Photo Black ink is printed along with HP 72 Matte Black ink. A chemical reaction occurs on the surface of the print between the dye and pigment inks that quickly precipitates and immobilizes pigment particles. Dry time is also reduced, and this enables production of smudge-resistant prints that can be handled immediately after printing.

<sup>2</sup> Compare to 80um (V) and 49um (H) from the HP Designjet 800- and 1000-series printers.

<sup>3</sup> Up to two of the three black inks are used to render a specific gray level: G, G + PK, G + MK, PK + MK.

## RGB Gray Preservation

Equal values of R, G, and B represent gray tones in RGB workflows.<sup>4</sup> HP RGB Gray Preservation ensures that gray pixels are preserved by separating grays from colors during conversion of RGB data into the printer's ink colors.

Pixels with equal RGB values use a separate lookup table that maps gray tones only into values of gray, photo black, and matte black inks. This process depends on the loaded media<sup>5</sup> and print mode, and it uses the results of HP Closed Loop Color Calibration.

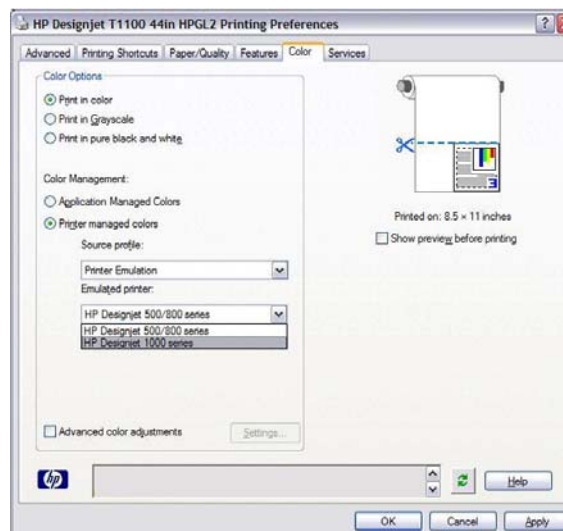
## Designjet Color Emulation

HP Designjet T1100- and T610-series printers can accurately emulate the colors produced by HP Designjet 500-, 800-, and 1000-series printers.<sup>6</sup> This allows users to step up to the higher productivity and image quality of the T1100 and T610series printers while maintaining color consistency with output from earlier-model HP Designjets to better than 3 dE for AutoCAD® and other popular applications.

HP Designjet color emulation is available on the following Original HP media: Universal Inkjet Bond Paper, Bright White Inkjet Bond Paper, Coated Paper, and Heavyweight Coated Paper.

HP Designjet color emulation is easy to use: from the printer's Printing Preferences Menu, select the "Color" tab, "Printer Managed Colors", and the Designjet series to emulate.

Figure 2. HP Designjet Color Emulation



## Closed Loop Color Calibration

HP Closed Loop Color Calibration (CLC) allows HP Designjet T1100- and T610-series printers to deliver significantly better color consistency and accuracy compared to the Designjet 800- and 1000-series printers.

With CLC, HP Designjet T1100- and T610-series printers offer color consistency with an average variability less than 3 dE printer-to-printer and print-to-print. 95% of samples are within 6 dE.<sup>7</sup> The average color error is less than 5 dE with 95% of samples within 10 dE.

<sup>4</sup> For example, R G B = {0,0,0} represents black and {128,128,128} is a middle gray.

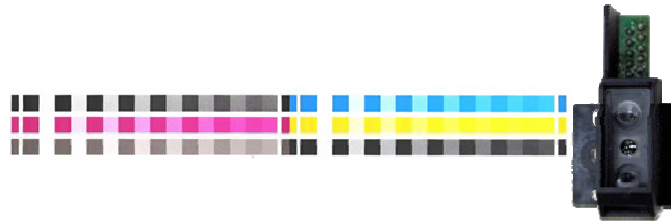
<sup>5</sup> On glossy media, only Gray and Photo Black inks are used.

<sup>6</sup> Support for emulation of additional HP Designjet printers will be added later.

<sup>7</sup> Based on internal HP tests on HP Universal High Gloss Photo Paper.

CLC works by calibrating the printer's image processing pipeline to account for the performance of the printheads, inks, and media loaded in the printer. The calibration process takes about 5 minutes, and is recommended whenever a printhead is replaced, a new type of media is used, or when significant changes occur in workplace environmental conditions.<sup>8</sup>

Figure 3. HP Closed-Loop Color Calibration: Test Chart with Ink Density Ramps and HP Embedded Densitometer



In the CLC process, a test chart of density ramps for each ink is printed on the loaded media, allowed to dry, and then scanned by the densitometer on the print carriage. The output density is measured for each color patch (the red curve in Figure 4), and an ink limit is determined for the media where density no longer increases with additional ink load. Using the ink limit, look-up table is computed for each ink to produce a perceptually-linear relation (linearization) between ink level and output density. Ink limits and the linearization table are used in the color pipeline that converts pixel RGB or CMYK values to the printer's ink colors.

Figure 4. Input-Output Densities for Each Ink Color

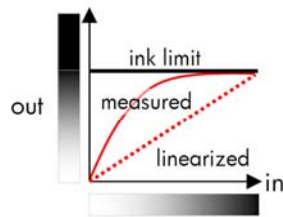
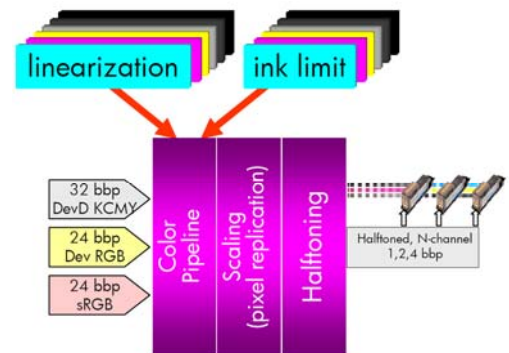


Figure 5. Ink Limits and Linearization in the Color Pipeline



## HP Professional PANTONE emulation

With a large coverage of PANTONE® colors, HP Designjet T1100ps-series printers offer accurate spot-color proofing for corporate logos and product packaging.

With HP Professional PANTONE emulation, PANTONE® color names can be assigned to graphical elements in designs, and ink values are specifically determined for the printer, inks, and print medium in an automatic process.<sup>9</sup>

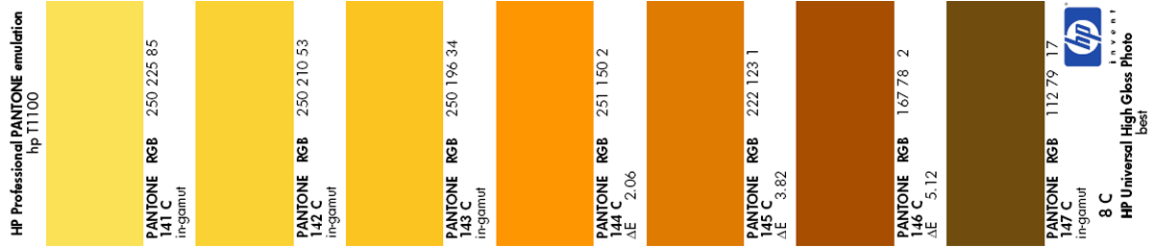
HP's Professional PANTONE emulation algorithm was designed in cooperation with professional graphic artists and pre-press professionals to mimic the choices they make when visually optimizing color matches.

<sup>8</sup> The user can see an alert in the Easy Printer Care utility when a Closed Loop Color Calibration is recommended.

<sup>9</sup> For HP Professional PANTONE emulation to work correctly, design applications must allow the assignment of the correct color name to design elements, and the name must be preserved intact in the PostScript or PDF file passed to a supported RIP with embedded HP Professional PANTONE emulation technology. Since ink values are calculated based on colorimetric information present in an ICC profile, a correct and up-to-date ICC profile is required for the specific printer, inks, and media being used.

Color swatches can be printed showing the closest match to PANTONE® colors using ICC profiles for the printer, inks, media, and selected print mode. The device color values<sup>10</sup> and the color difference (dE) between the original and emulated color are printed on the swatch. This provides clear communication of how closely solid colors match, and the device color values make it easier to create customized emulations.

Figure 6. Sample Color Swatch for HP Professional Pantone emulation



<sup>10</sup> These may be RGB or CMYK values, depending on workflow.

## For more information

To learn more about HP Designjet T1100- and T610-series printers and Original HP printing supplies, visit [www.hp.com/go/designjet](http://www.hp.com/go/designjet)

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