

Glossary

- **Additive colour model** – See RGB.
- **amplitude modulated halftone screening** – see Halftone.
- **Application** – A method for creating a graphic print for a specific purpose. This will normally include some type of finishing method i.e. lamination. See separate application guide.
- **Banding/Cascading** - Refers to light, visible lines in the printed picture running horizontally in the head direction. This fault can have the following reasons: the machine may have too small or too large lines, the print head may not be correctly adjusted, mixture of ink prior to it entering the material. The coating on the media can also contribute to this phenomenon if it is too high definition. This means that the ink is not allowed to spread enough (not enough dot gain) which then does not fill in the 'gaps' between the dots.
- **Black** – See K.
- **Black start** – This is an initial setting of where black is added to the printing colours. i.e. 30% black start, means that all colours printed below 30% will not have any black added to them.
- **Bleeding** - Refers to ink expanding over the margin of a printed area, which could be due to the fact that: the saturation of the paper (ink limit) is exceeded and the ink has not penetrated in to the coating. The excess ink cannot be controlled and will run, hence bleeding. If the coating is of a too low resolution, the dot gain is too high and also gives bleeding. In certain cases the wrong inks can also be used, with the result that the ink pigment cannot chemically and physically bond to the coating of the paper, which makes the ink pigments run if an additional solvent such as water or ink is added.
- **Bleed (external bleed)**– The amount an image extends past the desired size of the print. This extra image area allows for errors in sizing and positioning during finishing. There is an opposite of this called **Internal bleed**. This is the amount a panel extends over a seam between panels. It is used when separate panels will be adjacent to each other. (This should not be mixed up with the problem sometimes encountered with IJ printing).
- **Brightness** – In the HSB model brightness goes from black at a value of 0 to white at a value of 255.
- **Bubble Jet** – This is simply a thermal ink jet printing process that uses slightly different technology to other thermal heads. The 'Bubble Jet' name is simply a trademark of Canon.
- **Catalytic fading** – When colours are mixed there can be a negative impact on fading. The rate of fading can be up to 8 times faster comparing a single colour to a secondary (mixed) colour.
- **CCD** – A Charge Coupled Device is a light sensitive sensor array that measures the light being reflected from the image being scanned in the three primary colours of RGB. This information is then converted into digital data to be used to represent the picture in electronic form.
- **CMY** – A subtractive colour model that if all are added at full intensity will create three colour black. This model is used in three-colour printing.
- **CMYK** – subtractive colour reproduction, inks absorb all colours (wavelengths) apart from their designated colour that they reflect. Adding more colour subtracts wavelengths of light, (reflects less light) giving a darker colour. To measure this system, each ink has a percentage value 0 – 100% for each colour. Black is used to give true blacks and increase the tonal range.

- **Coated inkjet media** - The receptor coating on inkjet media is carefully designed to control the size of the dot, achieve dense colours, adhere the water-based ink to the substrate, and speed drying time. The back coating on the inkjet media helps keep the substrate flat and dimensionally stable as it moves through the printer and dries.
- **Cockling** - A term used when large quantities of mixed-colour inks with a high water content (80% liquid content, approx. 30-80% of which is water) start to bulge out of the coating and warp the paper. The warp may be reversible once the paper is dried, which indicates a case of "wet cockling". If the warp is permanent, this is called "dry cockling". A barrier coating is used with higher quality media to counter this effect.
- **Coalescence** – When inks cannot penetrate into the coating, especially gloss type coatings, they blend and run into each other on the surface. This can be contributed to a too high printing speed as the inks need to be given time to penetrate, choosing a different type of material with a better penetration rate for the specific ink can reduce this effect.
- **Colour Gamut** - Marks the so-called colour-space that is provided by a printing system. This refers to the maximum possible number of various colours that, with help from the print colours of the system (process colours: cyan, magenta, yellow, plus black as auxiliary colour), can be generated because of the subtractive colour-mix. (i.e. Three Colour Theory of Seeing).
- **Colour separation** – In the process of 4 colour printing the original image is split into the four separate 'screens' of cyan, magenta, yellow and black. The image is split so that the printer knows which ink to print in which place and how much.
- **Continuous-Flow Technology** - The oldest and most developed type of ink-jet technology. This means a continuous ink jet is generated by the system. This continuous ink jet can, on request and by way of electro-magnetic diversion, be diverted out of the normal projection onto the paper. Hence, a high drop quantity per time unit can be developed, which on today's systems can amount to up to 300,000 to 600,000 drops per second (i.e. IRIS, Storck). The disadvantage of this technology is its high cost, high ink consumption (only suitable for total-surface applications), the high sensitivity of the system and the special electrolyte ink. Additional disadvantages include that the material has, as a rule, to be webbed onto a rotation drum in sheets as the system works on a line basis.
- **Continuous tone image** – A perfect example of this is a photograph. Ink jet printers cannot recreate this so need to create the illusion. This is done by converting the image into half tones.
- **Contrast** – is the difference between the light and dark areas in an image.
- **Dither** – The process of distributing dots to create the appearance of a solid hue and tint. The dither patterns used in printing determines the sharpness, colour, contrast and saturation of the print.
- **Dot** - A "dot" is every single print dot on the print carrier which was produced by the computer via the software.
- **Dot Gain** – Once the ink droplet has made contact with the media it is absorbed into the coating. The coating controls an increase, or growth, of the dot and this is expressed in a percentage term as dot gain.
- **Dpi** – Dots per inch. This is a measurement of printed dots per inch on a media. In theory, smaller dot sizes will produce finer details, sharper text, and smoother curves. But if the dots aren't shaped properly or placed precisely where they need to be, then the print quality suffers.
- **Drop-on-Demand Technology** - As opposed to the continuous flow technology, the ink-dot is only created as required by the system, not continuously.
- **Dye-Based Ink** - Inks in which the dye completely dissolves in the solvent mixture (water + high boiling-point of orig. dyes). This process can be compared to dissolving sugar or salt in water. The advantage is that, here, the highest distribution of a dye in the ink is reached. Is often referred to as water based dye inks.

- **Dye sublimation** – Specialised inks are printed onto dimensionally stable paper, as shrinking can occur due to high temperatures used during the transfer. The inks at very high temperature change into a gaseous state and are sublimated into a receptive substrate. All receiving substrates must be polyester or coated with polyester to achieve penetration and fixing of the inks.
- **Enlargement factor** - If images are increased in size, this is measured as an enlargement factor. An estimation can be achieved by taking the optical resolution and dividing it by the output resolution of the printer times 1.5 i.e. $\text{input } 2400\text{dpi}/(\text{output } 600\text{dpi} \times 1.5) = 2.7$ times (can be stated as 270%). If the image will be printed at 360 dpi but printed at double the enlargement then a compensation should be made at scanning, by doubling the resolution to 720dpi then no quality loss is experienced. The other method to have no quality loss is to scan the image at twice its original size.
- **Expanded-gamut printing** - refers to any more-than-four-color process that expands the range of colors that can be reproduced compared to CMYK inks.
- **Feathering** - Refers to cases when ink dots expand, fiber-like, beyond their original width. This is most often found in little-or non-coated ink-jet materials and triggered by the natural characteristic of the cellulose fibers forming the base of most paper. In nature, these fibers serve the purpose of transporting nourishment dissolved in water from the roots to the leaf tips. This "instinct of nature" is also followed by paper fibers if they are provided with ink. This effect can be minimized by coating the surface with glue but still remains recognizable.
- **Frequency modulated halftone screening** – See Stochastic screening.
- **FPO** – For Position Only. A lower resolution image is used to give an idea of the final layout without hindering processing time during editing.
- **GCR** – Gray component replacement, replaces some or sometimes all of the grey components of each colour with single colour black. If colours are generated using CMY then they will always have some amount of grey present. This is across the whole picture.
- **GIF** – 'Graphics Interchange Format' file format. This file format can be relatively large (Especially when compared to JPEG). It is best suited to the correct storage of Line Art and when producing images to be used on the World Wide Web (as 'web safe' colours are used from a pallet of only 256 different colours).
- **Greyscale** – This is a scale set up in a 8-bit format which achieves 255 different shades of grey. From 0 which is the darkest – black, to 255 which is the lightest – white.
- **Halftone screening** – This is the illusion which is needed to generate shades in images. For the Ink Jet printing process the continuous tone image is changed into a series of dots which give the impression, at a certain distance, of being a continuous tone. The dots are regularly placed and vary only in size, this is often referred to as 'amplitude modulated halftone screening'.
- **Hi Fi** – High Fidelity. This system is six colour printing with CMYK and the addition of LC (light cyan) and LM (light magenta). CMYKLCM configurations add lighter densities of cyan and magenta ink to the traditional CMYK inks. The lighter cyan's and magenta's can be used instead of printing the more conspicuous dark inks in highlights and mid tones. The end result are fill areas that are less grainy and improved pastels and flesh tones.
- **Hexachrome** – This system is six colour printing with CMYK and the addition of O and G (orange and green). These are two very difficult colours to achieve when printing with CMYK. With the additions of O and G, the range of colors that can be reproduced (achievable colour gamut) on the printer are expanded. The Hexachrome process was invented by Pantone (an ink manufacturer) to expand the range of Pantone Matching System (PMS) colors that can be reproduced on a printer.

- **HSB** – The colour model system is defined by the three components of hue, saturation and brightness. This is most like the way the human eye perceives colour.
- **Hue** – This is the classification of the colour i.e. blue, green, red, etc. It is defined by its wavelength.
- **ICC** – International Colour Consortium.
- **ICC profile** – see profiles.
- **Ink** - Ink is comprised of a base carrier (water or solvent), a colorant (a dye or a pigment), and small amounts of chemical additives to provide desired characteristics. Most entry-level wide-format inkjet printers use water-based inks, which are comprised primarily of distilled water, a benign solvent known as glycerin, dyes, or pigments and small amounts of UV inhibitors, drying agents, or other chemicals.
- **Ink (water based dye)** - Water-based dye inks are known for their exceptional color gamut and quick fading. A new breed of enduring-dye inks is extending the life span of prints created with dye-based inks, but these inks produce a smaller range of colors.
- **Ink (water based pigmented)** - Water-based pigmented inks are known for their high resistance to fading and typically produce less vivid colors than dye inks. Like pulp in orange juice, pigment particle can be anywhere from 50 to 500 times larger than the molecules in dyes, which are more like granules of sugar in tea. Because the pigment particles remain suspended in the water or solvent, they can clog the nozzles of some print heads.
- **Ink (oil based pigmented)** – this type of ink has a specialised suspension that is printed using Piezo technology. The UV resistance is very high due to the pigmented ink and the smear/water resistance is also very high. The Xerox xpress, Raster graphics Piezo print 5000 and some Seiko printers use this technology.
- **Ink (Solvent based pigmented)** - Solvent-based pigmented inks combine fade-resistance with the ability to print directly on standard materials used for screen-printing. But the use of solvents raises some environmental and in-shop health issues that many digital-only shops may prefer to avoid. Un-coated vinyl's and some other substrates can be used with this ink type, as the solvent bites directly into the surface of the substrate, so a coating isn't necessary in order to adhere the ink on to the media. But different solvent-system inkjet printers use different types of solvents, and they don't work equally well on all un-coated substrates. Pre-testing media is important.
- **Inkjet printing** - Inkjet printing is a non-impact printing process in which text and images are formed by the precise placement of really small (Pico-liter sized) droplets of ink fired at high speeds from the nozzle of computer-controlled print heads. Droplets of cyan, magenta, yellow and black inks are combined to form precisely placed dots of various colors, which when viewed from a distance, composes an image.
- **JPEG** – Joint Photographic Experts Group. This file format is best suited to low resolution graphics, especially used in web design. It can be highly compressed but does loose detail.
- **K (black)** - stands for key. It was traditionally the reference color used to register the other process colors in printing. In inkjet printing, the proper use of black is still fundamentally important to getting good color reproduction. Black is used to reproduce text and line art neutralize the contamination of CMY inks, add density, and reduce total ink consumption in wide-format inkjet printing. Many of these black-generation functions are controlled by RIP software for wide-format inkjet printers.
- **L*a*b** – 3 dimensional graph enabling colours to be mapped and reproduced in a standard way. L –lightness value, as it gets higher it gets closer to white light. a – chromatic value, green to red axis. b – chromatic value, blue to yellow axis.
- **Mottling** - This phenomenon is normally more pronounced in full colour areas that are inhomogeneous and show lighter areas in 'specks and spots'. This can be caused by irregular drop sizes to what is expected or different absorption rates of the printed substrate (coatings can contribute to this effect if technically flawed).

The solution is to use the right ink and substrate combination and have the hardware delivering what is truly desired.

Mottling can also be attributed to interference (noise) during scanning. The outcome is that if images have facial features present the person can look as though they have a very bad complexion.

- **Nozzle** - The opening of the ink-jet cartridge (i.e. of one ink-jet print head).
- **OEM** – Original equipment manufacturer.
- **Offset printing** – This printing process adopts a press type technology. Using the basic theory of water and oil not mixing, the image area is treated so it repels water and attracts the oil based inks, and the non-image part vica versa. Only the image area of the printing plate attracts the ink for printing. The actual plate does not come into contact with the paper, it transfers its image to a rubber blanket that then has contact to the paper, this means that the image does not need to be reversed before printing.
- **Piezo-Electric Method** - These printers obtain their name from the Piezo crystal used in them. This special material, which reacts to electricity by contracting or to pressure by an electric shock, allows the crystal to function like a micro-pump and creates a pressure on the ink chamber and forcing ink through the nozzles. Drop-on-demand print heads are made in Japan by Epson and in England by XXAR/MIT and are incorporated in wide-format inkjet printers from Raster Graphics, Xerox ColorgrafX, Mimaki, Roland DGA, Signtech, Vutek, and Nur (the Fresco). Different types of continuous-flow Piezo inkjet systems are used in IRIS printers and the superwide NUR Blueboards. One of the benefits of Piezo inkjet print heads is that they can be engineered for use with either water-based inks or inks in which the colorants are suspended in a solvent such as oil, naphtha-alcohol, acetone, or a chemical called MEK (methyl ethyl ketone). They do not rely on the cooling properties of the water suspension to be effective.
- **Piezo print heads** - wide-format Piezo inkjet printers use more permanent (but more costly to replace) print heads, adapted from those originally developed for high volume, industrial inkjet printing applications such as personalization, package coding, and printing variable-data cards and tags. One drawback is that they require more space between nozzles than thermal inkjet nozzles. This affects the number of passes required to achieve a desired resolution. Some printers require vacuum pumps and ink-absorbent material to keep nozzles printing reliably.
- **Pico-liter** - A millionth of a millionth of a liter. Depending on the resolution of the printer, inkjet drop sizes range from 3 or 4 Pico liters to more than 25 Pico liters (some of the older printers even higher).
- **Pixel** - A “pixel” is a point defined as the smallest available, information which will later initiate the print point on the print carrier.
- **Plotter** - When digital printing was in its infancy (i.e., 5 to 10 years ago), the term plotter was widely used to describe either a wide-format inkjet printer or a computer-controlled contour cutter. These days, the term plotter is more commonly used to refer only to cutting devices. (But beware! In some circles, the terms plotter and printer are still often used interchangeably.)
- **Ppi** - pixels per inch refers to the picture elements (pixels) gathered by a scanner or viewable on a screen. There is no one-to-one correlation between the resolution of digital data (600 ppi) and the resolution of a printed image (600 dpi).
- **Process colour** – CMYK are the four main process colours, these four colours are used to achieve all of the colours needed to generate the image. In theoretical terms all colours can be achieved with CMY, due to limitations of the ink some black is also needed to get to true black and achieve some of the darker colours.
- **Profiles** - In commercial offset printing, printers use cyan, magenta, yellow, and black inks manufactured with Standard Web Offset Printing (SWOP) standards. In wide format inkjet printing, the magenta ink produced by one manufacturer can vary significantly from the magenta ink produced by other manufacturers. And how the ink ultimately appears on the print depends on the certain brightness, absorption, and reflectance

characteristics of the substrate and its inkjet-receptive coating. In order to provide proper instructions to the print engine in terms of how much ink to lay down per pass, your RIP software needs data about the color properties of your inks and your media. Color profiles (ICC and others) provide this information.

- **Print engine** - This is the combination of a number of components that make up the correct printing parameters. A print head is the component from which the ink is fired and is just one element of the print engine, which also includes the mechanics and firmware to control the movement and operation of the print head across the media. When a printer manufacturer buys a print head from Epson, Lexmark, HP, or other manufacturer, the printer manufacturer is given a certain amount of leeway to design firmware to control operating parameters such as firing rate and print modes. The printer manufacturer also engineers the paper-advance mechanisms that are so critical to the accurate placement of the dots. What all this means is that even though Roland Hi-Fi JET, Mimaki JV2, and Epson Stylus Pro 9000 all use the same Epson print head, each company has custom designed a different print engine to control it. For example, the print engines of the Hi-Fi JET and Mimaki were customized to fire water-based pigmented inks with a higher viscosity than the water-based dye inks used in the Epson Stylus Pro 9000.
- **Raster Image** – This type of image is what can be related to as a picture file, i.e. a photographic pictorial representation, like a dog running in a field. Each pixel within this image has a placement and a specific colour and this is how the computer stores this. By storing the file in this method, the image is very smooth, but the drawback is that the file is quite large and if you enlarge it, then it can become very jagged or 'blocky'.
- **Resolution (addressable)** - Identifies the maximum number of dots per measuring unit to be addressed and not the size of the print dot as such, measured in dpi (dots per inch). An addressable resolution of 600 dpi means that dots larger than $1/600^{\text{th}}$ of an inch (e.g., $1/300^{\text{th}}$ of an inch) are placed in a 600 dots per inch grid.
- **Resolution (apparent)** - Apparent resolution isn't a mathematical measurement, but rather describes how images are perceived by the human eye.
- **Resolution (enhanced)** - Enhanced resolution is a method of generating extra input information by adopting hardware and/or software interpolated data. This method enhances a lower quality scanner, but does not make up for having a better scanner with higher true resolution. This is especially true when attempting to enlarge images.
- **Resolution (Tonal / Colour)** - Also known as 'Colour or Bit depth'. Each pixel scanned is stored as a piece of data. This could be as low as 8 bit which gives 256 (2 to the power of 8) possible graduations of R, G, B, or as much as 48 bit which gives 2.8×10^{14} (2 to the power of 48) possible graduations. This can be tagged as the 'tonal resolution' as it is the amount of colour steps that are available to each pixel.
- **Resolution (True / optical)** – This is the amount of pixels (samples) that the scanner makes, or a printer outputs, measured in dots per inch (dpi). A 600-dpi printer means that each dot is $1/600^{\text{th}}$ of an inch in size. A 600 dpi x 600 dpi printer has an optimal dot placement in a 600-space/in. x 600-space/in. grid. A 300 dpi printer, means that each dot is $1/300^{\text{th}}$ of an inch in size, etc. The higher the resolution, the better the appearance of a print (graphics) if the print dot decreases in size at the same time.
- **Rendering** – If an image is displayed or printed it is rendered.
- **RGB** – Additive colour reproduction, more RGB colour applied the more light is transmitted and the colours get brighter/more intense and closer to white. To measure this system each colour has a value from 0 to 255.
- **RIP** – Raster Image Processor. Printers are a piece of hardware that is waiting for instructions of what to do, this is the task of a RIP or print controller. The RIP takes an ordinary data file, sets it for the appropriate output size, and then tells the printer exactly where to place the droplets of ink on the paper. There are dozens of RIPs on the market because RIPs also provide some of the functionality needed to customize inkjet printers for specific applications. For example, Wasatch PosterMaker, Onyx PosterShop, Scanvec-Amiable's Poster PRINT and AccuPrint, and 3M Cactus RIP's are designed primarily for print-for-pay production environments. Certain Agfa RIPs or the new BEST Color RIP provide functions that enable wide-format inkjet printers to be

used for imposition proofing or contract color proofs. Many RIPs geared specifically for the sign market have sophisticated design and layout programs that avoid the need to use Photoshop or QuarkXpress. Other RIPs enable wide-format inkjet printers to be networked with color copiers or film recorders.

- **Satellite Drops** - An unpleasant side-effect of the actual print dot which is caused by a separation of the accelerated drop which, in turn, results in the satellite drop being delayed in reaching the media and creating an additional colouring on the media.
- **Saturation** – The colour depth, purity of a colour and richness all describe saturation. If this colour is 100% saturation it contains no white, if it has 0% saturation it becomes a shade of grey.
- **Screen (silk screen) printing** – Four separate silk screens are created, one for each process colour, that allow the ink to penetrate at a specified point to generate a four colour printed image. This is the same theoretical process as ink jet printing, however the ink jet printer prints all four coloured dots at the same time and the screen print process prints all of the same coloured dots together. There are four inking passes to generate the final image.
- **Six colour printing.** There are two quality issues which are attempted to be addressed with six colour printing technology - 1) the ability to achieve smoother blends and gradations between colors, or 2) the ability to hit a wider color gamut. While it's true that six-color printers have more print heads to maintain and more ink chambers to keep filled, six-color inkjet printers typically don't use significantly more ink than four-color models because smaller quantities of each ink can be used to achieve equivalent image quality. See also Hi Fi and Hexachrome
- **Solid Ink / Phase-Change Technology** - In addition to water-based inks, there are also wax-based inks which are melted by subjecting them to heat. In their melted form, these inks are transported onto the media by a Piezo print head, cool off, and harden again. The following manufacturers provide printers based on this technology: Tektronik (recently bought by Xerox) and the wide-format Display Maker Express by Lasermaster.
- **Spectrophotometer** – Instrument for measuring colours for colour space.
- **Spot colour** – single ink/plate for a specific colour (used for CI logo, etc).
- **Stochastic screening** – This is a different way of printing which instead of varying the size of the dots to create the illusion of shading, it varies the position. By putting dots closer the image seems darker, by putting them further apart it gives the impression of the image being lighter. This is often referred to as FM half toning (frequency modulated)
- **Subtractive colour model**- See CMYK.
- **Thermal print heads** – These print heads are attached to the ink cartridges, as their life expectancy is not as high as Piezo print heads due to the excessive heating cycles they go through and so must be changed far more frequently. The repetitive heating cycles needed for thermal inkjet printing quickly degrades the performance of the print head's onboard electronics.
- **Thermal Pulses / Bubble-Jet Printers** - Similar to the Piezo printer, the bubble-jet printer works according to the "drop-on-demand" principle. The difference is merely the way the drop is generated which, here, is based on the physical characteristic of water that is, upon contact with hot surfaces, transformed into steam. The steam or gas aggregate of the water is more substantial than the liquid one. With the aid of a hot element inside the nozzle of the print head, this fact is used to eject the drop from the ink reservoir towards the paper. All thermal ink jet printers rely on the properties of water as a suspension so only water based inks can be used in this system.
- **Three Colour black** – area of solid Cyan, Magenta and Yellow toners combining to form black.

- **TIFF** – Tagged Image File Format. This file format does not allow so much for compression, but is a recognized standard for storing high quality images. There is no loss in this compression process.
- **Total area coverage (TAC)** - A total area coverage is the amount of ink printed onto the media, if all 4 process colours are printed at their full intensity, then a 400% total area coverage (TAC) is reached. Normal printing does not exceed 300% total ink coverage.
- **UCR** – Under colour removal. This is a method to reduce the amount of each colour, CMY in the blacks and the neutral tones (only the dark areas). It uses more single colour black. There are obvious advantages to this that there is not so much ink put onto the media (reduced TAC) which can cause issues such as coalescence, bleeding, cockling and reduced drying times.
- **USB** – Universal Serial Bus. This is the new standard in peripheral connection to computers. It is a so called 'plug and play' technology that as soon as the new hardware is connected it is recognised. It does not have so many limitations as previous methods of peripheral connection as up to 127 USB devices can be connected at once. Separate hubs are available to enable this connection, at a relatively inexpensive price.
- **Vector image**- This type of image is stored as a series of shapes which start at a specific point and are placed within specific coordinates, then a colour is applied to then or within the shape created. This method takes up a lower amount of memory and means that it is not size dependant, hence it can be enlarged to any dimension without the loss of quality. The main drawback is that it does not allow for smooth tonal changes, so text and shapes are very good in this format but photographic type pictures not.