

Variable Multiformating (VMF)

Technical Brief

Overview

Variable Multiformating™ (VMF)™ controls the placement of an arbitrary number of images onto a single page of printed output. The scope of VMF capabilities include:

- ◆ Support for an arbitrary number of images to be formatted onto a single page.
- ◆ Support for arbitrary positioning of images on the page.
- ◆ User selectable assignment of a clipping region for any image.
- ◆ User selectable scaling or rotation of any image.
- ◆ User selectable aspect ratio adjustment of any image and of the entire page.
- ◆ User selectable color correction of any image, including gamma, contrast, TCR, and MCM adjustments.
- ◆ User selectable fill regions of arbitrary size, location, and color.
- ◆ User selectable portrait or landscape orientation of paper.
- ◆ User selectable scaling of final output, allowing control of final image size on page.

Conceptual Summary

A simple mechanism for controlling VMF functions is designed into the NP-1600. The basic method for using VMF is illustrated here:

1. Create a Canvas for storing images.
2. Place images and fill regions on the Canvas.
3. Print the Canvas.

The VMF Device uses the concept of a “Canvas” as a buffer for storing images during multiformating. The Canvas is explicitly created by the user at the beginning of a VMF sequence using a **CANVAS** command. The user can control the size and color of the Canvas. Once the Canvas is specified, images are positioned on the Canvas using **PLACE** commands. Control of image placement includes scaling and cropping of images to achieve an optimal layout. After all images are placed on the Canvas, a **PRINT** command is issued to render the Canvas to paper.

VMF Control Commands

Support for VMF is assigned to Logical Device 10. Files can be transferred to this Logical Device using standard FTP and LPR network conventions.

The VMF Device recognizes two types of files: command files and image files. Command files are ASCII messages

which affect image processing. Image files include all standard image types currently supported by the printer, including PostScript. Users transfer a sequence of commands and image files to achieve the desired output.

Command files are ASCII files which contain one command per file. Commands can be uppercase or lowercase. White space on commands is used to delimit parameters. Tabs, spaces or newlines (CR or LF) can be used for white space. There are four commands recognized by the VMF Device:

CANVAS Command

```
CANVAS Width Height { COLOR rr/gg/bb }  
{ SCALE Scale_factor { Scale_method } }  
{ ASPECT X_aspect Y_aspect }  
{ Orientation }
```

The **CANVAS** command will define a region of the specified size which acts as a frame for holding images during the multiformating process. Each time this command is invoked, the old Canvas is erased and a new one is created.

Width and **Height** specify the size of the Canvas in pixels. These dimensions do not have to match the printable area on the paper. The origin coordinates of the Canvas (0,0) are in the upper-left corner. As images are placed onto the Canvas using the **PLACE** and **FILL** commands, they are placed within the Canvas region. When the **PRINT** command is received, the Canvas **SCALE** and **ASPECT** parameters are applied to the Canvas, so that the **SCALE** and **ASPECT** operations affect the final size of the Canvas as well as all of the objects placed within it.

The optional **COLOR** parameter is available which specifies a color to initialize the Canvas to. Colors are specified as **rr/gg/bb** where **rr**, **gg**, and **bb** are 2 digit hexadecimal values from **00** to **FF** which represent red, green, and blue respectively. The word **COLOR** must precede the **rr/gg/bb** information. If no color parameter is specified, white is used.

Scale_factor and **Scale_method** are optional parameters which allow the Canvas to be proportionally scaled to a different size. The word **SCALE** must appear before the **Scale_factor** and **Scale_method** parameters. **Scale_factor** is real number greater than 0.0 which specifies the how much to scale the Canvas. A **Scale_factor** of 1.0 will leave the Canvas unmodified. Scale factors greater than 1.0 will increase the size of the Canvas and numbers below 1.0 will

reduce the size of the Canvas. If the string **AUTO** is used as the **Scale_factor** the Canvas automatically will be scaled to the largest size that will fit within the printable area of the page. **Scale_method** is a string which specifies the technique used to scale an image. Supported methods include: **BILINEAR**, **BICUBIC**, **BOX**, **MITCHELL**, and **LANCZOS**. This **Scale_method** is used when no scale method is specified in the **PLACE** command for a particular image. If none is specified in either place, then the user or printer default method is used. Note that Canvas scaling is always performed **after** all images and fill regions have been placed on the Canvas, but **before** any orientation adjustment.

The **ASPECT** parameter option can be used to scale the Canvas by different amounts in the x- and y-directions to modify the aspect ratio of the Canvas and its contents. With aspect ratio modification, one direction is reduced while the other direction is held the same. The aspect ratio factor is determined by **X_aspect** divided by **Y_aspect**. If the aspect ratio factor is less than 1.0 then the canvas is reduced in the x-direction in proportion to the factor. If the aspect ratio factor is greater than 1.0, then the height of the canvas is reduced in proportion to the reciprocal of the aspect factor. Note that aspect ratio adjustment is always applied **after** all images and fill regions have been placed on the Canvas, but **before** any orientation adjustment.

The optional **Orientation (PORTRAIT or LANDSCAPE)** parameter will control the final rotation of the canvas when the print command is received. **PORTRAIT** specifies no rotation, and **LANDSCAPE** specifies rotation of 90 degrees. This rotation occurs **after** any scaling and aspect ration adjustments.

Examples:

```

CANVAS 2400 2680   A-size printable area.
CANVAS 1024 512   Smaller than A-size.
CANVAS 2680 2400 LANDSCAPE
                    A-size printable area in LAND-
                    SCAPE mode.
CANVAS 1000 800 COLOR FF/00/00
                    Red background.
CANVAS 1200 1340 SCALE 2.0 BILINEAR
                    Scale up 2.0X using Bilinear
                    method.
CANVAS 1800 1340 ASPECT 1:1.5 SCALE 2.0 BOX
                    Scale Width by 1.333 and Height
                    by 2.0 using Box method.
CANVAS 1800 1340 LANDSCAPE ASPECT 1:1.5
SCALE 2.0 BOX
                    Scale Width by 1.333 and Height
                    by 2.0 using Box method. Then
                    rotate 90 degrees for LAND-
                    SCAPE printing.

```

PLACE Command

```

PLACE X_offset Y_offset
{ CLIP Clip_width Clip_height { rr/gg/bb } }
{ SCALE Scale_factor { Scale_method } }
{ ASPECT X_aspect Y_aspect }
{ CENTER }
{ ROTATE Degrees }
{ GAMMA Value }
{ CONTRAST Value }
{ TCR Value }
{ MCM ID }

```

PLACE specifies how the next image is to be positioned on the Canvas. A command file containing the **PLACE** command is always followed by an image file.

X_offset and **Y_offset** are required integer parameters which specify where the top-left corner of the image is placed on the Canvas. These coordinates are absolute offsets from the origin (top-left corner) of the Canvas.

Clip_width and **Clip_height** are optional integer parameters which define a rectangular clipping region for the image. The word **CLIP** must precede the **Clip_width** and **Clip_height** parameters. Portions of the image which extend past the clipping region will not be visible on the Canvas. Only the image portion inside the clip region is printed. A color can be optionally specified at the end of the **CLIP** command which defines the color to set any unused portion inside the clipping region. Colors are specified as **rr/gg/bb** where **rr**, **gg**, and **bb** are 2 digit hexadecimal values from **00** to **FF** which represent red, green, and blue respectively. If no color is specified, then white is used.

Scale_factor and **Scale_method** are optional parameters which allow the image to be proportionally scaled to a different size on the Canvas. The word **SCALE** must appear before the **Scale_factor** and **Scale_method** parameters. Normally, an image is placed on the Canvas with a 1:1 relationship. One image pixel is the same as one Canvas pixel. **Scale_factor** is real number greater than 0.0 which specifies the how much to scale the image. A **Scale_factor** of 1.0 will leave the image 1:1. **Scale_factors** greater than 1.0 will increase the size of the image and numbers below 1.0 will reduce the size of an image. **Scale_method** is a string which specifies the technique used to scale an image. Supported methods include: **BILINEAR**, **BICUBIC**, **BOX**, **MITCHELL**, and **LANCZOS**. If a **Scale_method** is not specified, the Canvas scale method is used. If neither of those exist, then the user default or printer default method is used.

One special case of scaling is available when a clipping region is specified. The string **AUTO** can be used as the **Scale_factor** to automatically scale the image to the maximum size that will fit in the clipping region.

The optional **ASPECT** parameter can be used to scale the image by different amounts in the x- and y-directions to modify its aspect ratio. With aspect ratio modification, one direction is reduced while the other direction is held the same. The aspect ratio factor is determined by *X_aspect* divided by *Y_aspect*. If the aspect ratio factor is less than 1.0 then the image is reduced in the x-direction in proportion to the factor. If the aspect ratio factor is greater than 1.0, then the height of the image is reduced in proportion to the reciprocal of the aspect factor. Aspect ratio adjustment is applied to the image **first, before** any other **PLACE** operations, notably scaling and rotation.

The **CENTER** parameter is an option which allows an image to be centered within a clipping region. If an image is smaller than the clipping region either top to bottom or left to right, the **CENTER** option will center the image within the region. Without the **CENTER** option an image is placed such that the top-left corner of the image is at the coordinates of the x and y parameters of the **PLACE** command. Images larger than the clipping region are positioned as if the **CENTER** command was not issued.

The **ROTATE** parameter is an option which allows the current image to be rotated counter-clockwise in 90 degree increments. Legal values for *Degrees* are: **0, 90, 180, 270, AUTO**. If **AUTO** is specified, then the current image will be rotated either 0 or 90 degrees so as to produce the largest final image size within the clip region. If **AUTO** is specified without a clip region, then rotation is reset to 0 degrees for the current image.

GAMMA is an optional parameter which applies gamma correction to the current image. Legal values for *Value* fall in the range from **0.00** to **10.00**. Values below 1.00 darken the image and values above 1.00 lighten the image. A value of 1.00 has no effect on the image.

CONTRAST is an optional parameter which applies contrast enhancement to the current image. Legal settings for *Value* fall in the range from **-100** to **100**. Negative values reduce contrast. Positive values increase contrast. A setting of 0 has no effect on the image.

TCR is an optional parameter which applies Codonics True-ColorRendering (TCR) saturation correction to the current image. Legal values for *Value* fall in the range from **0** to **100**.

MCM is an optional parameter which applies Medical Color Matching correction to the current image. Legal values for *ID* fall in the range of **0** to **12**.

Examples:

```
PLACE 0 0
PLACE 0 500 CLIP 250 350
PLACE 500 500 SCALE 1.66
PLACE 1000 500 CLIP 400 200 SCALE AUTO BOX
ROTATE AUTO CENTER
PLACE 1000 1000 CLIP 300 300 A0/A0/A0 CENTER
PLACE 0 1500 CLIP 500 500 40/40/00
SCALE 0.25 MITCHELL CENTER
PLACE 0 1500 ROTATE AUTO GAMMA 2.0 TCR 15
```

FILL Command

```
FILL X_offset Y_offset Fill_width Fill_height
{ COLOR rr/gg/bb }
```

The **FILL** command allows users to specify a solid colored region within the Canvas. *X_offset* and *Y_offset* specify the location of the upper-left corner of the region within the canvas. *Fill_width* and *Fill_height* specify the width and height of the region.

The optional **COLOR** parameter specifies a color for the Fill region. Colors are specified as *rr/gg/bb* where *rr*, *gg*, and *bb* are 2 digit hexadecimal values from **00** to **FF** which represent red, green, and blue respectively. The word **COLOR** must precede the *rr/gg/bb* information. If no color parameter is specified, white is used.

Examples:

```
FILL 0 0 100 100
FILL 100 200 1000 2000 COLOR ff/ff/ff
```

PRINT Command

```
PRINT { COPIES Number }
```

The **PRINT** command will print the current contents of the Canvas. The user can control the number of copies made of the final canvas.

The user can specify a *Number* of copies to print by issuing the word **COPIES** followed by an integer number between 1 and 99.

For compatibility with older versions of VMF, the **Orientation** and **Scale** parameters currently supported in the **CANVAS** command can also be used in the **PRINT** command. However, it is recommended that these be used in the **CANVAS** command since this will yield the fastest print times.

When the **PRINT** command has finished, the Canvas is removed. The **PRINT** command will always center the Canvas on the printed page.

Examples:

PRINT
PRINT COPIES 5

CANCEL Command

CANCEL

The **CANCEL** command will delete the current Canvas and effectively erase all images placed up to that point. No **PLACE** or **PRINT** commands can be issued after a **CANCEL** command until a new Canvas is created with the **CANVAS** command.

Example Session

The following example will format two images and print a page.

Command File:
CANVAS 1500 2000 COLOR 00/00/00 PORTRAIT SCALE
AUTO MITCHELL

Create a Canvas 1500 pixels wide and 2000 pixels high which is set to the color black. The Canvas will be printed in PORTRAIT mode at the maximum size for the currently-installed paper using Mitchell scaling.

Command File:

PLACE 10 10 CLIP 1480 980 SCALE AUTO BILINEAR
CENTER

Define a clipping region, scale next image using bilinear interpolation, and center the image inside the clipping region.

Image File:

Sun Raster, 8-bit, indexed color (1152 x 900)

Image will be automatically scaled to the maximum size that will fit within the clipping region.

Command File:

PLACE 10 1000

Place next image 10 pixels to the right and 1000 pixels down from the origin of the Canvas.

Image File:

TIFF, 8-bit, greyscale (1024 x 512)

Image is placed on Canvas with the bottom 12 pixels truncated because they extended past the bottom of the Canvas which is 1500 pixels high.

Command File:

PRINT COPIES 5

The final Canvas is printed five times and then deleted.

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