

USB Digital Scale User's Guidebook

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Chapter 1 Introduction

We greatly thank you for your purchase of USB Digital Scale.

It is run in Microsoft Windows 95, 98 ,Me,or Windows NT(Ver. 4),2000. USB Digital Scale is the software exclusively developed for the purpose of image analysis and measurement. It is designed for easy quantitative measurement and length measurement by extracting infinitesimal sample with its rich functions such as image processing to image files captured by digital cameras or scanners. By using rich functions furnished in this USB Digital Scale, satisfactory results will be obtained even for the beginner who has not much experiences or technological knowledge about the image analysis to the expert.

Prior to using USB Digital Scale, it is required for you to familiarize with the way of using or operation manner of the PC and Microsoft Windows 95 / 98 /Me/ NT/2000 as well. The beginners for Windows 95 / 98 / Me / NT / 2000 are requested to read carefully the accompanied user's guidebook and accustomed to how to use the mouse, standard menu, or command, the way of opening, closing, or saving, etc..

1. About the User's Guidebook

「USB Digital Scale User's Guidebook」 provides instructions of tools and commands of USB Digital Scale in detail. You can use this as a reference in your daily operation.

First of all, install the USB Digital Scale to your PC following the instructions in Chapter 2. How to Install USB Digital Scale. Outline of this guidebook is as follows.

- Chapter 2. How to Install USB Digital Scale provides instructions for installing USB Digital Scale and the basic concept required for operating USB Digital Scale.
- Chapter 3. Basic Operation provides the operation instructions or processes required for using USB Digital Scale.
- Each of the following chapters provides instructions for operating each of the menu choices.
- Appendix comprises the specifications of capture board, literature cited, etc.

2. Inquiry to the Company

The Company proudly ships USB Digital Scale in secured packaging. If there is a defect in your copy of USB Digital Scale caused by shipping. We will replace it after receiving your written request, including explanation of defect.

Additionally, if you have any trouble in operating USB Digital Scale, please fax or mail a completed Inquiry Sheet, found on the page before this guidebook.

To receive a response, be sure to complete the entire inquiry sheet.

①Attention

SCALAR Corporation.

USB Digital Scale User Support Sec.

3-28-6, Yoyogi Shibuya-ku, TOKYO 151-0053 JAPAN

FAX 81-3-3378-6066

②The following items must be filled in to receive.

- (1)User's name, section, company name, address with ZIP code, phone and fax numbers.**
- (2)Version information and serial number of USB Digital Scale**
- (3) Your system configuration.**
- (4) Name, model, and memory size of your PC and HDD, and the resolution of your monitor.**
- (5) Your OS (Operation System) and its version information.**
- (6) Required message from you. Please be as specific as possible, using as many terms from this guidebook as possible.**

The above information is needed for us to reproduce the reported trouble.

Please include the exact operational procedures you followed until the trouble appeared.

Your data file in FD or MO related to the trouble is very helpful.

Be advised that any trouble caused by your own misuse of application, operation, or maintenance is out of our supporting range.

3. Package Contents

Confirm the contents of package, as follows.

① CD-ROM

CD-ROM for installation : one disk

② User Manual

USB Digital Scale User's Guidebook : one copy

③ Others

User Registration Sheet : one sheet

If you find any shortage, contact our Image Factory User Support Section for a replacement.

4. User Registration

Our technical support and information updates are helpful now and in the future for all USB Digital Scale users.

We restrict support and updates to those users who complete and return the attached User Registration Sheet.

5. Required System Configuration

In order to run USB Digital Scale, the following hardware and software is required:

① PC equipped with CPU driven by Intel i 486DX or more or Intel's Pentium or more, HDD with empty memory size in 15 Mbytes or more, and RAM for application with memory size 16 Mbytes or more (32 Mbytes recommended).

② Japanese version Microsoft Windows 95 / 98 or Japanese version Microsoft Windows NT Workstation

③ Color monitor with screen resolution in 640×480 pixels or more, and color level in 16 bit high color or higher. When you use with 256 colors or less, the grayscale image may involve some deterioration.

④ Pointing device such as a mouse.

Chapter 2 How to Install USBDigital Scale

1. Install USBDigital Scale

Before you install USBDigital Scale, confirm that Windows is already installed on PC. You should become familiar with the basic operation of Windows prior to your work on USBDigital Scale. As to the details for the way of use and the descriptions of Windows, refer to the User's Manual or On-line Help of Windows.

First of all, make a backup copy of Program Disk. For making copy, see the User's Manual attached to Windows.

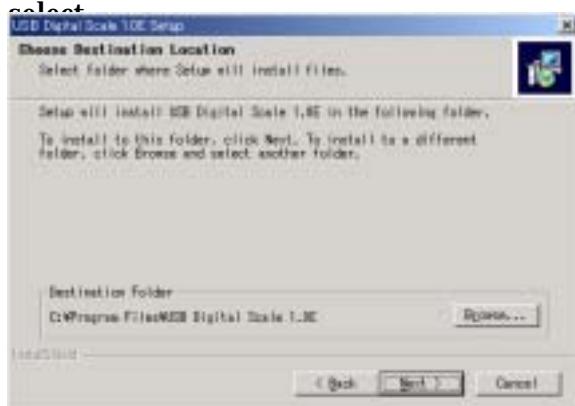
How to install USBDigital Scale :

- ① Turn the PC power on and start Windows.
- ② If you use Windows NT Workstation, you have to log in with user name "Administrator". If you are required to set up Password or other fields, ask your system administrator.



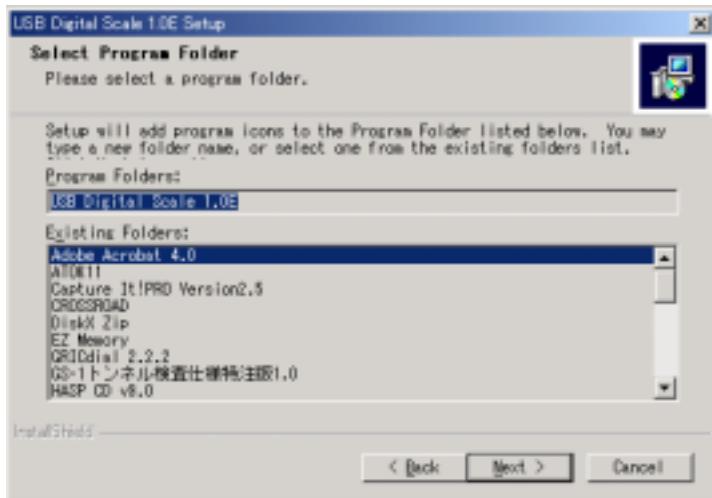
③ When you set the CD-ROM to your PC, the installation starts automatically. As the dialog box "Well come to USBDigital Scale Setup" appears, push the button "Next".

- ④ The dialog box asking the directory to install appears. In default value, it is to be setup at "¥Program files¥USBDigital Scale 1.0J" folder. If you do not change it,

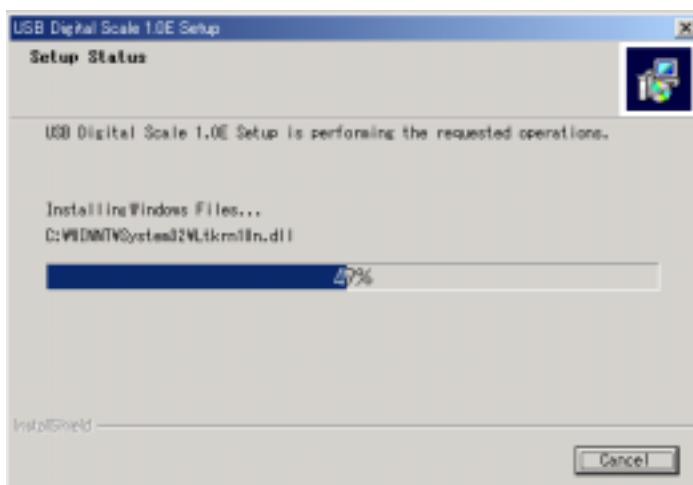


select the "Next" button. When you change the place to install, select the "Reference" button. The dialog box for the selection of the folder appears. Then, specify the folder to install.

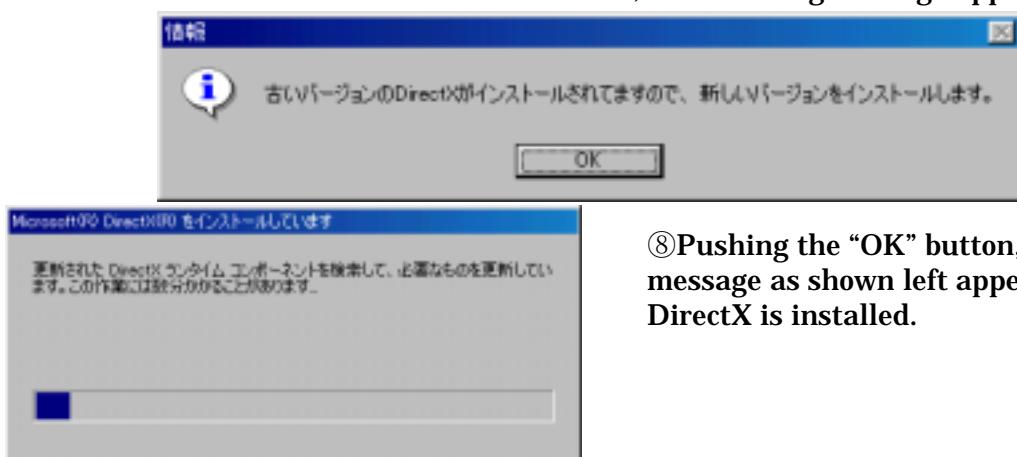
- ⑤ Next, the screen to select the Program folder to install appears. If it is not particularly necessary to specify, select the "Next" button.



⑥ Installation starts and the following dialog appears.

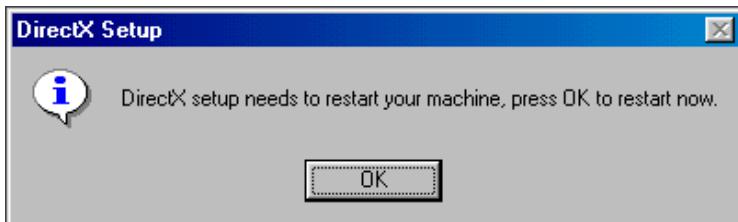


⑦ As USBDigital Scale uses the Microsoft Corp.'s DirectX service, if your PC is not installed with the same version or later one, the following message appears.

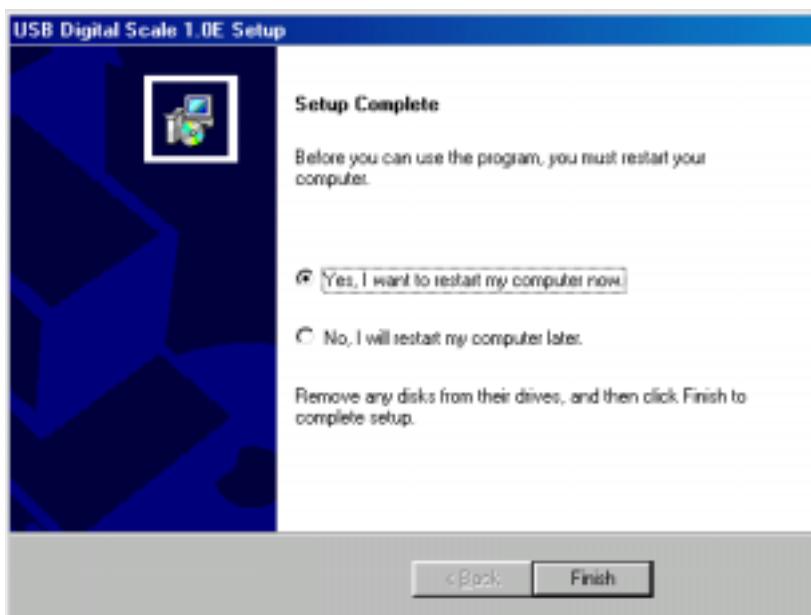


⑧ Pushing the “OK” button, the message as shown left appears and the DirectX is installed.

⑨When the installation of DirectX is finished, the following message appears. Then, click the “OK” button. In case that DirectX is installed, restarting of Windows is necessitated.



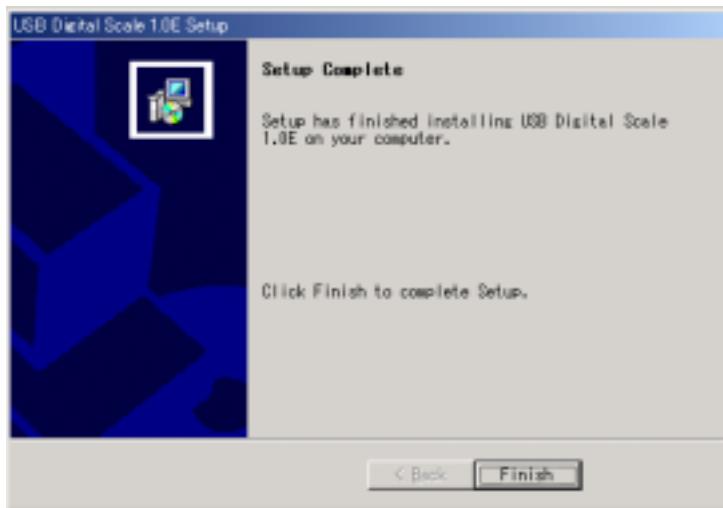
⑩Finally, the dialog box of the Setup completion appears. Confirm the message and select to restart now or not and push the “Completion” button. When you select the restarting, it restarts automatically, but if not, the installation program ceases. In this case, be sure to restart before the use of USBDigital Scale.



⑪At the stage of ⑦, if your PC has already been installed with DirectX or later version, the following dialog appears and the installation of DirectX is not done.



⑫When you select “OK” button, the following dialog box, Setup Completion, appears. If you do not install DirectX, as it is not necessary to restart there is no item to select restart. Select the “Completion” button.



⑬When the installation finishes, the execution program of USBDigital Scale is registered at the “USBDigital Scale” program folder.

⑭If your PC is connected with SCALAR USB Microscope and its driver is installed normally, but not installed with DirectX, USBDigital Scale start directory. However, if you install DirectX, USBDigital Scale only starts after when you restart the PC. “USBDigital Scale” menu is created in the “Program” at the “Start” menu. By selecting it, “USBDigital Scale” starts. As to the method of connecting SCALAR USB Microscope or installing its driver, refer to the Manual of SCALAR USB Microscope.

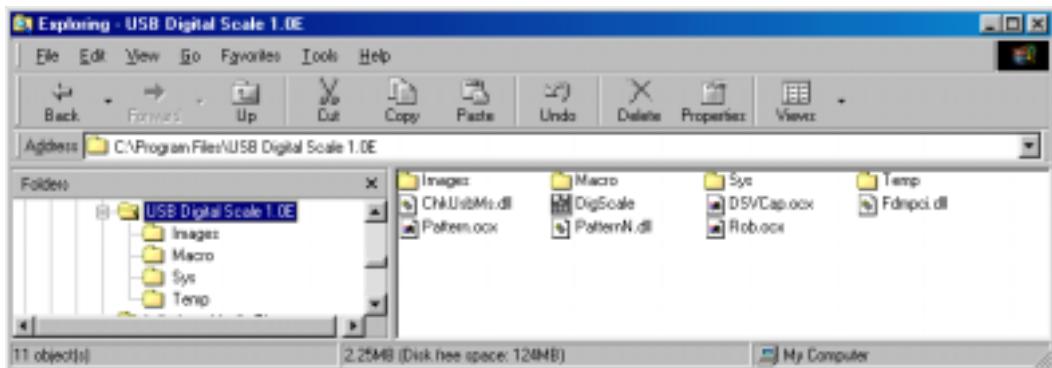
⑮When you operate USBDigital Scale, it is indispensable to connect SCALAR USB Microscope. Therefore, be sure to keep the state of its connection.

⑯When the installation is completed, the folder “USBDigital Scale 1.0J” is created at the specified folder and the folders “¥images”, “¥macro”, “¥sys”, “¥temp” are created.

In the “¥images” folder, two “tif” files as a image sample and twenty-one “jpg” files are create.

⑯ In the “Macro” folder, three calibration files which correspond to the sample image, nineteen macro files, and one distortion correction data is created. The macro file does not generate three picture files, “Back_gr, Noize, and Tip_many”.

In Appendix B, the detail explanations about Sample picture and Sample Macro are described. Opening the respective picture file, try calibration and sample macro. By executing the Step Performance or confirming the output data or measurement points at the geometrical measurement, you can confirm the contents of the macro file.



2. Re-install USBDigital Scale

In case of re-installing USBDigital Scale for the reason of its version-up, etc., delete the existing USBDigital Scale by using uninstaller which was installed at the time of existing program installation or Setup or Delete of Program icon at the Control Panel. When deleting, the dialog, do you delete the common files, appears, then select all not. After that, re-install. The manner of the installation is same as the first one.

3. Abbreviated explanation

The meanings of the command of the each menu are provided in Chapter 4.. When the command has the following function, the following abbreviated explanation is attached at the caption of such command.

Abbreviated explanation

Meaning

Macro possible : The command which can be incorporated in the Macro.

Area possible : The command which is effective only in the area specified.

4. Introduction of USB Digital Scale

USB Digital Scale is the Analysis and Measurement Software which ,by using digital image of the picture, enables many kinds of utilities such as image analysis, length measurement, infinitesimal sample extraction, product quality examination.

USB Digital Scale is designed to facilitate the aiming process or measurement in a short time making best use of graphical user interface which is furnished in Microsoft Windows 95 / 98. Moreover, USB Digital Scale provides rich technical functions for even the expert user in many kind of fields such as R/D.

Since the extracted or measured data can be sent directly to Microsoft Excel and the image data can also be easily pasted on Microsoft Word, it is very useful for preparing the report.

Through its abundant image processing technology, USB Digital Scale fully utilizes the information of the image. The file types of the image correspond to 21 types. Almost all images captured by digital cameras, scanners, or video cameras can be processed and printed. And by using SCALAR USB Microscope, you can take in the still image with 640×480 pixels of 24 bits full color from SCALAR USB Microscope, confirming the moving image.

USB Digital Scale provides mature image processing functions such as cut, paste, rotate, transform, reverse, resize, etc. and also is possible to draw line, diagram, character, etc. And it also has a functions to paste two images accurately and to correct the lens distortion.

It allows for the fine adjustment functions of image for contract,gamma, color balance, or brightness and fine adjustment by three primary colors is also possible. For the full color image, detail color composition examination such as analysis by 5 colors, conversion of color resolution, color distribution, color histogram, etc. can also be performable.

For the image processing, 23 kinds of space filter for image quality improvement and feature emphasis are prepared. Each of the filters enables the alternation of the kernel dimension or setup of the direction and also the user can create own filter. Moreover, the high-speed Fourier transformation or reverse- transformation for improving the image quality at a frequency range are available. And rich operation functions such as image comparison, masking process, etc. are provided, and the extraction and correction of the brightness of the background other than the object or averaging the intensity distribution are also possible.

It has the color extraction function with which you can extract the object from the image by specifying the multiple colors. In case of Fixed Threshold Binarization, you can select the display colors by dividing the intensity value into five grades, and in case of Adaptive Binarization, you can get the clear object at the indistinguishable image. Displaying intensity histogram, you can level the intensity value of whole image and obtain a clear image from extremely bright or dark image. The Shape Analysis of the Binarized image provide you with many functions such as Dilation, Erosion, Outline Skeleton,, Separation, etc.of the image.

As a utmost feature of USB Digital Scale,it has the excellent measurement function. With this function, you can easily calibrate the measurement unit for a image in a graphical manner. You can easily measure the features of 34 types from the object shape and with its infinitesimal sample you can extract and count the objects, and send its data to the table calculation software.

Also, by assigning random places and numbers of points at the gray scale image or binarized image, you can easily conduct geometric measurement such as width, height, angle, distance between the center of circles, pitch measurement between the lines, etc. And once you teach the measurement point on one object, it searches the same shape object on another image and measures as same after correcting the angle. As the measurement is possible on the multiple objects, almost all measurement done by projector or microscope so far is replaceable by this system, and you can simply measure the length, area, perimeter, etc.

As one of the featuring functions of USB Digital Scale, there is a mighty Macro function. After selecting Macro Register command, if you performs the aforesaid functions such as extraction of the features, color analysis or measurement of the shape, the Macro File is automatically prepared.On the Micro File, you can choose the manner to perform the file continuously to the end or partially checking and modifying the contents of setup. Therefore, the Macro File once made becomes a effective sample for the other image. Of course the Macro is possible to save or read.

USB Digital Scale is the OLE Server that opens the Object for the other several applications. Therefore, some objects from USB Digital Scale can be operated through the other Visual Basic applications.

Chapter 3. Basic Operation

If you are new to USB Digital Scale, it is recommended that you become familiar with application structure, basic terms, and operation by following the instructions in this chapter.

1. Scroll Bar

By dragging the scroll box up or down, or right or left, you can pull into view different image areas. Such action is called “Scroll of the window.”



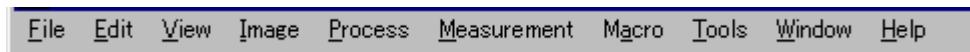
2. Title Bar

This is positioned at the complete top of the window. “USB Digital Scale” is usually displayed here and, if some image view is maximized, its file name is displayed here. By dragging the title bar, you can move the window view. The window view can be minimized and stored temporarily on the task bar as a running program or file, maximized to a view in full screen, or closed by clicking an appropriate icon located at the right end of title bar.



3. Menu Bar

This is positioned beneath the Title Bar and shows menus. By clicking a menu, its menu list is pulled down, filled by commands to access various functions of USB Digital Scale.



4. Window View

The wide area with a dark background is called Window View. Opened image files are displayed within this view. Multiple images can also be displayed simultaneously within this view.

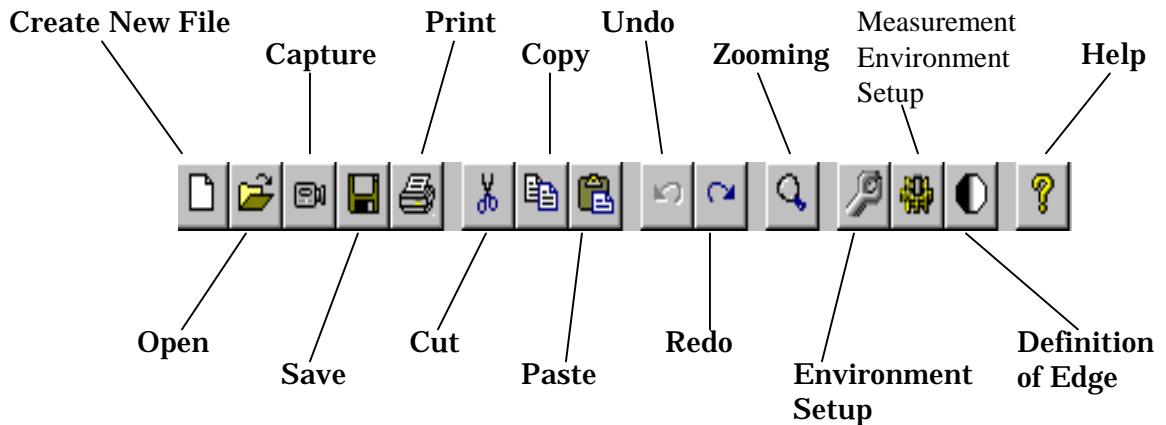
5. Status Bar

This is positioned at the bottom of the Window View and shows information for a selected object or operation, image size, color resolution, magnification ratio, zooming, file size, etc.



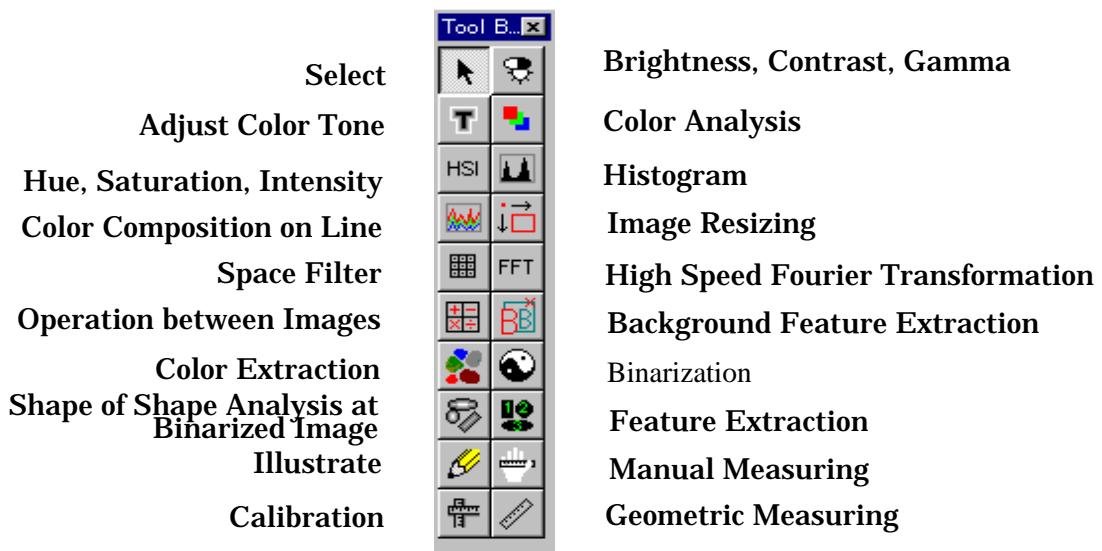
6. Toolbar

By clicking a menu on the Toolbar, you can promptly access frequently-used functions. You can also access the same function by clicking a menu on the menu bar.



7. Tool Box

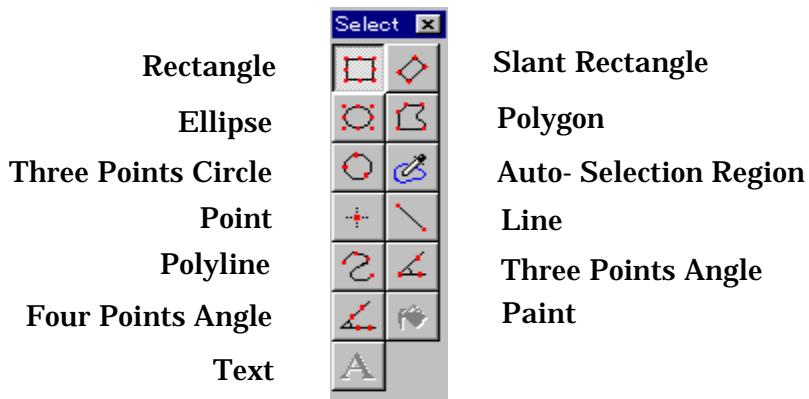
By clicking a menu on the Tool Box, you can promptly access frequently-used functions. You can also access the same function by clicking a menu on the menu bar. The shape or position of Tool Box can be changed freely by dragging.



8. Edit Drawing Toolbox (Select box)

Any of the icons on the Toolbox provides you with active commands, such as selecting the area or method of manual measuring, zooming, drawing method,etc. The shape or position of Toolbox can be changed freely by dragging.

Since you can adjust or resize the image by scroll bar or zooming button in the middle of selecting area or method of manual measuring, you can conduct accurate pointing or measurement. The method of selection is different depending on each button, but when you cancel the selection, right click the mouse on the image after selecting the area. Canceling only by right click enables you to select another area. The area once selected can be relocated or resized by dragging. By dragging with left button on the area, you can relocate it at your option. When resizing, drag the ■ mark on the edge of the area selected.



① Rectangle button

Only when you are selecting the Select, Illustrate, or Manual Measuring on the Tool Box mentioned above, this tool is effective. This tool allows for drawing rectangle shape. Pressing this button, the first point you left click on the image is the start point of selecting area and the second point left clicked becomes the diagonal point of the area.

② Slant Rectangle Button

Only when you are selecting the Select, Illustrate, or Manual Measuring on the Tool Box mentioned above, this tool is effective. By selecting this tool, you can draw inclining rectangle at your option. The first point you left click on the image is the start of first side of the selecting rectangular area and the second point left clicked becomes the end of the said side, and dragging mouse draws the parallel line to the side drawn first and next left click allows for the decision of area.

③ Ellipse button

Only when you are selecting the Select, Illustrate, or Manual Measuring on the Tool Box mentioned above, this tool is effective. The area you select constitutes oval or circle shape. The manner of the operation is same as the Rectangular Area. In case you select the circle, pressing the Shift key move the cursor.

④ Polygon button

Only when you are selecting the Select, Illustrate, or Manual Measuring on the Tool Box mentioned above, this tool is effective. You can select the area of the polygonal shape. By repeating the left clicks and moving the cursor on the image, you can select the polygonal area. The final right click connect the point to the starting point.

⑤ Three Points Circle button

Only when you are selecting the Select, Illustrate, or Manual Measuring on the Tool Box mentioned above, this tool is effective.

As same manner as selecting circle, you can select the circular area by left clicking the three points on the circumference line.

⑥ Auto-Selection Region button

Only when you are selecting the Select or Manual Measuring on the Tool Box mentioned above, this tool is effective. Selecting this tool, you can select the area which has same color of intensity value as the point left clicked on the image has. The color which is deemed same color varies within the value specified at Color Tolerance on the Process tab in the System Setup command of the Tool menu.

⑦ Point button

Only when you are selecting Manual Measuring on the Tool Box mentioned above, this tool is effective. In case you count manually, usi this tool.

⑧ Line button

Only when you are selecting Illustrate, or Manual Measuring on the Tool Box mentioned above, this tool is effective. The first point left clicked is the start of the straight line and second point left clicked becomes the end of it.

⑨ Polyline button

Only when you are selecting Illustrate, or Manual Measuring on the Tool Box mentioned above, this tool is effective. The point left clicked first is the starting point of the multi angled line and the second point so left clicked become the second angle point and the final point right clicked is connected to the starting point.

⑩ Three Points Angle button

Only when you are selecting Manual Measuring on the Tool Box mentioned above, this tool is effective. Appointing three points of the angle by this tool, you can measure the angle degree.

⑪ Four Points Angle button

Only when you are selecting Manual Measuring on the Tool Box mentioned above, this tool is effective. Appointing four points of the angle by this tool, you can measure the angle degree.

⑫ Paint button

Only when you are selecting Illustrate on the Tool Box mentioned above, this tool is effective. You can paint wholly with this tool.

⑬ Text button

Only when you are selecting Illustrate on the Tool Box mentioned above, this tool is effective. You can draw letters by this tool.

9. Information about Cursor

The information about the Cursor is indicated at two text boxes to the right of the Tool Bar.



Left box indicates the position of the cursor on the image by the number of pixels from the reference point for X , Y coordinates position. Right box indicates the size of the area you select by the number of pixels for X, Y coordinates position.

10. Window View

The wide area with a dark background is called Window View. Opened image files are displayed within this view. Multiple images can also be displayed simultaneously within this view.

11. Image Title Bar

Image File Title appears on the title bar at the top of Window View.



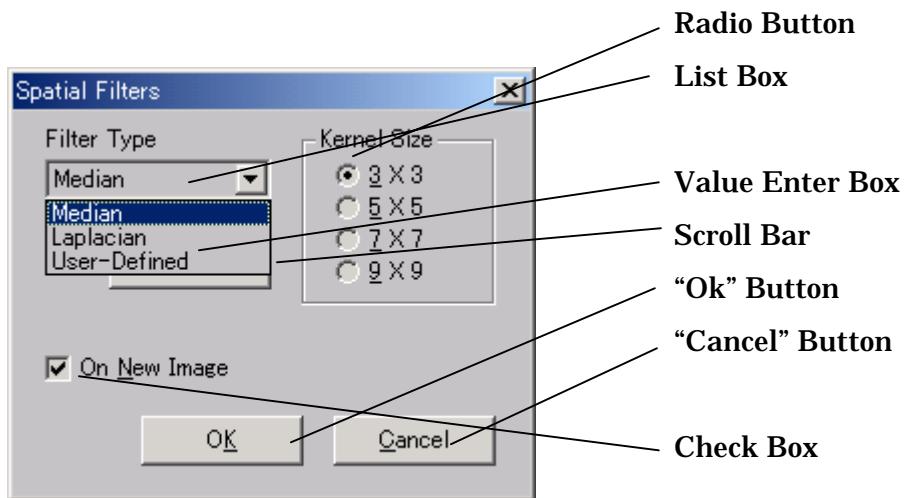
12. Outer Frame of the Window

This means rectangular lines that surround the window. Each window is resized by dragging its line.

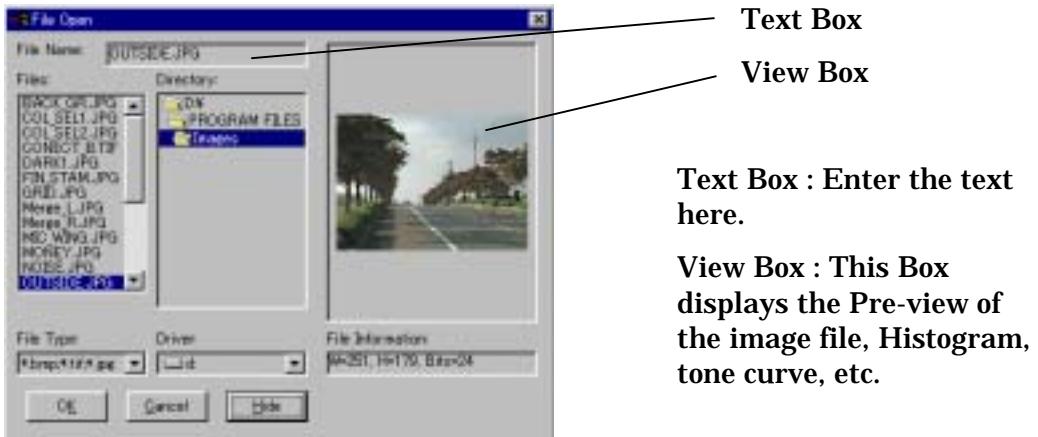
13. Using the Dialog Box

You can operate many kinds of functions by using the Dialog Box. As the Dialog Box is similar to the other Windows applications, you can easily operate it. About the dialog box of Windows, please see the User's Guide Book of Microsoft Windows.

Followings shows some instructions of the general Dialog Boxes.



- **Radio Button :** Only one button is selectable. By click the button, select one of the items.
- **List Box :** The box where all items are listed for selection. Scroll the item with the scroll bar. For the effectiveness of selection, double click on the item to select or press the “Ok” button after selection.
- **Value Enter Box :** Enter the figure from the keyboard or spin box.
- **Scroll Bar :** By moving the Scroll Bar, you can setup the figure.
- **Check Box :** By checking this box, you choose on/off of the option command. Check means “on” and no check means “off”.
- **“Ok” Button :** By pressing this button, the setup matters becomes effective and is reflected to the image processing.
- **Cancel Button :** When you press this button, all matters setup in this Dialog Box become null and recover to former state, and Box close.



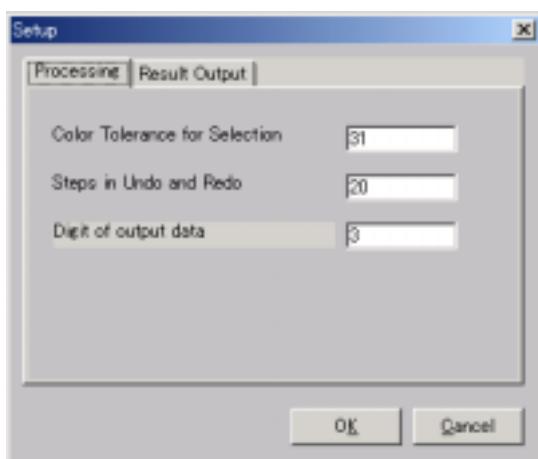
14. Setup of USB Digital Scale Environment

Before using USB Digital Scale, set up the Environment. Environment setup can be done by the command “System Setup” in the “Tool” at menu bar. When you select this command, “System Setup” dialog appears, then set up as described follows at each tab.

① “Processing” tab

In Processing tab, following two items are set up.

- **Color Tolerance for Selection :** When you select the area by Auto Selection Area tool mentioned at 8. ⑥ in this Chapter, the selection is done being based on the same color. Here you set up the tolerance value of the color intensity which you deem the same.
- **Steps in Undo and Redo :** By setup the number, you can return or repeat the process up to such times.



② Result Output tab

In this tab, you set up following two items.



• **Default Setting for Result Image :** In case you set up almost all image processing such as color adjustment, color conversion, transformation, filter processing, you select to create new image so processed or save on the former image. At each process stage, it also has On New Image check box. However, in this tab you set up the default value of each process

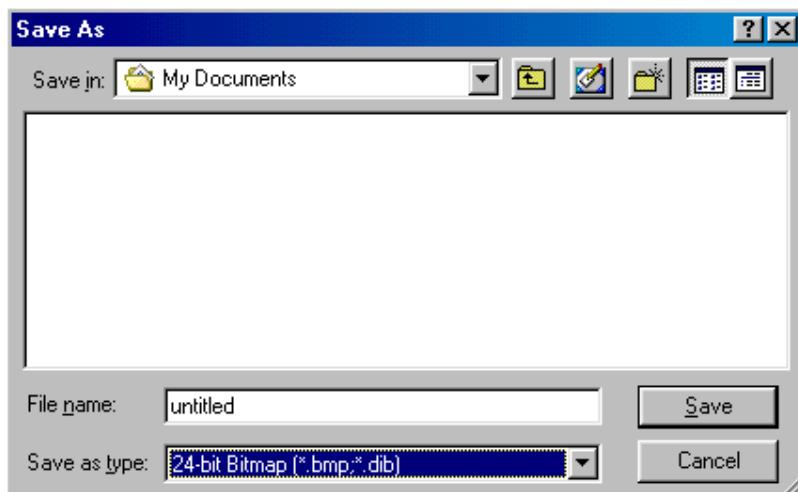
• **Measurement Result Output :** Here you set up the place where you send the data after measuring by histogram, color composition, shape feature extraction, geometric measurement, manual measurement, etc. By checking at Excel box, the measured data is sent to Excel sheet at the time you select the Output button after measuring.

When you check at the check box of the Text File and select Output button, the data is saved on the file you specified in the textbox here as a Text File. The name of the Text File is “c:\program files\imgfact\sys\Result.dat” at the default value, however, you can name the optional one by entering it. The file rewritten always creates the new file every time you put out.

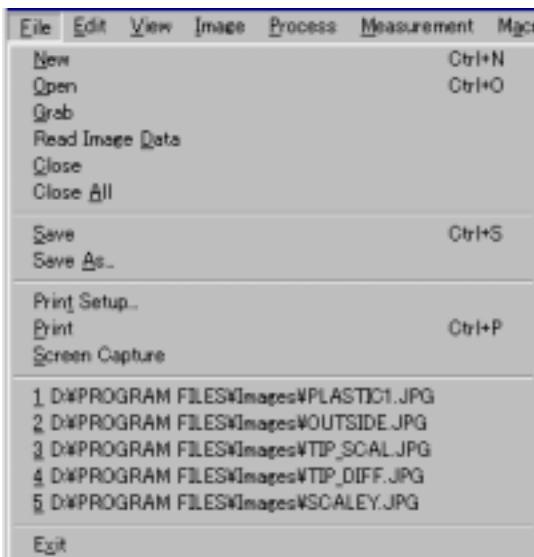
15. Send the Data to Excel

On each time data is sent to Microsoft Excel, it is saved on the new sheet renewing its No.. But when you close USB Digital Scale, the data sent to Excel sheet are also deleted. So, if you want to save, save it before closing USB Digital Scale.

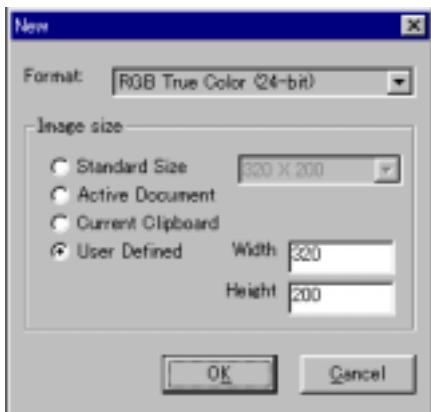
If you select “Yes” here, dialog box “Save as” appears. When you do not save on the above dialog box, save the Excel where data has already sent.



Chapter 4. File Menu

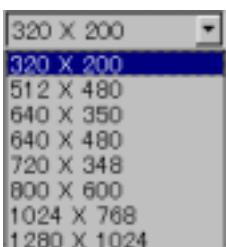


1. New Command



① You can create a new image file by choosing this command at File menu as shown above. Then, New file dialog box appears as shown left. Select the color resolution of image from dropdown list at Format. The types of resolution you can select are following colors for one pixel. Take note that when you paste a image which is copied from others or clipboard, it cannot be pasted if the resolution is different from one of the original image .

Black and White Binarized Image (1bit), Gray Scale (8 bits), 16 Colors (4bits), 256 Colors (8bits), RGB Full Color (24 bits)



② Set up the image size by selecting the desired number of pixels along horizontal and vertical lines. Sizing can be provided in following four different ways. Your preferred way is selected by turning on any either option within the Image Size group.

• Standard Size : You can select a frequently-used standard size from 8 kinds of size in the dropdown list. The figures shows the number of pixels. Select and click the desired size from the list.

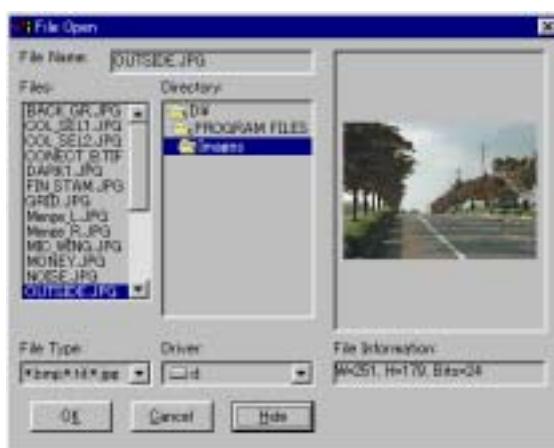
- **Sample Image Size** : You can select the same size image as now selected in the opening images.
- **Clipboard Image Size** : A new file is opened in the same size as the of image currently stored on the clipboard. Be sure that, when the stored image itself is pasted on the new file, the same color resolution as the stored image shall be selected.
- **Free Size** : Select desired number of pixels for horizontal and vertical lines respectively by typing numbers in each field.

③ Click OK button and image window opens in selected size and color resolution.



However, this window, which contains no image data, is completely white as shown left. Each image file is titled as "Untitled-No." where "No." stands for a numeral starting with "1" and increasing incrementally by one digit as new files are created.

2. Open Command



- ① This command is used to open a file from stored files. Choose the command from the File menu, and File Open dialog box appears as shown left.
- ② Select file type from File Type drop-down list. All the files with selected type appear in the File list box.
Following 22 file types are provided. Each type has its own image resolution.

- **BMP (Windows bitmap)** : Image in 1, 4, 8, 24, and 32 bits
- **TIF (TIFF)** : Image in 1, 4, 8, 16, 24, and 32 bits
- **JPG (JPEG format)** : Image in 8, and 24
- **CMP (LEAD CMP)** : Image in 8, and 24 bits with high quality and high compressive
- **EPS (PostScript Raster)** : Image in 1, and 8 bits

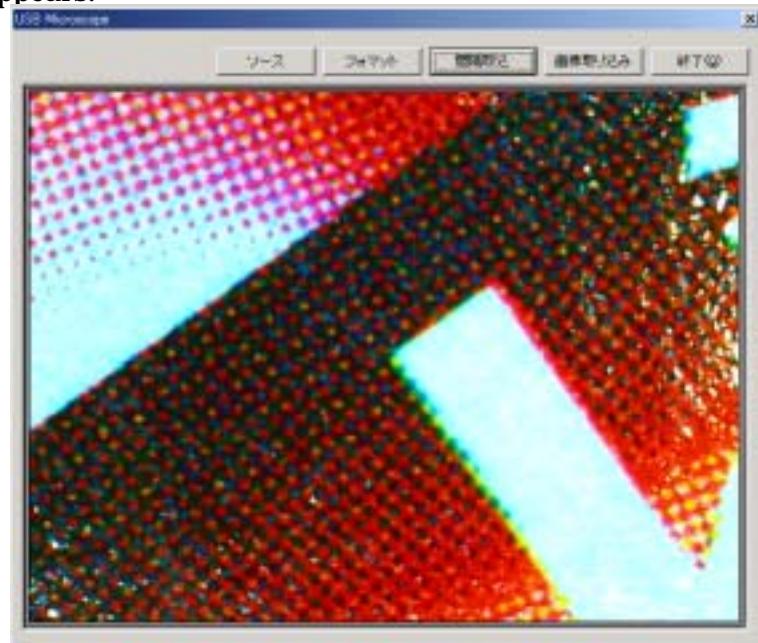
- PSD (PhotoShop Ver.3.0) : Image in 1, 8, and 24 bits
- PNG (portable Network Graphics type) : Image in 1, 4, 8, 16, 24, and 32 bits
- FAX (FAX type) : Image in 1 bit
- ICA (IBM Image Object Content Architecture) : Image in 1 bit
- IMG (GEM Image) : Image in 1 bit
- JFF (Full Color JPEG file interchangeable type) : Image in 8, and 24 bits
- JTF (TIFF interchangeable type with JPEG file) : Image in 8, and 24 bits
- RAS (Sun Raster) : Image in 1, 4, 8, 24, and 32 bits
- TGA (Truevision TARGA) : Image in 8 ,16, 24, and 32 bits
- MAC (MacPaint) : Image in 1 bit
- MSP (Microsoft Paint) : Image in 1 bit
- PCD (Kodak PhotoCD) : Image in 1, 4, 8, 16, 24, and 32 bits
- PCT (Macintosh Pict) : Image in 1, 4, 8, and 24 bits
- PCX (RLE type Compression) : Image in 1, 4, 8, and 24 bits
- WMF (Windows Metafile) : Image in 8, and 24 bits
- WPG (WordPerfect Raster file) : Image in 1, 4, and 8 bits
- FPX (FlashPix) : Image in 8, and 24 bits

You cannot open files of any other type than those listed above. If you try to open such files, or files with a different resolution, a message shown as left appears and the opening action is halted

- ③ Clicking the selected file, its file name is highlighted, when you click Show button, the preview image is displayed right side. However, it takes a little time. If you select other file in this state, its preview appears automatically.
- ④ Select a folder that contains the required file by choosing Look in drop-down list and select the file from the File box, then click the Ok. The file opens. By double clicking file name itself, the file also opens. There is no particular limitation about file size to open. It opens within the tolerance of the memory, however, when the size is extremely big, the operation speed slows down and efficiency grows worse.

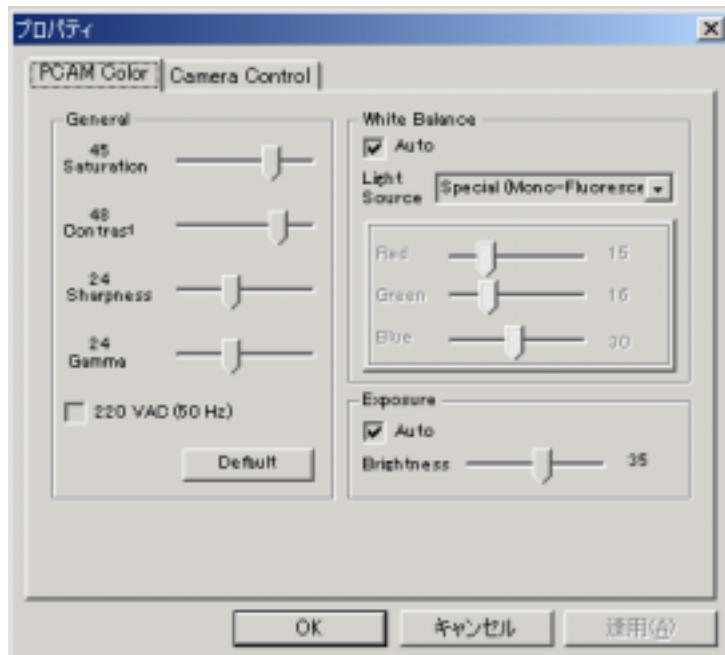
3. Grab Command

①With USB Digital Scale, besides Opening the file, the image is captured directly through SCALAR USB Microscope. When you select this command, USB Microscope dialog box appears.

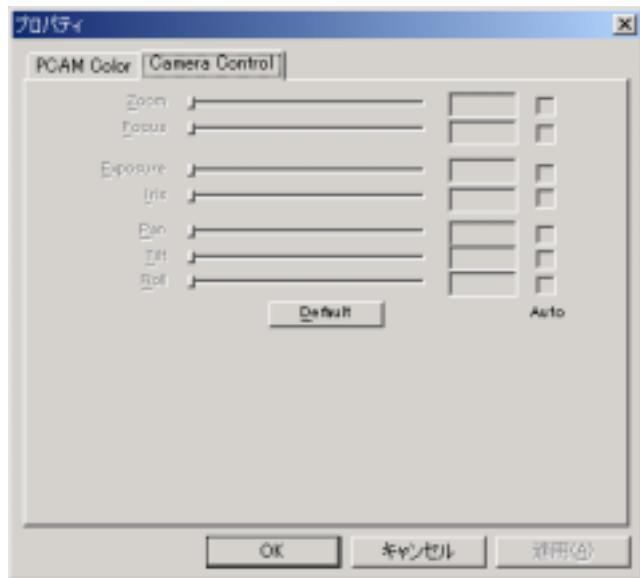


②At the window on the dialog, the images captured by USB Microscope appears as a continuous image.

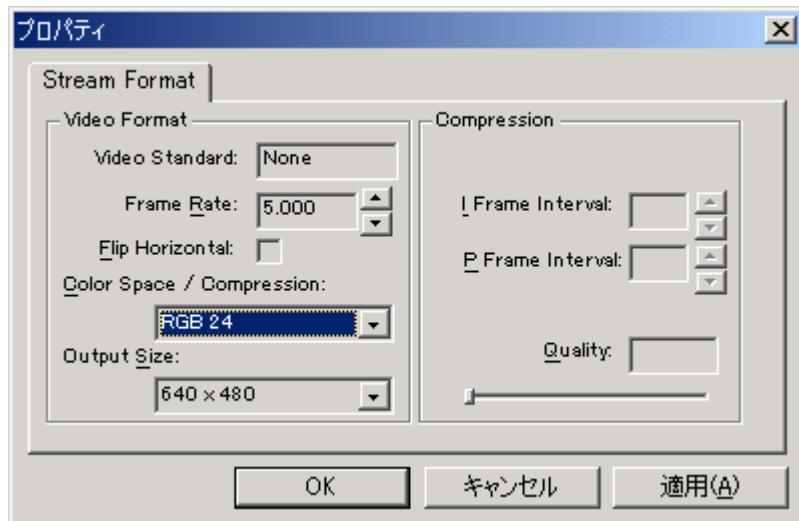
③When you click “Source” button, the property dialog box appears. At “PCAM Color” tab, you can set up the Saturation, Contrast, Gamma, White Balance and Brightness. In details, refer to USB Microscope Manual.



④At the “Camera Control” tab the following dialog box appears, however there is no particular item to set up.

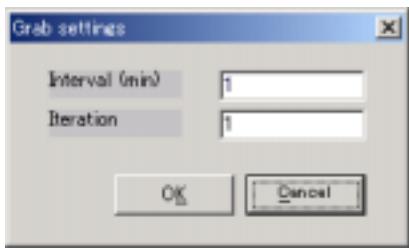


⑤When you select the “Format” button, the following dialog box appears and you can set up the frame rate for the continuous appearance of images, appearance color or the size of images to capture. In details, refer to the USB Microscope Manual.



⑥“Interval Capturing” enables you to capture the images at a regular interval. When the “Capture Setup” dialog appears, enter the “Capturing Interval” and “Capturing Times”. Since the duration for capturing differs depending on the capacity of PC, the number of currently opening programs or the capacity of loading memory, it is difficult to set up by the unit of second. Therefore, the unit of Capturing Interval time is set by minute.

⑥ **Interval Capturing** allows interval capturing of images. After setting the camera, click the **Interval Capturing** button. As the **Capture setup** dialog appears, enter the **Capturing Interval** and **Capturing Times**. Since the duration for capturing differs depending on the capacity of PC, the number of currently opening programs or the capacity of loading memory, it is difficult to set up by the unit of second. Therefore, the unit of **Capturing Interval** time is set by minute. Maximum time is possible to set up to 32,000 minutes, however, in case you take in many images, confirm your hard-disk capacity. If you want to take in within one minute interval, capture manually. When you click, the timer starts and the image is captured in after the setup time and it is



stored as "Grab0.tif" in the folder "¥USB Digital Scale 1.0J¥temp". After that the images are taken in next to nest and stored in the same manner. The figure after Grab of file name increases one by one each time captured.

⑦ When you click the **Image Take-in** button, the image at the time of clicking appears in the window. Images are taken in each time you click as far as the memory has the space. Each image file is named as "Untitled-No.", and the number is allotted at "No." in order of preparation.



⑧ When you close the **Real-time Image Control** window, select the Capture command at top of the main picture or **Image Take-in**  button.

4. Read Image Data Command

① By this command, you can open the Text File where the Intensity value and position information described as a image. When you produce the Text File in the following format after adjusting in detail or using original function on an image data, you can open the file as an image data.

② The File format is as shown below. This file has same format as *.DAT file which is produced when you save the data into the file by selecting RGB out of

X	Y	R	G	B	Blue
0	0	40	43	43	43
0	1	37	31	28	28
0	2	31	25	22	22
0	3	35	34	19	19
0	4	37	30	25	25
0	5	34	36	29	29
0	6	26	27	20	20
0	7	21	24	17	17
0	8	25	69	75	75
0	9	150	154	142	142
0	10	78	81	77	77
0	11	39	40	37	37
0	12	45	44	38	38
0	13	40	36	32	32
0	14	40	37	34	34

Histogram command at Process menu.

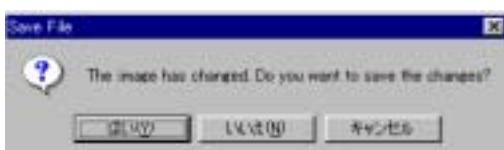
First column shows the total number of pixels, number of pixels on horizontal line and vertical line, and X value and Y value of output starting. In the 2nd and following column, X and Y value, R, G and B intensity value of each pixel are shown. After this, the description repeats in the same manner.

③ Selecting this command, the dialog box Open file appears. When you select the file with the extension Dat and press the Open button, the file opens as an image.

5. Close Command

① First, select the image in the opening images you want to close by the mouse.

② Next, select the Close command in the File menu, then the image closes. In case you are closing the newly created file, or edited, or processed file, the dialog,



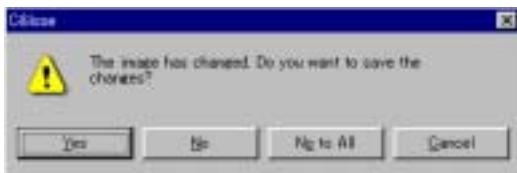
Save File appears, then select the button you desire.

6. Close All Command

① This command allows for the closing all images currently opened. In case you are closing the newly created file, or edited, or processed file, the dialog, Close, appears.

② In the dialog box, the message, The image has changed. Do you want save the changes? appears. When you click the Yes button, the file already named is saved in the same file. In case of no-named file, the dialog box, Save as, appears, then specify the place and name and save.

③ If you click the No button, the selecting image closes without saving. If you click the No to All button, all other opening images including selecting image close without displaying the dialog, Save File.

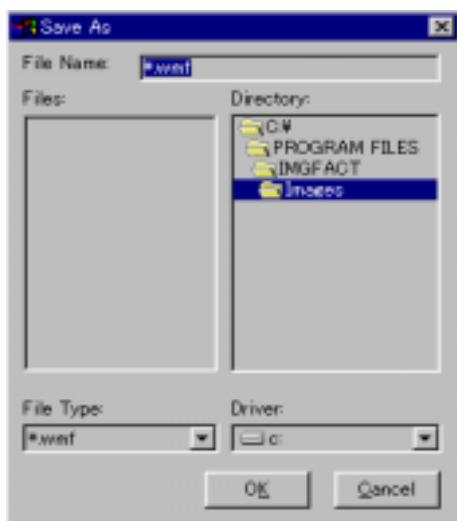


7. Save Command

① This command allows for saving image in a same file name. Before saving, select the image by mouse.

② Select the Save command in the File menu, then the selected image is saved in the same name and same file type. In case of no-named filed, the dialog box, Save as, appears, then specify the place and name and save.

8. Save As Command



① This command allows for naming and saving the image. Before saving, select the image.

② Select this command in the File menu, then Save As dialog box appears as shown left.

③ In this dialog box, select the folder in the Directory box to save and specify the file type in the File Type drop down list. There are following 22 file types.

④ Enter the file name in the File textbox and click Ok. The file is saved.

- BMP (Windows Bitmap) : 1, 4, 8 ,24 Bits Image
- TIF (TIFF) : 1, 4, 8, 16, 24 Bits Image
- JPG (JPEG format) : 8, 24 Bits Image
- EPS (PostScript Raster) : 8 Bits Image
- PSD PhotoShop 3.0 format) : 1, 8, 24 Bits Image

- PNG (portable Network Graphics format) : 1, 4, 8, 24, Bits Image
- FAX (FAX format) : 1 Bits Image
- ICA (IBM Image Object Content Architecture) : 1 Bits Image
- IMG (GEM Image) : Bits Image
- GIF (Save of Color Raster Image) : 8 Bits Image
- RAS (Sun Raster) : 1, 4, 8, 24, 32 Bits Image
- TGA (Truevision TARGA) : 8, 16, 24, 32 Bits Image
- MAC (MacPaint) : 1 Bits Image
- MSP (Microsoft Paint) : 1 Bits Image
- PCT (Macintosh Pict) : 1, 4, 8, 24 Bits Image
- PCX (Compression of RLE format) : 1, 4, 8, 24 Bits Image
- WMF (Windows Metafile) : 8, 24 Bits Image
- WPG (WordPerfect Raster file) : 1, 4, 8 Bits Image
- F



When you try to save the other resolution file than described above, the dialog shown asleft appears and you cannot save it.

9. Print Setup Command



① If you already have set up the printer to use on Windows 95, you can set up the printer with this command. If you did not set up the printer yet, set up first the printer. When you select this command, the dialog Print Setup appears, and you can set up the printer name, paper size, print direction, paper supply method, etc.

② By clicking Property, you can set up in more detail. For more detail information about the setup, see the Guidebook of the printer or Windows 95.

10. Print Command

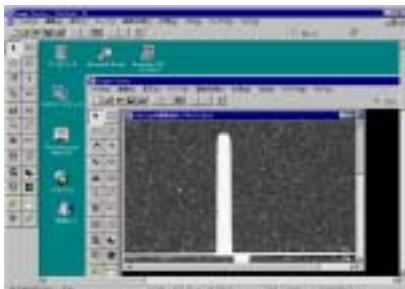
① In case you have already set up the printer for the use on Windows 95, you can print with this command. If you have not set up the printer, set up first the.

printer. First, select the image to print.



② When you select this command, the dialog Print appears, and you can set up the printer name, number of sheet to print, etc. By clicking Ok button, print starts

11. Screen Capture Command

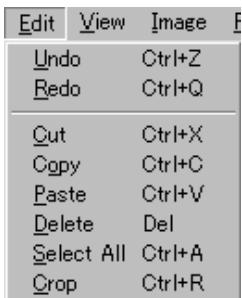


This command allows for capturing the whole picture currently appeared on the screen as a image data. When you select this command, whole part of picture is appeared in the window. You can save, edit, print, process, etc. this image.

12. Exit Command

When you select this command, the program closes and return to the Windows 95. However, if the image which is not saved remains, dialog box Close appears. If the data sent to Excel remains, that data is deleted at the time of pressing Exit. In case of this, save it before select Exit.

Chapter 5. Edit Menu



1. Undo Command :Area possible

When you edit, adjust, or process with a filter the image by any command, you can cancel such operation by this Undo command. If you do not operate any such command, this command cannot be selected. However, once you edit, adjust, etc. the image, you can select this command. The Toolbar button works in the same way. By setting up the times at Steps in Undo and Redo box in the Processing tab at the System Setup of the Tools menu, you can repeat such command until the steps you set up.

2. Redo Command : Area possible

When you want to redo the operation after cancel any edition on the image by Undo command, select this command. You can redo the operation you canceled. However, if you do not cancel the operation by Undo command, this command appears gray color and is unable to use. The Toolbar button works in the same way. By setting up the times at Steps in Undo and Redo box in the Processing tab at the System Setup of the Tools menu, you can repeat such command until the steps you set up.

3. Cut Command : Area possible

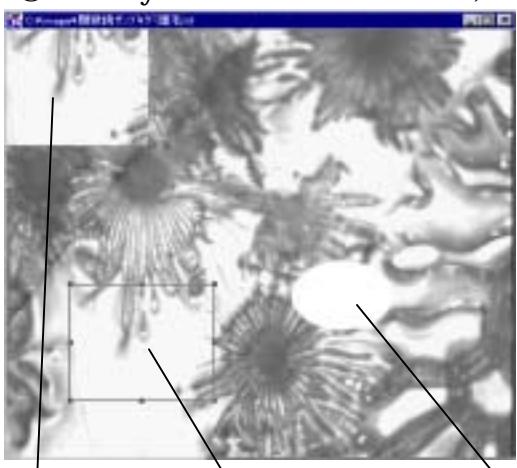
This command allows for the cutting off the image which is selected by Region selection command from the image and save it on the clipboard. The part so cut off appears white.

4. Copy Command : Area possible

This command allows for the saving of the part of image which is selected by Region selection command on the clipboard. The image saved on the clipboard can be used with the Paste command. For instance, you can easily paste it directly on Microsoft Word in preparing a report.

5. Paste Command : Area possible

① When you select this command, the image saved on the clipboard is pasted at top left on the image currently selected. If the color resolution of the image on which image data is being pasted differs from that on the clipboard, the image cannot be pasted.



Paste Copy Cut, Delete

② As the image pasted remains selectable, by dragging mouse on the image, you can move it to the position you want.

③ When you right click, the image pasted comprises part of the existing image data.

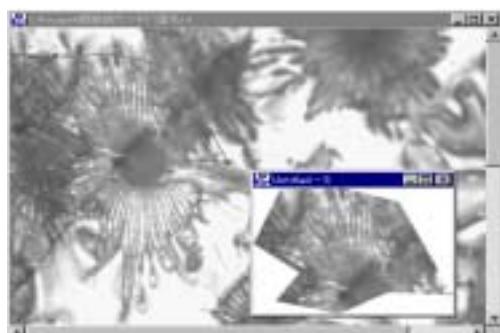
6. Delete Command : Area possible

This command allows the deletion of the image selected by any of Area Selection commands. The part deleted appears white.

7. Select All Command : Area possible

This command allows whole part of the image currently selected to be the state of selection.

8. Crop Command : Macro possible, Region possible

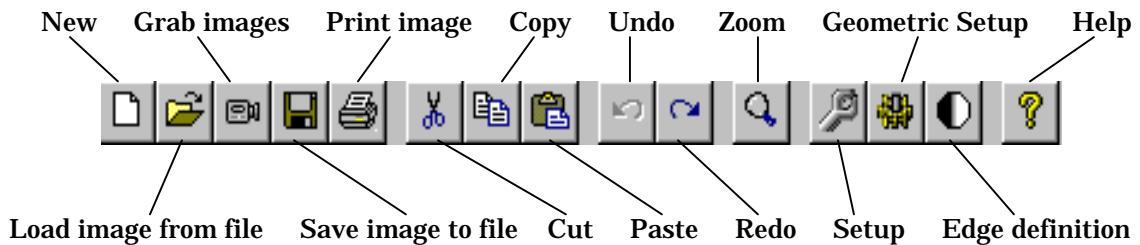


This command allows to create the new image from the image data selected by any of Area Selection Commands. Any shape, rectangle, ellipse, polygon, etc. of Region is applicable to this command.

Chapter 6. View Menu

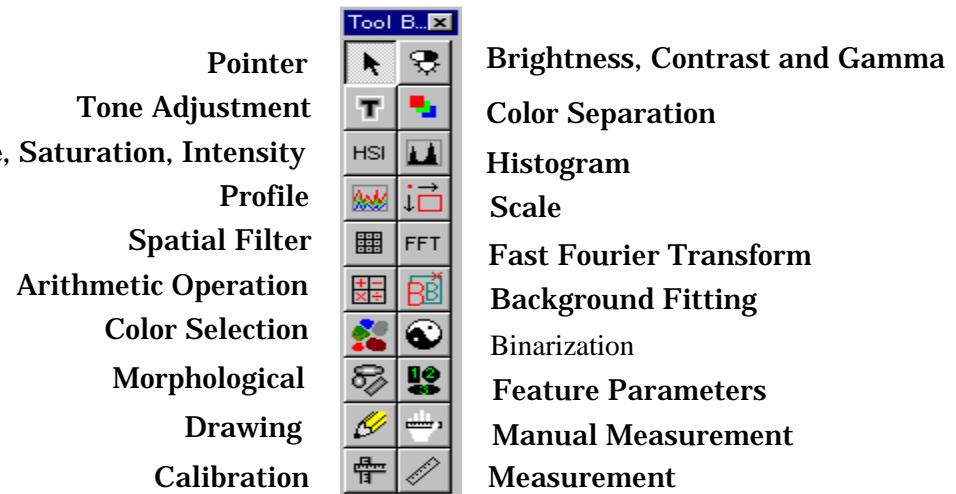


1. Toolbar Command



By this command, you can select the appearance or non- appearance of the Tool button under the Menu Bar. By simply clicking once a Toolbar, you can operate file or image edition.

2. Toolbox Command



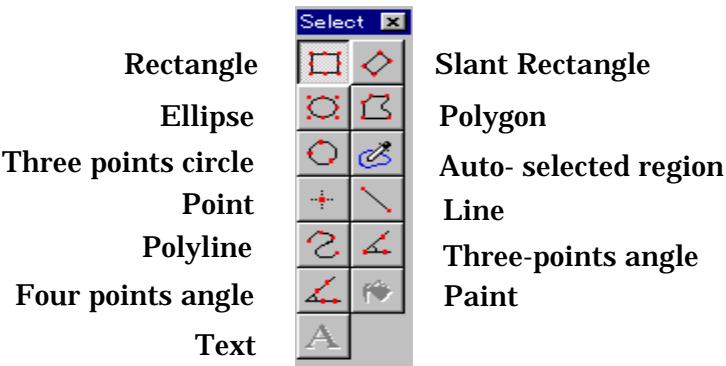
You can select the appearance or non-appearance of Toolbox at the bottom of window. There are 20 kinds of tool button in this box. These are frequently used commands in each Menu, and you can easily access these commands by clicking a button once. You can move and resize the box.

3. Statusbar Command



By clicking this command, you can select the appearance or non-appearance of the comment bar, Statusbar, shown above which is displayed at the bottom of the picture. At this Statusbar, object name currently selected, information about the operation, file name, image size, color resolution, magnification/reduction ratio against the original image, zooming ratio, file size, etc. are indicated.

4. Drawing Tools Command



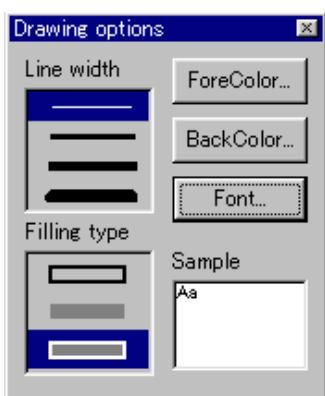
You can select the appearance or non-appearance of Tools for selecting a region, drawing, or manual measurement at right of the Toolbox at the bottom of window. About details and the contents of these tools, refer to Chapter 3. Basic Operation, 8. Edit Drawing Toolbox (Select box). You can move and resize the box.

5. Drawing Option Command

① With this command, you can select the appearance or non-appearance of the box for setup the conditions of entering the letters, drawing lines, etc. on the image. Selecting this command, the dialog Drawing options appears.

② At Line width, you can select one from 4 kinds of line width.

③ At Filling type, when you selects a region, you can choose one from the following 3 sorts of filling.



- Frame only : This allows to draw only frame line of the selected region with the selected Line width and color selected by pressing ForeColor button.

- Filling only : This allows for filling the selected region with the color selected by pressing BackColor button without drawing frame line.

- Filling with frame : This allows for filling the selected region with the color selected by pressing BackColor and drawing frame line of the color selected by pressing Forecolor button and selected line width.



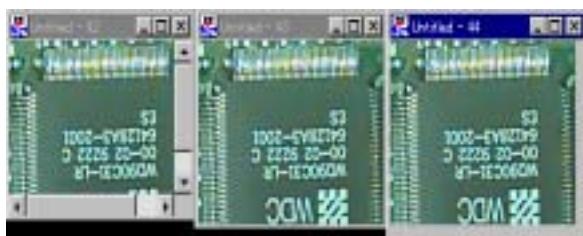
④ When you press the ForeColor button, Color setup dialog appears and you can select a color from Basic colors or make your own color for the line or letters.

⑤ When you press the BackColor, you can select or make the color in the same manner as above to paint within the region you select.

⑥ When you click the Font button, Font dialog appears and you can set up the font, style, size, etc. of letters.



6. Fit Window Command



selecting this command, the window is resized to the same size as it of image.

This command allows for adjusting the window size to image size. When image size is larger than the window, the horizontal and vertical scroll bar appears, on the other hand in case of reverse the space appears around the image. By

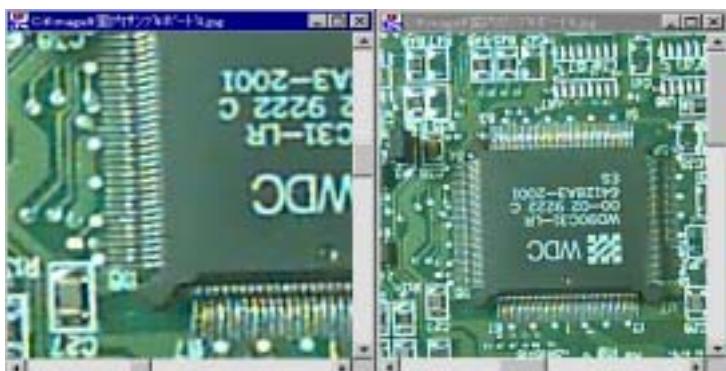
7. Zoom Command

This command allows for the magnification or reduction of the image appearance without resizing the window. When you select this command or Zoom button in the Toolbar, the cursor changes its shape to lens.

In the center of lens shape, + sign appears which means the magnification. When you left click the mouse on the image, the image is duplicated horizontally and vertically. When you click the Shift key, + sign changes to - sign. When you keep pressing Shift key and left click the mouse on the image, the image reduces half horizontally and vertically. Once you press the Zoom button, it function is kept effective and you cannot operate other command. By right clicking on the image, you can recover the command. Each time clicking the mouse, the function of magnification or reduction works by twice or half ratio. The ratio is displayed in the status bar. On the image magnified or reduced, you can use any function. And, even, in the course of selection the region, you can use this command.



Lens cursor



8. Image Information Command

① This command allows for the appearance of the Image information currently selected. Selecting this command, the following information is displayed in the Image Info dialog box.



② Image Type : shows the type of color composition of the image. (ex. Full color, Black and White, Binarized image, etc.)

Width : shows the number of pixels in width.

Height : shows the number of pixels in height.

Bit depth : shows the information volume of one pixel by unit of bits.

Size : shows the file size by unit of bytes.

X resolution : shows the number of pixels per one inch on X direction line.

Y resolution : shows the number of pixels per one inch on Y direction line.

X scale : shows the magnification ratio in X direction to the original image, when resizing.

Y scale : shows the magnification ratio in Y direction to the original image, when resizing.

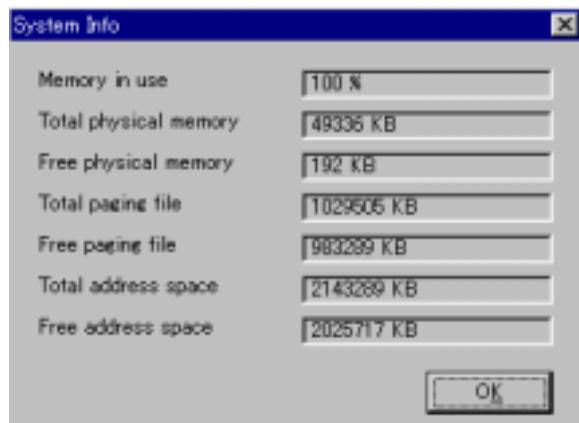
Zoom : shows the magnification ratio, when zooming.

File type : shows the file type for saving. (ex. Windows BMP, TIFF, JPEG, etc.)

Compression : displays None, when file is not compressed.

9. System Information Command

① This command allows for the appearance of the dialog box, System Info, which shows the following System information of the computer currently you are using.



② Memory in use : shows the ratio of the memory currently in use.

Total physical memory : shows the total volume of extended memory installed by the unit of kilobytes.

Free physical memory : shows the volume of unused free memory by the unit of kilobytes.

Total paging file : shows the total file volume where you can open the image.

Free paging file : shows the volume of unused free file where you can open the image.

Total address space : shows the total address space prepared in the System by the unit of kilobytes.

Free address space : shows the unused free space by the unit of kilobytes.

Chapter 7. Image Menu

1. Geometric Correction Command : Macro and Zoom possible



① By this command, distortional deformation on image affected to by lens aberration of camera is compensated using a reference image.

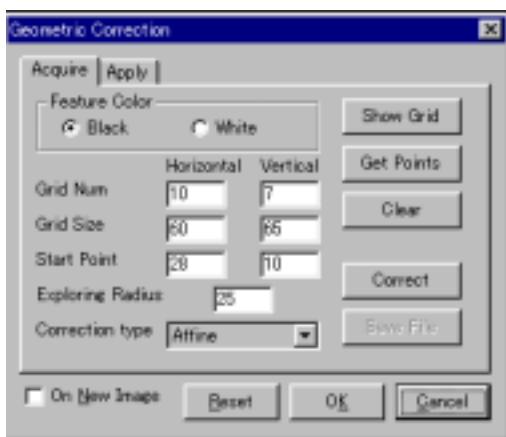
As shown left, a completely square-shaped grid which is attached in the Attachment F. is usually captured by camera to a image with slightly expanding deformation. You can correct such deformation by extracting the positions of intersection on a reference image.

② Clicking this command, Geometric Correction dialog box appears.

③ Data Acquire tab appears. In the Feature Color group, select the grid color with the radio button, Black or White, which you want to refer to in contrast to the background.

④ The reference of the location of the intersection points of the acquired image is conducted by creating orange color grid in tune with the grid on the image and searching the closest points of the orange grid automatically. In the Horizontal and Vertical boxes, enter the following data comprising orange color grid.

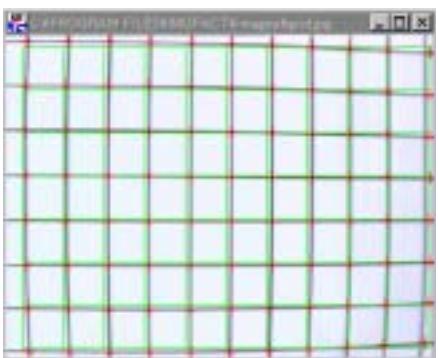
- Grid Num : Enter the number of the horizontal and vertical grid you are making.
- Grid Size : Enter the number of pixels for the horizontal and vertical size of the grid.



- Starting Point of correction : Enter the number from the top left of the pixel on the top left angle of the grid.

- Exploring Radius : This command allows the search of the intersection points of the image around the the orange color grid intersection. Here enter the number of pixels of the radius distance where to seach. Therefore, the number less than the half of the horizontal or vertical length of the grid should be entered.

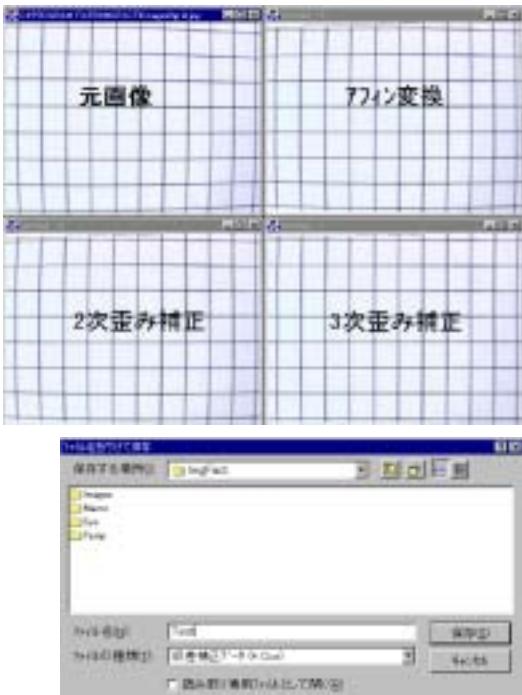
⑤ After entering the number as described as above, when click the Show Grid button, the orange color grid appears on the image. However, if you enter the number which makes the larger grid than the size of the image, the attention message appears. In that case, check the entered number and try to let the grid appeared several times and adjust the grid of the original image so that it becomes nearly same as the orange color grid.



⑥ When the orange color grid becomes nearly the same, you search the intersection points on the image automatically. When you click the Get Points button, the intersection points on the image which is close to those of orange color grid are referred and the red cross marks are put there. Confirm if the red cross marks are put on each intersection points.

⑦ By clicking the Clear button, orange color grid and red cross marks are cleared.

⑧ After confirming the acquisition of the intersection points, by clicking the Correct button, the distortion corrected image is created. As to the methods of distortion correction, you can select from three methods shown in the Correction Type list box. The samples of each correction type are shown below.



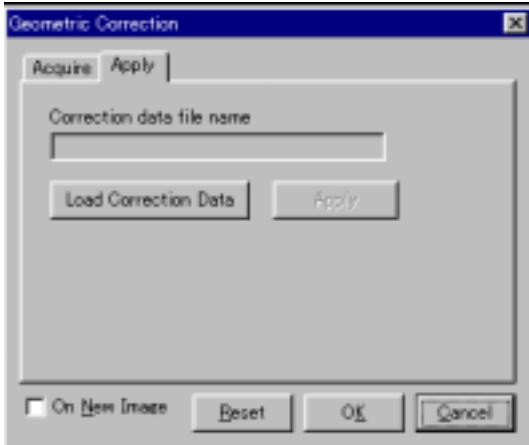
⑨ If the check is marked in the check box On New Image, the image is newly created.

⑩ When you push Correct button, the Save File button becomes effective. And if you select this Save File, the Save As dialog box appears. Here, you can save the conditions or data of distortion correction in the file type of Correction Data (*.Cor).

⑪ When you select the Reset button, the correction conducted until then is cancelled.

⑫ When you select the Apply tab, the dialog shown below appears. You can apply the Correction Data which was saved before to the image selected. Therefore, if you once create the Correction Data respectively for each CCD camera, you can correct the distortion by only using this Apply function on this page.

⑬ When click the Lostd Correction Data button Open dialog appears. Then. open the existing Correction Data file. The Correction Data File Name is appears in gray tone.



⑭ After selecting the file, when you push the Apply button, the Correction Data is applied to the image selected. If you put the check mark in the On New Image box, the image so applied is newly created.

⑮ By selecting Reset button, the correction process is cancelled.

This command provides giving the selected image gray scale in 256 steps with 8 bits for a pixel.

2. Duplicate Current Image Command

This command allows for the duplicate of image currently selected. Completely same image is created as the selected one. Before use this command, make sure to open the image you intend to duplicate.

3. To Grayscale Command : Macro possible

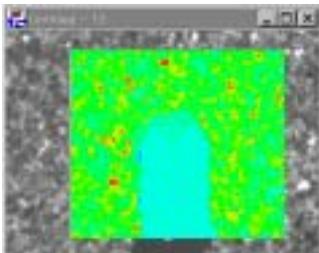
When you select this command, the image currently selected is converted to gray scale in 256 steps with 8 bits for a pixel.

4. Inversion Command : Macro and Area possible

This command allows for the creation of the new image of which intensity of each color of a pixel is inverted from the one of the image currently selected. In case of the black and white color image, it inverts black color to white or white color to black like a relationship between negative and positive film of photograph. If you select a certain area in the image, the only area so selected is inverted and new image of such area is created.



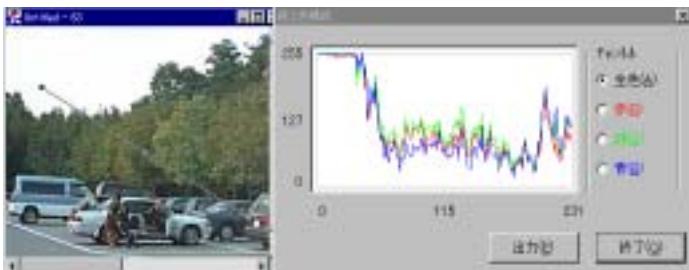
5. Pseudo Color Command : Macro and Area possible



This command allows for the creation of the artificially colored gray scale image. When a area is selected on the image, the pseudo color of such area is appeared.

6. Profile Command

- ① This command allows for the appearance of color composition of the straight line optionally selected on the image with the line diagram. When you select this command, the Profile dialog is appears and the straight line is drawn at the top left on the image and three rectangles are put on the line.
- ② The color distribution of Red, Green and Blue of the line put on the image are shown in each color line diagram respectively.
- ③ When you select the color with the radio button at the Channel box, the line diagram of selected color only appears.
- ④ The straight line drawn on the image is transferred by dragging the rectangle located in the middle of the line. Also by dragging the rectangle put at each end, you can lengthen or shorten the line or change the angle of the line.



- ⑤ By clicking the Output button, the appeared pixel data is transmitted to the location appointed at the System Set Up command one by one of each color.

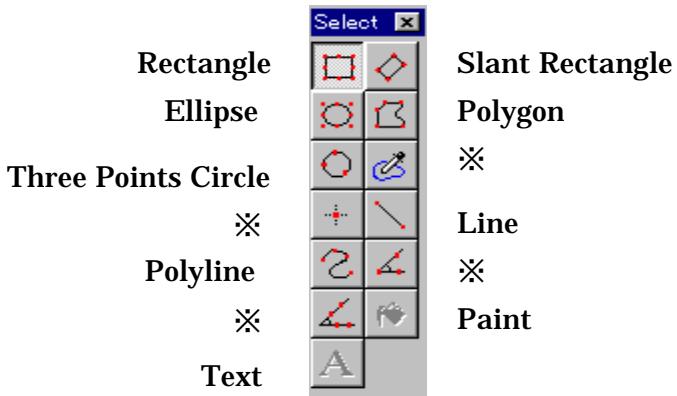
7. AOI Selection Command : Macro and Area possible

- ① This command allows for the conditions where you can select the optional area on the image, it enables you to cut off or copy such selecting area. When you select this command, the image turns to the mode of the area selection.
- ② If the image turns to the mode of the area selection, the arrow button in the Tool Box becomes effective and the Drawing Tool box (Select box) turns effective. The details of how to operate is described in the Chapter 3. Basic Operation.

8. Drawing Command : Zoom possible

① This command allows drawing line, rectangle, oval, polygon or character. In case of binarized image and the objects on it cannot be perfectly separated or such case like it, you can separate it by drawing the part you want to separate with white or black. When you select this command, the image you are currently selecting becomes effective and Drawing tool box (Select box) also becomes effective. The details of how to operate is described in Chapter 3. Basic Operation.

② Among the following drawing tools, the tool buttons marked with \times and appearing gray are not used.



③ The setup of the thickness, style and the color of the line to draw are done at the Drawing Option Command of View Menu. Please refer to Chapter 6. View Menu.

④ When you select the drawing tool and draw the line on the image, the line is drawn with the thickness which you selected at the Drawing Option Command and the color you selected by the ForeColor button.

⑤ When you select the tool with which the area is selected and draw the line on the image, the frame line is drawn with the thickness that you selected at the Drawing Option Command and the color selected by the Forecolor button and the color is filled with that you selected by BackColor button.

⑥ Paint button allows for the painting within the area where is deemed as same area. The color is changed within the area where the value is deemed same as that as appointed at the Color Tolerance for Selection of System Setup. After selecting the button, left click on the image, the the area is filled with color selected at the ForeColor and right click, then filled with the color selected at the BackColor. The area filled with the same color is that where is surrounded with the continuous points clicked on the image.

⑦ After selecting the text button A, click on the image at your discretion, the following dialog box, Input Text, appears. Enter the letters and push the OK button.



- ⑧ Select the font, size, style, color, etc. at the Drawing Option Command box. The color is to be that selected by the ForeColor button.
- ⑨ By clicking OK button, the entered letters are appeared at the location you click first on the image. At first the letters are appeared with the frame. You can move



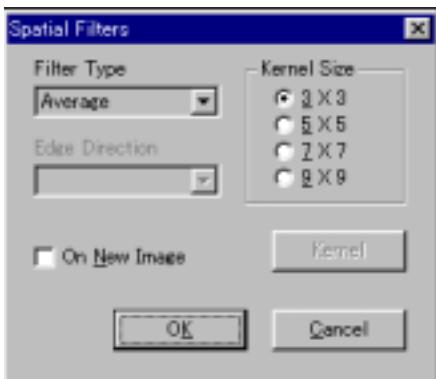
the letters by dragging the frame. By right clicking, the letters are decided and incorporated in the image data.

- ⑩ The letters or symbols once input can be canceled by undo command.

Chapter 8. Process Menu



1. Spatial Filters Command : Macro and Area possible

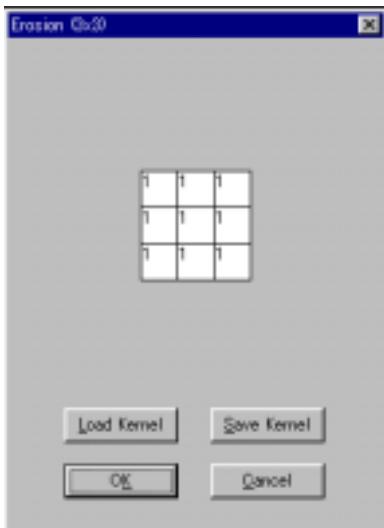


① By this command, you can improve the quality of the image or emphasize or extract the feature of the image with the filtering process. When you select this command, the Spatial Filters dialog appears.

② Select the Filter Type in the drop-down list. You can choose the one from 22 representative filters or even make your optional filter.

③ Depending on the filter type, you can alter the kernel size. In this case, the Kernel Size becomes effective and you can select the size from 3×3 to 9×9 .

④ Depending on the filter type, you can alter the direction of the edge extraction. In this case, as the drop-down list of Edge Direction becomes effective, select the direction you want.



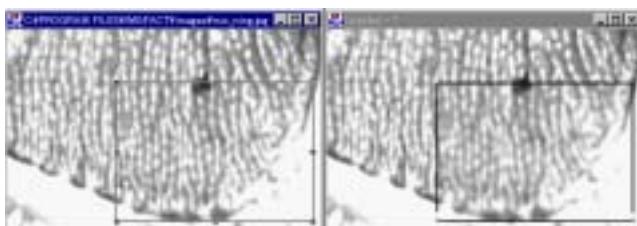
⑤ Moreover, depending on the filter type, you can alter the contents of kernel filter. In this case, the Kernel button becomes effective. Clicking the button, the contents of the filter appears and the figures which are setup are shown in each cells. As the figures are changeable, you can alter the filter effect by entering the number by transferring the cursor. When you change the figures, the filter type is changed then click the OK button, the filter type automatically changes to User-Defined.

The values setup is possible to save as the optional name or to load. And the kernel you prepared can be saved and loaded. When you click the Load Kernel button, the file Open dialog appears. And when click the Save Kernel button, Save As dialog appears. The extension of the kernel file is “ *.knl ”.

- ⑥ At the checkbox of On the New Page, you select to create the image processed with the filter as a new image or save it on the existing image. When you check here, the new image processed with the filter is created.
- ⑦ When you designate an area on the image and process it with filter, the area so designated is only processed and if you do not designate any area the whole image is processed.
- ⑧ As to the Filter Type, the following three types area selectable in the list box.

· Median:

With this filter, the pixel colors contained in the adjacent pixels area are processed to the intermediate color and the noises are removed. Without giving damage to such important information as edge image or others, you can remove the noise



particularly like spike shape.
And as to the even edge, this
filter can save it as it is.

You can select the Kernel Size
button and by getting enlarger
the image becomes vaguer.



·Laplacian:

This filter is the edge extraction operator of 2 dimension balancing type and is effective for the edge of mountain shape or roof edge. For this filter, you can select 4 kinds of kernel size and alter the contents of kernel.

·User-Defined Kernel:

You can create the kernel filter at your discretion. You can select one from 4 kernel sizes. Also, you can save or load the kernel you create. After selecting User-Defined Kernel and the radio button of the kernel size when you click the Kernel button, the User-Defined Kernel dialog appears.



The size appears at the selection of the kernel matrix. Alter the optional figures by moving the cursor. The kernel newly prepared can be saved or loaded. By clicking the Load Kernel button the file Open dialog appears, and by clicking the Save Kernel button the dialog Save As appears. The extension of the kernel file is “*.knl”.

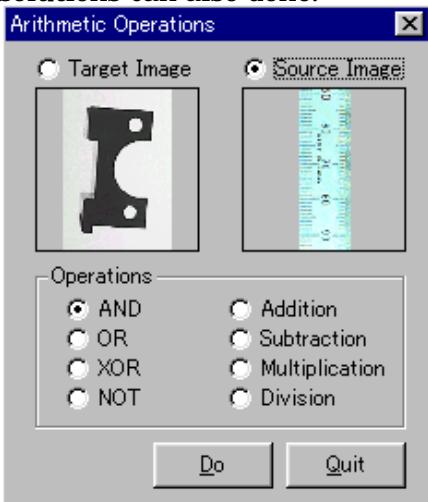
When you click the OK button, the kernel setup is fixed and the User-Defined Kernel dialog disappears.

In case that you use the User-Defined Kernel executing the macro, select the User-Defined Kernel after selecting the macro Start-Recording and enter the figures after clicking the Kernel button

or fix the figures by selection OK button after opening the Kernel File saved before. When you select the End-Recording of macro, the contents of the User-Defined Kernel is saved on the macro file.

2. Arithmetic Operations Command : Macro and Area possible

① This command allows for the arithmetic operations or logic operations between images. Selecting this command, the Arithmetic Operations dialog appears. If you select an area on the image, the operations on such part only is done. The operations between such images as with different color resolutions can also done.



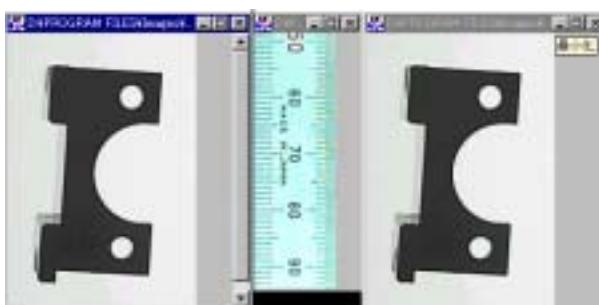
② After selecting the Target Image, when left click on the image the preview image of selected image is appears below.

③ After selecting the Source Image, when left click on the image the preview image of selected image is appears below.

④ After selecting each images and the operations type in the Operations box, when clicking Do button the image so operated is created.

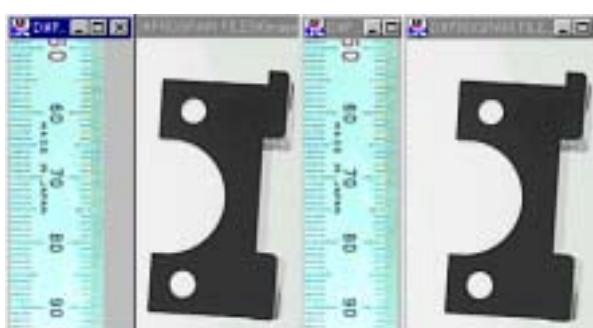
⑤ The datum point for the operation is the top left on the previewed image.

⑥ There are following 8 operation types. The source image is operated to the target image and the result of the operations get a new image displayed in the same size as the source image. In case extracting the different part of the two images, you can get almost all of them by using XOR or Division.



• AND :

This type conducts the logic AND operation between the pixels on the same location of the two images. The image with the low intensity value is over-written.



• OR :

This type conducts the logic OR operation between the pixels on the same location of the two images. The image with the high intensity value is over-written.

• XOR :

This type conducts the logic XOR operation between the pixels on the same location of the two images. The image with the high intensity value is over-written.



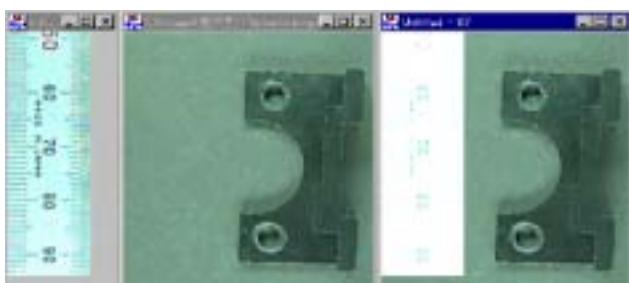
In the event that the intensity values are different each other 1 is output , and when same 0 is output. The different parts between the two imaged are extracted.

• NOT :



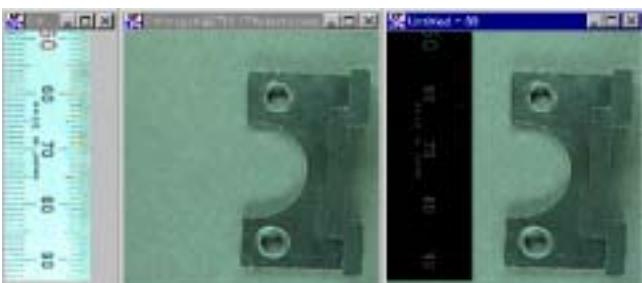
The image is inverted with its color composition. The operation between images is not done.

• Addition :



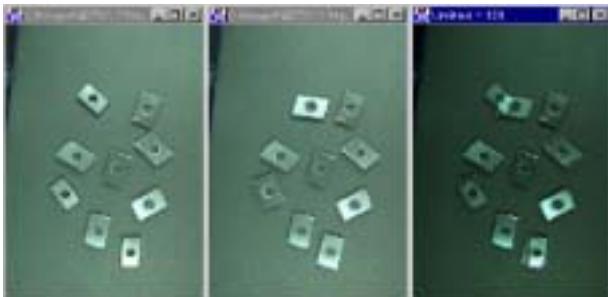
The two images are simply added on.In case of the same images, the image looks increase its luminosity and saturation. However the maximum intensity value of a pixel is 255.

• Subtraction



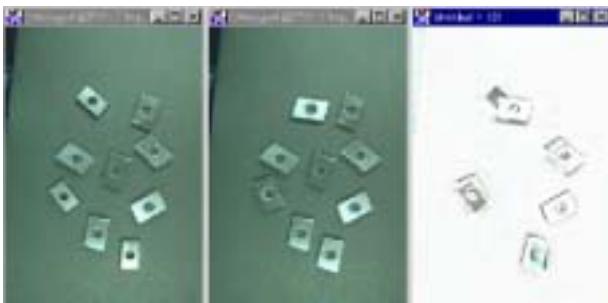
This type subtracts the source image from the target image. However, the intensity value of each pixel is 0 at minimum. The noises are removed.

• Multiplication



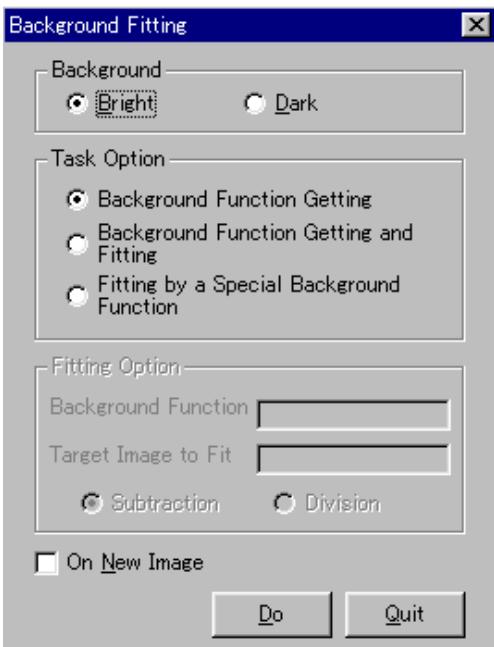
This type multiplies the pixels on the same location of the two images. The same part is intensified. However, the maximum intensity value of each pixel is 255 bytes.

• Division



This type divides the pixels on the same location of the two images each other. However, the minimum intensity value of each pixel is 0. The different parts are intensified.

3. Background Fitting Command : Macro possible



① In case the image has the unevenness of the brightness in the background, this command levels such unevenness. In case you binarize an image an image, but if you do not want to binarize its background (the brightness of background is also gradually altered), this function works efficiently. Selecting this command, the Background Fitting dialog appears.

② At the Background, choose the Bright or Dark. When choose the one, decide the background brightness comparing to the brightness of the object on the image .

- ③ At the Task Option, select the one from the following three processing options with the radio button.



· Selecting the Background Function Getting, when click the Do button, the image where the only distribution of the brightness of the background is extracted is created.

- When you select the Background Function Getting and Fitting button, it grasps the features of the background and levels the background using the grasping features. The leveling is done by arithmetical operations of the object image and background image.



When you select this button the Fitting Options becomes effective and you can select the Subtraction or Division. Depending on the arithmetical operations method, the fitting effect slightly differs.

- By selecting the Fitting by a Special Background Function, you can level the background combining the objective processing image and the background of the other image. When this option is selected, the Fitting Option is effective. Clicking on the object image, the name of the image is entered in the text-box of the Target Image to Fit. And clicking on the other image, its name is entered in the text-box of the Target Image to Fit and the name which has been there is transferred to the text-box of the Background Function. And you can choose the Subtraction or Division as a method of arithmetic operations with the radio button.

- ④ When you put the check in the On New Image box, the new image operated is created. However, if you do not check, it is saved on the original image.

4. Histogram Command : Area possible

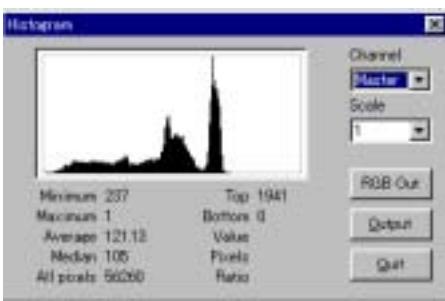
① This command allows for the intensity distribution of the pixels comprising the image as a histogram. By selecting this command, the Histogram dialog appears.

② The transversal axis of the histogram shows the intensity value and the longitudinal axis shows the numbers of pixels.

③ Selecting Master, Red, Green or Blue in the list-box of Channel, you can get each histogram of 4 colors.

④ You can alter the longitudinal axis scale at the Scale lis t-box. The scale of the size appeared first is the standard, 1.

⑤ The following information are appeared under the histogram.



Maximum : Maximum value of the intensity.

Minimum : Minimum value of the intensity.

Top : Maximum numbers of the pixels on the same intensity.

Bottom : Minimum numbers of the pixels on the same intensity.

Average : The average value of the intensity.

Median : The intermediate value.

All pixels : All the numbers of objective pixels.

Value : The intensity value at the point of the cursor moved on the histogram.

Pixels : The numbers of the pixels at the point of the cursor moved on the histogram.

Ratio : The ratio of the intensity value at the point of the cursor moved on the histogram to the whole intensity value.

⑥ The Output button allows for the transmission of the histogram data fixed at the System Setup.

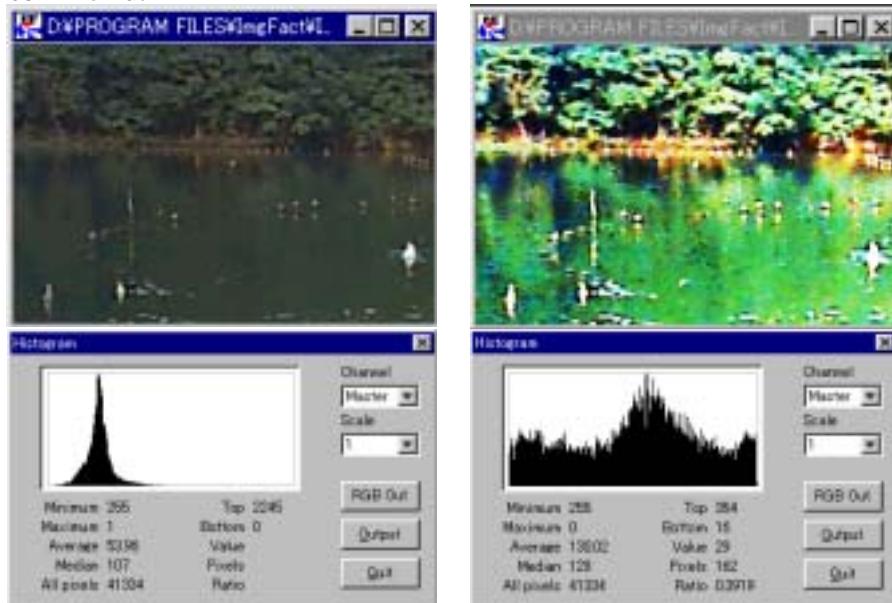
The screenshot shows a software interface with a menu bar at the top. Below the menu is a toolbar with various icons. The main area is a text editor displaying a grid of numerical values representing pixel data. The data is organized into columns: the first column contains starting coordinates (X, Y), followed by X coordinates, Y coordinates, and finally R, G, and B intensity values.

12210	110	111	45	29
45	28	95	129	111
45	29	94	128	110
45	30	98	132	115
45	31	101	136	118
45	32	102	137	122
45	33	100	136	121
45	34	97	135	118
45	35	100	136	119
45	36	101	136	114
45	37	103	138	114
45	38	95	121	111
45	39	91	128	108
45	40	99	132	115
45	41	94	121	115
45	42	97	134	117

⑦ By clicking the RGB Out button, the following file format is output in the text type of file. In the first left column, the total numbers of the pixels, the numbers of the pixels of width, the numbers of the pixels of the height and X and Y co-ordinates of the starting point of output are shown, and, on and after the second column, X co-ordinates, Y co-ordinates, R intensity value, G intensity value and B intensity value are described. After this, the data are described in the same manner repeatedly. By the command of Read Image Data in the File menu, this text file can be opened as an image.

5. Histogram Equalization Command : Marco possible

This command allows for the equalization of the intensity distribution of the image which can be confirmed by the histogram. As, by this command, the area of bright part and dark part on the image is almost equalized, the image which is excessively bright or on the contrary dark as a whole is appropriate for this command.



6. Color Selection Command : Marco possible

① This command allows for the extraction of the objective from the image with a color as a extraction factor. The selection by the the color of work is also possible. There is no limit in the resolution of the image and the gray scale image is also adaptable. When selecting this command, the Color Selection dialog appears.

② There are scroll bars at the Sample Color to designate the intensity value of red, green and blue color composition. There are two ways to designate the value. One is to move the scroll bar and another is to enter the numbers at the Color text box and push Enter key.



③ One more method. At the Color Selection dialog when you click on the image, the color composition of the point of the image so clicked is entered at the scroll bar.

④ At the Tolerance text box, enter the number with ± of scope of selection from the designated color. Adjust the scope so as to be able to extract the object.

⑤ The composed color of three primary colors designated is appeared at the color box and the registered designated color number is appeared at the list box.

You can designate the multiple colors to select and the first color is displayed as Color 1.

⑥ When you push the Add button, the Color 2 is displayed at the list box and you can add the selection color. In the state of appearance of the Color 2 if you select the color composition by scrolling the bar or enter the number using the mouse, you can add the extraction color. The addition of the color extraction is possible in the manner up to tens of kinds.

⑦ The alteration of the color composition once registered is possible any numbers of times. In the state of appearance of the color number at the list box, when push the Delete button, you can delete the registration.

⑧ At the ForeColor you can select the extracted displayed objective color from among Original, Black and White.

⑨ At the BackColor you can select the back color other than the objective color from among Original, Black and White.

⑩ When you check in the On New Image box, the new image after processing is created and if do not check it is save on the selected image.

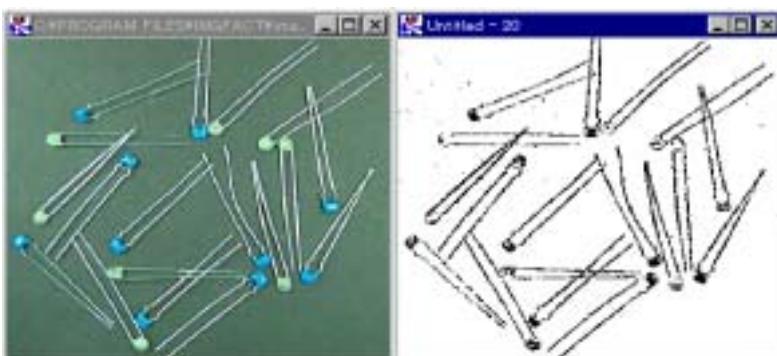
⑪ When you click on the Update button, the only designated color is extracted as you setup from the selected image and appeared.

⑫ When you click on the Reset button, the appearance extracted its color is restored to the original image.

⑬ When you click on the Do button, the color extraction is done as setup and the image is created, then the Color Selection dialog is closed.

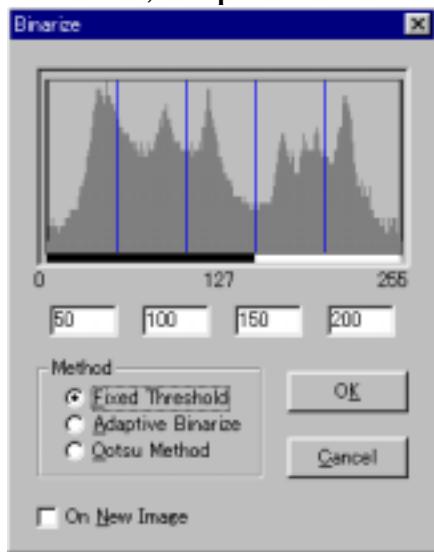
⑭ When you click on the Quit button, the Color Selection dialog is closed.

⑮ At the image shown below, the objects is extracted with the designated colors, Blue, Yellow-green and White.



7. Binarizaion Command : Marco possible

- ① This command allows for the binarazation of the image. Clicking on this command, the Binarizaion dialog opens.
- ② There are three methods in the binarazation as shown at the Method, Fixed Threshold, Adaptive Binarize and Otsu Method.



③ Fixed Threshold is done using an intensity histogram of the selected image. In usual binarization, an image is classified into two levels simply by a specified threshold value and the upper level is turned to white and the lower, black. However, such manner makes the image undistinguishable, very often. This command prepares five ranges of level and enables you to select a preferred range from them to avoid such inconvenience as mentioned above.

④ Four blue lines and a intensity distribution are shown in the histogram. Four text boxes are displayed beneath the histogram, and each shows the current position of each blue lines. And, the

histogram is highlighted in white or black in each range divided by the four lines. By default, the three ranges at left side are black and the others are white.

⑤ Confirm an object in the image to be extracted, and select a proper range and its highlighting color, black or white, to extract the object well. By pointing and double-clicking over the selected range, you can switch its highlighted color, black or white.

⑥ You can shift each of the blue lines and change ranges by dragging the line to a proper position to distinguish the required object easily. As the lines is shifted, the image is binarized at the same time. The image of no gray scale image is not changed.

⑦ As five ranges are selectable, judging the imaged select the highlighting the color, black or white. When you finish the adjusting of the range, push the OK

button and decide. The binarized image is created and the dialog closes. The images shown left are the sample of the binarized images processed as described above.



- ⑧ In case you cannot extract the object from the undistinguishable image or the image with a shadow at the background with the Fixed Threshold method, when you use the Adaptive Binarize method, you can get the object automatically. Selecting the Adaptive Binarize with the radio button and push the OK button, the automatic binarization is conducted which faithfully extract the edge of the undistinguishable image. This is because with this method the threshold value can be altered at each position and fine edge extraction can be acquired without being effected by each alteration of the brightness.

- ⑨ The Otsu Method is the representative method of binarization. This method decides the most preferable threshold value in the statistical sense from the density histogram of the image. This is the theory that, when you classify a histogram into two levels divided by a certain threshold value, it selects the threshold value which makes the distribution between two clasifications maximum.

8. Shape Analysis Command : Marco and Area possible

- ① This command provides an image conversion processing to extract geometrical features from a binarized image. Click this command and Morphological Operations dialog box appears.



- ② When you select the area, the only area selected is processed and if you do not select, the whole image is processed.

- ③ At the Operation list box, following nine of processing methods are provided.



- ④ From the Feature Color group, select Black or White as the color of object shape to be processed. Process is done on the selected color.
- ⑤ From the Layer input box, select the number of neighboring pixels for processing used in the Erosion,Dilation, Opening, Closing or Outline process. Select a proper number according to the degree of unevenness or grooves appearing on the image.
- ⑥ By checking the On New Image check box, the image processed is created as a new image and, if not, it is saved on the image.

- ⑦ The followings show how each process is done.



· Closing :



The image is processed by Dilation after a process by Erosion. This is effective in eliminating fine unevenness or grooves on the object figure. The number of the Layer is selectable. The sample images in the left show the case , “1” and “2” is selected for the number.

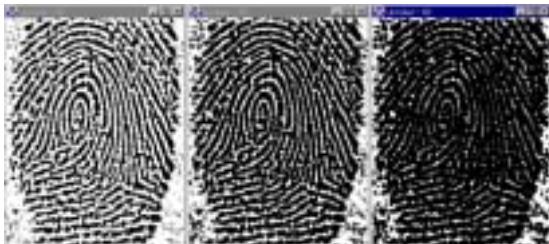
The image is processed by Erosion after a process by Dilation. This is effective in detecting fine unevenness or grooves on the object figure. The number of the Layer is selectable. The sample images in the left show the case, “1” and “2” is selected for the number.

· Erosion :



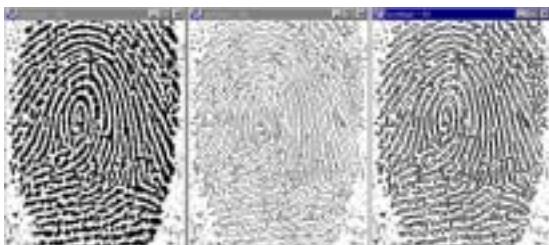
Element of the object figure is contracted by reversing its perimeter pixels by the value selected in the Layer box. The sample images in the left show the case, “1” and “2” is selected for the number.

- Dilation :



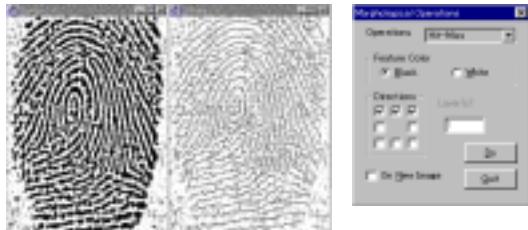
Element of the object figure is expanded by reversing its perimeter pixels by the value selected in the Layer box. The sample images in the left show the case, “1” and “2” is selected for the number.

- Outline :



Only the lines contouring the object figure are extracted and displayed with processed elements for the values selected in the Layer box. This is effective in recognizing the shape of figure. The sample images in the left show the case, “1” and “2” is selected for the number.

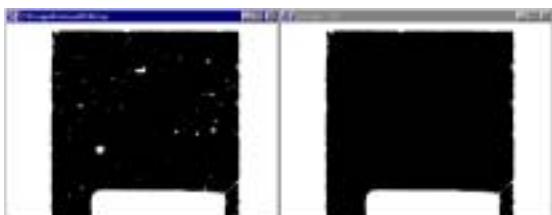
- Hit-Miss :



The edges of the object figure are extracted. And, as this extraction can be filtered by particular edge direction, you can get edges in the required directions easily. By checking the proper check boxes in the Direction group, that is active only while the Hit-Miss method is selected, you can select the directions with which extraction

is done. The eight check boxes are located in formation supposing the image is positioned at their center, to identify the direction of each box. The sample images in above show the case the three boxes on the top line are checked.

• Filling Hole :



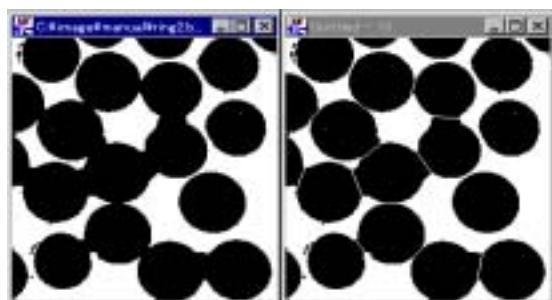
In case there are holes on the image, the all holes are filled with same color as the objective image. It is effective in eliminating the noises on measuring.

• Skeleton :



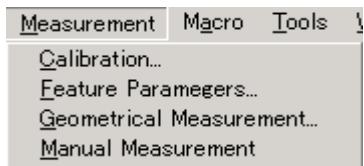
This method narrows line-shaped figures into the width value “1”. This is effective in extracting features of such figures as characters or drawn lines that has no their own width originally.

• Separation :



This process separates the overlapping or touching object figures in such event as analyzing the particles. This can separates the figures without harming its original features. The image left shows some separation of the figures touching one another.

Chapter 9. Measurement Menu

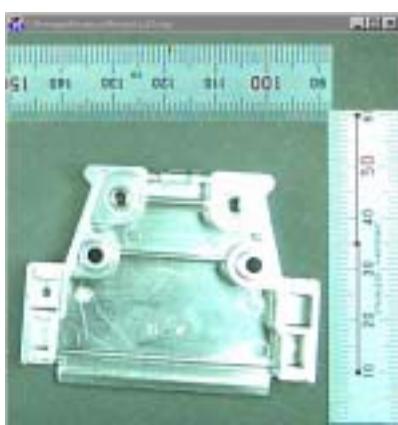


1. Calibration Command : Zoom possible

- ① This command allows for the specification of the relationship between the pixels of the image and practical length or location of the origin or setup of the correction of the inclination angle and others. When calibration is done, the extra small volume or length of the length, area, gravity position, etc. measured are calculated in the unit of setup value. If not, all values are calculated in the unit of the pixels. Selecting this command, the Calibration dialog box appears.
- ② At the mode group, there are two modes of setup, By Rulers and User Input. Selecting the By Rulers and clicking setup button, the standard line and rectangular mark appear at top left on the image. By moving or deforming the standard line or mark and adjusting them to the standard object, the standard values to correct are setup. When each correction value is known, select the User Input and enter the numbers of the pixels for unit length, inclination angle and position of the origin at each boxes in the Result group.
- ③ Specify the unit system to use at the Unit list box. Four unit systems are provided to select, pixel, mm, cm and inch.
- ④ At the Resolution group, specify the approximate area of the object on the image. This group is effective only when the unit other than pixel is selected at the Unit list box. For specifying more precise number of the pixels for unit



length, the Ruler 1 and Ruler 2 is provided to correct the resolution values of the images, those are in many cases impossible to be input with the same resolution value because of the character of the lens. However, in case there is no standard object on both X and Y axis, by checking in one of them both are corrected in the same manner.



⑤ When you specify using the ruler, specify the standard length on the image. Clicking the Ruler 1 button, white or black line and three rectangles appears at top left on such line. Adjust the length of the white line to the standard image of the length of X direction. By dragging intermediate rectangle, the line can be moved, and by dragging both side rectangles, the length or angle of the line can be changed. As, in the text box beside the Ruler 1 button, the specified number of pixels of the ruler is appeared automatically, enter the corresponding length in the specified unit.

⑥ In the same manner as X direction, specify the Y direction number by clicking the Ruler 2 button.

⑦ At the Position group, specify the inclination and the point of the origin. In default, the inclination is horizontal and the degree is 0, and the number is plus to the clockwise direction. Clicking the Angle button, a line is appears on the image, then put it on a X direction side of the object as a standard inclination of the image. The angle degree is input at the text box automatically.

⑧ In default, the value of the origin is X=0, Y=0 at the top left point on the image. As the center point of the object is calculated on the basis of the origin point of the image as a standard point, specify the origin point of the image at your discretion on the image. Clicking the Origin button, the cross

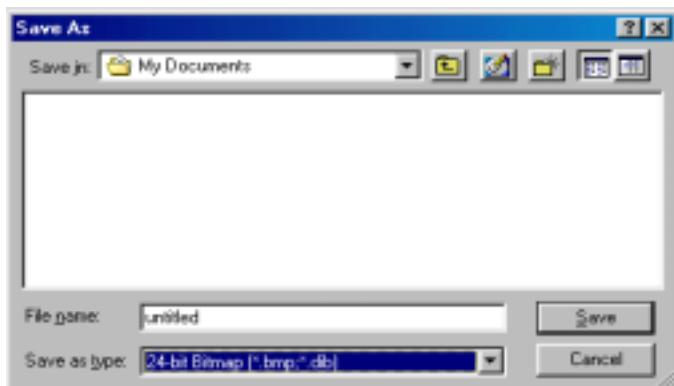
mark with small circle appears at the top left on the image. At first the mark is hard to find, however, if you move the cursor on the mark, the cursor changes its shape and easily you can find it. As this mark can be moved by dragging, move it on the origin point of the image. Then, the coordinates position is appeared with the pixel numbers of X and Y directions at the two text boxes respectively at the right side of the button.



⑨ At the Result group, X Resolution, Y Resolution, Angle degree and Origin position text boxes are provided. When you select the By Ruler, all the results are automatically entered. If you select the User Input, the text boxes are effective, and input the number directly.

⑩ The calibrated values can be saved or load as a file of the extension, “*.clb” .

By clicking the Load button, the Open the file dialog box appears and you can open the “.clb” file. When you click the Save button, the Save As dialog box

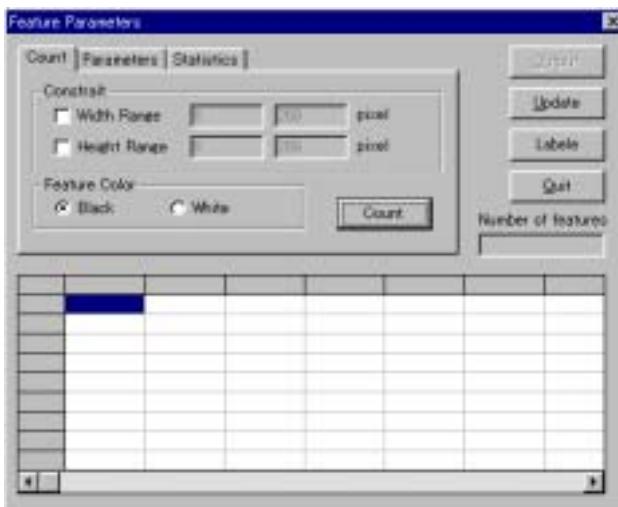


appears, and you can save the file as a “.clb” file.

⑪ When you click the OK button, the contents setup at the Calibration dialog box is recorded and they are reflected on the value of the extra small volume or length.

2. Feature Parameters Command : Macro and Area possible

① This command allows for counting the object, calculating the parameter of the object shape or selection of the object using the parameter on the binarized image. Selecting this command, the Feature Parameters dialog appears. In the dialog box, three tabs are provided for each type of process.

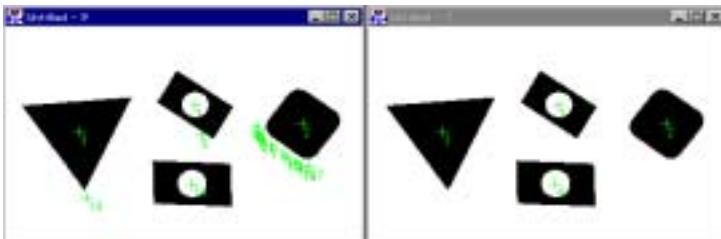


② At the Count tab, by specifying the size of the width and height of the object. the number of the objects on the image are counted. When you specify the area on the image, the only objects within the area specified are counted, but if not, the objects on the whole image is counted.

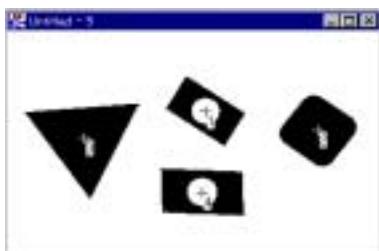
③ At the Extract group, specify the Width Range and Height Range of the object to extract.

By checking in the check boxes at the Width Range and Height Range, as the boxes are effective enter the range of the size of the object to extract.

- ④ At the Feature Color, select either Black or White with the radio button.
- ⑤ After specifying when clicking the Count button, it extracts the only objects smaller than the specified one and marks cross shapes and the numbers at the center of the extracted objects on the image. The number is put in order from the top located object on the image. The number extracted is displayed at the Number of Features text box.
- ⑥ By clicking the Update button, the object other than the extracted one of the image becomes back color and the image shows the extracted objects only.



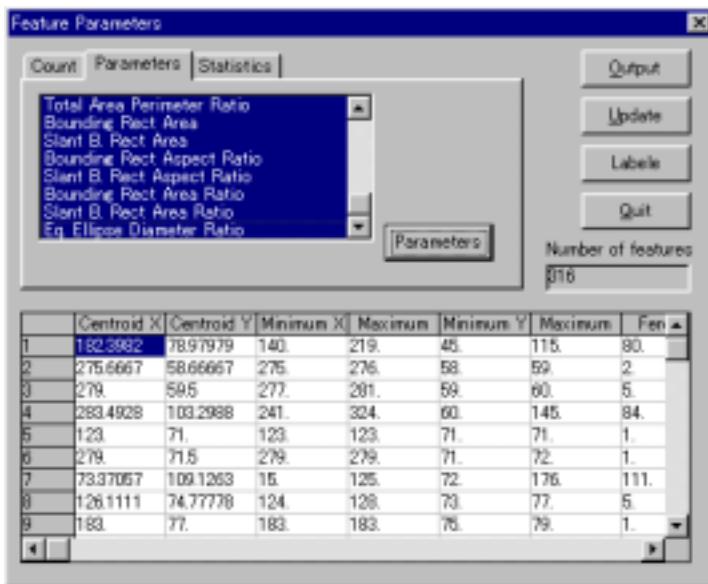
The left image of the images shown left is the case where the Extract command is not done, while the right one is image done and eliminated the object other than the target objects by clicking the Update button.



- ⑦ The numbers put on the image at the time when the objects are counted are not image data, therefore, they are not saved as a file or cannot be printed. However, by clicking the Label button, the image with the number is created on the conditions that as was counted. This is useful when you compare with the Excel data measured or verify the image information with the measured data.

- ⑧ At the Parameters tab, the extra small value of the object extracted is measured and displayed in a table. At the list box, select a objective parameter. By selecting, its background turns to blue. The selection of the parameter turns effective and ineffective at each clicking on it. By double clicking, all parameters are selected, and by right clicking, the selection is cancelled.

- ⑨ After selecting measurement parameter, clicking on the Parameter button, the measured value selected is displayed at the table below the dialog box. The total and average value of each feature are displayed at the bottom line or neighboring line on the table. And for the area of the Net Area, Hole Area and Total Area, the number of the ratio of the area to the whole area of the image is displayed at the last line.



⑩ For the direct calculation, the following 24 parameters are provided at the list box. After transmitting the data to the Excel, when you calculate the other parameter almost all parameters are calculated. The followings are the contents of each parameter.

· Centroid X : Xc

The X coordinates position of the area's centroid of the object from the origin point on the image.

· Centroid Y : Yc

The Y coordinates position of the area's centroid of the object from the origin point on the image.

· Minimum X : Xmin

The coordinate position of the minimum point to the X direction of the object.

· Maximum X : Xmax

The coordinate position of the Maximum point to the X direction of the object.

· Minimum Y : Ymin

The coordinate position of the minimum point to the Y direction of the object.

· Maximum Y : Ymax

The coordinate position of the Maximum point to the Y direction of the object.

· Feret X : Xdiff= Xmax – Xmin+1

The balance of Xmax and Xmin, the feret value of the X direction.

· Feret Y : Ydiff= Ymax – Ymin+1

The balance of Ymax and Ymin, the feret value of the Y direction.

· Number of Holes : Nc

The number of holes existing on the object.

· Net Area : Sa

The area of the object excluding the area of the holes.

· Hole Area : Sc

The total area the holes on the object.

· Total Area : St

The area of the object including the area of the holes.

- Hole Area Ratio(%) : $Hraio=Sc/St*100$
The ratio of the Sc to the St.
- Outer Perimeter : Po
The length of perimeter of the object.
- Inner Perimeter : Pi
The total length of the holes on the object.
- Equivalent Diameter : Deq
The diameter of the hole with same area as the object.
- Major Angle : θ
The angle of the major axis of inertia. The standard is the of $X+, Y=0$ on the XY plane and the angle is 0.
- Major Diameter : Dmj
The length of the long diameter of the ellipse with same area as the object.
- Minor Diameter : Dmm
The length of the short diameter of the ellipse with same area as the object.
- Length : L
The distance acquired when the object is reflected in parallel with the major axis of inertia.
- Breadth : B
The distance acquired when the object is reflected in parallel with the minor axis of inertia.
- Maximum Diameter : $Dmax$
The length between the most distant two points on the parameter of the object.
- Maximum Radius :
The length from the centroid to a most distant point on the parameter of the object.
- Minimum Radius : $Rmin$
The length from the centroid to a nearest point on the parameter of the object.
- Average Radius : $Rave=(Rmax+ Rmin)/2$
The average value of Maximum Radius and Minimum Radius.
- Net Area Perimeter Ratio(%) : $Peround=(4 \pi Sa/Po^2)*100$
The ratio of the Outer Perimeter to the Net Area.
- Total Area Perimeter Ratio : $PPS= Po^2/St$
The ratio of the Outer Perimeter to the Total Area.
- Bounding Rect Area : $Sx1=Xdiff*Ydiff$
The area surrounded by the Feret X and Feret Y.
- Slant B. Rect Ratio : $Sx2=B*L$
The area surrounded by the distances acquired when the object is reflected in parallel with the minor axis and major axis of inertia.
- Bounding Rect Aspect Ration : $Lratio\#1= Ydiff/Xdiff$
The ratio of the Feret Y to Xdiff

- Slant B. Rect Aspect Ratio(%) : Lratio#2=B/L*100

The ratio of the distance acquired when the object is reflected in parallel with the minor axis of inertia to the distance acquired when the object is reflected in parallel with the major axis of inertia.

- Bounding Rect Area Ratio : Sratio#1=Sa/Sx1*100

The ratio of the area of the object excluding the area of the holes to the area surrounded by the Feret X and Feret Y.

- Slant B. Rect Area ratio : Sratio#2=Sa/Sx2*100

The ratio of the area of the object excluding the area of the holes to the area surrounded by the distances acquired when the object is reflected in parallel with the minor axis and major axis of inertia.

- Eq. Ellipse Diameter Ration : Aratio=Dmn/Dmj*100

The ratio of the length of the short diameter of the ellipse with same area as the object to that of the long diameter.

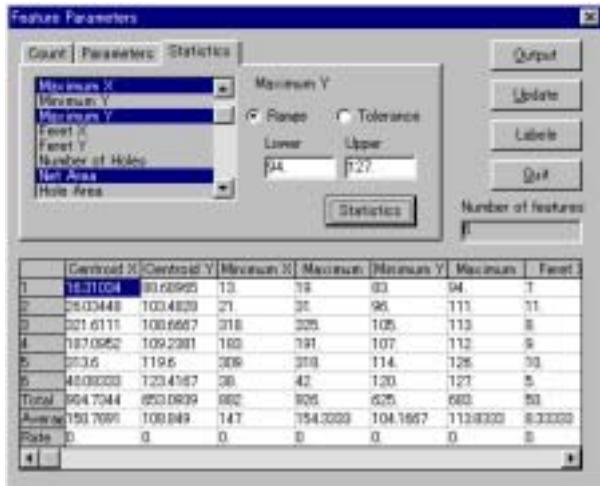
⑪ By clicking the Output button, the number of the objects and their

parameters being shown at the table are output in order to the place specified at the System Setup. The table shown left is the sample of the case when outputted on the sheet of Microsoft Excel.

Data from Image Factory						
	A	B	C	D	E	F
1		CentroidX	CentroidY	MininumX	MininumY	Maxinan
2	1	16.31034	88.68965	13	19	83
3	2	26.03448	103.4628	21	31	96
4	3	321.6111	108.6667	318	325	105
5	4	187.0952	109.2381	183	191	107
6	5	313.6	119.6	308	318	114

⑫ At the Statistics tab, you can select the of objects by specifying the range or standard value and tolerance of the measured parameters. This page is effective after measuring the parameter.

⑬ At the list box, the same value of the parameter as measured at Parameter tab are appeared. From among them, click on the parameter you want to select by specifying the limit value. Then, the background turns blue and the name of the parameter is appeared to the right of the list box.

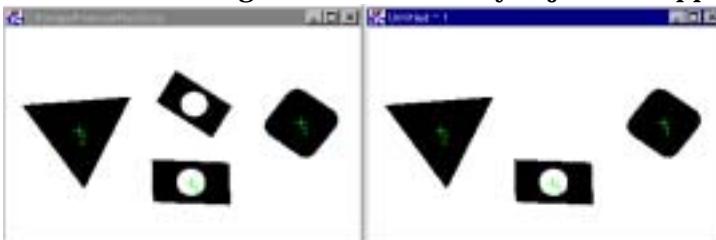


- ⑯ There are two methods to setup the limit. Select the either one at the radio button. The one is to specify the Range. When you select the parameter, the maximum and minimum value of the parameter are displayed, then enter the number to limit. Another one is to specify the Tolerance. When you select the parameter, the number of the intermediate value and the maximum and minimum value from the intermediate value of the object is displayed. Then, enter the number to limit. After specifying the limit, by clicking the Statistics button, the only objects answering the limit conditions are extracted and the numbers extracted is appeared at the Number of Features text box.

The numbers are put on the only objects extracted on the image and the data at the table are also for only the objects extracted.

⑯ By clicking the Output button, the numbers and the parameters of the objects displayed at the table are output to the place specified at the System Setup.

⑰ When clicking the Update button, the image eliminated with the objects turns to the background and the only objets are appeared on the image.



⑱ When clicking the Label button, you can create the image with the numbers on the objects on the conditions when it is counted.

3. Geometrical Measurement Command : Macro possible

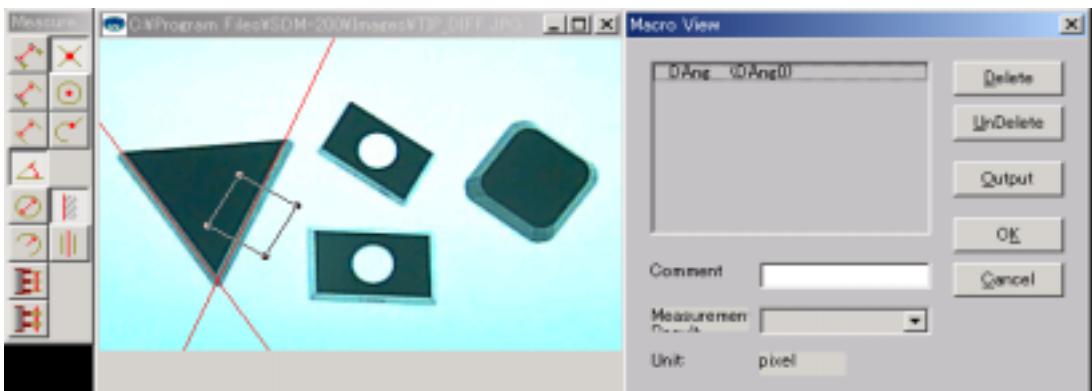
① This command allows for the such geometrical measurement, by recognizing the edge, as the width, angle degree, distance between the center of the circles, distance between the pitches, width of the line, etc. The measurement is done for the binalized or gray scale image. For the full color image, the measurement is done after being converted to the gray scale image. The stable measurement is obtained when it is done for binalized image. When the measurement is done for the gray scale image, you can extract the edges of the multiple intensity levels on a image at you discretion, however, they are affected by the major noises. When you measure, select the image, binarized or gray scale one, considering appropriateness for the most use of their respective features. When conducting the Geometrical Measurement, make the most use of such functions this USB Digital Scale has as adjustment of the brightness or color, elimination of the noises using filters, extraction by the color, analysis of the binalized image so as to make the image as clear as possible.

② For this Geometrical Measurement, the automatic measurement by the Macro is practicable. With this command when you teaches the positions of a work on a image with a single work to measure, the measurement of the number of the units, position, inclination, etc. of the same work or works which locates at the different position from the said position or rotates on the other image is done at the same part.

③ Before the measurement, specify the color, number of units, the range of error, etc. of the object at the Geometrical Measurement Setting. The setup can be done at the Geometrical Measurement Setting at the Tool menu or Geometric Setup button at the tool bar. In details, refer to the Chapter 11. Tool menu.

④ Before the measurement, specify the intensity value of the object edge and sorts of extracting edges at the Edge Direction Setting. The setup can be done at the Edge Direction Setting at the Tool menu or Edge Definition button at the tool bar. In details, refer to the Chapter 11. Tool menu.

⑤ When select this command, the Macro View dialog box and Measure Type tool box appears.



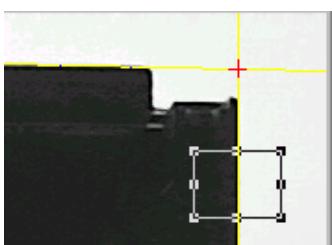
⑥ At the Measure Type tool box, the Measurement Method button where you select the measurement method, the Point Type button by which you specify the type of the point and the Line Type button by which you select the type of the line are provided. When you specify the area to refer for the edge, use the Edit Drawing Toolbox (Select box). For the method of specifying the area, refer to Chapter 3. Basic Operation. At first, the methods of the selection of the point type and line type are described, and then measurement method is described below.

⑦ Point Type button : Select one from the following three methods of specifying the position of a point.



- Intersection between two lines
- Center of a circle
- Intersection between a line and a circle

• Intersection between two lines button : The point of the intersection of the two lines is specified after selecting two lines one by one. As the line is drawn approaching to the edge at the area selected, be careful not to specify the two different lines at the same area, because, in this case, fully different lines are drawn from the line approaching to the edge. When you specify the two lines, the intersection point is highlighted with the red color cross mark.

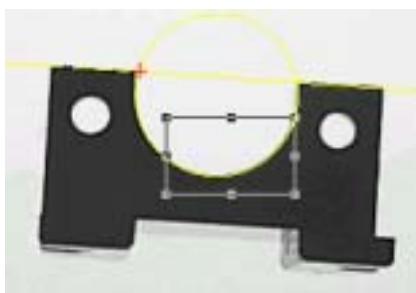


- Center of a circle button : This command allows for specifying the center of a circle. Select the area where the edge contained.



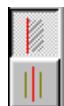
When you select the area where the whole circle is indicated, the stable result is acquired, however, selection of the part of a circle is also applicable. By selecting the area, the red color cross mark and approximate circle is displayed.

- Intersection between a line and a circle button :



This command allows for specifying the intersection between a line and a circle. First, specify the edge of a line, then the approximate line is drawn. Next, specify the area including the whole or part of a circle. The approximate circle is displayed and the intersection point between the line and circle.

⑧ Line Type button : Select one from the following two methods of specifying a line.



- Edge line
- Central line

- Edge line : By this command, a line is specified. Select the area where a edge is contained. By selection of the area, the approximate red color line is drawn.



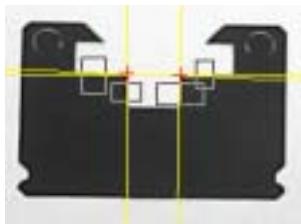
- Central line : By this command, after specifying two lines, a central line is drawn between two lines. When you specify the area containing a edge the approximate yellow line is drawn and the second line is drawn, a red color central line is drawn.



⑨ Measurement Method button : Select one from the following measurement method items.



- Distance between two points
- Distance from a point to a line
- Distance between two lines
- Angle between two lines
- Diameter of a circle
- Radius of a circle
- Distance between pins
- Pin width

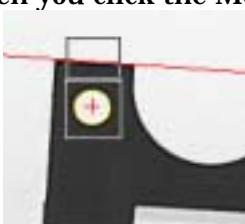


· Distance between two points :

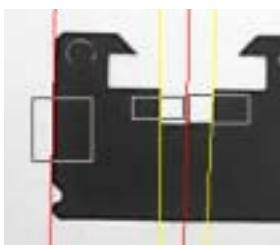
This command allows for the measurement of the distance between the intersection point of the lines and the center of a circle, and between the intersection points of a line and a circle. By specifying the first point and then second one, the distance between the two is displayed at the Measurement Result list box.

· Distance from a point to a line : This command allows for the measurement of the perpendicular distance between such point as intersection of the lines, center of the circle and intersection of the line and a circle and a line or central line of the two lines. Specify a point first and then the line. Then, the distance is displayed at the Measurement Result list box.

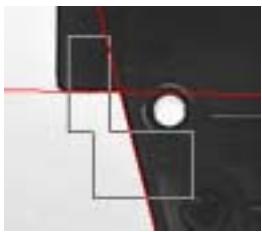
When you click the Measurement Method button, the Point Type button appears first. Select the one of them and specify the first point. Then, at such point the red color cross is displayed and at the same time the Line Type button is displayed. Select the one from two methods of specifying the line at the Line Type .



· Distance between two lines button :



This command allows for the measurement of the distance between the lines. When the lines are not parallel, it is measured with the average point of the edge at the selected area. By specifying two lines, the distance between them is displayed at the Measurement Result list box. When clicking the button, the Line Type button is newly displayed. Select the one from two methods of specifying the line at the Line Type .



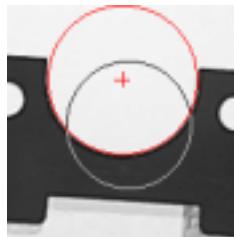
· Angle between two lines button :

This command allows for the measurement of the angle of the lines. When you specify the two lines, the angle is displayed at the Measurement Result list box. By clicking the button, the Line Type button is newly displayed. Select the one from two methods of specifying the line at the Line Type .



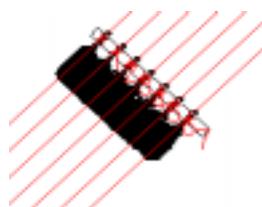
· Diameter of a circle button :

This command allows for the measurement of the diameter of a circle. When you select the area containing the edge of the whole or part of a circle, the diameter of the circle is displayed at the Measurement Result list box. By selecting the area containing the edge of a circle, the red color cross mark at the center of the circle and the approximate circle are displayed.



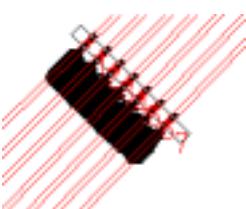
· Radius of a circle button :

By this command, measurement of the radius of a circle is done. Selecting the area containing the edge of the whole or part of a circle, the radius of the circle is displayed at the Measurement Result list box. By selecting the area containing the edge of a circle, the red color cross mark at the center of the circle and the approximate circle are displayed.



· Distance between pins button :

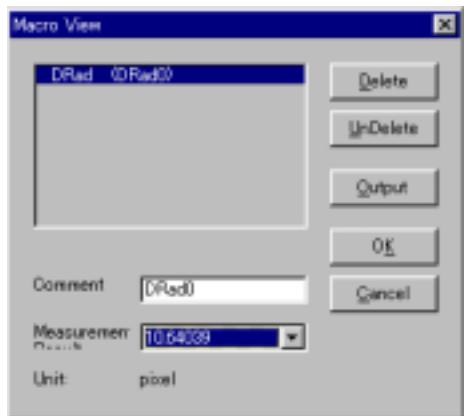
When multiple pins are lined, the distances between all pins existing within the area selected is measured at a time. When you select the area, specify it in such manner as the long side of the rectangle is vertical to the pins. Referring the pins in such area, the distance between the the centroids of the pin's area. The red color cross is displayed at the centroids and the approximate central lines is drawn.



· Pin width button :

When multiple pins are lined, the width of all pins existing within the area selected is measured at a time. When you select the area, specify it in such manner as the long side of the rectangle is vertical to the pins. After measurement, the red color lines is drawn at the both sides of the pins.

⑩ Selecting the Measurement Method and the specifying the edge, the abbreviation of the selected method is appears at the Macro View list box. When clicking on the abbreviation of the method, the back ground turns blue and at the same time the contents is displayed on the image. The appearance of the contents on the image indicates the the area where the edge is referred to with rectangle and a line or a circle as results measured. The meaning of the abbreviations are as follows.



- Distance between two points : DPtPt
- Distance from a point to a line : DPtLn
- Distance between two lines : DLnLn
- Angle between two lines : DAng
- Diameter of a circle : DDiam
- Radius of a circle : DRad
- Distance between pins : DPitch
- Pin width : Dwidth

⑪ In the state a Measurement Method is being selected, when you click the Delete button, the mark “*” is put at left side of the selected Measurement Method. If you selected the Measurement Method while it is being marked with “*”, the contents taught cannot be referred. And if you select the Output button in the state of being marked with “*”, the data are output on the conditions that such method is deleted.

⑫ By pushing the UnDelete in the state a method is marked with “*”, the mark is erased and the deletion is restored.

⑬ When you push the Output button, the data are output to the place specified at the System Setup.

⑭ At the Comment text box, you can add a note at each Measurement Method. Selecting a Measurement Method, the comment in default appears. Putting the cursor here, it becomes effective. Japanese words can be entered here, but as much as 256 letters in half scale can be entered. The comments recorded

	A	B	C
1	Angle between two lines	59.672	DAng0
2	Distance between two lines	62.09	DLnLn0
3	Distance between two lines	62.702	DLnLn1
4	Diameter of a circle	25.961	DDiam1
5	Diameter of a circle	27.843	DDiam2
6	Radius of a circle	13.921	DRad0
7	Distance between two points	110.153	DPtPt0
8			

appears at the right end column on transmitting the data to the Excel. To record, be sure to push the Enter key after entering the comments at your discretion. If you do not push the Enter key, the letters entered becomes void.

⑯ When selecting the recorded Measurement Method at the list box, the result of the corresponding measurement appears at the Measurement Result list box. Normally, the result is one for one method, however, in case of the Distance between pins and Pin width the multiple results are appears.

⑰ At the Unit, the unit used at the calibration is displayed.

4. Manual Measurement Command : Zoom possible

① This command provides measuring of the area or length by selecting the line or area. By selecting this command, the Manual Measurement dialog box appears.

② When you select the place by using the Drawing Tool Box (Select box) and measure it, the measured value appears at the table. At the table, the symbol of the selected tool, the number and measured values appear in this order.

③ The measuring items are different with each selected tool. The followings are measurement items for respective tools.

- Area Selection (Rectangle, Slant Rectangle, Ellipse, Polygon, Three Points Circle, Auto- Selection Region) : Perimeter, Area, Radius and Diameter.
- Line : Distance, Angle (the counterclockwise angle from the horizontal line)
- Polyline : Distance
- Three Points Angle, Four Points Angle : Angle (the angle between two line)

④ Regarding how to specify the area or line, refer to Chapter 3. Basic Operation. The area or line selected can be transferred or transformed and canceled by right clicking. By pressing the space key after measuring an item, a number is put on the selected place and another place is selectable. By repeating the selection and pressing the space key, many items can be measured.



Manual Measurement							
Index	Unit	Diameter	Perim.	Area	Angle	Radius	Distance
1	pixel	-	-	-	2	-	-
2	pixel	3.	-	-	-	-	-
3	pixel	-	-	-	2	-	-
4	pixel	-	-	2	-	-	-
5	pixel	-	-	2	-	-	-
6	pixel	-	3.	44	-	-	-
7	-	-	-	-	-	-	-

⑤ The number put when selecting area or pressing the space key is canceled by right clicking some times and at the same the data at the table are also canceled.

⑥ By clicking the Label button, the new file where such area or numbers are drawn at the image is created, so you can save it as a file or for printing.

⑦ When you click the Output button, the data are output at the place you set up at the System Setup. The following the sample of the case where the data are output at the Excel.

The screenshot shows an Excel spreadsheet window titled "Data from Image Factory". The table has columns labeled A through H. Column A is "Index", B is "Unit", C is "Distance", D is "Perimeter", E is "Area", F is "Angle", G is "Radius", and H is "Diameter". The data consists of 8 rows, indexed from 1 to 8. Row 1 contains headers. Rows 2 through 8 contain data points, mostly "pixel" units. The data is as follows:

A	B	C	D	E	F	G	H
Index	Unit	Distance	Perimeter	Area	Angle	Radius	Diameter
1	pixel	93.15	0	0	284.93	0	0
2	pixel	314.15	0	0	0	0	0
3	pixel	0	0	0	256.16	0	0
4	pixel	0	59.69	283.53	0	9.5	19
5	pixel	0	62.91	313.37	0	9.99	19.97
6	pixel	0	326.34	4452	0	37.64	75.29
7	pixel	0	504	6851	0	46.7	93.4

Chapter 10. Macro Menu



1. Start Recording Command :

If you once teach the functions of the USB Digital Scale by this command, almost of all functions can be performed later continuously. When you repeat the operations after performing this command, the orders or setup of such operations are recorded and the macro file is automatically created. The commands the macro can be effected are 22 commands which have the comment “Macro possible” at the Menu commands described so far. The commands other than those mentioned above are not possible with the Macro. The abbreviations when you perform the Macro are shown after the command name as follows. The commands which has the dialog box can be changed with its setup on performing Macro.

- **Crop : #Crop**

allows for cutting the specified area. It has no dialog box.

- **Brightness, Contrast and Gamma : #B.C.G**

allows for adjustment of the Brightness, Contrast and Gamma. It has the dialog box.

- **Hue, Saturation and Intensity : #H.S.I**

allows for adjustment of the Hue, Saturation and Intensity. It has the dialog box.

- **Tone Adjustment : #Tone Adjustment**

allows for the adjustment of “All colors”, “Red”, “Green” and “Blue” respectively. It has the dialog box.

- **Color Separation : #Color Separation**

allows for the 5 kinds of color separation,such as RGB, CMYK, etc. It has the dialog box.

- **Color Bit Change : #Bit Change**

provides the changing of the resolution of the pixels, palette and dithering. It has the dialog box.

- **Rotation : #Rotate**

allows for the rotation of the image. It has the dialog box.

- Geometric Correction : #Correct

allows for the correction of the lens distortion. It has the dialog box.

- Merge : #Merge

allows for the merging of the two images. It has the dialog box.

- To Grayscale : #Gray Scale

allows for the conversion of the image to 256 steps of black and white image. It has no dialog box.

- Inversion : #Inversion

allows for the inversion of the intensity value. It has no dialog box.

- Pseudo Color : #Pseudo Color

allows for the pseudo color display of the black and white color image. It has no dialog box.

- Spatial Filters : #Filter

provide with 22 kinds of filters such as Median, Sobel, Laplacian, etc. The type of filter, setup, etc. can be registered. It has the dialog box.

- Special Effect : #Effect

allows for such special effects as emboss, mosaic, etc. However,

- Arithmetic Operations : #Logic & Arithmetic

allows for such logic or Arithmetic operations between images as AND, OR, XOR, etc. The kind of operations can be registered, however, the file name of the image selected as an object is displayed automatically and that of the original image must be selected manually. However,

- Background Fitting : #Bkgd

allows for smoothing of the background image. It has no dialog box.

- Histogram Equalization : #Hist Equalization

allows for the equalization of the intensity distribution. It has no dialog box.

- Color Selection : #Color Selection

allows for the color extraction after setup of the three primary colors and the area selection. It has the dialog box.

- Binarization : #Binarization

allows for the binarization of the gray scale image. The method of the binarization such as Fixed Threshold, Adaptive Binarize, etc. or setup value are recorded. It has the dialog box.

- Morphological Operations : #Morphological

allows for the selection of such image process as Erosion, Dilatation, Outlining, Line Narrowing, etc. These kind or setup contents are registered. It has the dialog box.

- Feature Parameters : #Counting

All functions at this command such as Counting, Parameters Counting, Area Selection, Data Transmission, etc. can be recorded.

- Geometric Measurement : #Geometric Dimension

All functions at this command such as the measurement of the distance between the points or lines, angle degree, diameter, the distance between the pitches, transmission of data to Excel, etc. can be recorded. And as for the output of the data to the registered place, it is transmitted without clicking the Output button.

2. End Recording command

When you select this command after having performed the Start Recording command, recording on Macro is ceased and Macro file is created. This Macro file is being recorded on the memory, so you can perform it as it is, however, if it is not saved and other Macro file is opened, this file is deleted.

3. Play Macro command

This command allows for the execution of the Macro. There are two ways to perform the Macro. One is to do at one time to the end and another is to do step by step confirming the performance. For the method of doing step by step the setup value is possible to be changed, therefore the new Macro is easily created for more desirable image with minor change. When you select this command, the Play Macro dialog appears.

① Select the method at the Running Mode group. When you select the Batch button, all commands recorded at the Macro file are fully performed. In this case you cannot change any setup value.

② When you select the Interactive button and perform each command, the dialog box appears if you had setup the command with the dialog box, so you can change the setup value there.

③ At the text box on the dialog box, the command abbreviations of the Macro file's contents are displayed in its operation order with ">" mark to its left as a list form which show the current operation and waiting operation when you execute the Step Over.



When you click on the command abbreviation, its background turns blue. And at such blue turned command, the operation is suspended as a break point of the Macro on performing Macro. For the release of the break point, click on the same command again.

- ④ When you click the Run button in case of selecting the Batch, each command is not displayed, but continuously operated in such values as having been taught. If the break point is being setup, the operation is suspended at such command. For resuming, click the Run button again. In case of Interactive mode, when you click the Run button, the dialog box showing each command appears and operation is suspended at each command. However, at the



command without dialog the operation is not suspended and goes to the next command. At the dialog box if appears, you can change the values freely. When all operations are finished, the message "Macro completed" appears.

- ⑤ When you click the Step Over button, the command is performed one by one at each clicking. The mark ">" put to left of the abbreviation of command moves down one by one, so you can recognize the command currently being operated. In case of Batch mode, the dialog box of the command does not appears, but the command is performed one by one. In case of Interactive mode, the dialog box of each command appears.

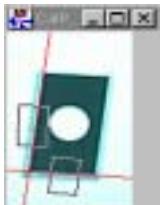
- ⑥ When you click the Stop button, the command currently performing is cleared and the state of the performance waiting is transferred to the first command. And the mark ">" is also moved to the top.

- ⑦ If you click the Clear All button, the whole break points of the command setup to be suspended are cancelled.

- ⑧ By clicking the Quit button, Play Macro command ceases and the dialog box is closed.

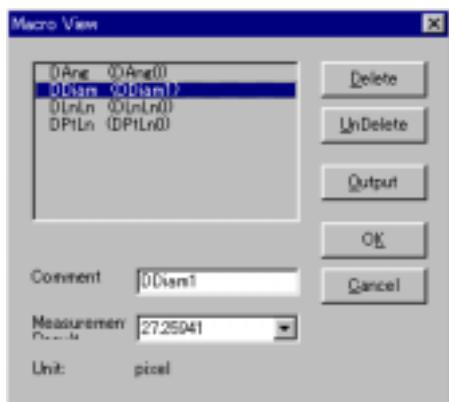
- ⑨ When you are performing the command in the Interactive mode, at Geometrical Measurement the Macro View dialog box appears, and therefore, you can confirm the contents of teaching.

- ⑩ The measurement items of the Geometrical Measurement for one object recorded with the Macro by Start Recording Command can be applicable to the other image if it has almost similar object. And, automatically searching the similar object on the other image, the measurement can be done for the same items and points to measure as formerly being taught after correcting the angle for such points. The setup of the conditions to refer the same work is done at the Tool menu, Geometrical Measurement Setting.



If the conditions are not setup correctly, the reference of the work can not be performed. Confirm the contents carefully.

⑪ First of all, teach the Angle between two lines, Distance between two lines or Diameter of a circle on an image file as shown left.

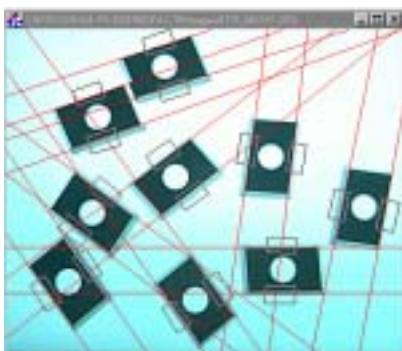


⑫ When you performs the Macro with same image, Excel data is output of one object.

	A	B	C
1	Angle between two lines	58.672	DAng0
2	Distance between two lines	62.09	DLnLn0
3	Distance between two lines	62.702	DLnLn1
4	Diameter of a circle	25.961	DDiam1
5	Diameter of a circle	27.843	DDiam2
6	Radius of a circle	13.921	DRad0
7	Distance between two points	110.153	DPtPt0
8			

⑬ Next, when you perform the Macro file on the other image where the almost similar multiple objects appears, it searches out the similar objects and measures for the same items and output the result. The judgement of the similarity is decided taking the area, perimeter, moment position, etc. into the consideration after binarizing the image.

⑭ When you perform the Macro of the Geometrical Measurement in the



Interactive mode, the Macro View dialog box automatically appears. By selecting the teaching items by the mouse at this dialog box, the measurement window and the lines measured displayed at the object, you can confirm the data and them respectively.

⑮ The Excel data appears at the column for each work. The order of the data input to the Excel is from top located object with its centroid and, if in the same height, it is from the left located one. In the meantime, for the

objects with different size or shape the accurate measurement data are not acquired.

A	B	C	D	E	F	G	H	I	J	K
1	二輪車頭高度	65.4452	65.7774	35.65379	96.21051	87.22058	86.27722	(5.7902)	94.78301	63.80075 Angle
2	二輪車頭高度	-63.0331	-74.7705	(6.7689	86.92908	66.52652	64.77876	43.77814	63.90011	66.81506 height
3	二輪車頭高度	43.06483	44.10839	43.01547	43.94881	44.23255	43.05542	47.22931	-65.44	46.93269 trans
4	二輪車頭高度	72.21652	78.17802	34.69324	76.56939	78.51695	78.57711	36.60448	78.8708	77.39129 part
5	円筒直徑	21.48275	21.41979	20.02462	21.9617	21.60712	21.26566	37.16276	21.61528	21.33673 part
6										
7										
8										
9										

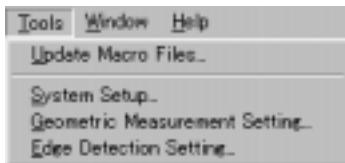
4. Load Macro File command

This command allows for the opening of the Macro file and enabling to perform it. Selecting the command, Open the file dialog box appears, then open the object file. The extension of the Macro file is “* .mac”. At the same time of the file opening, the Run Macro dialog appears and Macro becomes effective of performance. The Macro file once opened is kept hold until the new file is created or other file is opened.

5. Save Macro File command

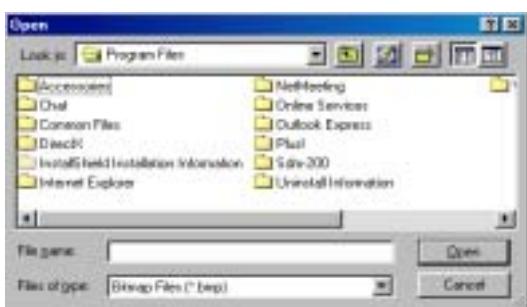
This command allows for the naming and saving the newly created file. When you select this command, the Save As dialog box appears. The extension of the Macro file is “* .mac”.

Chapter 11. Tools Menu



1. Update Macro Files command

- ① The Macro file was renewed from this Ver. 3, and the files had lost interchangeability. This command allows for making the Macro files created with the old version renewed and creates the new one which corresponds to the Ver. 3.
- ② When click this command, the Open file dialog box appears. At this box after selecting the old Macro file when you click the OK button, the new Macro file corresponding to Ver. 3 is automatically created.



The name of the new file has the same name as the former one and the old Macro file automatically becomes the backup file with the extension ".BAK".

2. System Setup command

This command allows for the setup of USB Digital Scale environment such as the setup or deletion of it for a capture board, the number of the repeat times, color tolerance value at the automatic area selection, creation or no creation of the new image after processing, the place where the data are to be output, etc. In details, refer to Chapter 3. Basic Operation.

3. Geometric Measurement Setting command

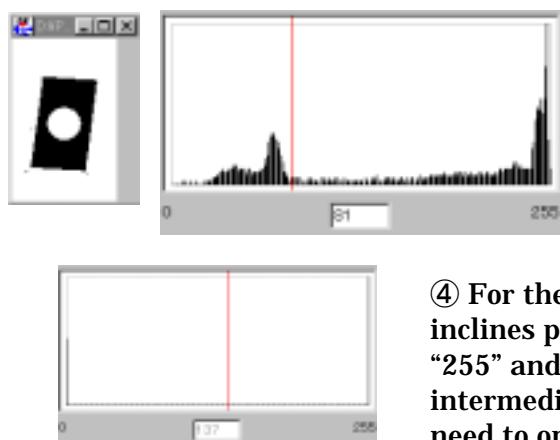
① This command allows for the setup, at the Geometric Measuring, of the tolerance value of the color or number of the units of the objects, identity recognition level, etc. In case the setup at this command is not done correctly, the object work may not be found. Selecting this command, the Condition setup dialog appears.

② At this dialog box, the setup for recognizing the object on the image is done. At this program, the teaching on an object is done and the Macro file is created.



And the measurement of the position, rotation angle and the number of units of the objects, even though they locate the different position, rotate or exist multiply taking the area, perimeter, moment position, etc. of the objects into consideration on the basis of the setup value at the Macro file after converting the image to gray scale, binarizing and recognizing the identity. Set up the Threshold value for binarization with the histogram. At the top, the histogram for the intensity value appears and the red color line is drawn on it.

③ For the set up of the threshold, specify the intensity value where the objected can be recognized. By dragging the red color line on the histogram or input the value at the input box under the histogram and press the Enter



key, the setup is done. When you move the red color line, the image is changed according to the change of the threshold. You can confirm the image in the above. At the same time, if you know the relationship between the histogram and image, it useful for the setup of the next Edge Detection Setting.

④ For the binarized image, the histogram inclines partially to the both value "0" and "255" and the red line appears at the intermediate position, therefore there is no need to operate.

⑤ At the Feature group, select the object color by Dark or Bright with the radio button. Decide it on the basis that if the object is darker or brighter than the background of the image.

⑥ In case of the measuring by Macro, by recording the multiple objects simultaneously, if they have the same relationship of the position, this command searches the corresponding group as a group on the other image and

measures the points taught of such detecting group. When you conduct the Macro measuring, the number of the objects at the image must be specified at the time of Macro Recording. At the Type group, specify the number of objects, single or multiple, by selecting either button, Single As One or Multiple As One. If there are the elements which are not connecting each other, select the Multiple As One.

⑦ At the Noise setting group, specify the tolerance value in case of searching object in the unit of the pixels. At the Maximum noise area text box, enter the number of pixels of tolerance where the difference occurs in the areas with the object works. In case of the smaller number, the areas of the teaching work and measuring work are almost equal and the searching is done for sure. However, when the difference is deemed, input the larger one. When you conduct the Geometric Measurement with the Macro and this number is excessively small, the searching of the object may not be done correctly.

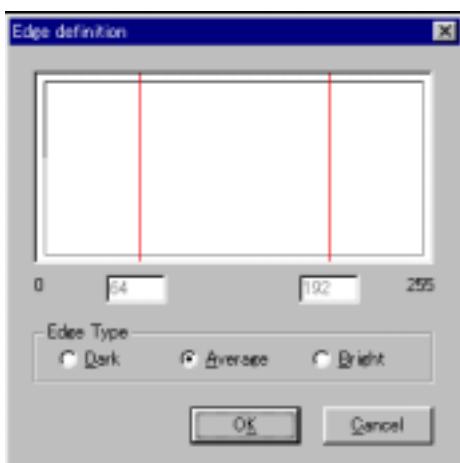
4. Edge Detection Setting command

① At this command, the conditions of the edge detection is set up in case of Geometric Measurement with the edge recognition. When select this command, the Edge definition dialog box appears.

② The intensity values of the object and background are set up at the histogram for detecting the edge. By conducting Edge definition, the measurement of the edges with the different intensity levels can be done at the same time in case of the measurement of the gray scale image which has often different intensity levels of each edge at the same object. As this Edge definition can be conducted at each area of the edge to measure, you can alter the setup value at each measuring point. And the threshold values defined at each measured area of the edge are recorded on creating the Macro file.

③ The histogram of the intensity appears and two red color lines are drawn on it. Each of them shows the threshold value of the object and background

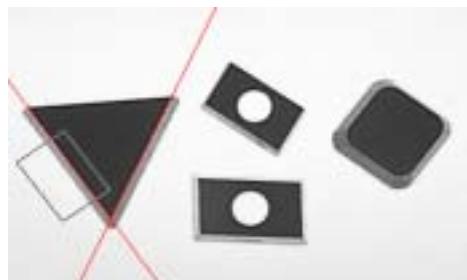
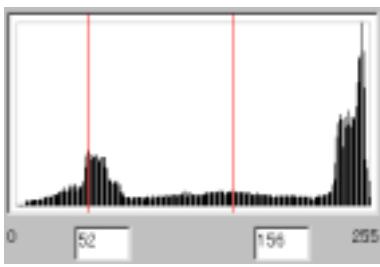
respectively for detecting the edge and setup values are displayed at the text boxes. When you refer to the object edge, find the intensity values at the histogram which deems to be the value of both sides of the boundary and drag the lines to the approximately intermediate position of each mount of the intensity. In case of the binarized image, the histogram appears extremely inclined to the both sides and the threshold values are also automatically appears moving to the both sides.



④ The followings are the samples how to select the measuring edge by changing the setup.

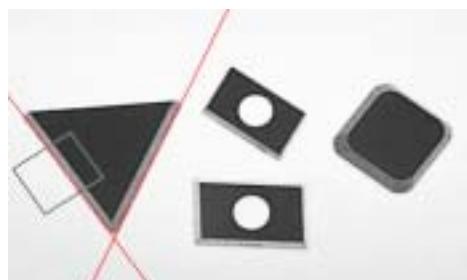
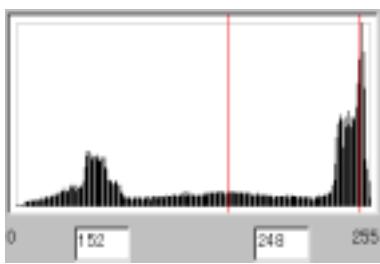
- In case of detecting the neutral color and black color edge :

There is the approximately three colors gathering at the image and the mounts are found at each histogram. By setting the lower threshold value to the intensity value of the nearly intermediate point of the mount of the black color and higher threshold value to the intensity value of nearly intermediate points of the moderate mount of the neutral color, the object edge can be detected.

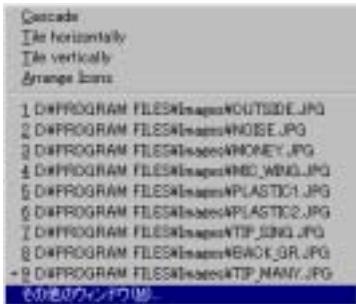


- In case of the detection of the neutral color and white edge :

By setting the lower threshold value to the nearly intermediate intensity value of the neutral color and higher threshold value to the intermediate intensity value of the bright white color, the object edge can be detected.



Chapter 12. Windows Menu



1. Cascade command

This command allows for the appearance of the opening image in the cascade style.

2. Tile horizontally command

This command allows for the appearance of the opening image in the horizontal tile style.

3. Tile vertically command

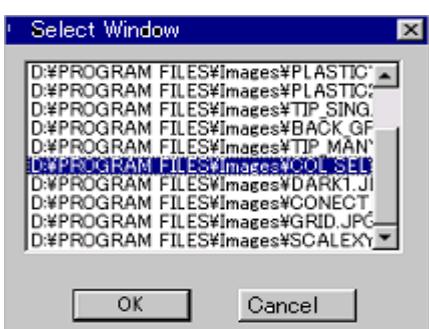
This command allows for the appearance of the opening image in the vertical tile style.

4. Arrange Icons command

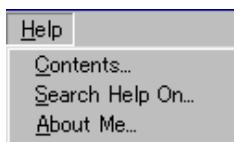
This command allows for the arrangement of the minimized icons of the images.

5. Image Selection command

This command allows for the appearance of the file names of the opening images in the list style. By selecting the file name, the image of which file name is selected appears to the fore. At this menu, up to nine files can be displayed and the more are collectively shown as the Other window. By clicking this, Selection of window dialog box appears and such file names are shown as a list style. Select one by double clicking or clicking after selection.



Chapter 13. Help Menu



1. Contents command

By this command, you can refer to the Help in a contents style.

2. Search Help On command

You can refer to the Help in a key word.

3. About Me command

When you select this command, the following dialog box appears.

Chapter 14. Incorporation Function to the software

The functions of this USB Digital Scale can be incorporated to the self developed software. USB Digital Scale is the OLE Server which opens its objects to the other applications software. Therefore, some objects of USB Digital Scale can be operate through the other Visual Basic applications. Followings are brief operation methods and sample program.

1. Install the Visual Basic (Ver. 4.0 or more) and USB Digital Scale
 2. Start Visual Basic.
 3. Select the Reference Setup at the Tool menu and check at USB Digital Scale OLE Server at the Reference Library. When USB Digital Scale is installed, normally it is displayed at the list, however if it is not shown, select USB Digital Scale by the Reference button.
 - ① Next select the Object Browser at the View menu and find the object library. Then, select USB Digital Scale from among the Library Projects List. Every Method or Property shown at the object browser is available in the preparing application software.
 - ② The samples are listed below. Referring to them, develop the application software.

• Name : VB sample of invoking USB Digital Scale from user's application
• Author : Asahi Hi-tech Co., Ltd.
• Date : July 4, 2001

Public Sub CallSDM2000

' The definition of the object parameter
Dim insSDM200 As SDM200

' The definition of the performance mode of the Macro
Dim RunMode As Integer

- The definition of the return parameter
Dim nRet As Boolean

• The instance creation of SDM200 Set insImgFact–New ImgFact

```
' Open the imaged file  
nRet=insImfFact.OpenImage("c:\ImgFact\Image\Example.bmp")
```

If Not nRet Then Exit Sub

- ‘ Open the calibration data file
nRet=insImgFact.LoadCalibration(“c:\ImgFact\Image\Example.clb”)
- ‘ Open the Macro file
nRet=insImgFact.LoadMacro(c:\ImgFact\Macro\Example.Mac”)
- ‘ Output the measured result to the text file
insImgFact.SendToFile=True
- ‘ Set up the file name to which the measured result is output
insImgFact.ResultFileName=“c:\ImgFact\Data\Example.dat”
- ‘ Output the measured result to the Excel
insImgFact.SendToExcel=True
- ‘ Select the Macro mode
‘ 0: Continuous performance mode
‘ 1: Confirmation, correction mode
RunMode=0
- ‘ Macro performance
nRet=insImgFact.RunMacro(RunMode)
- ‘ Save the final image performed with the Macro to file
nRet=insImgFact.SaveImage(“c:\ImgFact\Data\Test.bmp”)
- ‘ Close all images
insImgFact.CloseAll
- ‘ Release of the instance of SDM200
Set insImgFact=Nothing

End Sub

Appendix A. Reference Literature

1. Pattern Recognition by Ootsu Nobuyoshi, Kurita Takio, Sekita Iwao. Published by Asakurashoten, Jul., 1996.
2. Image Processing Application Technology by Tanaka Hiroshi. Published by Kogyo Chosakai, Jul., 1989.
3. Computer Vision by Taniuchida Masahiko. Published by Maruzen, Mar., 1990.
4. Image Measurement by Hiroshi Tsuchiya. Published by Shokodo, Mar., 1994.
5. Pattern Recognition and Image Processing by Junichiro Toriwaki. Published by Asakurashoten, Dec., 1992.
6. Calculation Logic and Expression in the Brain translated by Inui Toshiro and Ando Hiroshi. Published by Sangyotosho, Oct., 1987.
7. The Basis and Application of Neural Net by Baba Norio, Kojima Fumio, Ozawa Seichi. Published by Kyoritsu Shuppan, Sep., 1994.
8. The Processing and Recognition of Image by Yasuiin Takeshi, Nagao Tomoharu. Published by Shokodo, Nov., 1992.
9. Image Process Engineering, Basic by Tniguchi Keiji. Published by Kyoritsu Shuppan, Nov., 1996.
10. Image Analysis Handbook by Takagi Mikio, Shimoda Akihisa. Published by Tokyo University Shuppankai, Jan., 1991.
11. The Image Processing Handbook, Second Edition by John C. Russ. Published by CRC Press, 1995.
12. The Pocket Handbook of Imaged Processing Algorithms in C by Harley R. Myler, Arthur R. Weeks. Published by Prentice Hall PTR, 1993.

Appendix B. Regarding the Sample Image and Sample Macro

When USB Digital Scale is installed, the folder, “¥Image”, is automatically created and 23 sample images are also created there. And also Macro folder is created where the calibration files and Macro files corresponding the images are created.

The followings are outline of the procedure of how to use the sample images and sample Macro.

- ① Open the object image file at the “¥ImgFact¥Image¥” folder with the File - Open command.
- ② Open the calibration file corresponding to the image file at the “¥ImgFact¥Macro” file by pressing the Load button at the Measurement - Calibration command. As, if you once conduct the calibration, such value is effective until next calibration is done without relation to the image, therefore, while the same calibration is being selected, there is no need to calibrate.
- ③ Open the Macro file at the “¥ImgFact¥Macro” corresponding to the image by selecting Macro - Load Macro File command. The Run Macro dialog box appears. Then, by selecting Run button, automatically processing is performed. When you want to confirm the contents, select the Interactive mode and press the Step Over button. However, in case of the Feature Parameters command it is performed at one step, therefore, confirm it at the data output on the Excel.

Followings are the descriptions about the sample image and sample macro.

After the number, the image file name, Macro file name and calibration file name follows in this order.

1. Back_gr.jpg, No Macro, saclexy.clb :

The dark part of the road is shot. There is no Macro file. By performing the smoothing of the background with Process - Background Fitting, the intensity of value of graduated background can be leveled.

2. Col_sel1.jpg, Col_sel1l.mac, scalexy.cob :

This is the image of colored electronic device parts. By performing the Macro, the distance between four pins of the tip is measured respectively. At Macro file, the following processing is done.

- ① Extract the color (almost white) of the pins. Display the background black and object white.
- ② Reversing the intensity, display black and white in reverse.
- ③ Change to gray scale.
- ④ Binarization with Fixed Threshold.

⑤ Extract the objects with the feature parameters in shape limiting the width and height, 1.5mm and 1.8mm each or more, and delete the one other than the extracted objects by the Update button.

⑥ With the Geometric Measurement, the distance between four pins and transmit the data to the Excel. With the Interactive mode, the measurement points are confirmed.

3. Col_sel2.jpg, Col_sel2.mac, scalexy.clb :

This is the colored electronic device part. On performing the Macro, only blue color tips are extracted and the number of units and the positions are measured. With the Macro file, following process is performed.

① Raise the brightness degree a little.

② Raise the intensity value a little.

③ Lower the brightness degree of blue of the color tone a little.

④ Extract the blue color of the tips. Display the object black and the background white.

⑤ Convert into gray scale.

⑥ Binarization with fixed threshold.

⑦ Closing processing with the shape analysis of the binarized image.

⑧ Filling hole processing with the shape analysis of the binarized image.

⑨ Limited extraction with Feature Parameters by specifying width of 2mm or more and height of 2mm or more.

⑩ Transmission of such measured data as centroid, area, etc to Excel.

4. Conect_b.tif, Conect_b.mac, Scalexy.clb :

Binarized image with circles, some of them touched one another. By performing the Macro, the touching parts are automatically separated and select the objects with the hole shape, area, etc. to extract and measure their areas or positions.

With the Macro file, following process is performed.

① Particle separation processing with the shape analysis of the binarized image.

② Counting with the feature parameters.

③ Limited extracting of objects without holes, of which area is 20m^2 or more, etc.

④ The transmission of such measured data as cectoid position, area, etc to Excel.

5. Dark1.jpg, Dark1.mac, scalexy.clb :

The dark image as a whole of a pond and woods. By performing the Macro, the pond and the woods is distinguished and the approximate area of the pond is measured. With the Macro file, following process is performed.

① Leveling of the intensity.

② Conversion into gray scale.

③ Binarization with fixed threshold

④ Limited extraction with the feature parameters of count width and height of 20mm or more.

⑤ Closing processing with the shape analysis of the binarized image.

⑥ Filling hole processing with the shape analysis of the binarized image.

⑦ Deletion of small objects by Feature Parameters with the limit of width and height of 10mm or more.

⑧ After measuring the area of the pond, transmit the result to Excel.

6. Fin_stam.jpg, Fin_stam.mac, scalexy.clb :

This is the indistinguishable fingerprint image. By performing the Macro, the only line of the fingerprint is extracted and image is displayed with a line of a single pixel. With the Macro, the following process is performed.

- ① Adaptive Binarization.
- ② Opening process with the Shape Analysis of the Binarized image.
- ③ Closing process with the Shape Analysis of the Binarized image.
- ④ Filling Hole process with the Shape Analysis of the Binarized image.
- ⑤ Skeletonizing process with the Shape Analysis of the Binarized image.

7. Grid.jpg, Grid.mac, scalexy.clb :

This is the ① image the standard grid is shot a camera. By performing the Macro, the lens distortion is automatically corrected. With the Macro, the following process is performed.

- ① The image of the distorted grid shot with the distorted lens is corrected with the Distortion Correction Data file “¥ImagFacto¥macro¥Grid.cor” prepared with this image.
- ② The conditions by which the Distortion Correction Data file was prepared are as follows.

	Horizontal	Vertical
· The number of grids	10	7
· Grid size	60	65
· Starting point of correction	28	10
· Reference Radius		25
· Type of distortion correction	3 dimensions distortion correction	

8. Merge_l.jpg, Merge_r.jpg, Merge.mac, scalexy.clb :

This is the image of a house shot separately to its right and left. By performing the Macro, two images are joined together and a complete image is made. The process performed with the Macro file is as follows.

- ① Open the two images, Merge_l.jpg and Merge_r.jpg.
- ② When you perform the Macro, the Image Mergence dialog box appears, then double click on the image to be joined at left.
- ③ Then, the two standard marks having been taught appear at the image. The marks are put on the same place you selected at each image. These marks can be transferred by dragging.
- ④ Next, double click on the image you want to join to the left. The marks appear in the same manner as above.

9. Mic_wing.jpg, Mic_wing.mac, scalexy.clb :

This is the image of the insect's ala taken with an microscope. By performing the Macro, the approximate shape of ala is extracted and its Parameter is measured. With the Macro file, the following process is performed.

① Closing process with the Spatial Filters.

② Binarization with a Fixed Threshold.

③ Deletion of the small objects with a Feature Parameters where width and height are 8mm or more respectively.

④ Measurement of such parameters as the area, the number of holes, inner or outer perimeters and transmission of such data to the Excel.

10. Money.jpg, Money.mac, scalexy.clb :

This is the image the part of one thousand bill is taken. By conducting the Macro, the Spatial Filters and the arithmetic operations between images are performed. With the Macro file, the following process is performed.

① Prewitt process to all direction with the Spatial Filter.

② Median process with the Spatial Filter.

③ Subtraction of the two images mentioned above with the arithmetic operation between images. As the only original image is kept appeared in the state of being selected during the arithmetic operation between images at performing the Macro, select the image to subtract and proceed.

11. Noise.jpg, No Macro :

This is the image where the part of the one thousand bill is taken which contains periodic noise. There is no Macro file, however, the noises can be removed with the Fast Fourier Transform command.

12. Outside.jpg, Outside.mac, scalexy.clb :

This is the image of outside scenery. By performing the Macro file, some Spatial Filters are operated and an edge is extracted. With the Macro file, the following process is performed.

① Minimizing process with the Spatial Filters.

② Closing process with the Spatial Filters.

③ After Laplasian process with the Spatial Filters, extract the edge.

13. Pitch.tif, Pitch.mac, scalexy.clb :

This the binarized image of a tip. By performing the Macro, the distances between pins are measured. With the Macro file, the following process is performed.

· Measuring the distance between the pins of a chip with the Geometric Measurement, transmit the data to the Excel. The measuring points can be confirmed with the Macro View button.

14. Plastic1.jpg, Plastic1.mac, scalexy.clb :

This is a image of die cast plastics part. By performing the Macro, the extraction of the parameters and Geometric Measurement are operated. With the Macro file, the following process is performed.

① Binarization with a Fixed Threshold.

② Measurement of such parameter as the area with the Feature Parameters and data transmission to the Excel.

③ Measurement of width, height, shape, etc. with the Geometric Measurement and data transmission to the Excel. The measurement points can be confirmed with the Macro View button.

15. Plastic2.jpg, Plastic2.mac, scalexy.clb :

This is a image of die cast plastics part. By performing the Macro, Geometric Measurement are done. With the Macro file, the following process is performed.

- ① Binarization with a Fixed Threshold
- ② Opening process with the Shape Analysis of the Binarized image.
- ③ With the Geometric Measurement, the radius, the distance between the center, etc, are measured and the data are transmitted to the Excel. The measurement points can be confirmed with the Macro View button.

16. Plastic3.jpg, Plastic3.mac, scalexy.clb :

This is a image of die cast plastics part. By performing the Macro, Geometric Measurement are done. With the Macro file, the following process is performed.

- ① Binarization with a Fixed Threshold
- ② Filling Hole process with the Shape Analysis of the Binarized image.
- ③ With the Geometric Measurement, the degree of an angle, the distance between a point and a line, etc, are measured and the data are transmitted to the Excel. The measurement points can be confirmed with the Macro View button.

17. Scalexy.jpg, Scalexy.mac, scalexy.clb :

This is a image of die cast plastics part with the scales of X and Y direction. By performing the Macro, the centroi, area, etc. are measured. With the Macro file, the following process is performed.

- ① Prewitt process with the Spatial Filter.
- ② Conversion into gray scale.
- ③ Binarization with a Fixed Threshold.
- ④ Filling hole processing with the shape analysis of the binarized image.
- ⑤ Opening process with the Shape Analysis of the Binarized image.
- ⑥ Filling hole processing with the shape analysis of the binarized image.
- ⑦ Limited extraction with Feature Parameters by specifying width and height of 20mm or more respectively ,and selection of the plastic parts only as a object, and measurement of its position or area, and transmission to the Excel.

18. Scaley.jpg, Scaley.mac, scaley.clb :

This is the image of the Y direction scale. By performing the Macro, the division of the scale is extracted and distance between the divisions are measured. With the Macro file, the following process is performed.

- ① Leveling of the intensity.
- ② Conversion into gray scale.
- ③ Binarization with a Fixed Threshold.
- ④ With the Geometric Measurement, the distance between the pitches are measured and the data are transmitted to the Excel. The measurement points can be confirmed with the Macro View button.

19. Tip_diff.jpg, Tip_diff.mac, Tip_scal.clb :

This is a image of several kinds of extra-hard chips for cutting and shaving. By performing the Macro, the Geometric Measurement is done. By this measurement the gray scale object is measured as it is and each edge within a object with different intensity value is extracted and measured respectively. With the Macro file, the following process is performed.

- The Geometric Measurement is performed and measured data are transmitted to the Excel. The measurement of the angle or distance by changing the intensity value at each measuring edge for edge detection is done. The measurement points can be confirmed with the Macro View button.

20. Tip_scal.jpg, Tip_scal.mac, Tip_scal.clb :

This is a image of several kinds of extra-hard chips for cutting and shaving with a scale. By performing the Macro, the Binarization, Feature Parameters and the Geometric Measurement are done. With the Macro file, the following process is performed.

- ① Raise the brightness degree a little.
- ② Conversion into gray scale.
- ③ Binarization with a Fixed Threshold.
- ④ Deletion of smaller and other objects by Feature Parameters with the limit of width and height of 5mm or more.
- ⑤ Measuring the area, centroid, etc., delete the objects of which area is smaller than 450m^2 , and transmit the measured data to the Excel.
- ⑥ Measuring the angle or width by the Geometric Measurement, send the data to the Excel. The measurement points can be confirmed with the Macro View button.

21. Tip_sing.jpg, Tip_sing.mac, Tip_scal.clb :

This is a image of a extra-hard chip for cutting and shaving. By performing the Macro, the width or angle is measured of the object at the gray scale image as its gray scale is. With the Macro file, the following process is performed.

- The Geometric Measurement is done and its data are transmitted to the Excel. The measurement of the angle or distance by changing the intensity value at each measuring edge for edge detection is done. Confirmed the measurement points with the Macro View button.

22. Tip_many.jpg, Tip_sing.mac, Tip_scal.clb :

This is the image of some extra-hard tips located at random which are same one as at the Tip_sing.jpg image. There is no Macro file, however, opening this image and performing the Macro of the Tip_sing.mac, the positions or angles of the all tips at the image are recognized and the measuring items measured at Tip_sing.mac is done for such tips. And the measured results are sent to the Excel.