C150-E073-02XA

IPC-3 Image Processing Guide

Including IPC-2

User's Guide

ユーザーズガイド

FUJITSU

IPC-3 Image Processing Guide

Including IPC-2

Fujitsu Limited

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If you want to use IPC-3 image processing immediately and if it's already installed in your image scanner, refer to Appendix C. To obtain a high image quality, some tuning is required. Refer to Section 3 to learn about various settings and parameters for tuning.

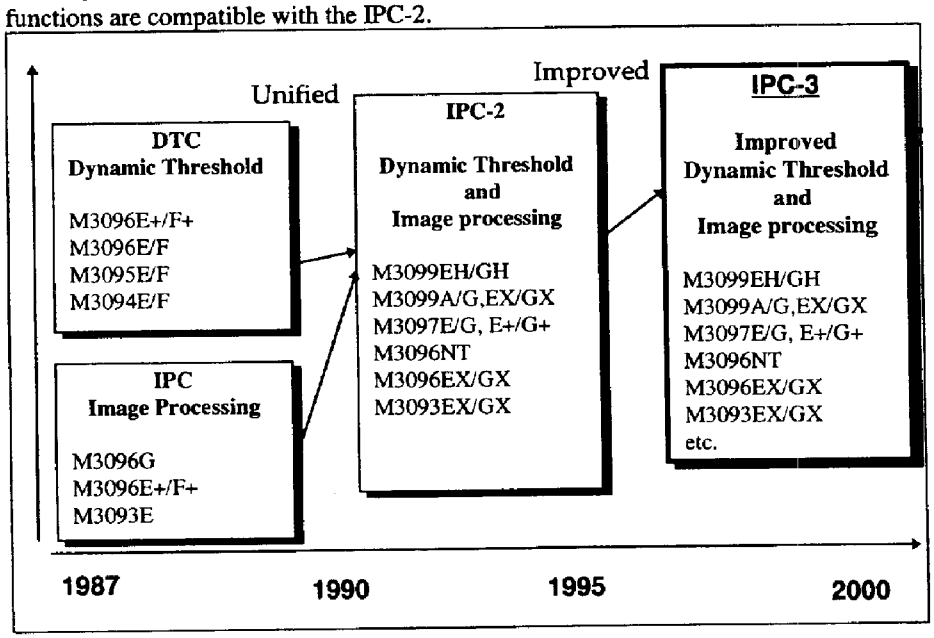
1. General

The IPC-3 (Image Processing Circuit - 3) is the third generation of the M309x Fujitsu Image Scanner series.

The IPC-3 provides many kinds of image processing for Fujitsu Image Scanners to improve the image quality of documents and offer various effects.

The IPC-3 is plug-compatible with the IPC-2 (Image Processing Circuit - 2). If you have been using IPC-2, IPC-3 is compatible with your current device driver. This document also provides IPC-2 information for such users.

The "Dynamic Threshold" and "Automatic Separation" are new algorithms. Most other functions are compatible with the IPC-2.



The new "Dynamic Threshold" was developed for targeting real world documents. The image quality for normal documents and test charts has been improved over that of the IPC-2. In the real world, there are various type of forms and documents. For example, some colored or black background documents are difficult to scan.
The IPC-3 can capture the text on such background documents.
However, the Simplified Dynamic Threshold algorithm of IPC-2 is still available for scanning test charts and plain documents.

The new "Automatic Separation" automatically discriminates between the text and photo regions of documents. The IPC-3 Automatic Separation has been improved for thick and large font text. It provides better separation for large, dithered font texts and small text in photo regions.

2. Specifications

2.1 Functions

IPC-3 supports the following image processing functions.

Table 2-1: IPC-2/3 Functions

Item	IPC-2	IPC-3
DTC mode[1, 2]		
Prefilter	Ordinary/Ball-Point Pen	Ordinary/Ball-Point Pen
Gradation	High Contrast/Ordinary	Ignored[3]
Dynamic Threshold Curve	8 types	8 steps (Sensitivity)[2]
Smoothing	Image/OCR	Image/OCR
Noise Removal	2x2 to 5x5	2x2 to 5x5
Equal to White	ON/OFF	ON/OFF
IPC mode[1]		
Simplified Dynamic Threshold[2, 3]	7 steps (Variance rate)	7 steps (Sensitivity)[4]
(IPC-2 like Simplified Dynamic Threshold[5])	-	7 steps (Sensitivity), High/Med/Low
Automatic Separation	ON/OFF	ON/OFF[6]
Outline Extract	ON/OFF	ON/OFF
Image Emphasis[5]	High/Mid/Low	High/Mid/Low
Image Emphasis (Smooth)	Smooth	Background Removal[7]
Mirror Image	ON/OFF	ON/OFF
Black and White Reverse	ON/OFF	ON/OFF
Subwindow	Max. 4	Ignored[8]
Common		
Zooming (Resolutions)[9]	50 to 1600 dpi at 1dpi	50 to 1600 dpi at 1dpi
Dither Downloading	Max. 8	Max. 8
Overlay Downloading	Max. 8	Max. 8
Gamma Downloading	Max. 8	Max. 8

Notes :

1) DTC and IPC mode functions are exclusive.
2) In IPC-3, DTC and IPC mode Simplified DTC use the same algorithm.
3) In IPC-3, the Gradation parameter is ignored.
4) In IPC-3, a seven step parameter is used like as with the Simplified Dynamic Threshold but the algorithm is different.
5) In IPC-3, if both Simplified DTC and Image Emphasis are specified, the Simplified DTC algorithm is activated. At that time, both the Simplified Dynamic Threshold Sensitivity and the Image Emphasis High/Mid/Low parameters are in affect.
6) In IPC-3, if Automatic Separation is specified, then Simplified Dynamic Threshold and Image Emphasis/Smoothing are ignored.
7) In IPC-3, if Smoothing is specified, then Background Removal is applied. This effect is similar to IPC-2 Smoothing.
8) In IPC-3, Subwindows are not available and are ignored if specified.
9) The zooming range depends on the Image Scanner being used. See Tables 2-2, 2-3.

Table2-2: Binary Halftone Zooming

	without IPC-2/3	with IPC-2/3
M3099EH/GH	200/240/300/400 dpi	50 to 400 dpi at 1 dpi/step
M3099A/G, EX/GX	200/240/300/400 dpi	50 to 400 dpi at 1 dpi/step
M3097E/G, E+/G+	200/240/300/400 dpi	100 to 1600 dpi at 1 dpi/step
M3096NT	200/240/300/400 dpi	50 to 800 dpi at 1 dpi/step
M3096EX/GX	200/240/300/400 dpi	50 to 800 dpi at 1 dpi/step
M3093EX/GX	200/240/300/400 dpi	50 to 800 dpi at 1 dpi/step

Table 2-3: Grayscale Zooming

	Without IPC-2/3	With IPC-2/3
M3099EH/GH	Grayscale is not supported.	
M3099A/G, EX/GX	Grayscale is not supported.	
M3097E+[1]/G+	200/240/300/400 dpi	100 to 400 dpi at 1 dpi/step
M3097E/G	Grayscale is not supported.	
M3096NT	Grayscale is not supported.	
M3096EX[1]/GX	200/240/300/400 dpi	50 to 400 dpi at 1 dpi/step
M3093EX[1]/GX	200/240/300/400 dpi	50 to 400 dpi at 1 dpi/step

1) Available only with a third party slot interface.

2.2 Compatible Image Scanners

IPC-3 is compatible with following image scanners:

Table 3-1: Compatible Image Scanners

	IPC-2	IPC-3	IPC-2D	IPC-3D (TBD)
M3099EH/GH	Yes[1]	Yes[1]	No	No
M3099A/G, EX/GX	Yes[1]	Yes[1]	No	No
M3097E/E+	Yes	Yes	No	No
M3096NT	Yes[2]	Yes	No	No
M3096EX/GX	Yes	Yes	No	No
M3093EX/GX	Yes	Yes	No	No
M3093DE/DG	No	No	Yes	Yes

1) Two boards are required
2) Available, but not fully supported

2.3 Physical Specifications

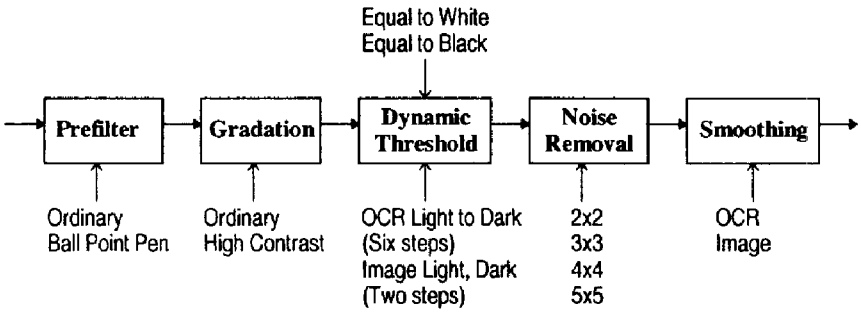
Item	Specification	Description
Dimension	112 mm x 80mm	
Weight	under 0.5 Kg	
Power Consumption	under 0.5 VA	

3. Image Processing

3.1 DTC Mode

DTC Mode is provided for compatibility with Fujitsu's image processing DTC (Dynamic Threshold Circuit) option. This circuit has been designed to scan for better quality images to provide OCR (Optical Character Recognition). The Dynamic Threshold algorithm was developed to capture important text features for recognition purposes.
The DTC Mode is recommended for OCR applications.

The image processing in DTC mode is shown below.



In the IPC-3, the Dynamic Threshold algorithm is identical to the Simplified Dynamic Threshold in IPC mode.

Notes:

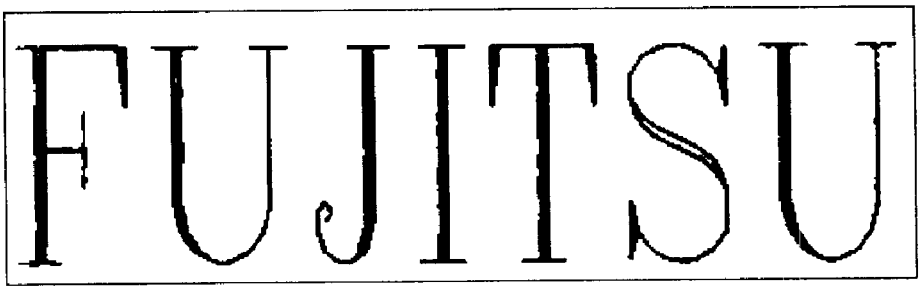
1. Threshold, brightness, and contrast settings are ignored in DTC mode.
2. Gamma correction is ignored in DTC mode.

a) Prefilter [Ordinary/Ball-Point Pen]

The prefilter performs filtering before processing the Dynamic Thresholding.
The ordinary filter is the default.
Texts written by ball point pens actually have two lines per stroke. To the human eye, this is not big problem, but OCR may not recognize the text. The Ball Point Pen Filter averages these two lines into one solid line.

Effect Example

Ordinary Filter

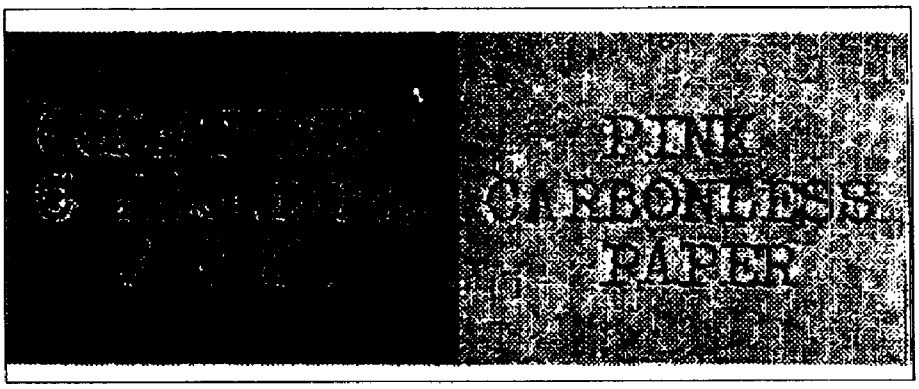


Ball Point Pen Filter

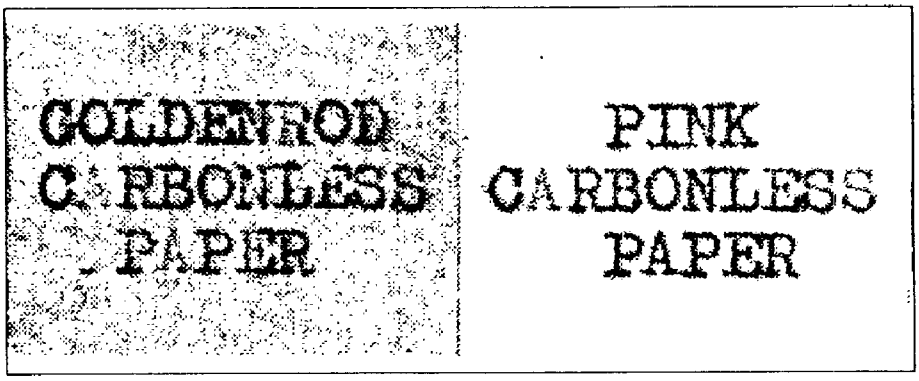
b) Gradation [Ordinary/High Contrast] - Ignored in IPC-3

Gradation specifies the Gamma Correction in DTC Mode.
The default is Ordinary.
When scanning new papers or old documents that are not white, the High Contrast gradation should be used.
IPC-3 Dynamic Threshold includes an automatic contrast adjustment, so this parameter is not required.

Example in IPC-2



Ordinary Gradation



High Contrast Gradation

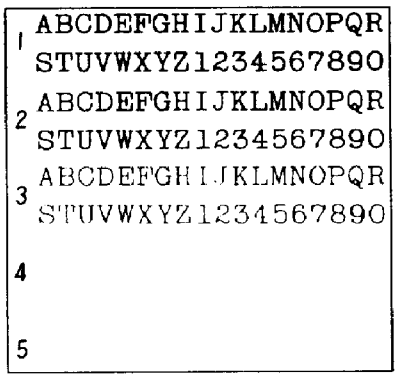
c) Dynamic Threshold Curve [for OCR, 0-5: Dark to Light 6: Dark Image 7: Light Image]

The Dynamic Threshold is the algorithm to calculate suitable threshold for binarizing. The Dynamic Threshold Curve was used to select Threshold Curve which is defined for darkness in IPC-2. The definition of this parameter is changed in IPC-3 to specify sensitivity.
The defaults are four in IPC-3 and six in IPC-2.

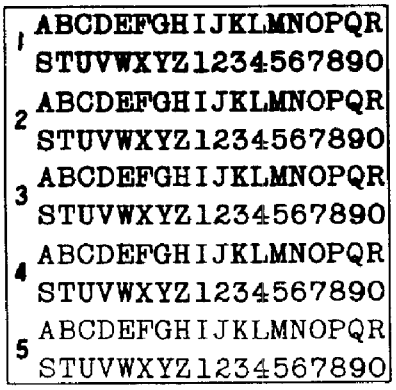
In IPC-3, this parameter specifies the sensitivity. Zero is the lowest and seven is the highest. If the image is not clear, increase the sensitivity. If the image is noisy, decrease the sensitivity.

In IPC-2, 0 to 5 is the parameter for OCR and 6 and 7 is for Image. If the scanned image is too bright, specify a higher value. If the scanned image is too dark, specify a lower value.
For filing purposes, specify 6 or 7. If the scanned image is too bright, specify 6. If the scanned image is too dark specify 7.

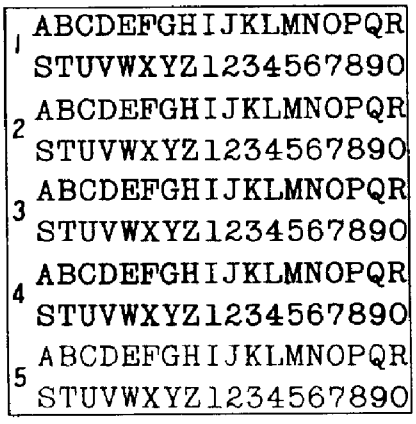
See 3.2 (b) for IPC-3 effect example.



Normal Threshold [128]



Low Threshold [25]



Dynamic Threshold

IPC-3 Sensitivity vs. IPC-2 Setting

The IPC-3 Dynamic Threshold algorithm parameter - "Sensitivity" as selected from the IPC-2 Setting/User Interface below.

IPC-3 DTC Sensitivity	DTC mode Threshold Curve	IPC mode Variance Rate (Video/SCSI)
0: Low	0: Light OCR	Not Available
1	1	1 / 01h - 3Fh
2	2	2 / 40h - 5Fh
3	3	3 / 60h - 7Fh
4: Normal	4	4 / 80h - 9Fh (default 0/00h)
5	5: Dark OCR	5 / A0h - BFh
6	6: Dark Image	6 / C0h - DFh
7: High	7: Light Image	7 / E0h - FFh

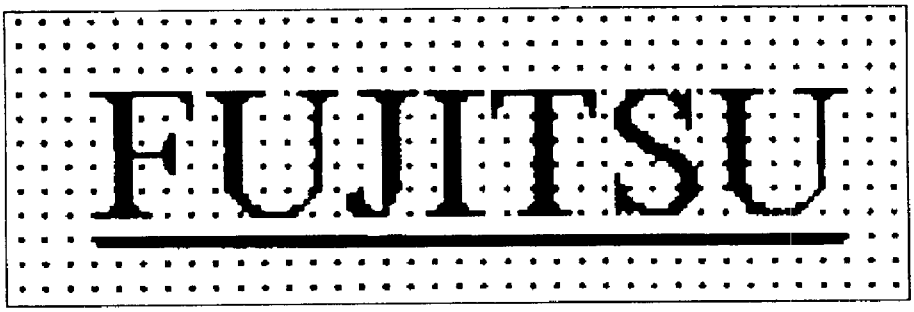
d) Equal to [Black/White]

Equal to Black/White is specifies the output value when image the level equals the threshold.
The default is Equal to Black.
If the scanned image text is bold, set to Equal to White, and if the scanned image text is too narrow or lost, set to Equal to Black. The effect on the image is slight.

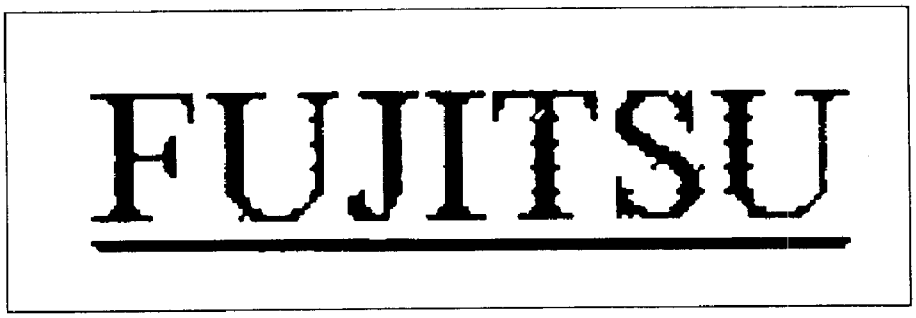
e) Noise Removal [ON/OFF, 2x2/3x3/4x4/5x5]

Noise Removal reduces the spot noises after thresholding.
The default is OFF.
If the scanned image is noisy, turn on the Noise Removal and set the granularity of the noise to be removed. 2x2 means isolate dots equal or less than 2x2 are removed, and 5x5 means isolate dots equal or less than 5x5 are removed. Therefore, when 5x5 is specified, most 4x4, 3x3, and 2x2 isolated dots are removed. Usually, it is enough to set the one largest granularity.

Example:



Noise Removal [OFF]



Noise Removal [ON, 2x2, 3x3, 4x4, 5x5]

f) Smoothing (Binary) [Image/OCR]

Smoothing in DTC mode is done by binary smoothing. After thresholding, the outline of the text is smoothed.
The default is Image.
The "Image Smoothing" is almost no smoothing. If an image is scanned in low resolution and the outline is jagged, specify the OCR smoothing.
In IPC-3, if OCR Smoothing is specified, Noise Removal is ignored.

Example:

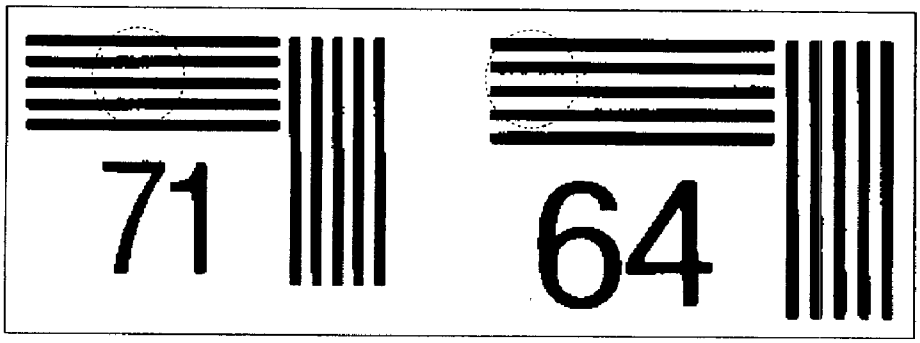
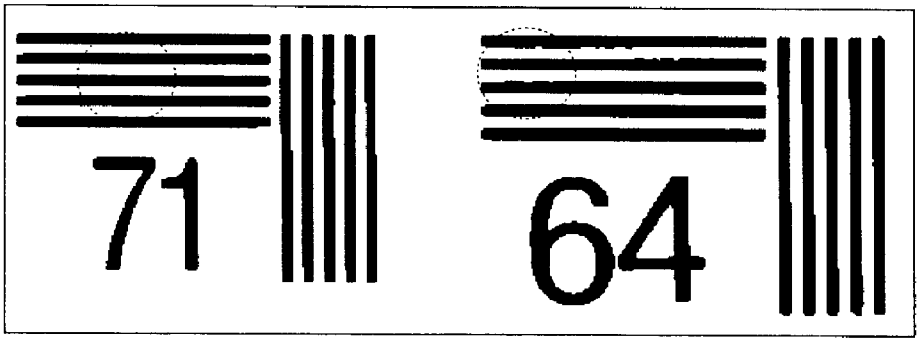


Image Smoothing

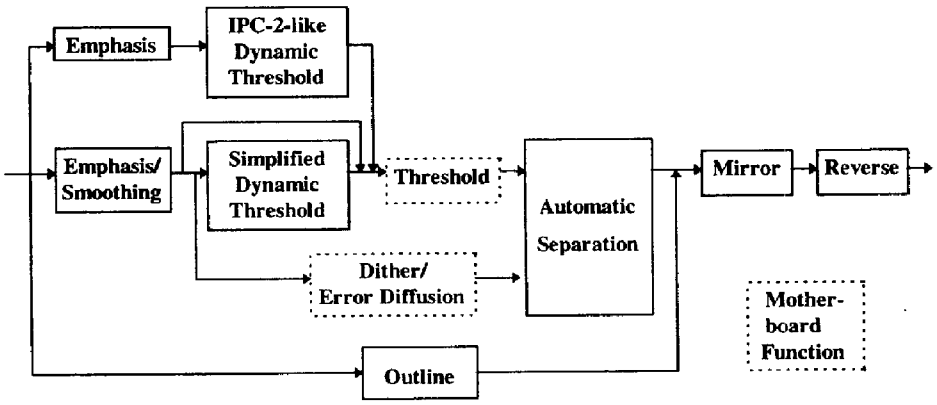


OCR Smoothing

3.2 IPC Mode

IPC Mode provides miscellaneous image processing functions and is compatible with the IPC (Image Processing Circuit) option. By combining IPC Mode image processing, various types of documents can be scanned to a desired quality.
The IPC Mode is recommended for general electrical filing purposes.

The conceptual image processing flow in the IPC mode is shown below.



In the IPC-3, the Simplified Dynamic Threshold algorithm is identical to the Dynamic Threshold in DTC mode. In this mode, an IPC-2-like Dynamic Threshold is also available when Image Emphasis is specified with Simplified Dynamic Threshold. In this case, two parameters, Sensitivity of Simplified Dynamic Threshold and High/Mid/Low of Image Emphasis, are affected.
The hardware default disables all functions.

a) Image Emphasis [High/Med/Low/Smooth]

Image Emphasis performs filtering to emphasize image edges and to remove background noise.
If text edges are not clear or are faint, turn on the Image Emphasis. High is for high emphasis and Low is for low emphasis. Image Emphasis also emphasizes the noise. It is better to set Image Emphasis higher to obtain good image, until the noise is not perceptible. Smooth is negative emphasis so image edges are faint even if, it is originally sharp.
In IPC-3, Image Smoothing effects as "Back Ground Removal". Background removal is effective to remove back ground tones. For example, forms sometimes have a background tone caused by dithering or small dots. This should be removed to emphasize the text. This function is available for such cases.
In IPC-2, Image Smoothing averages small areas which may lead to blurring in some cases. This is normal smoothing. The purposes of "Back Ground Removal" in IPC-3 and "Smooth" in IPC-2 are different, however, the output results are similar.

Example 1 (Emphasis)

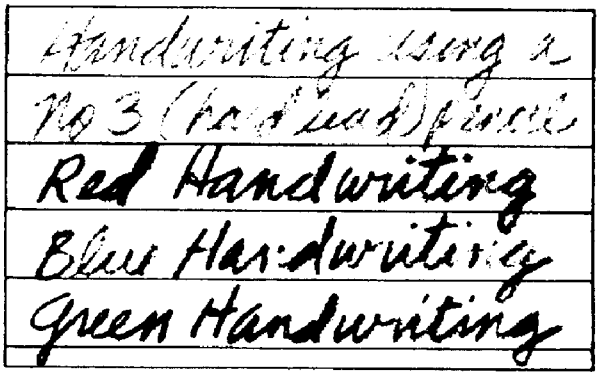


Image Emphasis [OFF]

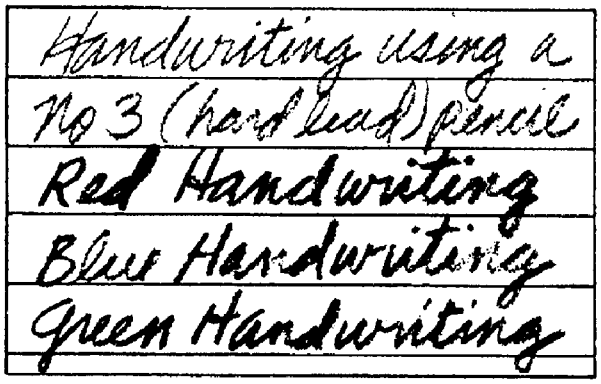
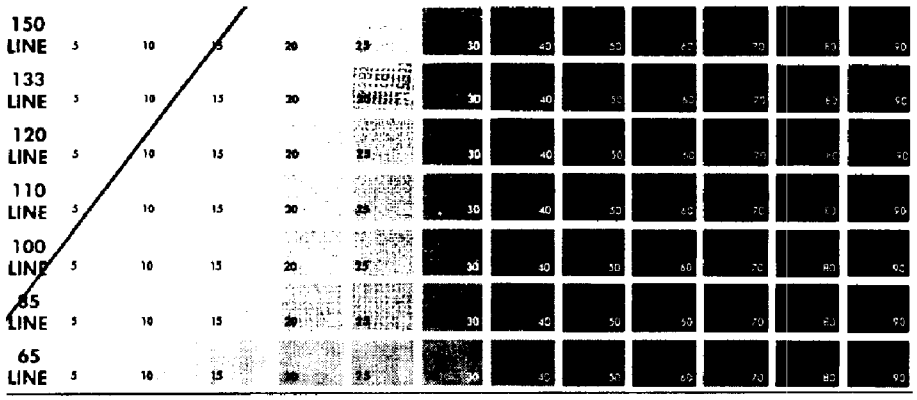
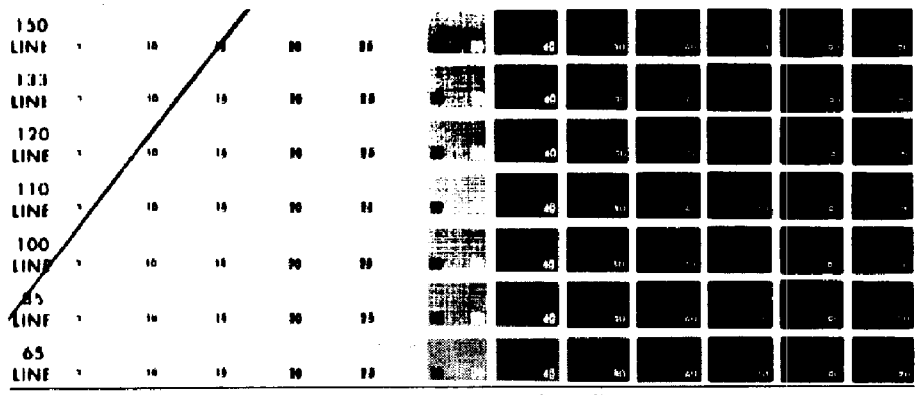


Image Emphasis [High]

Example 2 (Smoothing/Background Removal)



Background Removal [OFF]

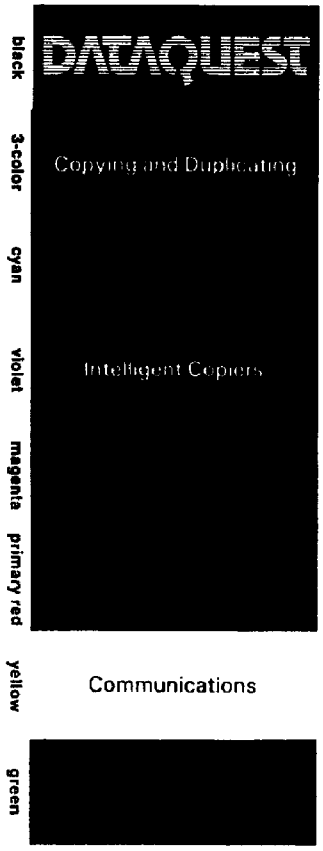


Background Removal [ON]

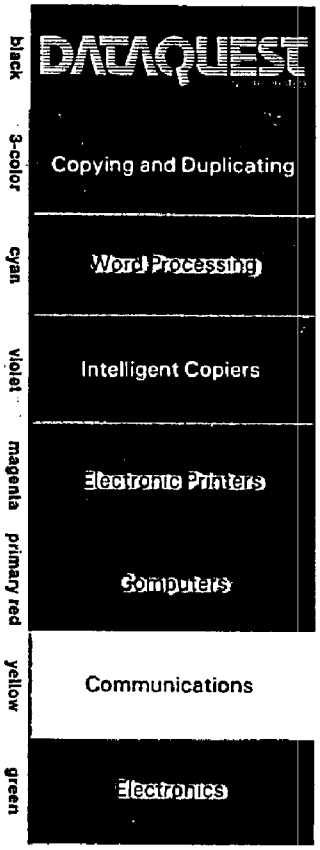
b) Simplified Dynamic Threshold [Sensitivity scale from 0 to 7]

The Simplified Dynamic Threshold is effective to obtain sharp images or capture texts having colored backgrounds. This effect is similar to Image Emphasis. The difference is that the Simplified Dynamic Threshold does not emphasis the background. This is useful for forms, checks, and most real world documents.
In IPC, Simplified Dynamic Threshold was a simplified implementation of the Dynamic Threshold. In IPC-2, Simplified Dynamic Threshold is no simpler, but sometimes more effective than Dynamic Threshold for background texts. In IPC-3, both Dynamic Thresholds are the same and sophisticated.

Example IPC-3 Dynamic Threshold



Simplified Dynamic Threshold [OFF]

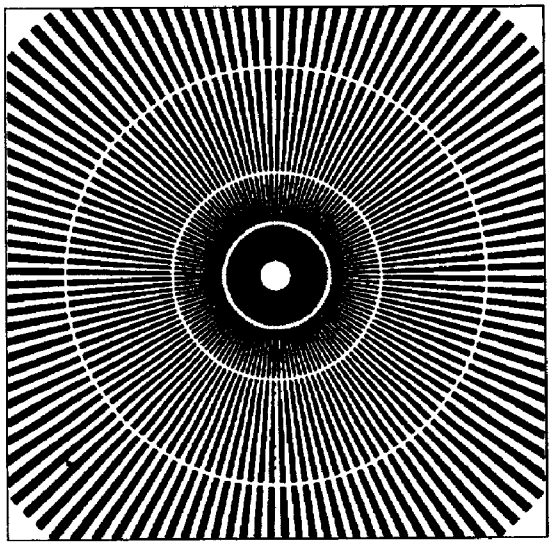


Simplified Dynamic Threshold [Sensitivity: 6]

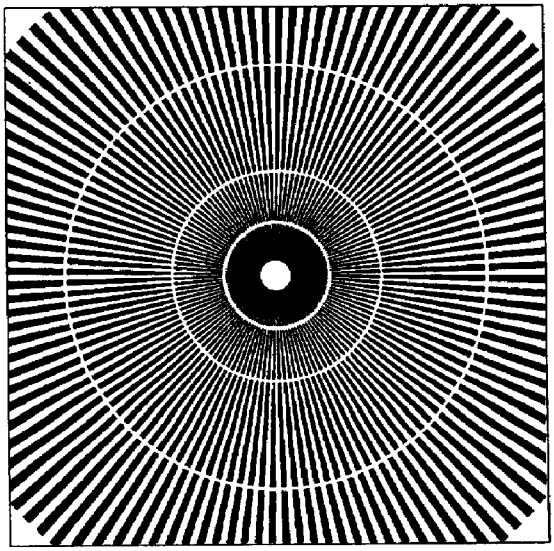
c) IPC-2-like Simplified Dynamic Threshold [SDTC Variance Rate 0 to 7]

IPC-3 supports IPC-2-like Simplified Dynamic Threshold for compatibility purposes. When both Image Emphasis and Simplified Dynamic Threshold are set, it is regarded as IPC-2-like Simplified DTC. In this case, IPC-3 Sensitivity parameters in Simplified DTC are used as the Variance Rate, and Image Emphasis parameters are used for emphasis. The IPC-2-like Simplified Dynamic Threshold increases resolution.

Example:



Simplified Dynamic Threshold [OFF]



Simplified Dynamic Threshold [Variance Rate: 7, Emphasis: High]

d) Outline [ON/OFF]

The Outline function extracts the edges from images. This function is rarely used. It may be used in DTP for image effects or image sensing.

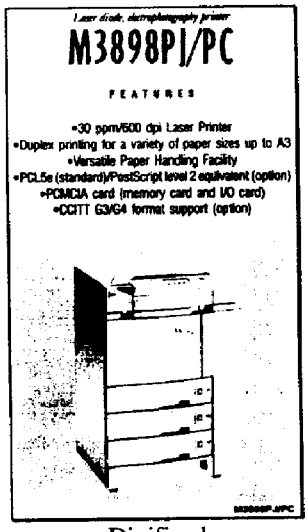
Example:

Outline [OFF]

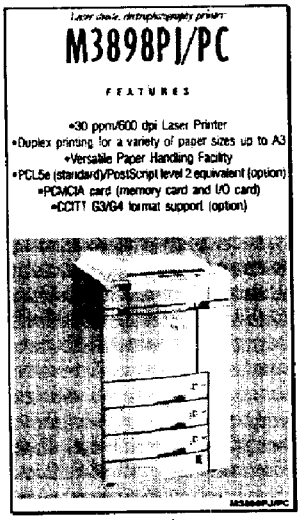
Outline [ON]

e) Automatic Separation [ON/OFF]

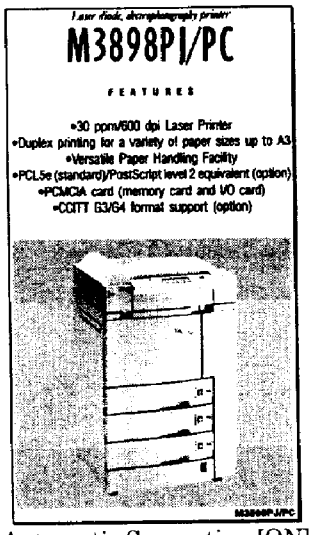
Automatic Separation automatically dithers photo regions and digitizes text regions with one path scanning. Dither patterns can be selected from four built-in choices, from downloads, or using Error Diffusion.
Simplified DTC and Image Emphasis are available for binary regions.
This function is useful to scan documents containing both text and photos.
In IPC-2, other image processing as Simplified Dynamic Threshold and Image Emphasis are ignored.



Digifized



Dithering



Automatic Separation [ON]

f) Mirror [ON/OFF]

Mirror is used to reverse the image, similar to the reflective effect of a mirror. This function may be used with DTP.

Example:

Mirror [OFF]

Mirror [ON]

g) Black and White Reverse [ON/OFF]

Black and White Reverse turns the black part of the image white and the white part black. This effect is similar to the negative/positive images from a camera.
This function may be used with DTP.

Example

Black and White Reverse [OFF]

Black and White Reverse [ON]

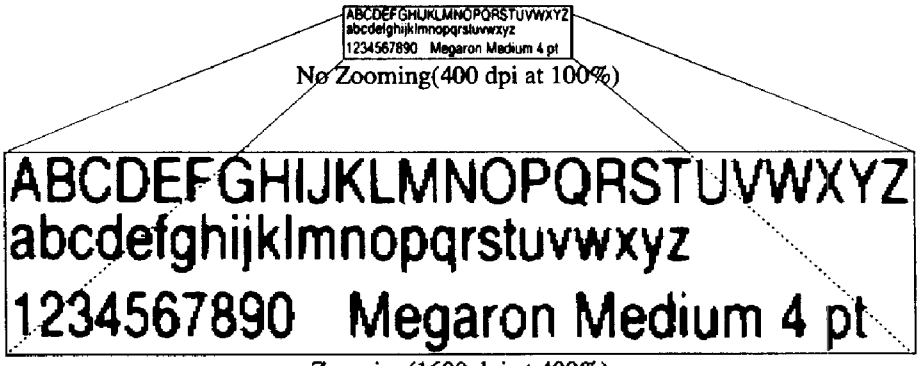
3.3 Common (Both DTC/IPC Modes)

a) Zooming [50 dpi to 1600 dpi at 1dpi/step]

X and Y independent variable resolutions are supported by IPC-2/3. Changing the resolution is used to adjust input resolution to output device resolution or to enlarge or reduce the image. This zooming is processed in grayscale, so smooth and non-distorted images can be obtained even when halftone is applied.
The range of variable resolution depends on the image scanner. See Tables 2-2, 2-3.
Zooming is available for both binary/halftone and grayscale images. However, enlargement of grayscale images is not available.

CAUTION:
This variable resolution is an electrical method, therefore, no matter how high a resolution is applied, small texts and narrow lines are not resolved.

Example:



No Zooming(400 dpi at 100%)

Zooming(1600 dpi at 400%)

b) Dither/Overlay/Gamma Correction pattern downloading

Dither/Overlay/Gamma Correction pattern downloading is not image processing. They are used to extend the availability of the built-in functions.

b-1) Dither Downloading [max. of eight patterns]

Dither downloading is supported to scan images with the users' own dither patterns.
If you are not acquainted with dithering, it is recommended to use only the built-in dithers.
See each scanner's OEM Manual or Device Driver manual for downloading pattern data formats.

b-2) Overlay Downloading [max. of eight patterns]

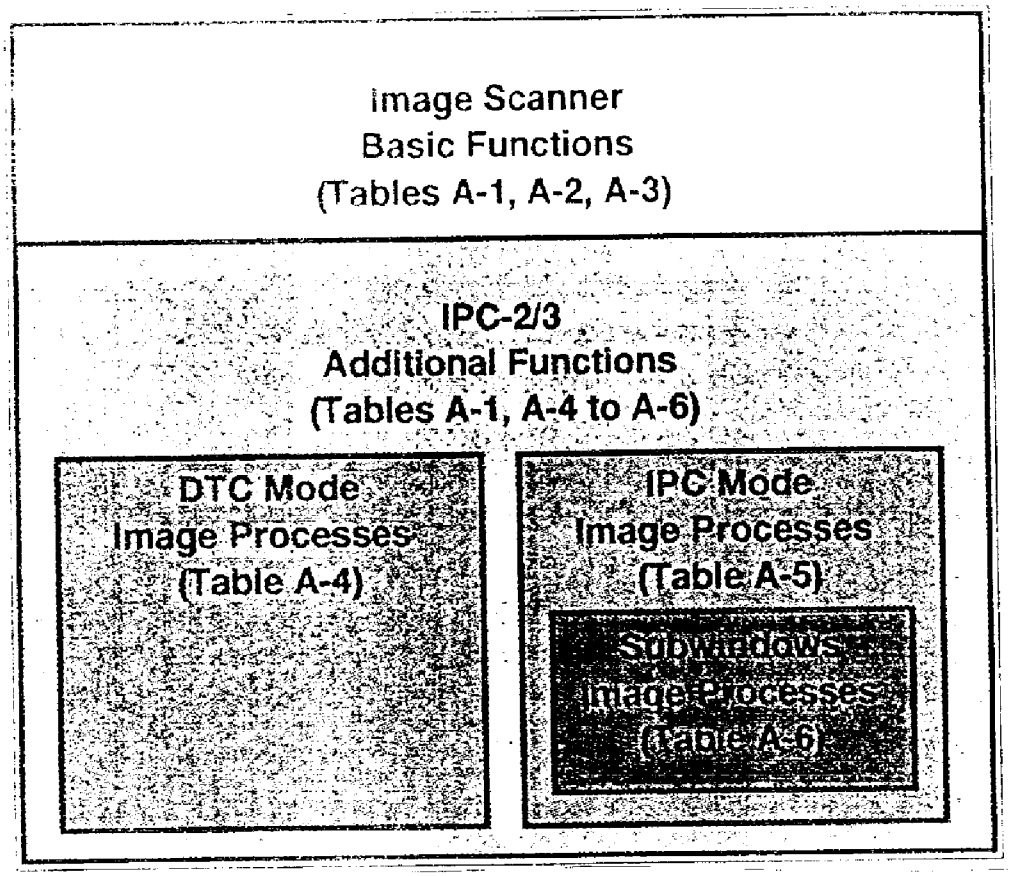
Overlay downloading is supported to scan images with the users' own overlay patterns.
If you are not acquainted with overlays, it is recommended to use the built-in overlays.
Overlays are supported by M3097E/E+, M3096EX, NT and M3093EX.
See each scanner's OEM Manual or Device M3096EX, M3096NT Driver manual for downloading pattern data formats.

b-3) Gamma Downloading [max. of eight patterns]

Gamma downloading is supported to scan images with the users' own gamma correction patterns. If you are not acquainted with gamma correction, it is recommended to use the built-in gamma correction patterns.
See each scanner's OEM Manual or Device Driver manual for downloading pattern data formats.

Appendix A: Scanning Parameter Restrictions

The IPC-2/3 image processing functions have some mode and combination restrictions. The table below shows the relationships between modes and the image processing combination restrictions.



In IPC-3, the **White Level Follower should be turned OFF** even in Binary mode. (Photos should be selected from Document Text/Photo with "RS232C+ Video" interface image scanners.) Because the IPC-3 New Dynamic Threshold algorithm is so sensitive, White Level Follower acts to increase the background noises.

Table A-1: Basic Scanning Parameters

Basic Parameters			
Image Composition	Binary	Halftone	Grayscale[1]
Path	ADF/FB		
Document Size	See Table A-2		
Scan Area X	See Table A-3		
Scan Area Y	See Table A-3		
Scan Area W	See Table A-3		
Scan Area L	See Table A-3		
Threshold	Auto,[2,3] 1 to 255	Ignored	
Brightness	Auto,[2] 1 to 255		Ignored
Contrast	Auto,[2] 1 to 255		
Resolution[4][dpi]	200/240/300/400		
White Level Follower	Auto, ON/OFF[4]		
Gamma Correction	Soft/Normal/Sharp		
Halftone	Ignored	4 patterns, Error Diffusion[5]	Ignored
Overlay[6]	Ignored	6 patterns	Ignored
Additional Functions by IPC-2/3			
DTC mode (Mode 1)[7]	**See Table A-4**	**Ignored**	**Ignored**
IPC mode (Mode 2)	**See Table A-5**	**See Table A-5**	**Ignored**
Variable Resolution[8]	See Table 2-2		See Table 2-3
Gamma (Download)	max. 8		
Overlay (Download)[6]	Ignored	max. 8	Ignored
Halftone (Download)	Ignored	max. 8	Ignored

Notes:

1) Grayscale is supported by SCSI interface scanners M3097G+, M3096GX, and M3093GX. Grayscale is also supported by RS232C+ Video interface scanners such as M3096EX and M3093EX through a third party slot. Network Scanner M3096NT does not support Grayscale.
2) Auto is 128.
3) If IPC-2/3 is attached, Auto is Simplified Dynamic Threshold.
4) White Level Follower is ON in Binary and OFF in Halftone/Grayscale as the default.

   White Level Follower is the same function with RS232C+ Video Interface parameter "Document" - Text (ON)/Photo (OFF).
5) Halftone is referenced from Binary mode when Automatic Separation is specified.
6) Overlay is available for M3097E/E+, M3096EX/NT, and M3093EX.
7) Gamma Correction is ignored in DTC mode.
8) Variable Resolution extends the resolution when used with IPC-2/3. See Table 2-2.

Table A-2: Valid Document Sizes

	A6	A5	A4	A3	B5	B4	8.5x11	8.5x14	11x17
M3099EH/GH	P/L[1]	P/L	P		P/L		P/L	P	
M3099EX/GX	P/L[1]	P/L	P/L	P	P/L	P	P/L	P	P
M3099A/G		P/L	P/L	P	P/L	P	P/L	P	P
M3097E+/G+	P/L[1]	P/L	P/L	P	P/L	P	P/L	P	P
M3097E/G	P/L[1]	P/L	P/L	P	P/L	P	P/L	P	P
M3096NT		P/L	P/L	P	P/L	P	P/L	P	P
M3096EX/GX		P/L	P/L	P	P/L	P	P/L	P	P
M3093EX/GX		P/L	P		P/L		P/L	P[2]	

P: Portrait, L: Landscape, blank: Not available

In addition to the above, non-standard documents are available. See OEM Manual details for each image scanner.

Notes:

1) Not defined as standard document on interface specifications.
2) ADF mode only.

Table A-3: Scan Area [dots]

	Max. X[1]	Max. Y[2]	Max. W[1]	Max. L[2, 3]
M3099EH/GH	0 to 3456	0 to 6912	9 to 3456	0 to 6912
M3099EX/GX	0 to 4864	0 to 6912	9 to 4864	0 to 6912
M3099A/G	0 to 4864	0 to 6912	9 to 4864	0 to 6912
M3097E+/G+	0 to 4864	0 to 6912	9 to 4864	0 to 6912
M3097E/G	0 to 4864	0 to 6912	9 to 4864	0 to 6912
M3096NT	0 to 4864	0 to 6912	9 to 4864	0 to 6912
M3096EX/GX	0 to 4864	0 to 6912	9 to 4864	0 to 6912
M3093EX/GX	0 to 3456	0 to 5600	9 to 3456	0 to 5600

Notes:

1) The value of X+W should not beyond the maximum W.
2) The value of Y+L should not beyond the maximum L.
3) The maximum of L can be extended by special settings. See the scanner's OEM manual.
4) The maximum number of SCSI interface scanners is also restricted by the buffer memory size. It must be under 4,063,232 (3E0000H) bytes.

Table A-4: DTC Mode Available Scanning Parameters

Image Composition	Binary	Halftone	Grayscale
Prefilter	Ordinary/ Ball-Point Pen	Ignored	
Gradation	Ordinary/ High Contrast	Ignored	
Dynamic Threshold Curve[1]	0: OCR Dark to 5: OCR Light 6: Light Image 7: Dark Image	Ignored	
Smoothing	OCR[2]/Image	Ignored	
Noise Removal[3]	ON/OFF	Ignored	
2x2	ON/OFF	Ignored	
3x3	ON/OFF	Ignored	
4x4	ON/OFF	Ignored	
5x5	ON/OFF	Ignored	

Notes:

1) In IPC-3, the Dynamic Threshold Curve has the same affect as the eight step Sensitivity settings.
2) When OCR Smoothing is specified, Noise Removal is ignored.
3) Noise Removal is turned ON or OFF, 2x2/3x3/4x4/5x5 dots are valid.

Table A-5: IPC Mode Available Scanning Parameters

Image Composition	Binary	Halftone	Grayscale
Simplified DTC[1, 4]	7 steps	Ignored	
Automatic Separation[2, 4]	ON/OFF[3]		Ignored
Outline[3, 4]	ON/OFF	Ignored	
Image Emphasis[4]	High/Mid/Low		Ignored
Mirror	ON/OFF		Ignored
Black & White Reverse	ON/OFF		
Subwindows	Ignored (IPC-3), Max. 4 (IPC-2) See Table A-6		Ignored

Notes:

1) In IPC-3, an IPC-2-like Simplified DTC operates if Image Emphasis is specified.
2) In IPC-3, Automatic Separation is specified as Simplified DTC or Image Emphasis.
3) In SCSI interface scanners, the effect of Automatic Separation is different in Binary and Halftone. White Level Follower is ON in Binary mode and OFF in Halftone mode.
4) When Outline is specified as Simplified DTC, Automatic Separation and Image Emphasis are disabled.

Table A-6: Available Scanning Parameters in SubWindows (In IPC-3, all parameters are ignored.)

	Binary[1]	Halftone[1]
Subwindow Area X	See Table A-3[2, 3]	
Subwindow Area Y	See Table A-3[2, 3]	
Subwindow Area W	See Table A-3[2, 3]	
Subwindow Area L	See Table A-3[2, 3]	
Simplified DTC	7 steps	Ignored
Automatic Separation	ON/OFF	
Outline	ON/OFF	Ignored
Image Emphasis	High/Mid/Low	
Black & White Reverse	ON/OFF	
Gamma Correction	Soft/Normal/Sharp 8 downloaded	
Halftone Pattern	Ignored	4 patterns, Error Diffusion, 8 downloaded
Overlay Pattern	Ignored	6 patterns, 8 downloaded

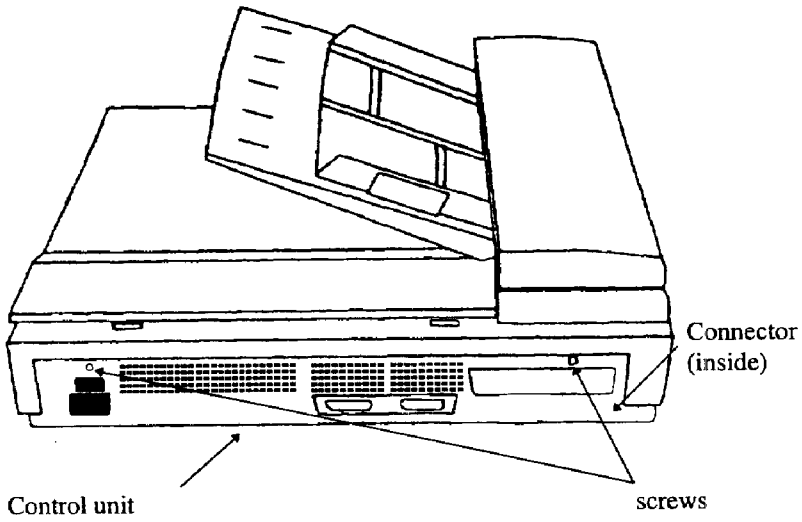
Notes:

1) White Level Follower is the same as the main window's setting.
2) The Subwindow area should fit into the main window.
3) Each Subwindow must not overlap with another horizontally.

Appendix B: Installation

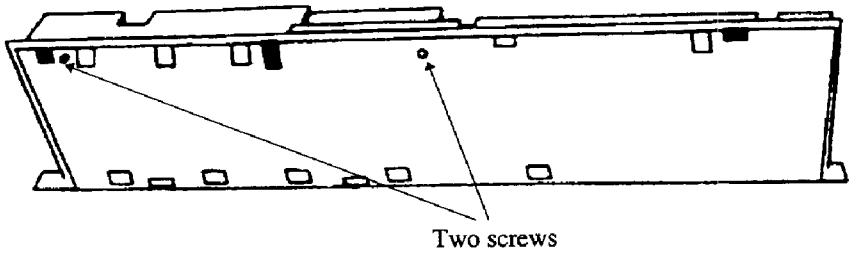
B-1) IPC-3 Installation for M3093EX/GX

1. Verify the scanner power is turned off.
2. Remove the AC and interface cables from the rear of the scanner.
3. Remove the two screws securing the control unit.
4. Pull the control unit out about 2 inches (5cm) and unplug the connector from socket. Then pull out the entire assembly.

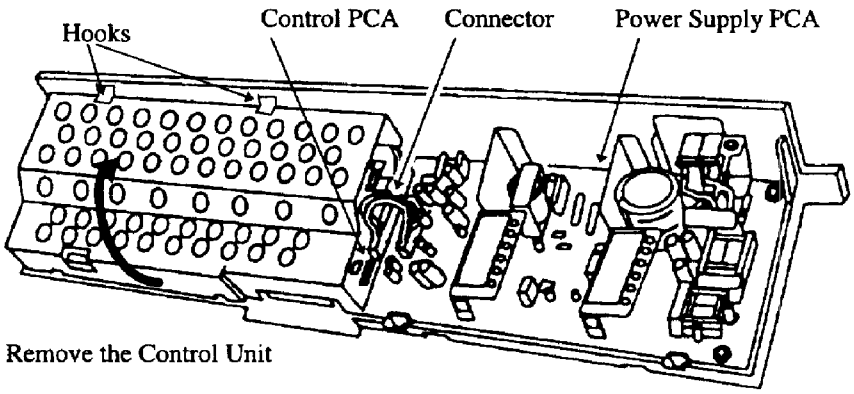


Notes: Figures show the M3093EX

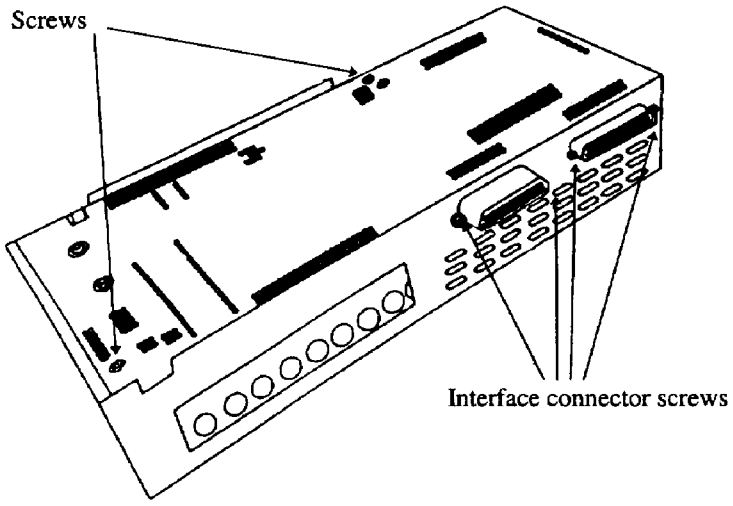
5. Remove the two screws as shown below.



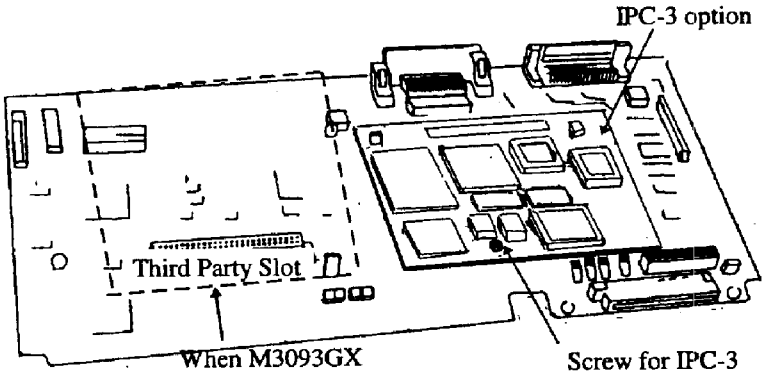
Remove the connector between the control PCA and the Power Supply Unit and remove the Control Unit being careful of the hooks.



7. Remove the four screws which fix the cover to the interface connector and remove the two screws shown as below.



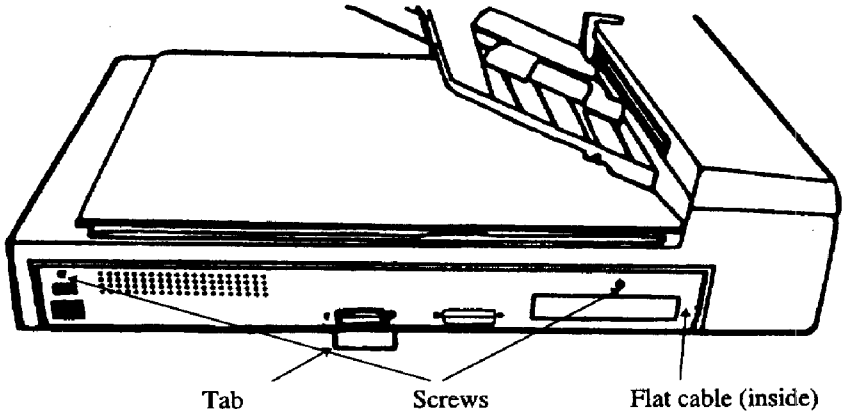
8. Attach the IPC-3 option board to the motherboard connector and secure with the attached screw.
   If the scanner is an M3093GX and a CMP-2 or Memory Board is installed, first remove the board before installing the IPC-3. After installing the IPC-3, reinstall the CMP-2/Memory Board.



9. Attach the Control Unit in the reverse order.

B-2) IPC-3 Installation for M3096EX/GX/NT

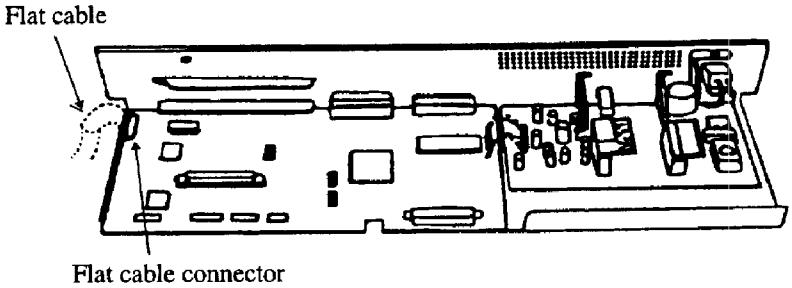
1. Verify the scanner power is turned off.
2. Remove the AC and interface cables from the rear of the scanner.
3. Remove the two screws securing the control unit.



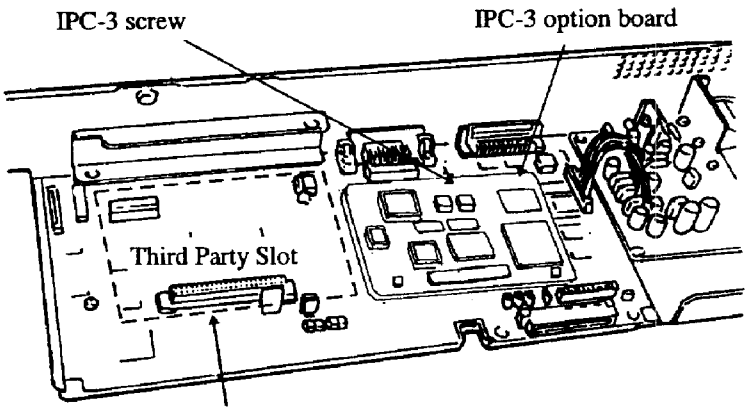
Notes: Figures show the M3096EX

4. Pull the power supply and the PCA assembly out about 2 inches (5cm). Pull on the connector socket to loosen the cable lock. Remove the flat cable from the connector. Then pull out the entire assembly.

CAUTION: Do not pull the flat cable hard, it is easily damaged.



5. Attach the IPC-3 option board to the motherboard connector and secure with the attached screw.

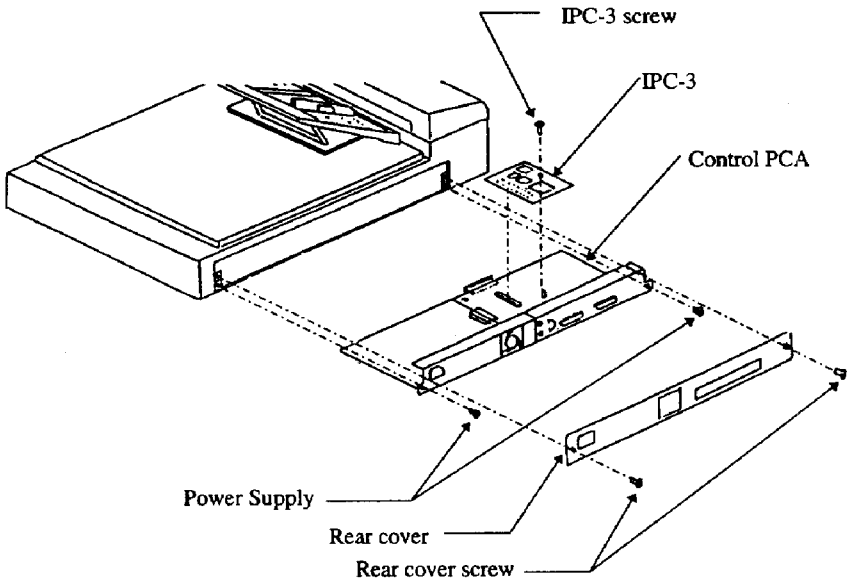


When M3096GX CMP-2 or a memory board is located, here
When M3096NT Network Controller Board is attached, here

6. Attach the control unit in the reverse order of removal.

B-3) IPC-3 Installation for M3097E/G/E+/G+

1. Verify the scanner power is turned off.
2. Remove the AC interface cables from the rear of the scanner.
3. Remove the two rear cover screws and remove the rear cover.
4. Remove the two control unit screws and pull out the control unit
5. Install the IPC-3 to the control unit and secure it with the attached screw.
6. Reinstall the control unit to the scanner and fix with two screws.
7. Attach the rear cover and secure with the two screws.



B-4) IPC-3 Installation for M3099A/G, EX/GX, EH/GH

Please contact Fujitsu Technical Support Engineer, Mr. George Brown, or Fujitsu's authorized technical support/maintenance agency for IPC-3 installation M3099A/G, EX/GX, EH/GH.

Appendix C: Setting

The followings shows scanning parameter setting examples in IPC-3. These parameters are specified in the Graphical User Interface on your personal computer or workstation. The settings and description in the dialog box may differ from the text. If you can't understand the GUI message, please contact your device driver vendor.

Some device driver dialog boxes showing IPC and DTC mode, both setting can be specified. In case of conflicting functions they are ignored by scanner or device driver. If the scanning settings do not operate as expected, please check the image processing combinations described in Appendix A.

In the following settings, Paper Path, Document Size, Scan Area X/Y/W/L, and X/Y Resolution are described, but they are not related to image processing.

Notes :
These settings are optimized for IPC-3. They are not always applicable to IPC-2.

Examples

Item	Setting	Description
1	General Document - 1	General document, Sharpen the Text
2	General Document - 2	General document, Capture Ball-point-pen handwriting
3	General Document - 3 [M3099 Off-line setting-1]	General document, Separate foreground from background
4	General Document - 4 [M3099 Off-line setting-2]	General document, Capture handwriting
5	Form - 1	General Forms
6	Form - 2 [M3099 Off-line setting-3]	General Forms, Background removal
7	Form - 3 [M3099 Off-line setting-4]	NCR Forms, Dropout colored background
8	Text and Photo - 1 [M3099 Off-line setting-5]	Magazines/brochures, Text and photo
9	Text and Photo - 2	Magazines/brochures, Text and photo(Copier Like Output)

C-1) General Document - 1

Condition : General Text
Application : Archive/OCR
Effect : Sharpen the contour of the text edge
Example : General office document/forms/news paper, etc.

	Item	Parameters
	Document Size	A4/Letter (8.5'x11')
	Scan Area X	0 mm/0 inch
	Scan Area Y	0 mm/0 inch
	Scan Area W	210 mm/8.5 inch
	Scan Area L	297 mm/11 inch
	X Resolution[dpi]	300
	Y Resolution[dpi]	300
	Image Output	Black&White
	White Level Follower/Document	ON/Lineart
	Gamma	**Sharp**
	Halftone	Pattern 0 (Ignored)
	IPC/DTC Mode	**IPC**
IPC	Simplified DTC	OFF
	Auto Separation	OFF
	Outline Extract	OFF
	Image Emphasis	**Mid**
	Mirror Image	OFF
	B&W Reverse	OFF
	Subwindows	OFF

Vital Point of Tuning:
Image Emphasis set to 'High', if not clear, set to 'Low' if noisy.
White Level Follower set to 'OFF' if noisy.

C-2) General Documents - 2

Condition : Black and White print or handwriting(Ball-point-pen) text on white paper.
Application : OCR
Effect : Smooth the ball-point-pen stroke for recognition
Example : Word processor output, black and white form, clear copy

	Item	Parameters
	Document Size	A4/Letter (8.5'x11')
	Scan Area X	0 mm/0 inch
	Scan Area Y	0 mm/0 inch
	Scan Area W	210 mm/8.5 inch
	Scan Area L	297 mm/11 inch
	X Resolution[dpi]	300
	Y Resolution[dpi]	300
	Image Output	Black&White
	White Level Follower/Document	**OFF/Photo**
	Gamma	Normal (Ignored)
	Halftone	Pattern 0 (Ignored)
	IPC/DTC Mode	**DTC**
DTC	Filter	**Ball Point Pen**
	Gradation	Ordinary(Ignored)
	Dynamic Threshold	**4**
	Smoothing	Image
	Noise Removal	**ON**
	Noise Removal 2x2	**ON**
	Noise Removal 3x3	OFF
	Noise Removal 4x4	OFF
	Noise Removal 5x5	OFF
	Equal to	White

Vital Point of Tuning:

Dynamic Threshold set to higher if not clear, set to lower if noisy.

C-3) General Documents - 3

Condition : Gray text on gray background
Application : Archive
Effect : Separate foreground text from background
Example : General color document/forms, etc.

	Item	Parameters
	Document Size	A4/Letter (8.5'x11')
	Scan Area X	0 mm/0 inch
	Scan Area Y	0 mm/0 inch
	Scan Area W	210 mm/8.5 inch
	Scan Area L	297 mm/11 inch
	X Resolution[dpi]	300
	Y Resolution[dpi]	300
	Image Output	Black&White
	White Level Follower/Document	**OFF/Photo**
	Gamma	Normal
	Halftone	Pattern 0 (Ignored)
	IPC/DTC Mode	**IPC**
IPC	Simplified DTC	**4 (or 128~159/255)**
	Auto Separation	OFF
	Outline Extract	OFF
	Image Emphasis	OFF
	Mirror Image	OFF
	B&W Reverse	OFF
	Subwindows	OFF

Vital Point of Tuning:

Simplified DTC set to higher if not clear, set to lower if noisy.

Image Emphasis set to 'High' if not clear, set to 'Low' if noisy.

C-4) General Document - 4

Condition : Black and White print or handwritten text on white paper.
Application : OCR
Effect : Increase resolution, capture details
Example : Clear copy, Fine Text

	Item	Parameters
	Document Size	A4/Letter (8.5'x11')
	Scan Area X	0 mm/0 inch
	Scan Area Y	0 mm/0 inch
	Scan Area W	210 mm/8.5 inch
	Scan Area L	297 mm/11 inch
	X Resolution[dpi]	300
	Y Resolution[dpi]	300
	Image Output	Black&White
	White Level Follower/Document	**OFF/Photo**
	Gamma	Sharp
	Halftone	Pattern 0 (Ignored)
	IPC/DTC Mode	**IPC**
IPC	Simplified DTC	**4 (or 128~159/255)**
	Auto Separation	OFF
	Outline Extract	OFF
	Image Emphasis	Low
	Mirror Image	OFF
	B&W Reverse	OFF
	Subwindows	OFF

Vital Point of Tuning:

Simplified DTC set to higher if not clear, set to lower if noisy.

Image Emphasis set to 'High' if not clear, set to 'Low' if noisy.

C-5) Form - 1

Condition : Black print or handwritten text on colored paper.
Application : Archive/OCR
Effect : Capture light text with Noise Removal
Example : Color form, text on white background

	Item	Parameters
	Document Size	A4/Letter (8.5''x11'')
	Scan Area X	0 mm/0 inch
	Scan Area Y	0 mm/0 inch
	Scan Area W	210 mm/8.5 inch
	Scan Area L	297 mm/11 inch
	X Resolution[dpi]	300
	Y Resolution[dpi]	300
	Image Output	Black&White
	White Level Follower/Document	**OFF/Photo**
	Gamma	Normal
	Halftone	Pattern 0 (Ignored)
	IPC/DTC Mode	DTC
DTC	Filter	Ordinary
	Gradation	Ordinary (Ignored)
	Dynamic Threshold	**6**
	Smoothing	Image
	Noise Removal	**ON**
	Noise Removal 2x2	**ON**
	Noise Removal 3x3	OFF
	Noise Removal 4x4	OFF
	Noise Removal 5x5	**ON**
	Equal to	White

Vital Point of Tuning:

Dynamic Threshold set to higher if not clear, set to lower if noisy.

Noise Removal 5x5, 4x4 set to remove large size noise, 3x3, 2x2 set to remove small size noise. If details are lost, turn OFF from large Noise Removal.

C-6) Form - 2

Condition : Light text on gray background
Application : Archive
Effect : Capture light text with background dropout
Example : Color Form, Carbon Copy

	Item	Parameters
	Document Size	A4/Letter (8.5'x11')
	Scan Area X	0 mm/0 inch
	Scan Area Y	0 mm/0 inch
	Scan Area W	210 mm/8.5 inch
	Scan Area L	297 mm/11 inch
	X Resolution[dpi]	300
	Y Resolution[dpi]	300
	Image Output	Black&White
	White Level Follower/Document	**OFF/Photo**
	Gamma	**Sharp**
	Halftone	Pattern 0 (Ignored)
	IPC/DTC Mode	**IPC**
IPC	Simplified DTC	**6 (or 192~223/255)**
	Auto Separation	OFF
	Outline Extract	OFF
	Image Emphasis	**Smooth**
	Mirror Image	OFF
	B&W Reverse	OFF
	Subwindows	OFF

Vital Point of Tuning:

Simplified DTC set to higher if not clear, set to lower if noisy.

Gamma set to 'Normal' or 'Soft', if still noisy.

C-7) Form - 3

Condition : NCR Forms, or Color Background Form
Application : OCR/Archive
Effect : Dropout color background on NCR Form
Example : NCR Form, Text on Color background

	Item	Parameters
	Document Size	A4/Letter (8.5'x11')
	Scan Area X	0 mm/0 inch
	Scan Area Y	0 mm/0 inch
	Scan Area W	210 mm/8.5 inch
	Scan Area L	297 mm/11 inch
	X Resolution[dpi]	300
	Y Resolution[dpi]	300
	Image Output	Black&White
	White Level Follower/Document	**OFF/Photo**
	Gamma	Normal
	Halftone	Pattern 0 (Ignored)
	IPC/DTC Mode	**IPC**
IPC	Simplified DTC	**2 (or 64~95/255)**
	Auto Separation	OFF
	Outline Extract	OFF
	Image Emphasis	**Smooth**
	Mirror Image	OFF
	B&W Reverse	OFF
	Subwindows	OFF

Vital Point of Tuning:

Dynamic Threshold set to higher if not clear, set to lower if noisy.

If foreground/background is not sepated, Dynamic Threshold set to 'OFF' and adjust Threshold around 32~64/255.

C-8) Text and Photo - 1

Condition : Text and Photo (Grayscale photo)
Application : Archive
Effect : Halftoning photo part and binarizing text part
Example : Magazine/Brochure

	Item	Parameters
	Document Size	A4/Letter (8.5'x11')
	Scan Area X	0 mm/0 inch
	Scan Area Y	0 mm/0 inch
	Scan Area W	210 mm/8.5 inch
	Scan Area L	297 mm/11 inch
	X Resolution[dpi]	300
	Y Resolution[dpi]	300
	Image Output	Black&White
	White Level Follower/Document	**OFF/Photo**
	Gamma	**Sharp**
	Halftone	Pattern 0
	IPC/DTC Mode	**IPC**
IPC	Simplified DTC	OFF
	Auto Separation	**ON**
	Outline Extract	OFF
	Image Emphasis	OFF
	Mirror Image	OFF
	B&W Reverse	OFF
	Subwindows	OFF

Vital Point of Tuning:

Halftone pattern 0 or 2 should be selected for better photo. 1 or 3 should be selected for better text.

C-9) Text and Photo - 2

Condition : Text and Photo (Dithered photo)
Application : Copy/Printout
Effect : Capture text inside photo
Example : Magazine/Brochure (Copier like output), News Paper

	Item	Parameters
	Document Size	A4/Letter (8.5'x11')
	Scan Area X	0 mm/0 inch
	Scan Area Y	0 mm/0 inch
	Scan Area W	210 mm/8.5 inch
	Scan Area L	297 mm/11 inch
	X Resolution[dpi]	400
	Y Resolution[dpi]	400
	Image Output	Black&White
	White Level Follower/Document	**OFF/Photo**
	Gamma	**Sharp**
	Halftone	Pattern 0
	IPC/DTC Mode	**DTC**
DTC	Filter	Ordinary
	Gradation	Ordinary (Ignored)
	Dynamic Threshold	**7**
	Smoothing	**OCR**
	Noise Removal	**ON**
	Noise Removal 2x2	**ON**
	Noise Removal 3x3	**ON**
	Noise Removal 4x4	**ON**
	Noise Removal 5x5	**ON**
	Equal to	White

Vital Point of Tuning:

Dynamic Threshold set to lower if noisy.

Noise Removal 5x5, 4x4 set to remove large size noise, 3x3, 2x2 set to remove small size noise. If details are lost, turn OFF from large Noise Removal.

Resolution set to lower if large noises are not removed.

Appendix D: For Device Driver Developers

This Appendix describes how to discriminate IPC-2/3 from RS232C+Video Interface and SCSI interface. The IPC-3 is plug compatible to IPC-2 therefore Image Scanner identifies IPC-3 as IPC-2, if any modification is not made. This plug compatibility brings advantage to IPC-3 because IPC-3 image processing functions are available from existing IPC-2 supporting device drivers.

However, IPC-3 has some incompatibility to IPC-2, for example, SubWindow is not supported, OCR Smoothing does not operate when Noise Removal is specified, SDTC/Image Emphasis are ignored when specified with Automatic Separation, etc.

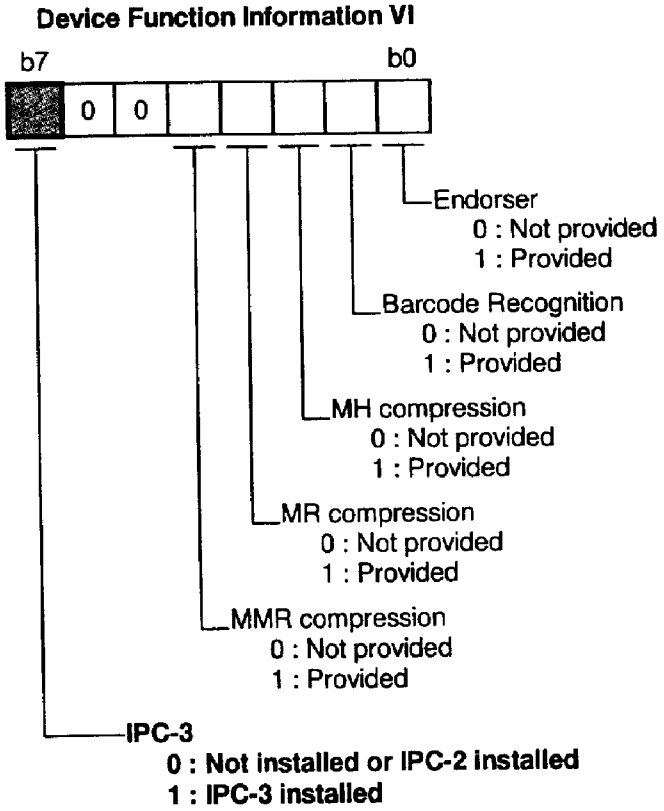
For better user friendly interface, IPC-3 special Graphical User Interface should be supported by Device Drivers. This documentation describes how to discriminate IPC-2 and IPC-3 from Device Driver or RS232C+Video/SCSI Interface.

D-1. Scanner firmware detects IPC-2 or IPC-3

If the scanner firmware is updated to detect IPC-2 or IPC-3, Device Drivers can obtain information from Interface command/response.
Firmware modification proposed for M3099 video scanners.
This is the definition of the register that is returned from the main board to the driver.

a) RS232C+VIDEO Interface.

When the scanner interface is RS232C+VIDEO, this information is returned to Device Function Information VI - bit 7, as UNIT STATUS response to INQUIRY command.



b) SCSI Interface

When the scanner interface is SCSI, the information is returned to Extended Vital Product Data - Byte 89 bit 5 for Inquiry command.
This section describes the firmware modification in terms of the M3099 SCSI scanners. This describes what the main board sends to the driver over SCSI to determine IPC-2 vs. IPC-3.

Caution: In Product Identifier both IPC-2 and 3 returns 'i'. The lower case character indicates IPC option is installed.

Standard VPD Extended Format

Bit / Byte	7	6	5	4	3	2	1	0
30	Reserved							
31	Reserved							
32	(MSB)	Physical Function						
33								(LSB)
34	(MSB)	Buffering Capability						
37								(LSB)
38	(MSB)	Implemented Standard Command						
41								(LSB)
42		Implemented Vendor Specific Command						
49								
50		Implemented Vendor Unique Parameter						
81								
82		Image Control Function						
87								
88		**Image Processing Function**						
89								
90		Compression Function						
91								
92		Endorser Function						
93								
94		Barcode Function						
97								
98		Reserved						
99								

Image Processing Function

Byte	Bit	Description
88	1xxxxxxxb	Reverse Image Format
	x1xxxxxxb	Dynamic Threshold Circuit
	xx1xxxxxb	Simplified DTC
	xxx1xxxxb	Outline Extract
	xxxx1xxxb	Image Emphasis
	xxxxx1xxb	Automatic Separation
	xxxxxx1xb	Mirror Image
	xxxxxxx1b	White Level Follower
89	1xxxxxxxb	SubWindow
	x1xxxxxxb	Error Diffusion
	xx1xxxxxb	**IPC-3 Function**
	xxx1xxxxb	Reserved
	xxxx1xxxb	Reserved
	xxxxx1xxb	Reserved
	xxxxxx1xb	Reserved
	xxxxxxx1b	Reserved

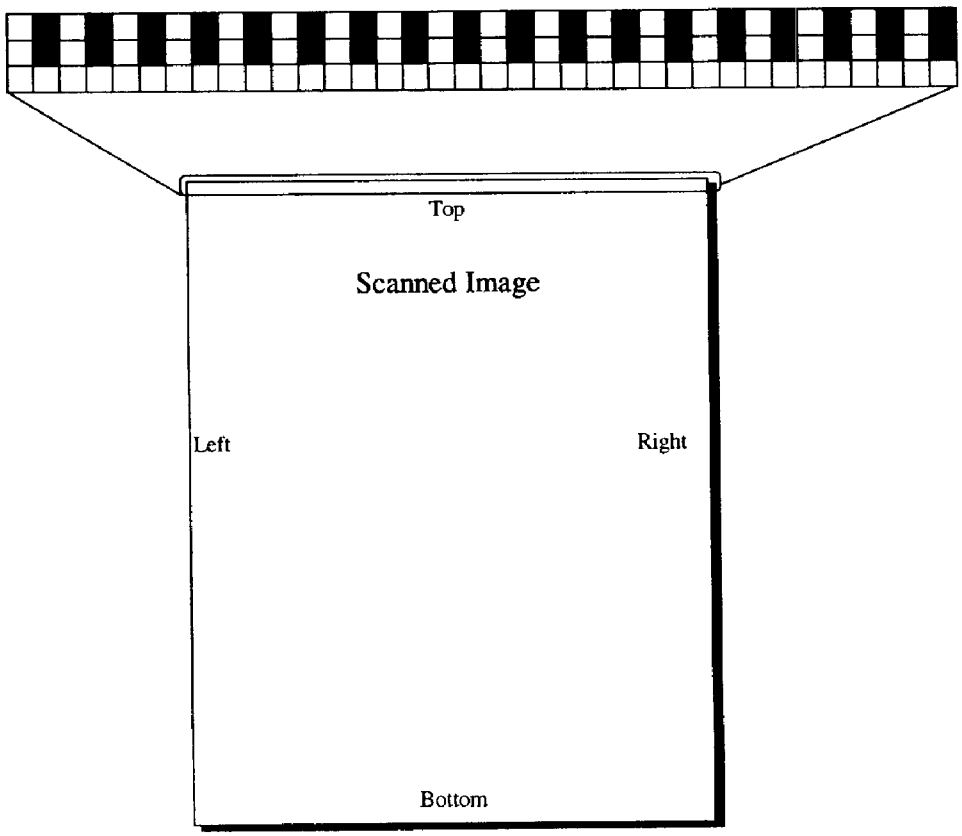
Turned off when 'IPC-3 Function' bit is set

This is additional information for the driver developer to turn off sub Window selections when an IPC-3 is detected. This is not directly related to the discrimination of IPC-2 vs. IPC-3 but an addition that could be done while modifying the driver.

D-2. Scanner firmware does not detect IPC-2 or IPC-3

When IPC-3 is installed into image scanners those can not detect IPC-3, there is no way to discriminate from Interface.
For such case, IPC-3 provides another path to identify the IPC-3. When both 'Outline' and 'Mirror' is specified, IPC-3 produces Black and White alternative pattern on the top of the image. By recognizing this pattern, device driver/application software can identify IPC-3.

CAUTION:
This method is recommended in the M3093/96/and 97 in Flatbed mode. In case of, ADF mode/M3099, it needs to ask user to set a paper for this scanning.



Register Settings :

Image X	= don't care
Image Y	= don't care
Image width	= don't care
Image Length	= Greater than 12 lines
Resolution	= 100 dpi or higher, 300 dpi preferred for recognition.
Outline	= ON
Mirror	= ON

The IPC-3 upon receiving these settings will always respond with a known pattern in the first two lines of the scanned image that is sent back to the driver. The pattern sent back is alternating black and white pixels. A Black pixel indicates a binary '1' and a white pixel a binary '0'.

This pattern will be repeated for all pixels on the first two lines. The driver then does a simple pattern match to identify that IPC-3 is installed. If an error code indicating that the option is not present is received or the image data does not match the above pattern on any pixel boundary in the first two lines, then an IPC-3 is not installed. This process only needs to be done once upon the installation of the driver and after installation during the sequence of selecting a new scanner. From that point on, the driver is expected to "remember" the IPC configuration of the scanner it is talking to.

NOTE:

Due to internal pipeline delays the scanner main board may shift pixels left or right or may drop a line at the top. Also there is a one line uncertainty in the output of the IPC3 card. Therefore in order to decide that an IPC3 card is installed, as a minimum the driver will have to look for a pattern match in at least the first 64 pixels of the first line received and, furthermore, no byte boundary alignment can be assumed.