



# FLEX<sup>3</sup> / FLEX<sup>3</sup>PRO preliminary user manual

Introduction .....	3
Safety Instructions .....	3
Warning .....	3
General safety rules .....	3
Unpack the Device .....	4
Installation .....	5
Install the FLEX <sup>3</sup> software .....	5
Manually install the camera driver .....	6
Manually install the FLEX <sup>3</sup> PRO driver .....	7
Manually install the RELIX digital indicator driver .....	7
Run the application .....	8
Configure the software according to your needs .....	9
Calibrate the Device .....	11
Main menu .....	12
Select the Plate Type .....	14
Automatic measurement .....	15
Add a not- yet-selected dot .....	16
Measure with pre-set screen ruling .....	16
Manual measurement .....	17
HD-Flexo contrast image .....	18
Stochastic screens .....	18
Quick FM screen measurement: .....	20
Skip a proposed dot group and view the next proposal .....	21
Manual selection of a dot group .....	21
Add several objects manually to the FM result .....	22
Remove single objects from the FM result .....	22
Line width measurement .....	23
Magnifier Tool .....	24
Save Image, Copy Image to Clipboard .....	25
Copy partial image .....	25
FLEX <sup>3</sup> Statistics .....	25
FLEX <sup>3</sup> Image Comparison .....	27
Zoom in function .....	28
Fine tuning of location and direction overlay image: .....	29
Manual Selection of dots by drawing the dot based on 3 positions .....	29
Stain Density measurement .....	30
Print FLEX <sup>3</sup> Reports .....	30
Reflection mode measurement .....	32
Dot Shape measurement .....	34
Image Contrast and Image Brightness .....	34
Dot Structure Index .....	34

Dot Structure Index Reference handling:.....	35
Store dot shape reference images.....	35
Compare Dot Shape images:.....	36
Create a dot cross section.....	36
Manual measurements of Dot characteristics.....	37
Measure Print.....	38
Multi-color analyses (BAL & 4C).....	39
Mottle .....	40
Fourier analysis of the mottle structure .....	41
Additional Mottle values.....	41
Measure Relief depth with RELIX.....	42
Analysis results .....	45
Dot area (%) .....	45
Dot diameter (µm, mil) .....	45
Dot surface area (µm <sup>2</sup> , mil <sup>2</sup> ).....	45
Dot Perimeter.....	45
Edge factor .....	45
Dot void factor.....	46
Slur Factor .....	46
Line Quality index .....	46
Mottle .....	47
About.....	47

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## Introduction

Congratulations! You have just acquired the portable Flexo Plate Reader FLEX<sup>3</sup> manufactured by PERET GmbH. This device is the optimum tool to control transparent Flexo plates of all types in the trade shop and press room in a fast and intuitive manner. All standard plate control functions such as dot area, screen ruling, dot surface area, dot diameter, dot perimeter, and dot edge factor can be measured. In addition the width of positive and negative lines on the flexo plate can be measured with high accuracy. The FLEX<sup>3</sup> software supports conventional (AM) screening and stochastic (FM) screening in a wide range of screen rulings and spot sizes.

**Important:** *This manual describes the current version of the FLEX<sup>3</sup> hardware and software. Future enhancements or modifications are reserved.*

## Safety Instructions

### Warning

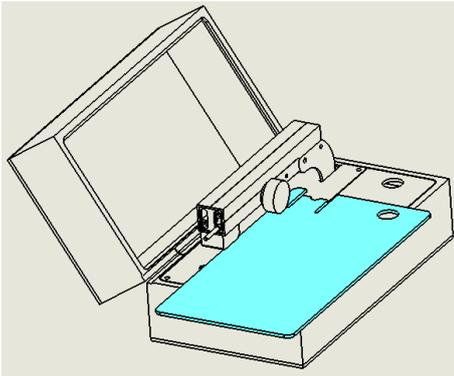
For safety reasons it is absolutely necessary to read through the user's guide and all of the instructions it contains.

### General safety rules

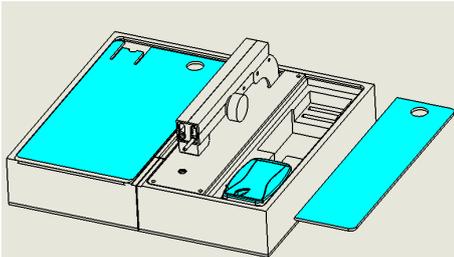
If the safety recommendations and instructions in this User Guide are not complied with, measurement errors or data loss or physical injury or property damage may result

- FLEX<sup>3</sup> is not intrinsically safe. Therefore the device cannot be used in an environment with explosive vapors where there is a risk of spark ignition.
- FLEX<sup>3</sup> may not be used in an area with strong electromagnetic fields.
- Use the FLEX<sup>3</sup> in ambient temperatures between 10°C (50° F) and 40°C (104°F), and do not expose the FLEX<sup>3</sup> to direct sun light.
- Neither the FLEX<sup>3</sup> Sensor nor the FLEX<sup>3</sup> transmission light box should ever be opened as there are no user-serviceable parts. Doing so voids the guarantee. Contact your authorized dealer if repairs are necessary.
- To avoid incorrect handling, the FLEX<sup>3</sup> should only be used by trained personnel
- The FLEX<sup>3</sup> should only be used on dry measurement objects.
- The FLEX<sup>3</sup> should be protected against chemicals, corrosive vapors, strong mechanical vibrations and impacts.
- Use original PERET spare parts and accessories only.
- Use the original packaging exclusively when transporting.
- The FLEX<sup>3</sup> casing can be cleaned with a dry cloth.

## Unpack the Device

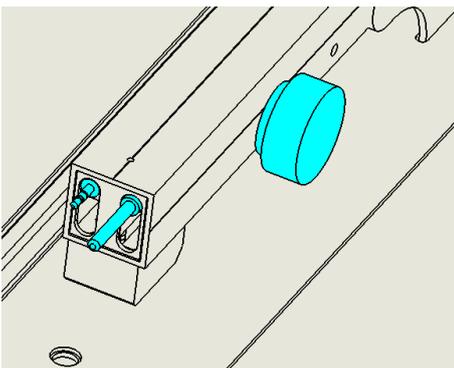


Open the device box and remove the large Plexiglas cover by sliding it to the front.

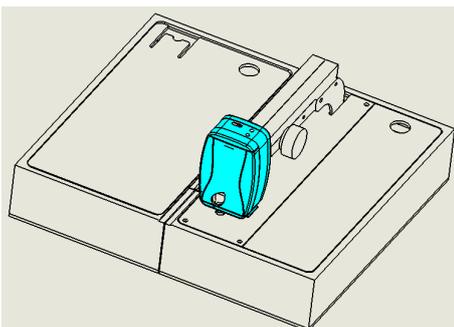


Put the large Plexiglas cover into the cover of the device box as outlined in the image to the left. Now remove the small Plexiglas cover on the right side and take out the sensor, the software, the manual and the calibration target

Put the small Plexiglas cover back to its original position



Make sure the Sensor connector is in the raised position by rotating the wheel clockwise on the right side of the support arm.



Connect the Sensor to the support arm by inserting the longer pin first and sliding it straight on until the shorter connector makes firm contact.

The device now is ready to operate.

## Installation

Start your Computer and wait until all boot processes have terminated and your computer is ready to operate. **Do not plug the USB cables in at this time.**

Plug the FLEX<sup>3</sup> USB Memory Stick into a free USB Port and wait until Windows has recognized and registered the USB Stick as a Mass storage Device.

### *Install the FLEX<sup>3</sup> software*

The USB Memory stick contains a setup utility '**setup FLEX3.exe**' or '**setup FLEX3PRO.exe**', which can be run to install the FLEX<sup>3</sup> Software on your PC.

Run the setup utility and follow the instructions.



Before termination the video driver installer will automatically be started. Click **INSTALL**.



Wait until the installation of the driver is finished.

Now connect the black USB cable to a free USB2.0 port. Windows will automatically detect the driver and assign it to the device.

Now connect the gray USB cable to a free USB port. Windows will automatically detect the VCP driver and assign a COM port to the device. The COM port has to be COM1 to COM8. If a COM port higher than that is assigned, follow the procedure described in chapter 'Manual Installation of FLEX<sup>3</sup>PRO Driver'.

There is a fully functional demo installation including sample images available in the USB stick folder '**RUN DEMO**'. It runs independently of installing the software or hardware and can be helpful for training and demonstration purposes.

## Manually install the camera driver

Administrator rights are required for the driver installation on your computer.

The FLEX<sup>3</sup> is equipped with a single USB connector, while the FLEX<sup>3</sup>PRO has two USB connectors.

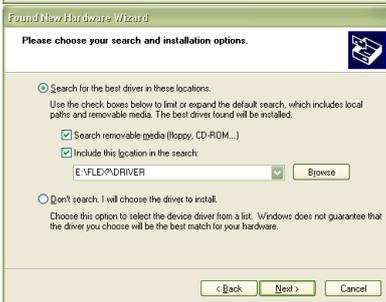
Connect the USB connector of the FLEX<sup>3</sup> Sensor or in case of FLEX<sup>3</sup>PRO the **black** USB connector to a free USB2.0 port of your computer



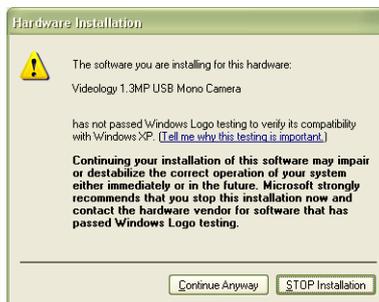
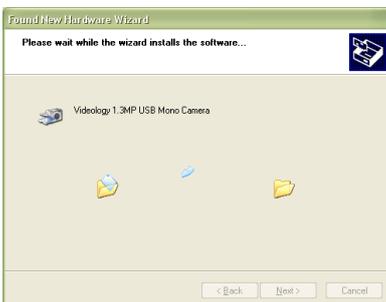
Select '**Not at this time**' and click next



Select '**Install from a list or specific Location**' and click next



Browse to and select the \DRIVER subdirectory of the FLEX<sup>3</sup> USB Stick. Click next



Confirm with '**continue anyway**' and wait until the driver installation has completed successfully.



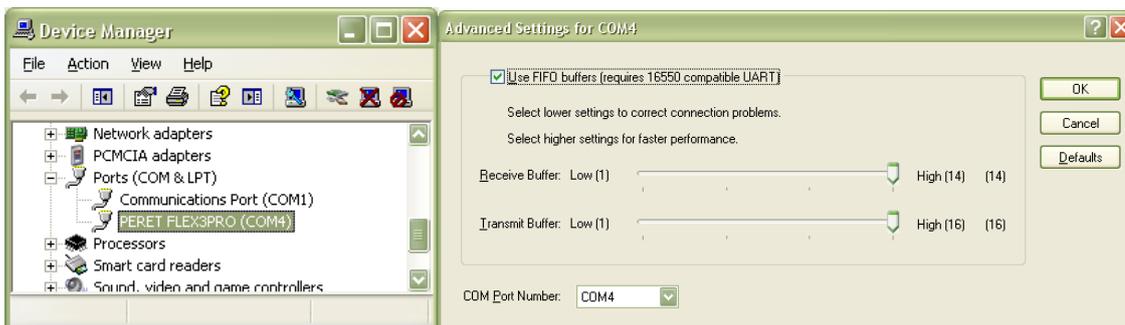
If the driver Installation fails for any reason, unplug the black cable of the FLEX<sup>3</sup> device from the USB Port and run the wipcam.exe utility in the \DRIVER directory of the FLEX<sup>3</sup> USB Memory Stick. This utility will clean up your PC and make it ready for re-installation of the driver. Before re-installing the driver you need to reboot your PC.

### **Manually install the FLEX<sup>3</sup>PRO driver**

If you have a FLEX<sup>3</sup>PRO device now connect the gray USB connector to a free USB port. Follow the steps as described above. The directory holding the FLEX<sup>3</sup>PRO driver is located in \DRIVER\FLEX3PRO subdirectory. In case you have already installed the software on your hard disk, you can find the driver also in the subdirectory of your installation directory. For example; C:\PERET\FLEX3PRO\DRIVER\FLEX3PRO

The FLEX3PRO Driver supports COM1 to COM8. In case your Windows operating System has assigned a COM port higher than that, assign a proper COM port as follows:

- Click the Start button and then click on the Control Panel.
- Double-click the System icon.
- On the Device Manager tab, double-click Ports (COM & LPT).
- Double-click the communications port, FLEX<sup>3</sup>PRO. This opens the Communications Port Properties window.
- Click the Port Settings tab
- Click Advanced
- Select a COM port between COM1 and COM8



### **Manually install the RELIX digital indicator driver**

Connect the USB cable of the RELIX to a free USB port. Windows Update will automatically find the driver. In case the driver can not be installed automatically follow the steps as described above. The directory holding the RELIX driver is located in the \DRIVER\RELIX subdirectory of the USB Stick.

## Run the application

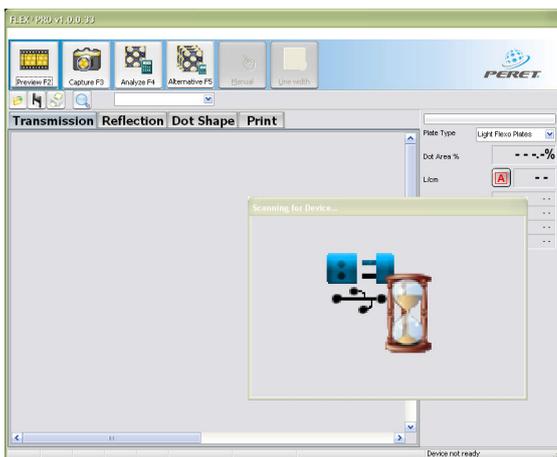
- Launch the FLEX3.exe or FLEX3PRO.exe or,
- Click the FLEX<sup>3</sup> Icon or FLEX<sup>3</sup>PRO on your desktop or,
- Run the FLEX<sup>3</sup> from the Windows Start Menu



If no camera is connected, then the following message will appear:

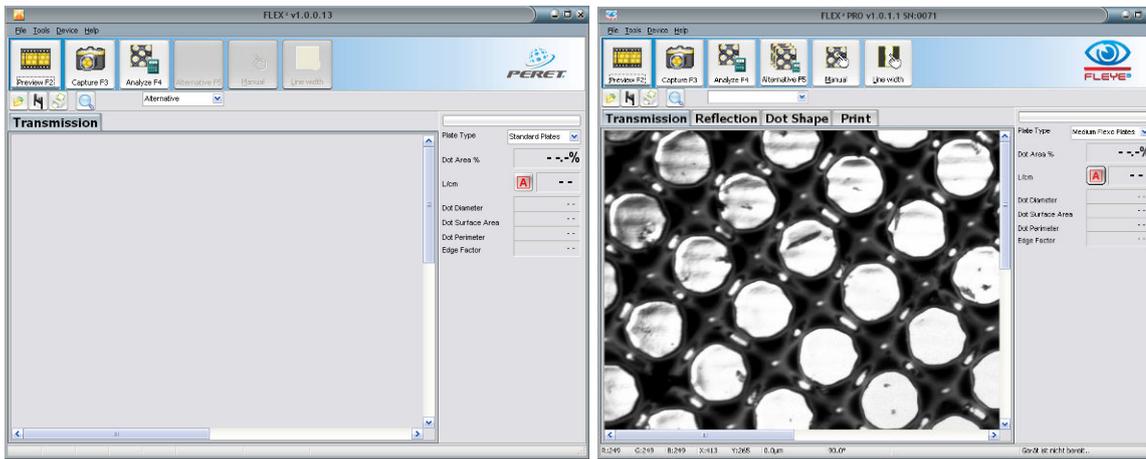


The first time you are running the FLEX<sup>3</sup>PRO software the software will automatically scan for the Device. This can take a few minutes. Please do not interrupt this process.



The actual COM port number is stored permanently in the FLEX3PRO.INI file and recalled the next time you start the software.

Click OK to start the FLEX<sup>3</sup> application software.



The FLEX<sup>3</sup> software will offer the transmission page only while the FLEX<sup>3</sup>PRO software will also offer 'Reflection', 'Dot Shape' and 'Print' Pages.

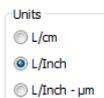
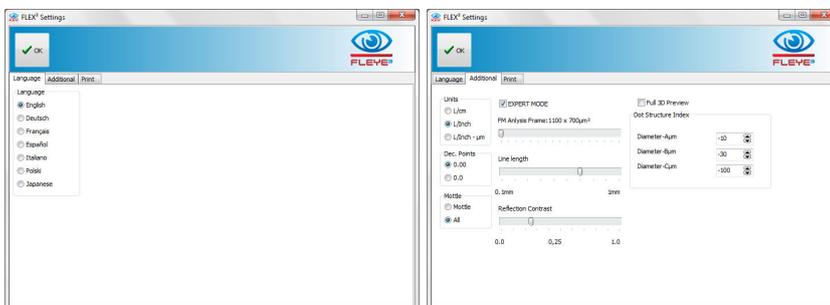
If a camera is connected then the software will automatically display the live image in transmission mode. The device status is displayed on the right end of the status line at the bottom of the frame.

Position the flexo plate below the sensor. Lower the Sensor head until it is in contact with the plate surface by rotating the black wheel on the right hand of the measurement lever. A sharp image will be displayed.

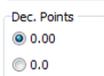
## Configure the software according to your needs

Select File/Settings from the main menu to open the Settings window.

- Select language



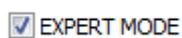
Select L/cm to get measurements in metric system, select L/Inch to get measurements in Inch and mil, select L/Inch-µm to get Lines per Inch and other measurements in displayed in µm



Select the number of the decimal points you would like the dot area measurement to be displayed with.



Select All if in addition to the standard Mottle value you would like to display also ISO Graininess and Coverage and to get the visual simulation after a mottle measurement.



Select EXPERT Mode to get access to all EXPERT Mode Function.



In FM Screening there is no real cell size available that could be used to calculate a dot area % value. Therefore the dot area % is calculated based on a fixed area of view by measuring the area of all printing dots and comparing it to the total area. Use FM Analysis Frame ruler to set the size of the FM area. Make sure you're always using the same area size within one measurement application.

Line length



0.1mm 1mm

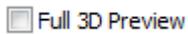
Line width is measured as the average width of the line over a defined length. For high repeatability and accurate measures it is essential, that the length of the line segment, that's used to calculate the line width, is constant. Set the length of line you would like to use by moving the ruler to the proper position.

Reflection Contrast



0.0 0,25 1.0

Plates that are measured in reflection mode often are showing low contrast. The Reflection Contrast ruler can be used to optimize the contrast for a plate type. The contrast setting is saved permanently such as the plate type will always be measured with the same setting.



Select Full 3D Preview to show the full preview image. If Full 3D Preview is checked the refresh rate of the Preview will slow down.

Dot Structure Index

Diameter-A $\mu$ m	-10	
Diameter-B $\mu$ m	-30	
Diameter-C $\mu$ m	-100	

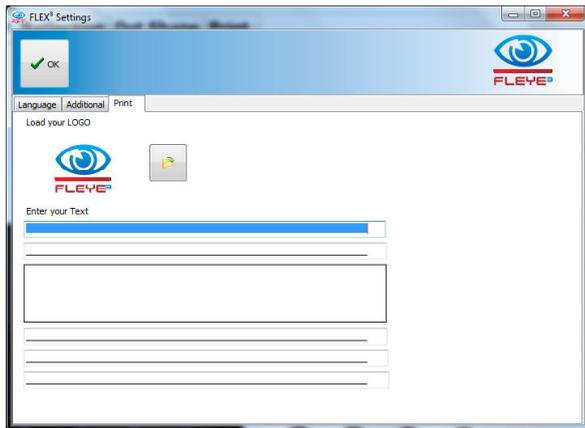
The dot structure Index is calculated based on 3 diameters of the dot on 3 different depth levels. You can set your own levels by modifying the proper values in the setting menu.

If EXPERT MODE is checked some additional special functions for special applications are enabled.

Special functions include:

- Manual adjustment of LED Brightness in Reflection and Dot Shape mode
- HDRC available in Dot Shape mode
- Manual adjustment of Density Threshold in PRINT mode
- Slur Factor calculation
- Line quality information displayed at line width measurement
- HD-Flexo contrast image display
- MAXBR and SMOOTH Flag visible for grainy plate surfaces in transmission mode
- Brightness ruler in transmission mode
- Brightness and Filter rulers in reflection mode

It is recommended to leave the EXPERT MODE unchecked. These special functions are not needed in most cases. Manual adjustment of analysis parameters may lead to different measurement results.

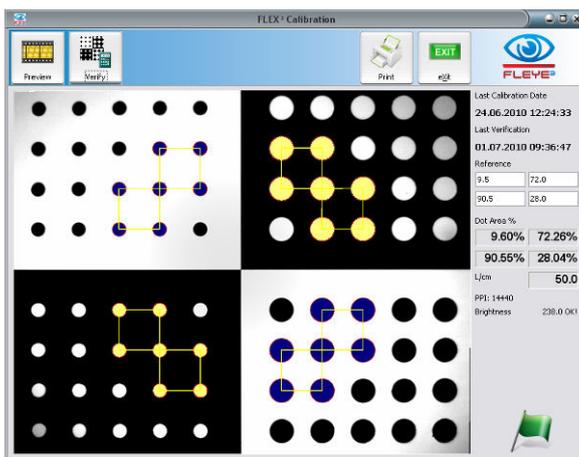


- Change default Print Layout Settings (head lines, foot lines, Logo) permanent

## Calibrate the Device

After installing the application software and hardware and before using the FLEX<sup>3</sup> device for the first time it is strongly recommended that you run the calibration process once.

Select Tools/Calibrate from the main menu to start the calibration process. The Calibration window will open. Click the Preview Icon to preview the live image from the FLEX<sup>3</sup> camera. Center and rotate the image of the calibration target as shown below.



A horizontal and vertical red line are superimposed on the image to guide the correct positioning of the calibration target. It is important that the image captured matches the expected image in order to ensure a valid calibration of the system.

Reference values are printed on the calibration target. If the reference values displayed on screen differ from the values on your target then type the reference values in the same order as printed into the reference edit fields on the upper right area of the window. This might occur if a replacement target is issued.



Click the Verify Icon to capture and analyze the image. The image will be analyzed and the actual measured dot areas of the four patches will be displayed. The screen ruling will be displayed as well.

The measured dot area values are compared with the reference values and a Calibration Quality Index is calculated.



A green flag icon is displayed if the index is  $\leq 1$



A warning icon is displayed if the index is  $\leq 2$



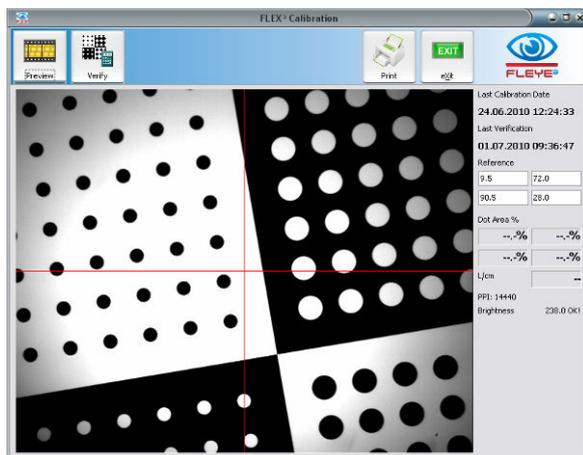
A fail icon is displayed if the index is  $> 2$ . Check the positioning of the target and clean the target in this case and restart the calibration process.

In the top right corner of the calibration report the last calibration (factory calibration) date is displayed next to the last on-site calibration (Verification). The dates are stored permanently as well as the reference values. The next time the calibration process is run the values are re-loaded automatically. The measured PPI (Pixel per Inch) setting is also displayed.

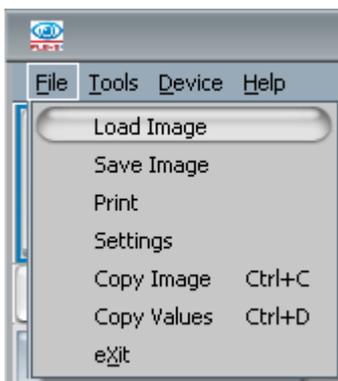
This ensures the highest accuracy of screen rulings and linear measurements.

A report of the current calibration process can be printed.

If the captured image does not match the expected calibration target image because it has been incorrectly aligned, or any other sample is used, then no result will be displayed and no calibration will be performed. This feature prevents accidental corruption of the calibration system values.



## Main menu



Select **Load Image** or click the File Open Icon  to load a previously saved image into the main window. This image can then be analyzed or printed.

Select **Save Image** or click the Save Icon  to save the captured image to a file in Windows bitmap format (.bmp or .png). The original image which was captured by the FLEX<sup>3</sup> camera is saved without any additional analysis information.

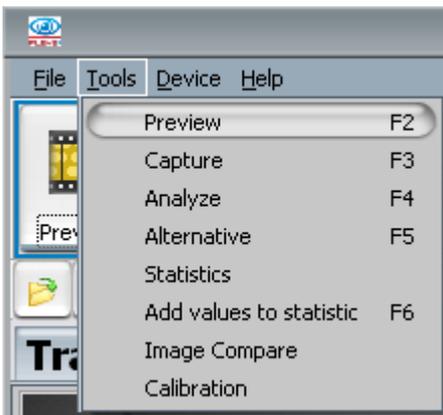
Select JPG Format to save the analysis Window for documentation. JPG Images are only for documentation purpose can not be reloaded for analysis.

Select **Print** or click the Print Icon  to open the print window. There are several different types of reports available.

Use **Settings** to change the language or unit of measure.

Select **Copy Image** or press CTRL+C to copy the actual displayed image into the Windows clipboard

Select **Copy Values** or press CTRL+D to copy the actual measurement values into the Windows clipboard.



Select **Preview (F2)** from the main menu or click the Preview Icon of the main tool bar to preview the live image of the FLEX<sup>3</sup> camera



Select **Capture (F3)** from the main menu or click the Capture Icon of the main tool bar to capture the displayed image

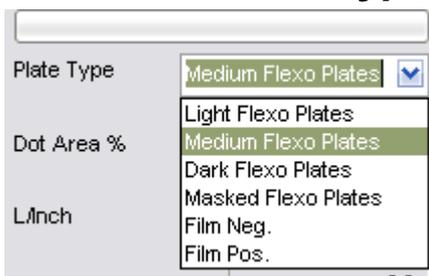
The menu items Analyze, Alternative, Statistics, and Image Compare will be explained in detail in the following chapters.

- **Analyze** calculates the Dot Area of the captured image and offers a series of possible results
- **Alternative** is used to step through the alternative result proposals
- **Statistics** is used to collect subsequent measurement data, calculate Mean, Range, and Standard Deviation, and display a graph
- **Add values to statistic** is used to copy the actual measurement values to the statistics.
- **Image Compare** is used to compare native images for example;
  - Plate Type A with Plate Type B
  - Ablation Mask with Finished Plate
  - Plate made in one facility with a Plate made in another facility
  - Remade Plate with image of original Plate



The Device Menu gives direct access to the Video Driver and FLEX<sup>3</sup> sensor. This can be used to diagnose problems or to change the shutter speed and gain for very special applications. Use this function with care. Making measurements with non-factory settings can lead to misinterpretation of the measurement result. A restart of the software always resets the parameters to the factory settings.

## Select the Plate Type



There is a drop down list with plate types to the right of the application window. Select Medium Flexo Plates setting for almost all Plates. Select Dark Plates only if the captured image is extremely dark. Select Light Flexo Plates for plate types that are showing an overexposed image with Medium Flexo Plate setting. For other samples such as Film or Ablation Mask, select the proper setting.



A small white star indicates that the selected Plate Type resulted in an excessively bright image and another plate type should be used to obtain more accurate results (medium or light in this case).



A small black star indicates that the selected Plate Type resulted in an excessively dark image and another plate type should be used to obtain more accurate results (medium or dark in this case).



A small green star indicates that the selected Plate Type works fine for your plate.

Inside the installation directory you will find three text files named as follows:

PLATETYPE0.TXT for light flexo plates

PLATETYPE1.TXT for medium flexo plates

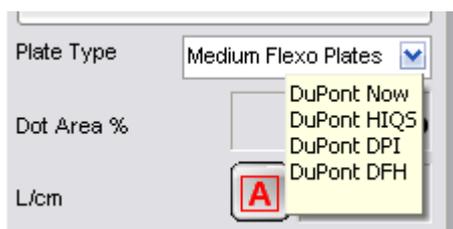
PLATETYPE2.TXT for dark flexo plates.

After the installation these files will contain only a head line with comment. Add lines with plate names to create a help text for the proper plate type.

Move the mouse pointer over the plate type to display the content of the text file assigned to the proper plate file. Use this function to remember, which plate you're going to measure with which plate type.

Example File content:

```
PLATETYPE1.txt : Medium Flexo Plates
DuPont Now
DuPont HIQS
DuPont DPI
DuPont DFH
```

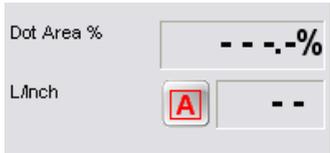


Example help information displayed based on above text file content.

Click on the little green star to open and edit the help file.

## Automatic measurement

The FLEX<sup>3</sup> software supports an automatic dot-finding algorithm and screen ruling measurement. Select Preview to display a live image of the sample. Once the patch is in the correct position click Capture to capture an image. Click Analyze to analyze the image and to display the most probable result.



Verify that the screen ruling is set to Auto Detection. An 'A' character is displayed next to the screen ruling result field when Auto Detection is active.

If a different symbol is displayed click on the symbol until the 'A' is displayed.



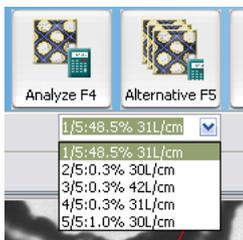
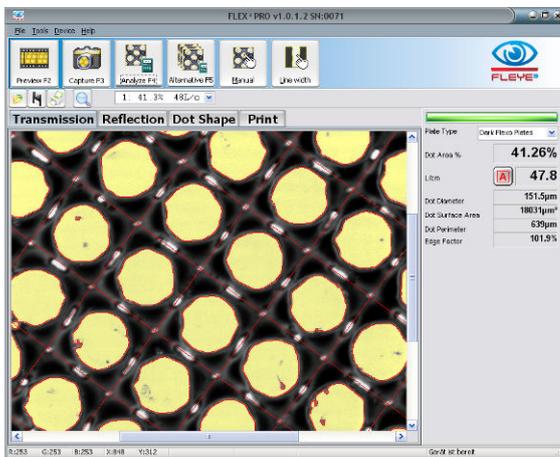
This symbol is displayed whenever a fixed screen ruling is used to calculate the dot area %.



This symbol is displayed whenever stochastic screening analysis is selected. In the case of stochastic screening no screen ruling is calculated.



HD is a special FM mode function where only round areas are considered to be printing areas.



The Analyze function typically calculates more than one possible result. By clicking the Alternative Icon you can step through the different result proposals. The proposals are listed in the drop down list below the Alternative Icon and can also be selected directly.

The algorithm collects dots that are similar in size, shape, transparency and other criteria. You can make the sorting criteria less restrictive by selecting Fuzzy.



Restrictive sorting on the left side, fuzzy sorting on the right side image.

The measurement results are displayed in the data panel on the right:

- Dot Area % shows the halftone dot area coverage in percentage
- L/cm or L/Inch displays the screen ruling
- Dot Diameter is calculated as the diameter of a perfect circle with the same area as the average area of all detected dots, expressed in microns or thousandths of an inch (mils) depending on the unit of measure selected
- Dot Surface Area displays the average surface area of all detected dots in square microns or square mils
- Dot Perimeter is the average edge length of all detected dots in microns or mils.
- Edge factor is the relationship between the measured edge length (perimeter) of the sample plate and the edge length of a circle of the same surface area.

### **Add a not- yet-selected dot**

Add a not yet selected dot to the overall result by clicking into the dot with the left mouse button + CTRL key.

Remove a selected dot from the overall result by clicking into the dot with the left mouse button + SHIFT key.

### **Measure with pre-set screen ruling**

Sometimes the screen ruling is known and can be used to reduce variations in measurement results due to locally different dot distances on the plate.



Click the  Automatic Screening Icon to switch to the fixed screen ruling mode. An edit window will open. Enter the screen ruling value and press the ENTER key on the keyboard.

All subsequent calculations will now use this screen ruling. The fixed screen ruling is active until the screen ruling mode is set to FM or to Auto. After a restart of the software Auto Screen ruling is always active.

The preset of screen ruling enables the Cursor Size function in the secondary tool bar.



Click the  Cursor Size Icon to enter a fixed dot area percentage value between 1% and 54%. An edit window will open. Enter the value as displayed below.

Press the Enter key to be displayed in the main over the image, a circle current the fixed screen ruling of 47.5 L/cm. Left click to attach an image of the cursor to the captured image..



confirm the dot area % value. The dot area % result will data panel on the right side. When moving the cursor will show the theoretical size of a 30.5% dot for the

## Manual measurement

Sometimes the automatic measurement will fail or will pick too many or too few dots to perform a valid calculation. In this case the manual measurement system can be used.

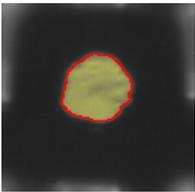
The starting process is the same –

- Preview
- Capture
- Analyze

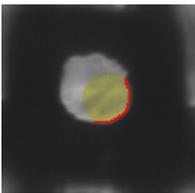


Now click the Manual Icon. The manual dot selection mode will start. The little hand will turn yellow to show that the selection mode is active.

Move the mouse cursor to the center of the dot that should be added to the manual calculation and click the left mouse button.



The selected dot will become highlighted. Continue to select additional dots until all proper dots are selected.

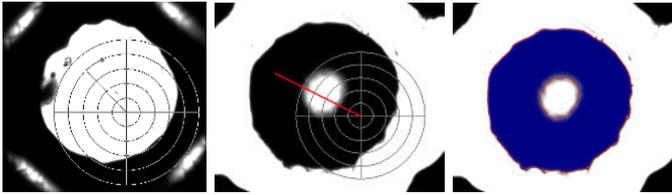


If a dot has been selected in error, click inside the highlighted area again to un-select the dot.

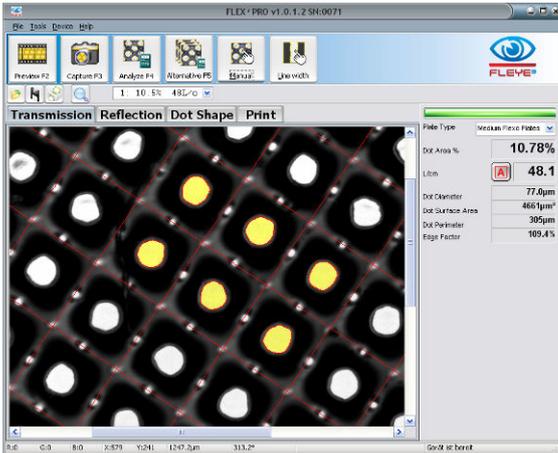
The manual dot detection algorithm is looking for a maximum dot dimension, assuming that you clicked on the dot somewhere near its center. If you click inside a dot too close to the edge, an incorrect result will be obtained, as shown here.

In this case un-select the dot by clicking inside the highlighted area of the dot. Do not try to select the remaining part of the dot by clicking inside the non-highlighted area. This would lead to an additional dot, composed only of the added area. The measurement result will be invalid in this case.

In some cases it might be difficult to pick the center of the dot. In this case draw a line inside the dot to select the dot.



After the Dots are selected, click the Manual Icon again. The result will be calculated and displayed.

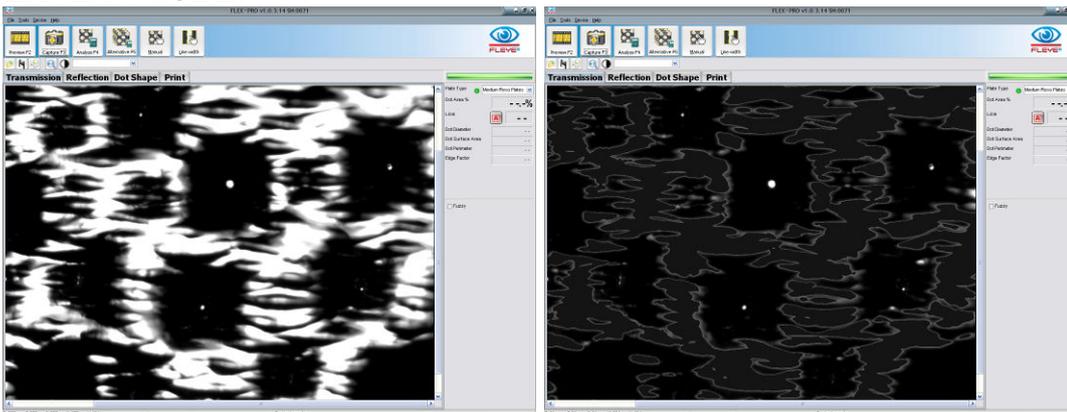


At least 3 dots adjacent to each other must be selected to obtain a correct result when using the Automatic or Fixed screen ruling function. Selecting more than three adjacent dots improves the repeatability of the result by averaging more dot locations.

## HD-Flexo contrast image



The contrast symbol can be clicked to switch the display mode. Non uniform regions will be blacked out to ease the dot selection on HD-Flexo samples. This function is available only in EXPERT MODE.



## Stochastic screens

Stochastic screening does not have any regularity in dot location or dot shape. Therefore the system cannot determine whether a bright area of the transmission image is part of the printing area, or if it is part of the relief structure.

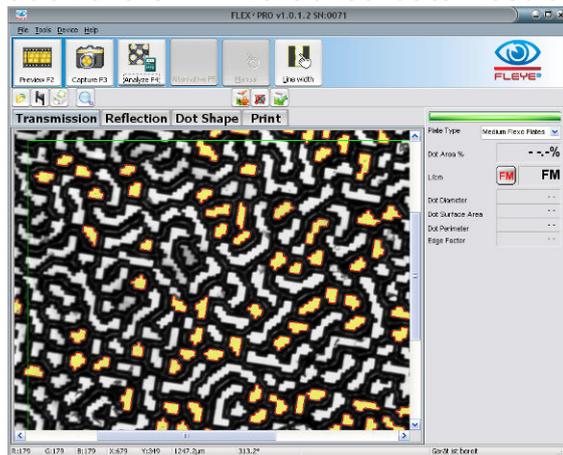
The FLEX<sup>3</sup> software relies on operator input to achieve a repeatable and accurate result. In order to measure stochastic screening or hybrid screens, follow the procedure outlined below.

Set the software into FM Mode by clicking the screen ruling mode icon until it shows FM.



Select Preview to produce a live image of the sample. Once the patch is in the correct position click Capture to capture an image. Click Analyze to analyze the image and to display a preliminary result.

Stochastic screen analysis uses both automatic feature detection and user input. Automatic detection creates a display of “proposals”, areas that the system believes to be printing portions of the plate. The user may accept or reject any number of these objects while the system keeps track of them. The Consolidate Result Icon calculates the final dot area of selected objects.



In FM mode there are three tools available on the secondary tool bar:



The Add Dots Icon adds all selected dots to the global FM result



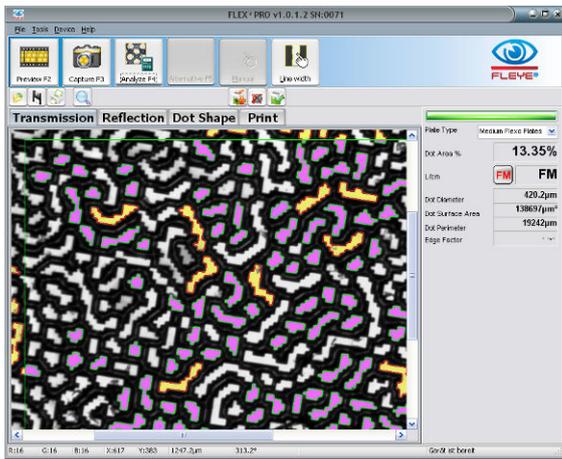
Dot Remove Icon removes one single dot from the global FM result or skips a dot group



Consolidate Result will calculate and display the final result.

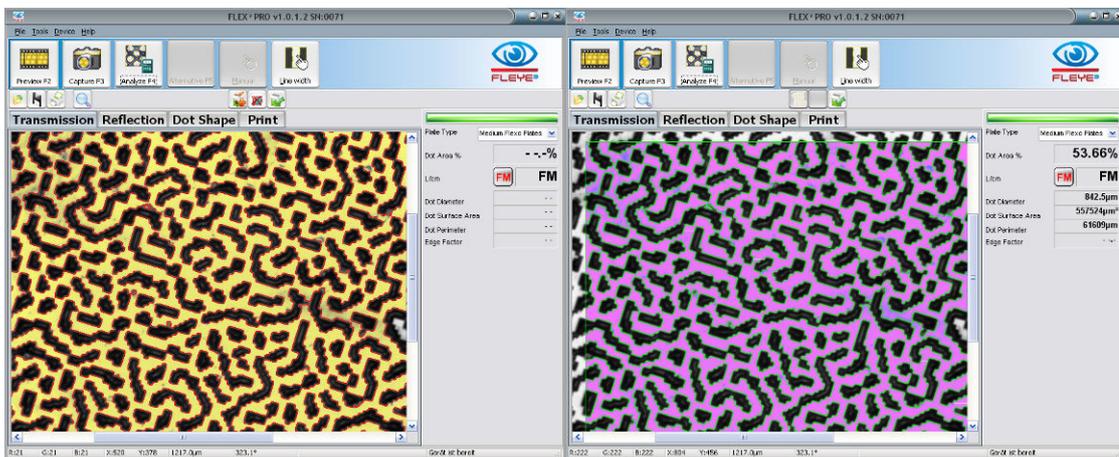
If the proposed result is part of the printing area in case of a highlight patch or part of the non-printing area in the case of shadow patch, then add the selected dots by clicking the Add Dots Icon.

The first result is now displayed.

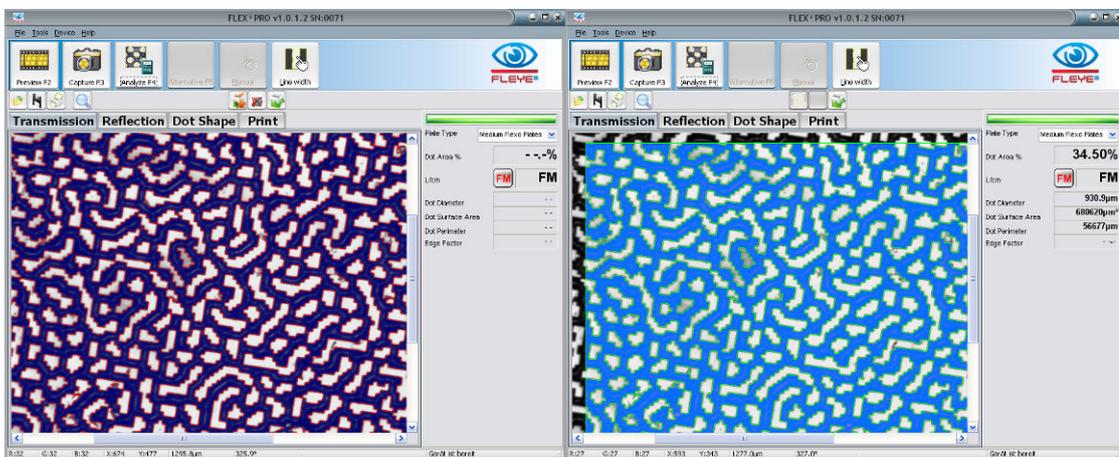


### Quick FM screen measurement:

If almost all surface regions (white) are connected to each other, then move the mouse pointer over the surface region and click the left mouse. The surface region will now be selected. Click the Add Dots Icon to add the surface region to the result.

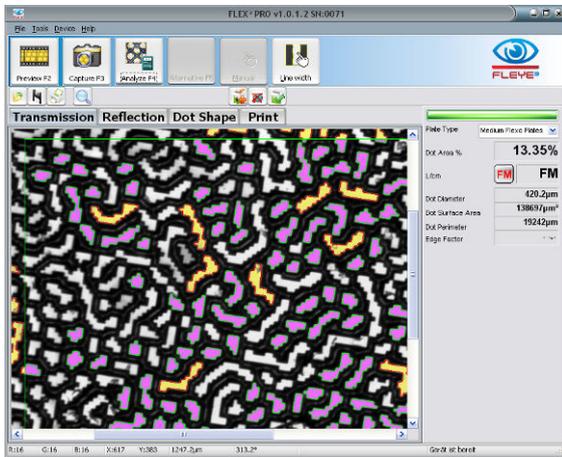


If almost all shoulder regions (black) are connected to each other and no large floor regions (white) are visible, then move the mouse pointer over the shoulder region and click the left mouse button. The shoulder regions now will show selected. Click the Add Dots Icon to add the shoulder regions to the result



In order to maximize inter-instrument agreement between FLEX<sup>3</sup> devices and to improve the absolute accuracy, the FLEX<sup>3</sup> software always picks printing area elements within a constant area when in FM Mode. The size of the area can be selected in the settings.

This area is bounded by a green rectangle. All printing areas inside the rectangle displayed with a light blue tint are part of the FM measurement result. Dots displayed in yellow are the next proposed group of dots that may be added to the FM result **if appropriate**.



If additional dot groups are available, the FLEX<sup>3</sup> software automatically prepares a new proposal of the FM result after a dot group has been added. The dots of the new proposal are displayed with a yellow tint.

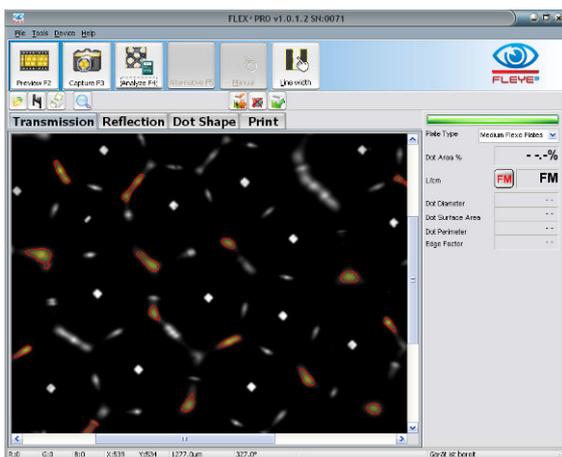
Click the ADD Icon again to add these dots to the overall result. The Add Icon will be disabled when no more dot groups are available.



After a few clicks all dots and regions are added and the FM result can be calculated by clicking the Consolidate Result Icon.

### ***Skip a proposed dot group and view the next proposal***

The relief structure of flexo plates creates images with bright areas corresponding to all areas that are parallel to the base. These areas may include the printing portion of the dots as well as the floor of the plate. FLEX<sup>3</sup> can not independently determine which areas are the dots to be measured. As a result a proposal may contain portions of the floor that should not be added to the overall FM result:

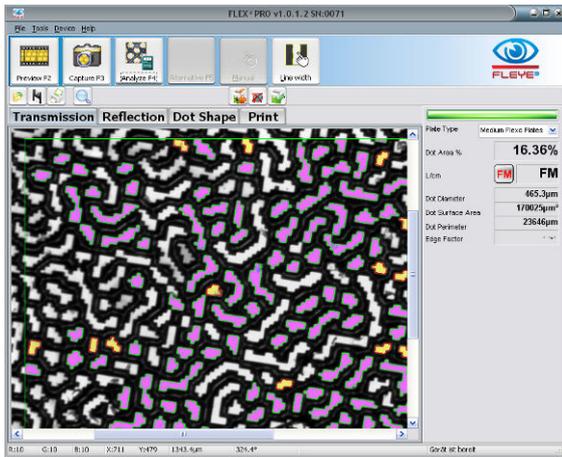


In this case skip to the next proposal by clicking the Dot Remove Icon. The proposal will be removed from the list of proposals.

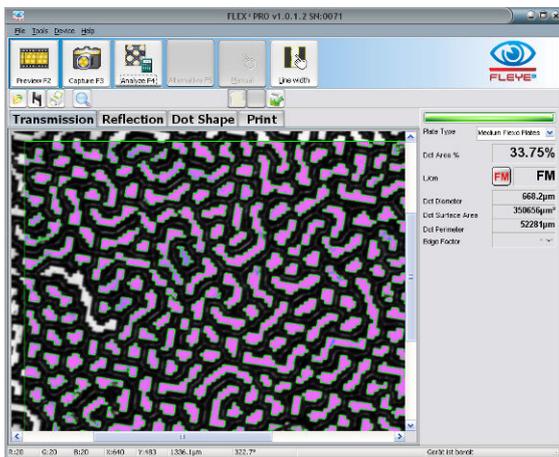
The next proposal, if any, will be displayed automatically.

### ***Manual selection of a dot group***

Move the mouse pointer over an object you would like to add to the overall FM result. Press the left mouse button down. All dots that are members of the same dot group will be highlighted



Click the ADD Icon to add the selected dots to the overall FM result.

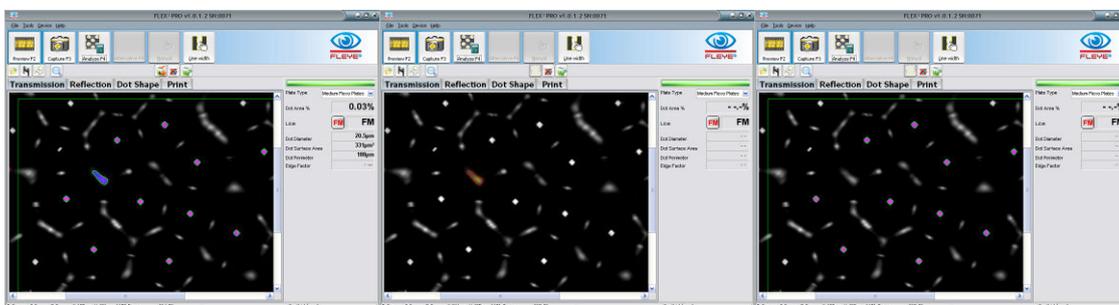


### Add several objects manually to the FM result

Press key CTRL down and keep it depressed. Move the mouse pointer into an object that should be added to the result. Click the left mouse button to add the object to the final result.

### Remove single objects from the FM result

It may happen that a bright area corresponding to the floor of the plate was erroneously added to the overall FM result and needs to be removed. In this case place the cursor over the object, press and hold the **shift** key on your keyboard, and click the **left** mouse button to select the object:



## Line width measurement

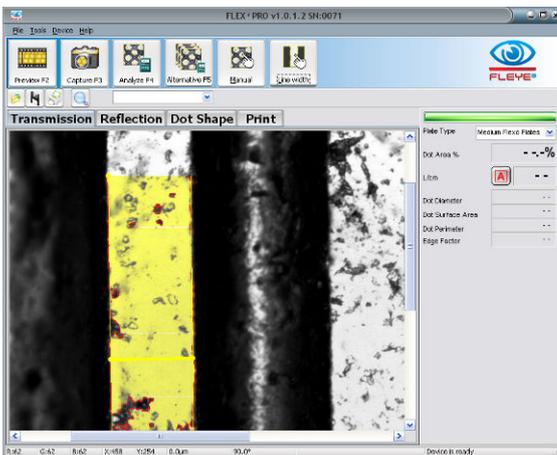
The FLEX<sup>3</sup> software supports a high-precision line width measurement function. The line width measurement calculates the average width of a positive or negative line along a length of exactly 1mm. To measure the width of a line, follow the procedure outlined in the following steps:

- Click Preview to preview a live image.
- Position the Flexo Plate with the line to be measured oriented vertically
- Click Capture



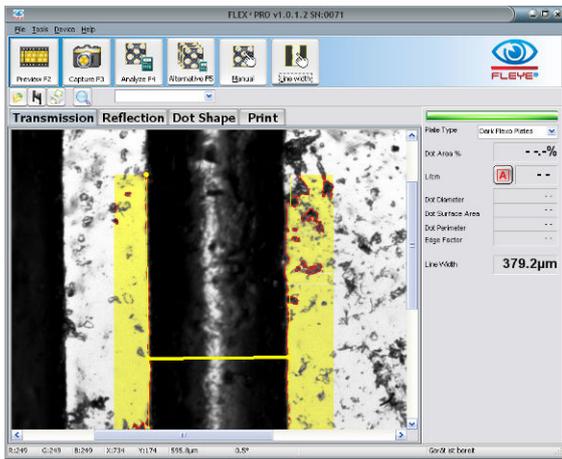
Click the Line Width Icon. The little hand will turn yellow to indicate that the line width measurement mode is active.

In the case of a positive line width measurement, click in the middle of the positive line. The line width function will automatically find the edges of the positive line and fill the corresponding space with a yellow tint. A bold yellow line is placed perpendicularly across the element being measured.



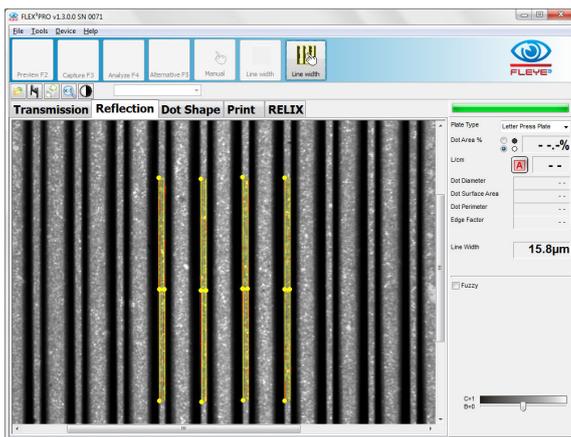
In the case of a negative line width measurement follow the steps outlined below.

- Move the cursor to the area left of the negative line
- Press and hold the left mouse button down
- Drag the mouse across the negative line to the area right of the line
- Release the left mouse button. The line width function will automatically find the edges of the negative line. The area outside the line will be marked with a yellow tint. A bold yellow line is placed perpendicularly across the element being measured.



After each line width measurement the line width mode may be re-selected.

Use the Multi Line Width measurement tool to measure the average line width of several lines.



## Magnifier Tool

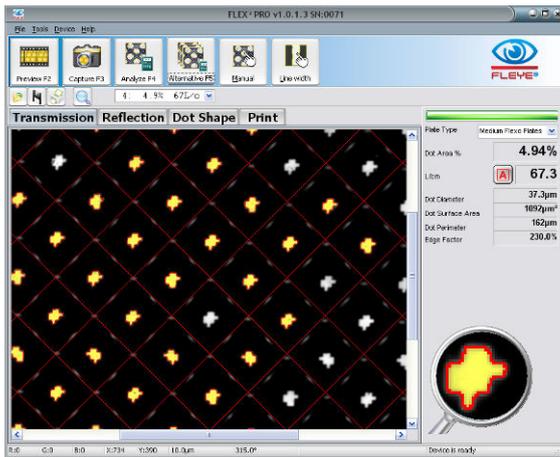
Sometimes it is helpful to be able to see the image in greater detail. The FLEX<sup>3</sup> software offers a magnifier next to the Print Icon on the secondary icon bar.



Click the Magnifier Tool Icon to activate the detail viewer.

-  Hardware resolution (preview, and main window)
-  zoom x2 – Dot Shape preview and Dot Shape main Window
-  Zoom x4 – Transmission, Reflection, Print Window

As you move the mouse over the image an 2x magnified view will appear inside the magnifier glass.



Click the Magnifier Tool Icon again to stop the magnification process.

## Save Image, Copy Image to Clipboard

Click the right mouse button inside the Analysis Window. A Popup Window will appear. Select Save Image to save the image in JPG format, select Copy Image to copy the Image to the Windows Clipboard

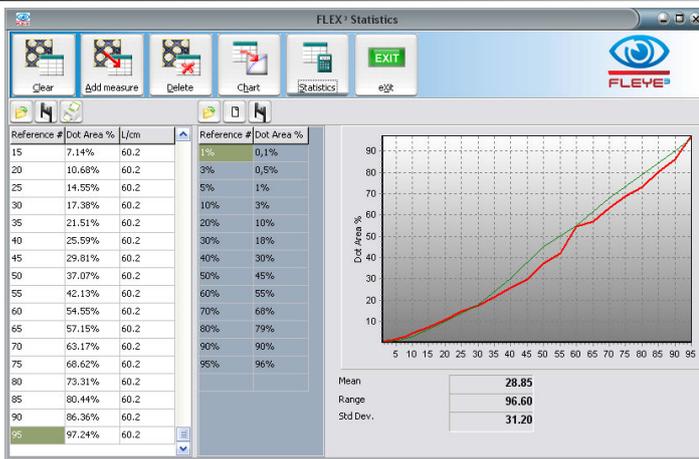


### *Copy partial image*

- Press the SHIFT key down and keep it depressed.
- Move the mouse pointer to the top of the 3D dot
- Press the right mouse button down and select 'Copy Image' from the pop up menu
- The proper part of the image will be copied to the windows clipboard.

## FLEX<sup>3</sup> Statistics

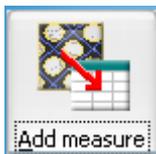
Select the Tools/Statistics Item from the main menu. The FLEX<sup>3</sup> Statistics window will open.



On the left there is a table containing the basic data for statistical analyses.



Select Clear to remove all data from the table at the left.



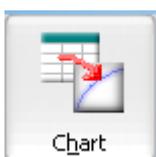
Click ADD measure to add the current measurement to the table. Adding a measurement will set the 'Reference' Column to edit mode. Enter the reference value of the patch and press ENTER on your keyboard. The Statistics window will always stay on top. You can continue to make measurements in the main Window and add these measurement results to the statistics data table. The reference value can be modified by a double click inside the proper cell. Edit the value and press ENTER to confirm the new value.

**The function keys of your keyboard can be used to quickly collect measurement data without using the mouse to switch between windows:**

- Press F2 to start preview
- Bring the patch in position move the Sensor head down
- Press F4 to capture and analyze
- If necessary press F5 to select next alternative
- Press F6 to add the actual measurement data to the statistic table
- Enter the reference number and press ENTER on your keyboard



Click Delete to delete the selected line or selected lines. Multiple line selection is possible.



Click Chart to draw a graph using the data of the selected lines. If only one line is selected then the entire table will be used.

Click **Statistics** to calculate the Mean, Range, and Standard Deviation of the measurements in the table.



- All measurements in the table are used in the calculation if none, one, or all lines are selected

- Only selected measurements are used in the calculation if two or more lines are selected by clicking and dragging across the lines or Shift+click at the first and last selected line.



The table data can be saved and re-loaded at a later time. Use the File Open Icon, the File Save Icon, and the Print Icon.

Any previously stored curve can be used as a reference for future.



In the middle there is a table containing the Reference Curve data. Re-load the reference curve into the graph by clicking the File Open Icon on top of the table. Click the New Icon to clear the reference curve and type in a new reference curve. Click the Save Icon to save the reference curve.

Statistic data is stored into a tab-delimited text file. You can open the file with many other applications such as spread sheet programs for further analyses.

## FLEX<sup>3</sup> Image Comparison

Select Tools/Image Compare from the main menu to open the FLEX<sup>3</sup> Image Comparison window.

On the right there are two Image boxes, one with a blue frame, one with a yellow frame. Next to each box there is a File Open Icon. Click this icon to load a FLEX<sup>3</sup> image into each box.

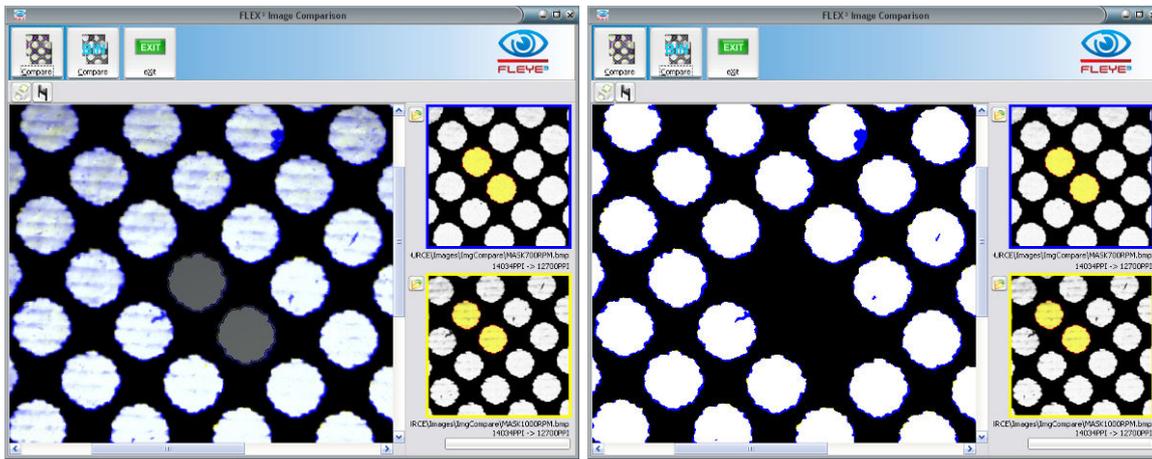
Now select two dots adjacent to each other in each image by clicking on the dot centers. On shadow tints select two single holes per image. The four selected dots will be automatically overlaid during the image comparison process. Click the Compare Icon to overlay the two images.

The FLEX<sup>3</sup> software automatically performs the following steps:

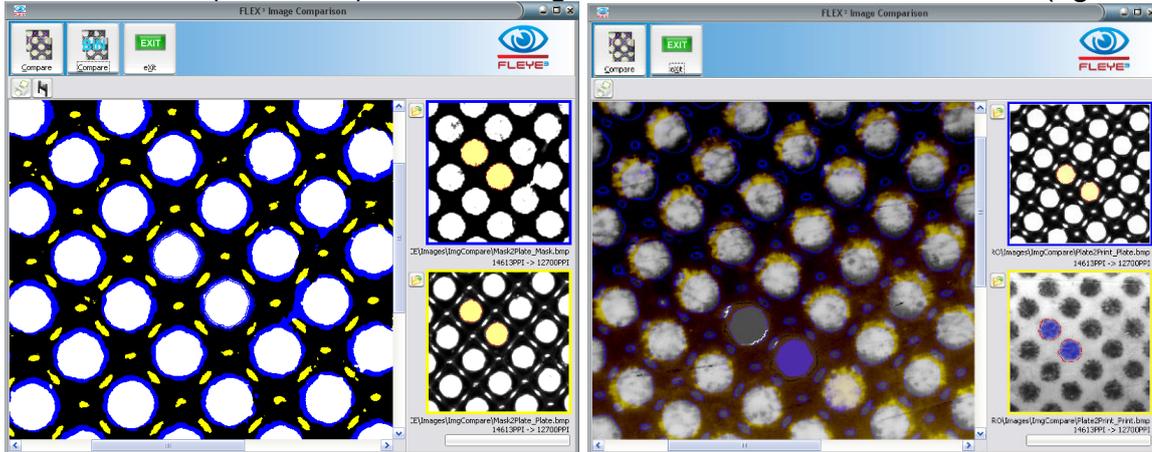
- Resize the images to exactly 12700PPI resolution. This makes it possible to compare images captured with two different FLEX<sup>3</sup> devices.
- Adjust Brightness and Contrast such as both images are showing a very similar gray scale.
- Automatically detect the orientation and position of the dots and rotate and move the 'yellow' image accordingly. Differences in screen rulings can be easily detected.
- Display the differences in yellow or blue color tint.

The two source images on the right are framed in blue and yellow respectively.

If the overlap image shows yellow, then the yellow framed image has larger dots than the blue framed image. If the overlap image shows blue areas, then the blue framed source image has larger dots. Select BIN Compare to show the difference with high contrast.



The examples above show differences in masks due to exposure and machine RPM. Compare Mask to Plate (left below) to see the digital dot reduction or Plate to Print (right below):

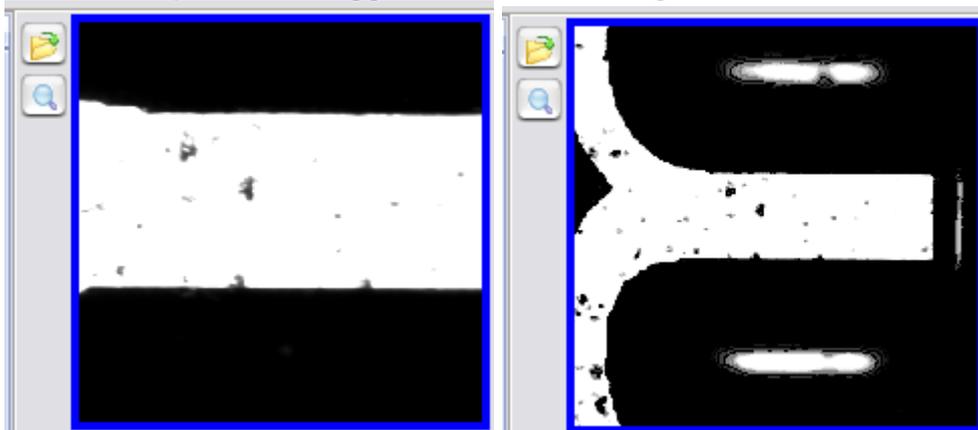


The blue areas surrounding the dots means that the blue image dots (ablation mask) are larger, showing the dot reduction between ablation mask and finished plate.

Export the comparison image in JPG format for documentation by clicking the Save Icon.

### Zoom in function

Click the Lupe icon to toggle between two magnifications



Standard (0.5x)

Zoomed in (0.25 x)

### Manual selection of overlay position by drawing a vector:

- Move mouse arrow to the starting position (rotation zero position)

- Press left mouse button down and keep it depressed
- Move mouse arrow along the reference line
- Click right mouse button to confirm the coordinates
- Release left Mouse button
- The vector is drawn as a red line. The rotation zero position is displayed by a little red circle.

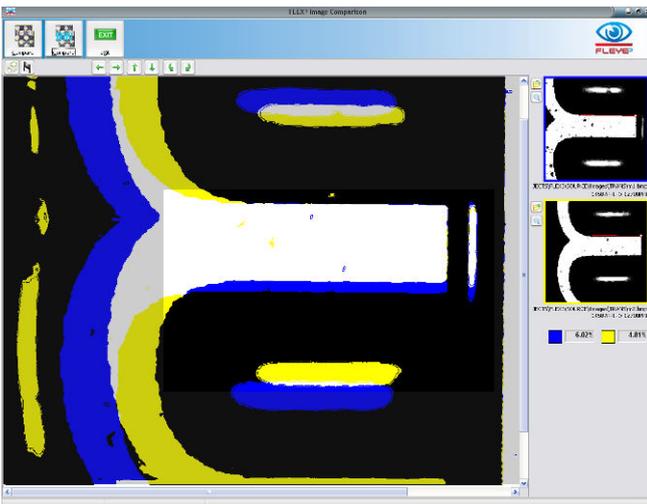


### Fine tuning of location and direction overlay image:

There are functions available to move the overlaid image left, right, up and down by a pixel at a time or to rotate it counter clockwise or clock wise by  $0.25^\circ$  at a time.



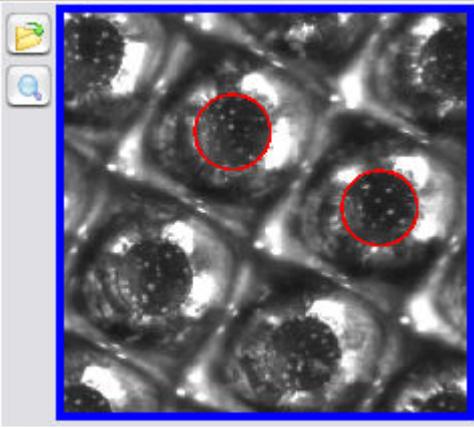
Example: real difference of a font:



### Manual Selection of dots by drawing the dot based on 3 positions

Additional possibility to select dots by manually selecting edge coordinates the same way as in reflection mode:

- Move the mouse arrow to the first edge position of the dot
- Press left mouse button down and keep it depressed
- Move the mouse arrow to the second edge position of the dot
- Click right mouse button
- Move the mouse arrow to the third edge position of the dot
- Click right mouse button
- Release the left mouse button.
- A circle is calculated based on the 3 positions and drawn as dot.



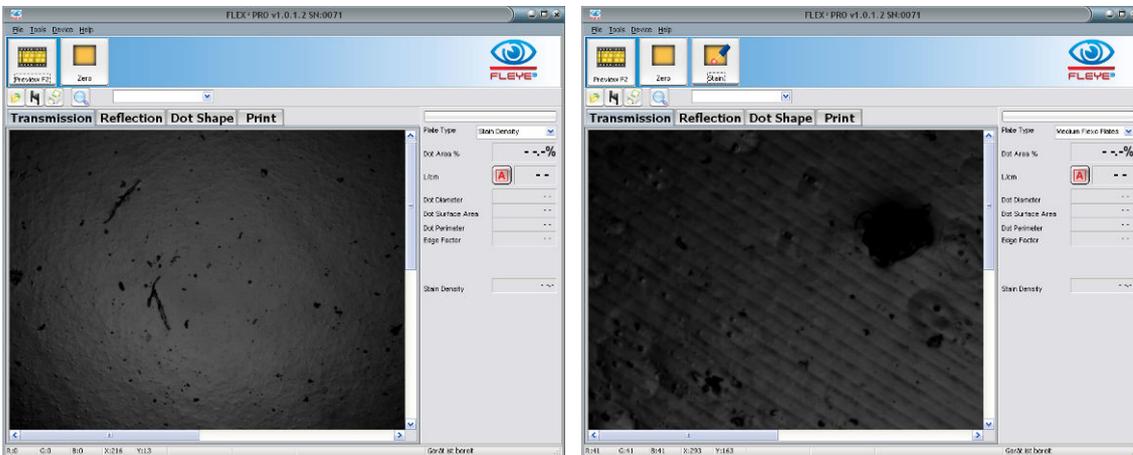
## Stain Density measurement

Select the Transmission page and select Stain Density from the Plate Type List.

The 'Zero' button on the Tool bar will activate. Position the aperture on a tape-pull region of the ablation mask. Lower the sensor head and click Zero.

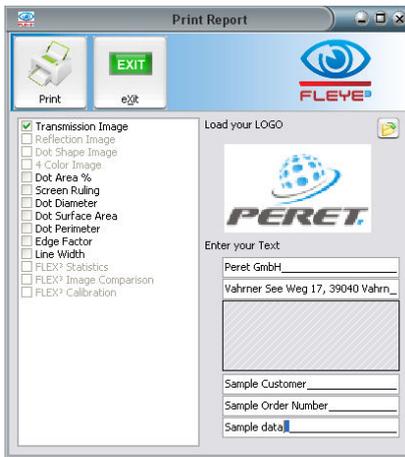
Now position the aperture on a 100% exposed patch of the ablation mask, lower the sensor head and click Stain.

The stain density is displayed in the data panel on the right side. The transmission densitometer function is linear up to a density of 1.00



## Print FLEX<sup>3</sup> Reports

Select the Print Icon to print FLEX<sup>3</sup> reports:



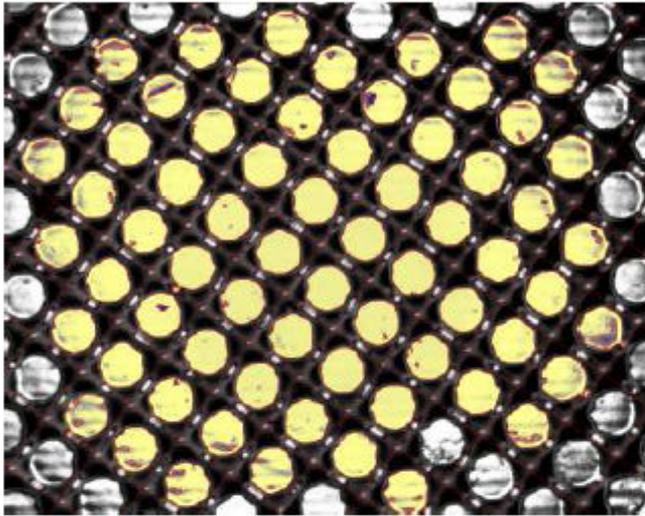
The report can be configured to suit your individual needs. Select the information that you wish to be displayed on the report. You can load your company logo image in Windows bitmap format (\*.bmp). This logo will then be used until you select a different logo.

You can add two header lines (for example your company name and address) and three footer lines (for example Customer, Plate type, Process parameters, Operator, etc.)

When you open the print report window the next time, the header and footer text will automatically be loaded.

Click the Print Icon to print the report

Example Report below:

**FLEX<sup>®</sup> REPORT**Peret GmbH  
Vahmer See Weg 17, 39040 Vahm

Dot Area %	41.26%
L/cm	47.8
Dot Diameter	151.5µm
Dot Surface Area	18031µm <sup>2</sup>
Dot Perimeter	639µm
Edge Factor	101.9%
Line Width	--

01.07.2010

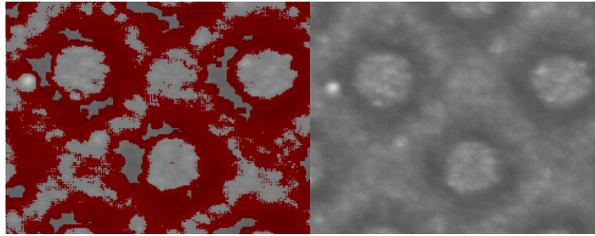
Sample Customer  
Sample Order  
Sample data

## Reflection mode measurement

Non-transparent plates can be measured in reflection mode. The functions available are the same as for the transmission mode. Select the proper plate type before capturing an image.

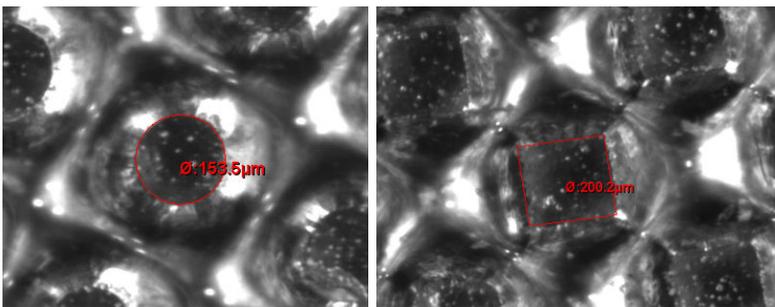


In Reflection mode the Shadows of the dot shoulders are displayed in red color. Click the contrast icon to switch between original image and red-image display.



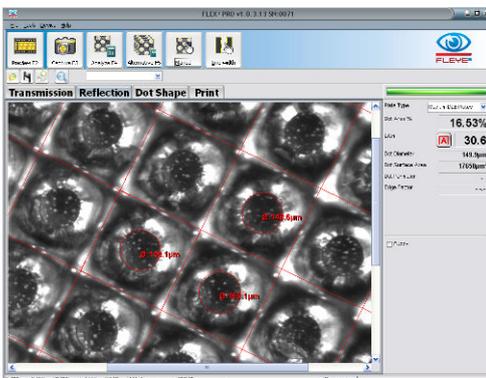
In reflection Mode an additional manual measurement possibility is available. The dot size can be determined as follows:

- Move the mouse pointer to the edge of the dot and press the left mouse button down. Keep the left mouse button depressed until the end of the process
- Move the mouse pointer to another position at the edge of the dot and confirm the position with a right mouse button click
- Add up to 15 positions
- Release the left mouse button.
- If 3 positions have been inserted, a circle through these positions is calculated and drawn
- If more than 3 positions have been inserted, a polygon is drawn. The diameter displayed is the diameter of a circle with the identical area of the Polygon.
- If less than 3 positions have been inserted, no result is calculated



The same function can be used to measure dot percentage and screen ruling.

- Select Manual first.
- Then measure at least 3 dots in the neighborhood.
- Click Manual again to obtain the final result.

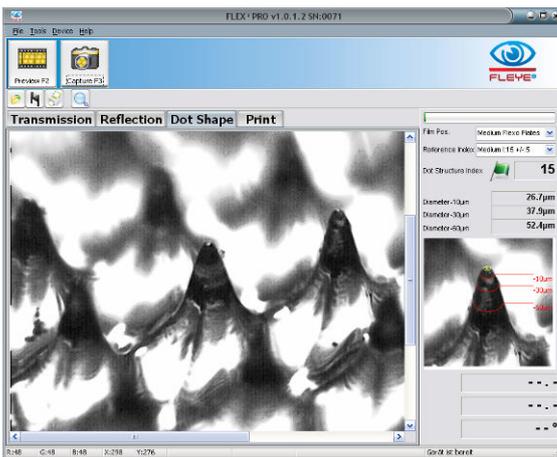


## Dot Shape measurement

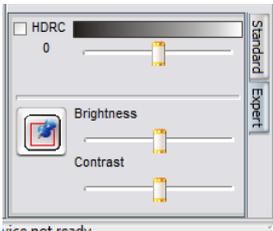
Select the Dot Shape Page of the main Window. The device will ask you to toggle the switch in front of the Sensor head



Click preview to display a live image, click capture to capture the image



## Image Contrast and Image Brightness



On the right bottom there is available a tab page ,Expert' offering functions to optimize the visual contrast and brightness of the 3D Image.

**HDCR** : High Dynamic Range Capture. If HDCR is selected, the captured image is based on 3 real images captured with different camera settings. This will improve the visibility image details on some plate materials.

**Black&White Track bar**: This Track bar controls the physical illumination brightness to optimize reflections during image capture.

**Brightness and Contrast Track bar**. Use these track bars to optimize the visual brightness and contrast of the image. These modifications are performed digital like doing it with an image elaboration software. The preview of the result is displayed in real time in the main window.



Click the ,fixed' Icon to make the adaptations permanent. After 'fixed' has been clicked, no un-do of the changes is possible.

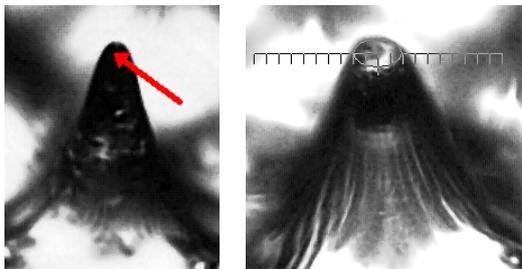
These functions are available only in EXPERT MODE.

## Dot Structure Index

The dot diameter at different relief levels can be measured and a dot structure index is calculated and displayed.

$$\text{Index} := \text{Normalize} \left[ \frac{(\text{Diameter\_minus10} + \text{Diameter\_minus30} + \text{Diameter\_minus60}) * (\text{Diameter\_minus60} - \text{Diameter\_minus10})}{50 \text{microns}} \right]$$

The Index is defined up to a Diameter\_minus10 of 100µm. No Index is calculated on larger dots.



Click inside the black top of the dot to obtain a dot structure index calculation In case of a small dot.

Draw the diameter of the printing dot surface to obtain a dot structure index in case of a larger dot.

Dot Structure Index		<b>11</b>
Diameter-10µm	▲ ▼ ◀ ▶	15.6µm
Diameter-30µm	▲ ▼ ◀ ▶	27.8µm
Diameter-60µm	▲ ▼ ◀ ▶	42.3µm

Use the up and down icons next to the diameters to enlarge or make the diameter smaller, use left and right icons to specify their positions.

### Dot Structure Index Reference handling:

The Dot Structure Reference database now is holding the Dot Structure P Index, the diameters at 3 levels and the reference dot image as well.



Once a reference dot is measured, click the bull's eye icon next to the reference index list. Insert the Plate name into the edit field that appears. Press ENTER to add the current dot as Reference. Select the reference from the reference list to re-load the reference numbers and the reference image

Clicking on Preview or Capture will always re-load the reference image and data. The green flag / warning / fail icon has been moved to the bottom of the image and will show up as follows:

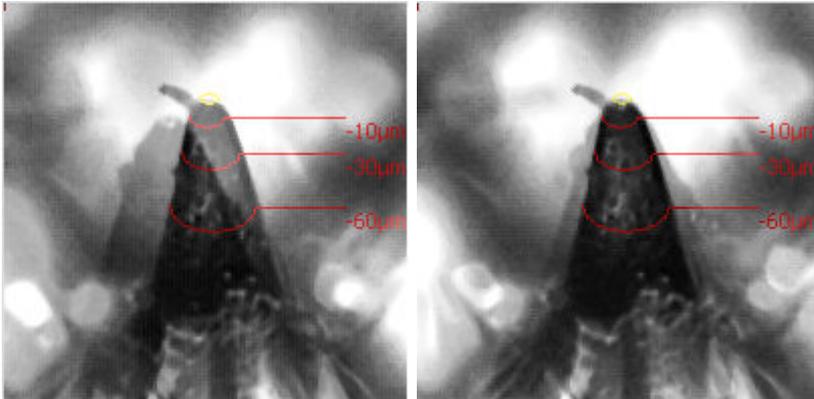
- Green flag:  $\text{abs}(\text{ref-act}) < 0.6 * \text{sqrt}(\text{ref})$
- Warning:  $\text{abs}(\text{ref-act}) \leq \text{sqrt}(\text{ref})$
- Fail: else

### Store dot shape reference images

Click with the left mouse button inside the top of the dot with the SHIFT key depressed. Save the reference as described above.

## Compare Dot Shape images:

Load the reference image as described above. Now capture a 3D image of the actual plate that you want to compare to the reference dot. Press the CTRL key of your keyboard and keep it depressed while moving the mouse pointer to the top of the dot in the main window. A ghost image is displayed in the reference window. Keep moving the mouse until they are perfectly overlaid



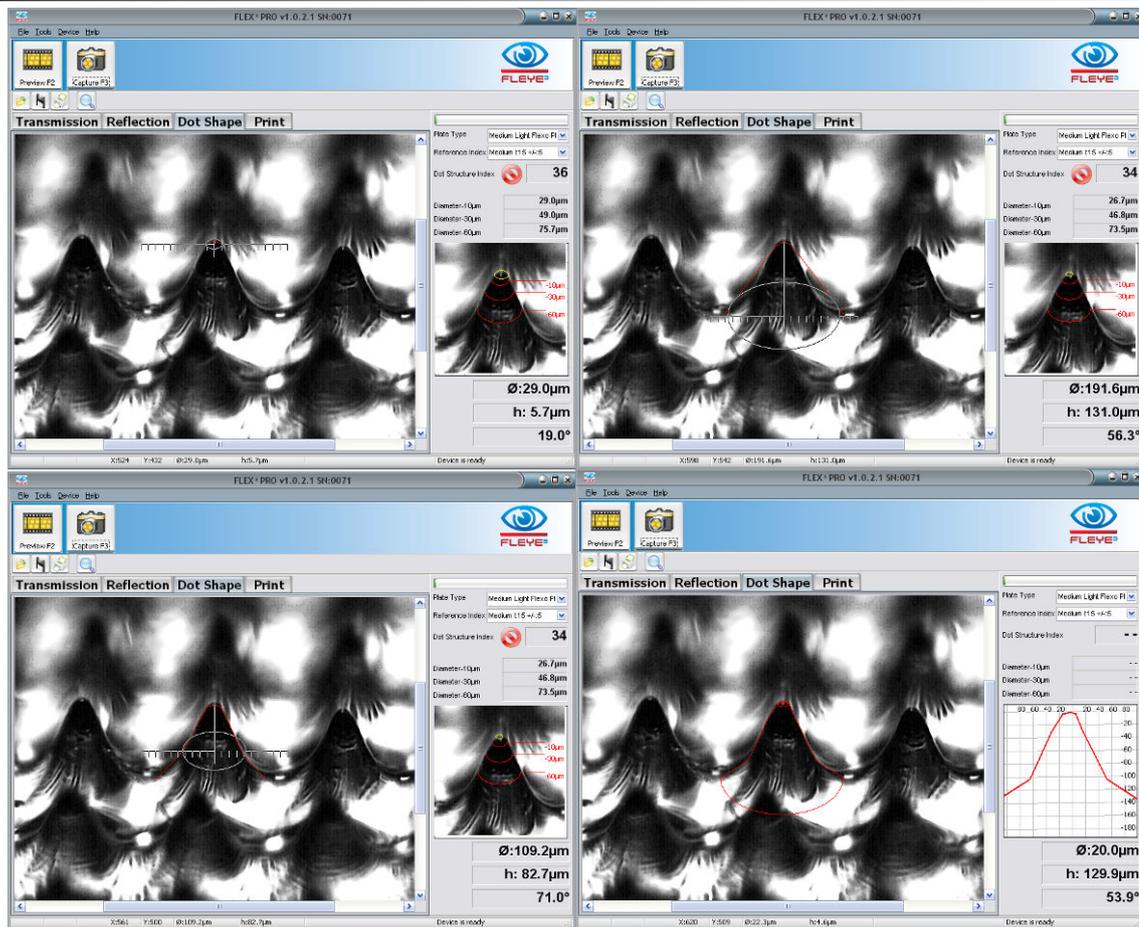
## Create a dot cross section

A dot cross section can be obtained on large dots as follows:

- Move the mouse button into the center of the dot surface and press the left mouse button. Keep the left mouse button depressed until the end of the selection process
- Click the right mouse button while the left mouse button is still depressed. The following popup menu will appear:

Create a dot cross section  
draw actual diameter  
draw actual height  
Draw actual angle

- Select 'create a dot cross section' from the menu to start the coordinate selection.
- Move the mouse to the right, top, left or bottom and draw an ellipse that will approximate the dot on any possible relief level of the dot.
- Click the right mouse button to confirm the actual coordinates
- Continue to add such coordinates as required.
- Release the left mouse button.

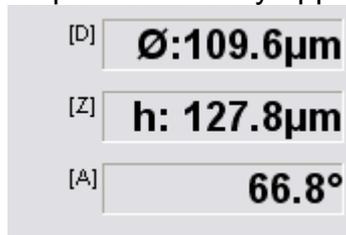


When moving the cursor across the window with left mouse button depressed, the diameter of the displayed ellipse, the relief depth, and the angle between the start point and the current position will be displayed.

## Manual measurements of Dot characteristics

Move the mouse cursor into the center of the dot surface and press the left mouse button. Keep the left mouse button depressed until the end of the selection process. The actual motions are documented as diameter, height, and angle.

To copy the dot measurement data to the Windows Clipboard press CTRL+D. Once copied it may be pasted into any application.

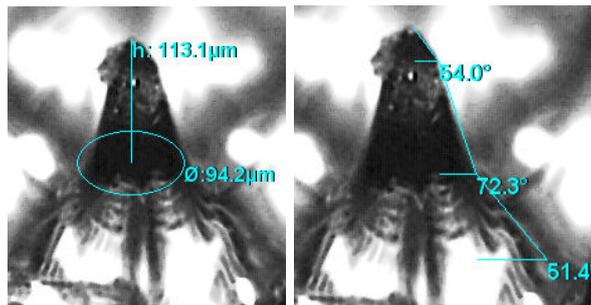


- The diameter is the diameter of the actually displayed ellipse corrected by the viewing projection

- The height is the actual height of the relief from starting point to actual position of the mouse pointer. It is not the distance on the screen, but the distance vertically into the relief corrected by the viewing projection.
- The angle is the angle from the starting point to the actual position of the mouse.

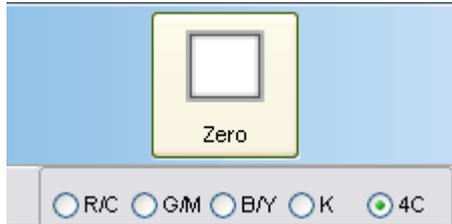
Next to this information a letter shows, which key on your keyboard can be used to draw the information into the analysis Window.

- Press key D on your keyboard to draw the actual diameter
- Press key Z to draw the Z axis height
- Press key A to draw the angle.



## Measure Print

Select the proper substrate type from the Plate Type List.



After installation and before starting measurements it is necessary to zero the device on your substrate.

Position a white area of the substrate below the aperture, move the head down and click the Zero Icon. Zeroing takes a few seconds. The zero reference is stored and automatically reloaded when selecting the substrate type.

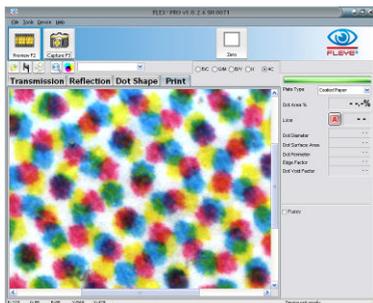
Select the color you are going to measure:



- R/C : measure a cyan (or blue, cold green) tint percentage patch with red illumination
- G/M: measure a magenta (or red, violet) tint percentage patch with green illumination
- B/Y: measure a yellow (warm green, orange) tint percentage patch with blue illumination
- K: measure a black tint percentage patch
- BAL: measure balance (Cyan, Magenta, Yellow)
- 4C: capture a multi color image

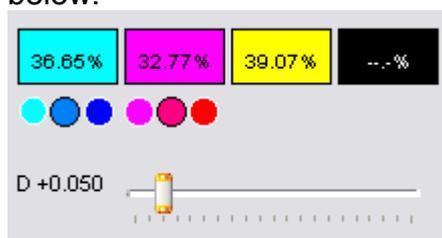
Preview, capture and analyze the image.

## Multi-color analyses (BAL & 4C)



- Select the substrate type
- Zero on your substrate
- Select 4C or BAL from the color list
- Position the head properly
- Capture an image

Click Analyze to analyze all three or four color channels. The results will be displayed as shown below:

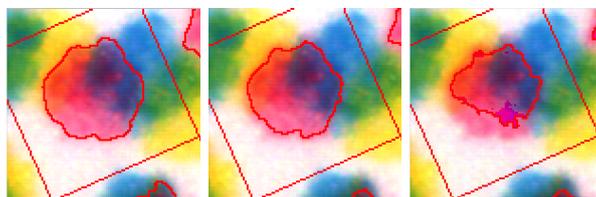


Below the cyan result and the magenta result you can select the type of ink in use: cool, normal or warm. This has an impact on color separation as the secondary densities are different for different inks.

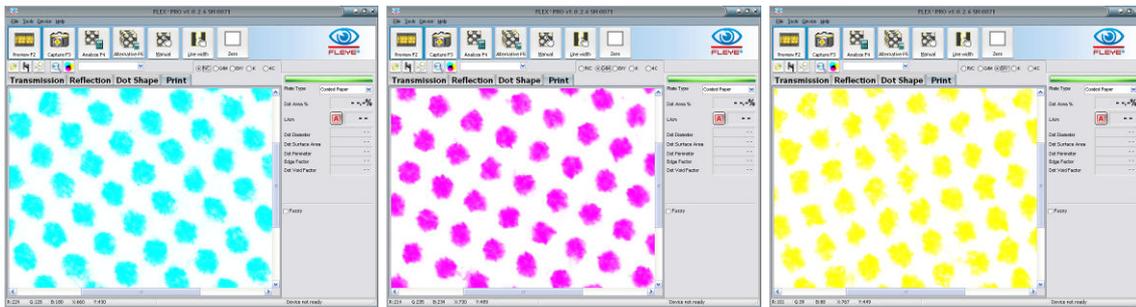
How to know which ink is actually used? Capture an image on a tint percentage of this color (> 10%). A little Pointer will give the recommendation.



The slider control below the result boxes allows the dot edge detection threshold to be manually adjusted. **This function is available only in expert mode.**



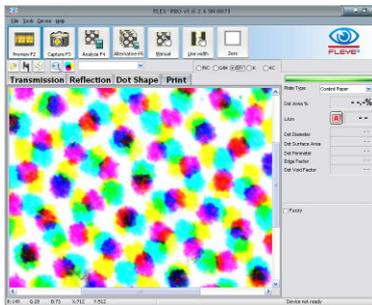
Click on the color you want to see. The proper color will be separated and displayed:



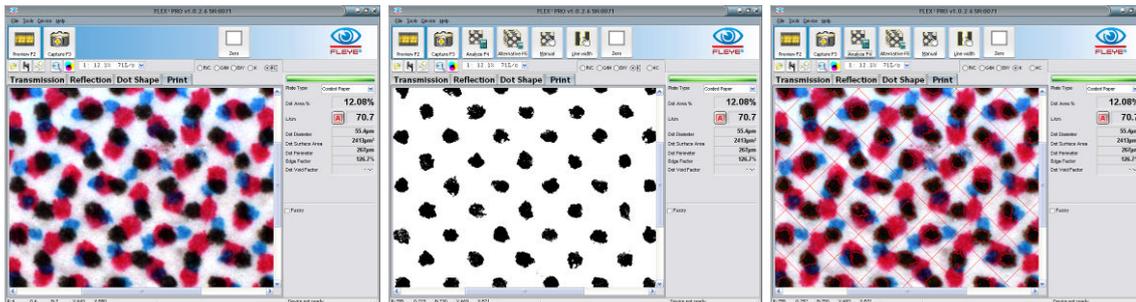
Click **Analyze** to determine the dot area of the separated color.



Click the Color Contrast Icon to display the multi-color image with high contrast schematic color.



Black color separation:

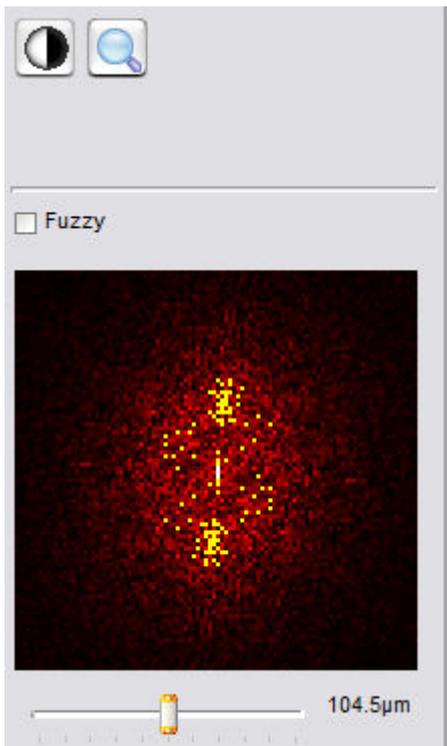
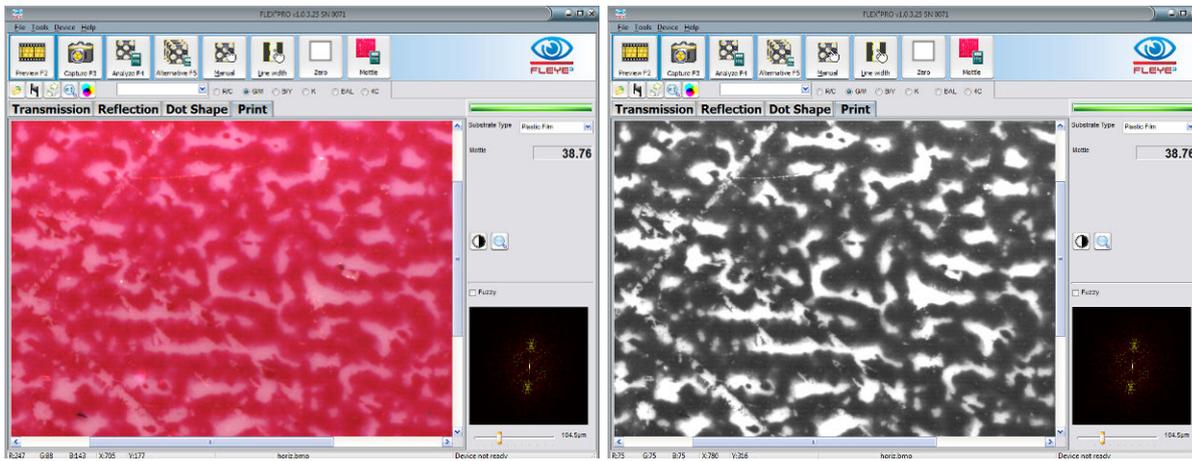


## Mottle

The FLEX<sup>3</sup>PRO offers a density based Mottle function. Capture an image of a solid printed area. Click the MOTTLE Icon. The MOTTLE is calculated based on areas of different low density levels. A white paper will have a MOTTLE of 100%, a solid area with high density all over the area will result in a MOTTLE of 0%



Click the contrast icon to display the mottle effect in high contrast.



### Fourier analysis of the mottle structure

If EXPERT MODE is selected, then there will be calculated the frequency image of the captured sample and it will be displayed in the right bottom corner.



Click the zoom icon to zoom the frequency image.

Position the track bar on bottom to the right and left to adjust the brightness of the frequency image and to highlight better single frequencies (dots).

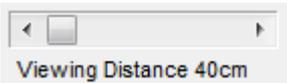
Click with the left mouse button on a Frequency (bright dot) to calculate the periodic distance. The periodic distance can be an indicator for the source of a high mottle.

Click with the left mouse button on the periodic distance value to insert a distance. The periodic distance will be translated into frequency and displayed as white circle inside the image.

### Additional Mottle values



Select the 'ALL' setting in the settings Window to get access to the additional mottling analysis



In case 'ALL' is selected, the visual impression of the solid is displayed in the main window in relation to the viewing distance. The viewing distance can be selected using the ruler on the right side.



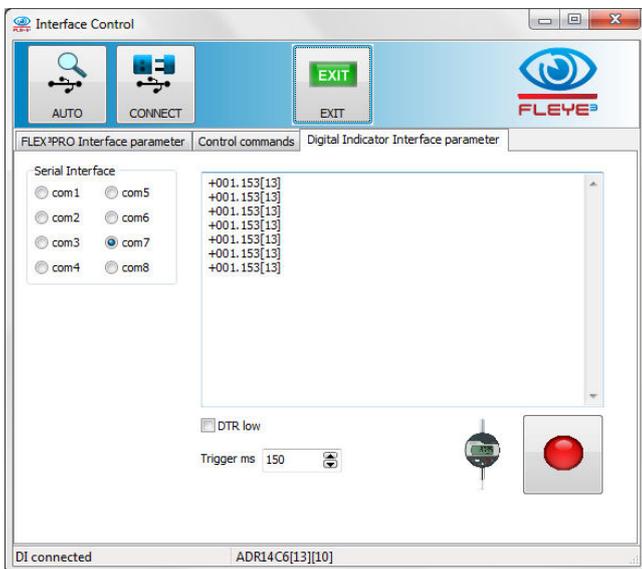
The 'All' setting offers two additional values to evaluate the surface coverage of solid ink films.

**Coverage:** This is a value calculated based on the average size of the areas not covered well with ink.

**ISO 13660 Graininess:** this is the density standard deviation calculated on a ISO tile of 1.27mm x 1.27mm, taking 900 readings inside the tile.

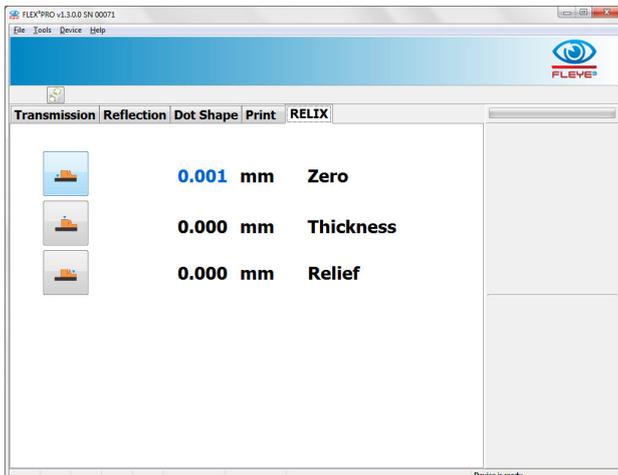
## Measure Relief depth with RELIX

If you have installed the optional RELIX digital micrometer select Device/Control from the main menu to open the proper com port. The com port is saved and automatically connected at the next software start.



Test the proper connection by clicking the red button. Once the micrometer is connected multiple functions are offered.

Select the RELIX page on the main screen



The software offers a remote measurement such as there is no need to touch the micrometer buttons at all. Click the ZERO icon to start the zeroing of the device:



the actual value of the micrometer will be displayed in real time at the screen. Remove any plate below the micrometer and zero the micrometer on the table. Click the Zero Icon again to save the zero position of the micrometer



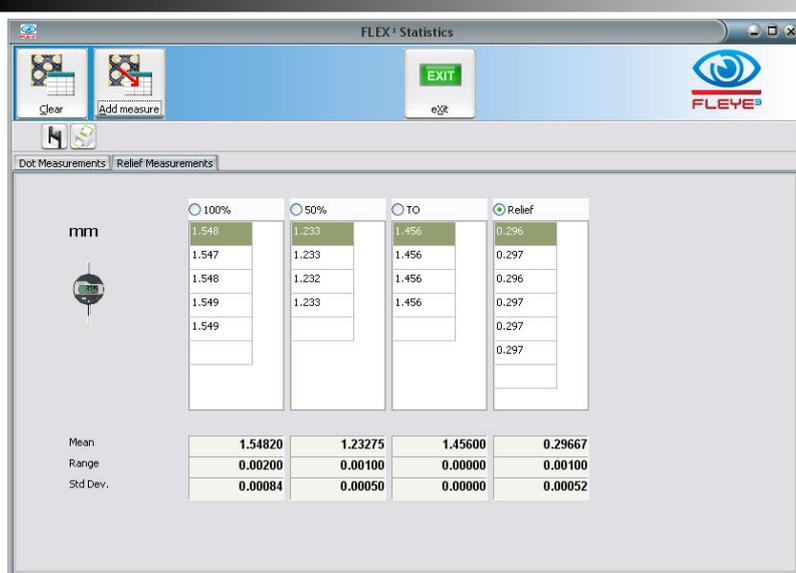
Now select the Thickness measurement icon. Position a solid area of the plate below the micrometer pin and click the Thickness Icon again. The difference in height between the zero position and the Thickness position will be displayed.



Finally start the Relief measurement with a mouse click on the relief Icon. The difference between the Thickness position and the actual position will be displayed in real time. Position the micrometer pin on a relief depth position and click the icon again. The relief depth in terms of a difference between the plate top and the relief bottom will be displayed.

The RELIX measurements can be added to the statistics or the FLEYEplus reports (see FLEYEplus manual for details).

When the optional RELIX depth measuring micrometer is fitted you may select the page 'Relief Measurements'. Select the type of measurement you would like to make (100% Patch, 50%Patch, TO Patch, Relief depth). Position the patch below the digital indicator and click Add measure to add the actual measurement to the table. Mean, Range and Standard Deviation are updated automatically. Inch/mm are used according to the settings in the software.



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## Analysis results

### Dot area (%)

This is the measurement value most commonly used. It specifies the percentage ratio of the dot area to the cell area. The cell area is assumed to be square. The cell area is therefore given by the distance of the dot to its neighboring dots.

Dot area (%) =  $(\text{Average\_Dot\_Area} / \text{Average\_Cell\_Area}) \times 100$  Screen Ruling (Lines/cm, Lines/Inch)

The screen ruling is determined from the mean value of the dot distances. The cell width (pixel) is multiplied by the relevant factors PPcm (Pixel Per cm) or PPI (Pixel Per Inch).

Screen ruling (lines/cm) =  $(1 / \text{Average\_Cell\_Width}) \times \text{Pixel\_Per\_cm}$

Screen ruling (lines/inch) =  $(1 / \text{Average\_Cell\_Width}) \times \text{Pixel\_Per\_Inch}$

### Dot diameter (µm, mil)

In RIP technology, different dot shapes are used. The Software calculates a virtual circle with the same area as the corresponding dot and uses this to calculate the diameter.

Dot diameter (µm) =  $2 \times \sqrt{\text{Average\_Dot\_Area} / \pi} \times \text{Pixel\_per\_}\mu\text{m}$

Dot diameter (mil) =  $2 \times \sqrt{\text{Average\_Dot\_Area} / \pi} \times \text{Pixel\_per\_mil}$

### Dot surface area (µm<sup>2</sup>, mil<sup>2</sup>)

The dot size reflects the effective dot area in the unit selected (µm<sup>2</sup>, mil<sup>2</sup>). This measurement result is of interest for those applications where no fixed, defined cell is specified (e.g. Samba screening, Super Cell Technology).

Dot size (µm<sup>2</sup>) =  $\text{Average\_Dot\_Area} \times \text{Pixel\_per\_}\mu\text{m}^2$

Dot size (mil<sup>2</sup>) =  $\text{Average\_Dot\_Area} \times \text{Pixel\_per\_mil}^2$

### Dot Perimeter

The dot perimeter is the average perimeter of all selected dots in µm or in mil.

### Edge factor

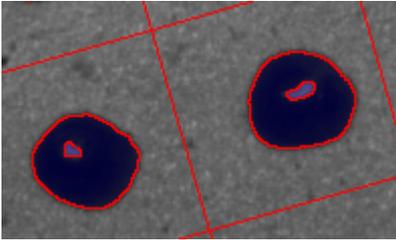
Many print defects start at the edge of the printed dot. For two dots of equal area, the one with the irregular edge will typically exhibit higher dot gain. The ratio of the increased length of the irregular edge, as compared to edge of a perfectly round dot is expressed as the Edge Factor.

Edge factor =  $100 \times (\text{Average\_Dot\_Edge\_length} / \text{Dot\_Edge\_Length\_Circle})$

## Dot void factor

The dot void factor is a measurement value for the coverage of a dot with color. The low density areas inside the dots are measured and put into relation to the entire dot area applying the following formula:

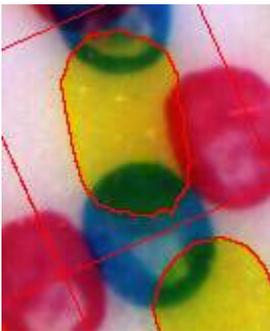
$$\text{Dot void factor} = 100 \times \text{Average\_DotVoid\_Area} / \text{Average\_Dot\_Area}$$



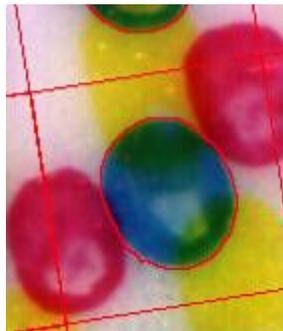
## Slur Factor

The slur factor is a measurement value for the dot length to dot width relationship. For example invalid printing pressures, printing speed changes, un-round printing oscillations, or variations in cut-off length can lead to stretched dots. This is measured with the Slur Factor. The Slur Factor is available only in Expert mode.

$$\text{Slur Factor} = 100 \times \text{dot\_length} / \text{dot\_width} \%$$



Slur Factor Yellow = 170%



Slur Factor Cyan = 131%

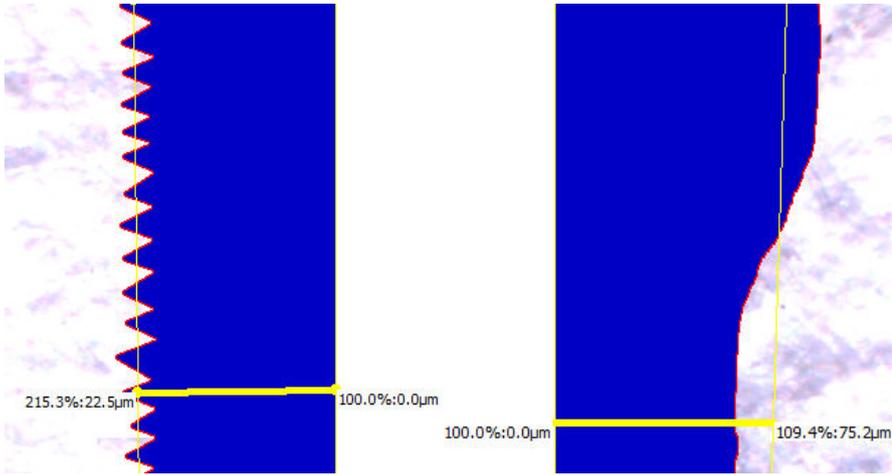
## Line Quality index

Two additional line quality parameters are calculated in EXPERT MODE. The first one is a ratio in percent between the total edge length of the line and the shortest possible edge.

$$\text{Line smoothness [side]} = 100\% \times \frac{\text{line edge length[side]}}{\text{Shortest possible edge length [side]}}$$

The second one is calculated in microns as the mean thickness deviation of the line compared to the mean thickness of the line

$$\text{Line thickness variation [side]} = \text{average distance of real edge to yellow regression line [side]}$$



While the line smoothness is a sensitive indicator for high frequency deviations of the line edge, the line thickness variation is a sensitive indicator for low frequency thickness variations of the line.

### **Mottle**

$$\text{Mottle} = \sqrt{\frac{1}{V} * \sum_{i=1..n} (w_i * p_i)} * 100\%$$

Whereby

$$V = \sum_{i=1..n} (w_i)$$

$W_i$  = weighting function

$P_i$  = surface coverage calculated with threshold  $i$

Coverage =  $\frac{\text{sum}(\text{size of bright areas})}{\text{number of bright areas}}$

ISO 13660 Graininess = Standard deviation of Densities

### **About**

- Link to software upgrade download page