

### Contrast Enhancement

This built-in NP-1600 printer feature allows users to adjust the amount of contrast in their prints. The level of adjustment is specified by a single value ranging from -100 to +100. Contrast enhancement may be specified on printer default and per-user basis across the network, and on a printer default basis through the printer's front panel.

### The Contrast Curves

The printer adjusts image contrast by applying a "contrast curve" to the image prior to printing. The shape of the contrast curve is determined by the "contrast setting" which is a number ranging from -100 to +100. A setting of 0 results in no change in the image. Settings less than zero reduce contrast. And settings greater than zero increase contrast.

Increasing contrast increases the differences between light and dark portions of an image so that light areas become lighter and dark areas become darker. Decreasing contrast reduces these differences. By manipulating contrast in this way, users can highlight the most important information within their images, thereby maximizing the usefulness of their prints.

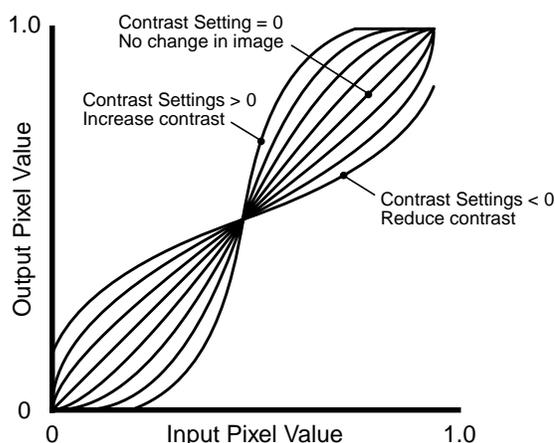


Figure 1: Contrast Curves

In Figure 1, the pixel values range from 0.0 representing pure black, to 1.0 which represents pure white. As the figure dem-

onstrates, positive contrast settings increase contrast, while negative contrast settings reduce contrast. The larger the contrast setting, the more pronounced the adjustment. The contrast setting of 0 results in no change in the image. Note that, except for large negative settings (large reductions in contrast), pure white and pure black are always left unchanged so that the absolute density range of the image is unaffected.

The printer automatically truncates contrast settings of [80 through 100] to 80, and settings of [-80 through -100] to -80. Larger settings are not supported.

### Setting Contrast Enhancement Values

The printer contrast setting can be adjusted two ways. First, the printer default contrast value may be set using the printer's front panel. Second, users may set their individual contrast value preference on the printer by sending a text file to Logical Device 0.

### Setting Printer Default Contrast Value

Setting the contrast value through the printer's front panel specifies the **printer default value**. This value is used for any users who have not stored a personal settings file on the printer. This value is entered into the printer as follows:

Use the following front panel key sequences to select the Contrast Value. When an **<Up-arrow>** or **<Down-arrow>** is indicated, press the key repeatedly until the correct response is showing on the LCD.

Start from the READY display.

Use Key	Until LCD Displays
<b>&lt;Setup&gt;</b>	SETUP: NETWORK
<b>&lt;Down-arrow&gt;</b>	SETUP: IMAGE
<b>&lt;Setup&gt;</b>	IMAGE: TCR
<b>&lt;Down-arrow&gt;</b>	IMAGE: CONTRAST
<b>&lt;Setup&gt;</b>	<i>The LCD will display the current Contrast Value.</i>

To change the Contrast Value, use the following front panel commands:

<u>Use Key</u>	<u>Until LCD Displays</u>
<Up-arrow> or <Down-arrow>	Until the desired Contrast Value is shown on the LCD.

Once the desired Contrast Value is displayed, exit from the setup menu and return to the READY state as follows:

<Setup>	IMAGE: CONTRAST
<Down-arrow>	IMAGE: EXIT
<Setup>	READY

The front panel menu hierarchy just described is summarized below:

READY → IMAGE → CONTRAST → *default\_value*

Where *default\_value* is a number from -100 to +100.

### **Setting Personal Contrast Preference**

Users may store a file on the printer specifying their personal image processing preferences. The file must be a plain text file. To specify the contrast value, first create a file with the following text:

#### **CONTRAST *value***

Where **value** signifies a number from **-100** to **+100**. Then, send the text file to Logical Device 0 of the printer using the FTP or LPR programs. The user must be logged-in under his/her own username for LPR and must use their own username and binary transfer mode when using FTP.

*Note:* The text file is stored on the printer and is referred to any time that user makes a print. **If the user previously stored a personal settings file on the printer, this will overwrite the original.** Therefore, all other personal preferences should be included in this file, as well. An invalid file sent to Logical Device 0 will clear any existing file which would return all settings to factory defaults.

### **Querying Printer Status**

The printer default contrast value can be determined by querying the front panel as described in the previous section. The printer default and user-specific settings can also be

determined using the **root** login from a Telnet session and running the **stat** command. Users that are familiar with Telnet can log into the printer as follows:

1. Telnet to printer's **hostname** or **IP Address**
2. Login as **root**
3. Run **stat username** command.

This command displays a page of useful information about the printer status. All of the image processing options for both **root** (printer default settings) and the specific **username** are displayed.

### **Combining Gamma and Contrast**

Often, gamma correction and contrast enhancement must be used together on the printer to achieve the best results.

A fundamental property of contrast is that it splits the gray levels of an image down the middle. When increasing contrast, for example, pixels that are darker than 50% gray are made darker and pixels that are lighter than 50% gray are made lighter. This works fine when the image to be enhanced is already evenly distributed around the 50% gray level. If this is not the case, contrast will not have the desired effect. For instance, if an image is already very dark, with most pixels being darker than 50% gray, then increasing contrast will tend to make the image even darker. Likewise, light images will tend to be made lighter by an increase in contrast.

Gamma correction can be used to overcome this problem. On the printer, gamma correction is applied to an image before contrast enhancement. Because of this, gamma can be used to lighten or darken the image so that it is evenly distributed around the 50% gray level before contrast is applied, causing contrast enhancement to produce the intended result. If a print turns out to be too dark or too light following contrast enhancement, the user need only adjust the gamma value on the printer until the desired output is achieved. For more information on gamma correction, refer to the [Gamma Correction Technical Brief](#).

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