



DpuScan

Janich & Klass
Computertechnik GmbH



DpuScan 6.x

Referenzhandbuch

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1 Optical Marks

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How to Use the OMR

1.1 Overview

OMR means the method to recognize marks on scanned documents, like questionnaires, for example. Often, mark areas are printed boxes that are manually marked by crosses, hooks, or any other mark. Also, there are cases where the marks can be set directly beside the text, without a defined box.

For better determining the position of such marks fields in a scanned image, the alignment (rotation and movement) of the entire image can be found out. This alignment recognition orientates itself to specific alignment marks which must exist in the image.

If suitable alignment marks exist, the alignment recognition should always be activated.

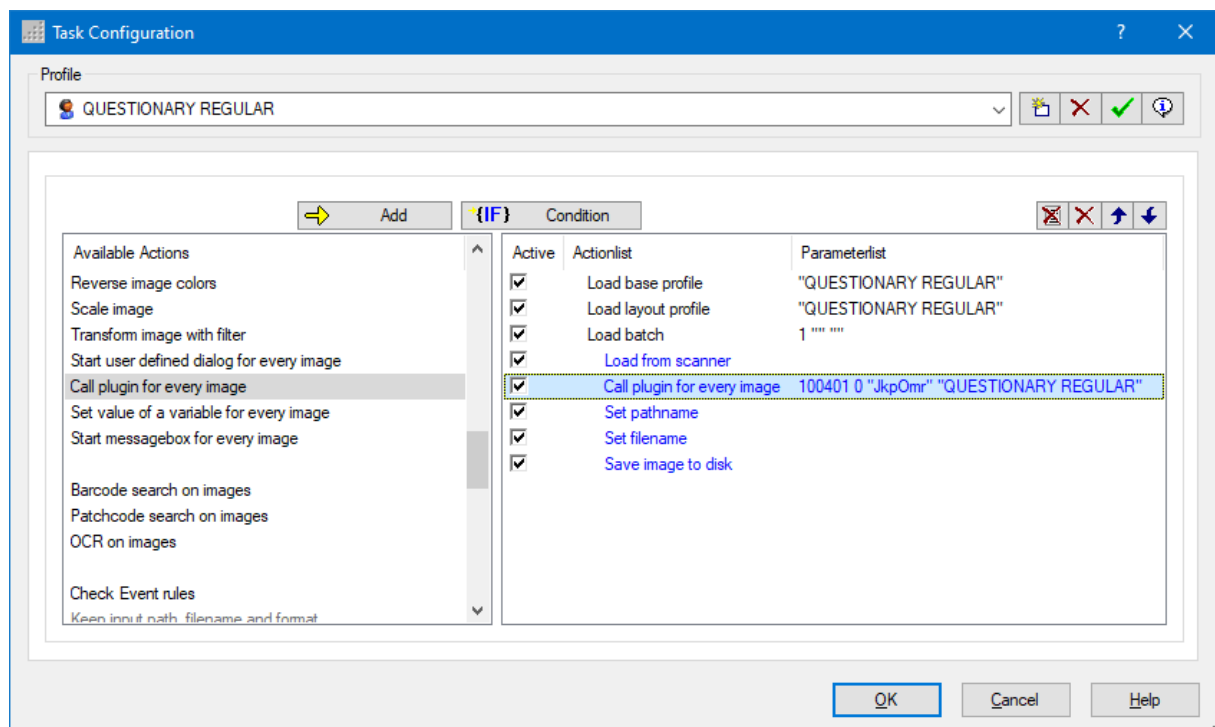
The OMR Plugin serves for evaluation of such marking fields on scanned documents. For using it, the Plugin must be loaded in the Class, must be configured there and be inserted into the Task as a new action.

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1.2 The Plugin in the Task Definition

The search for marks can be added in the Task definition, after getting the images by the action "Load from scanner" or "Load from directory".

This Task action is available only if the OMR Plugin was loaded in the actual Class.



Plugin as Task Step

You can configure the Task action via selection lists: select the **OMR** Plugin, the prior established configuration and the color format / image, and also determine the paper side to be processed (Front side / Rear side / Both sides).

A bitonal image is required as base for the evaluation. If a color image or a grayscale image is selected, it will be transformed into a bitonal image by internal settings.

If the quality of the questionnaires to be evaluated is good enough, the originals can directly be scanned as bitonal images.

If a color image is available, the specific image enhancement methods of DpuScan can be utilized, like color noise reduction, color filtering, or enhanced modification, in order to achieve an optimum image for the OMR.

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1.2.1 Settings for a Task Step

If a plug-in is used in the program, it may have its own sub-profile and may work with certain images in the image group only:

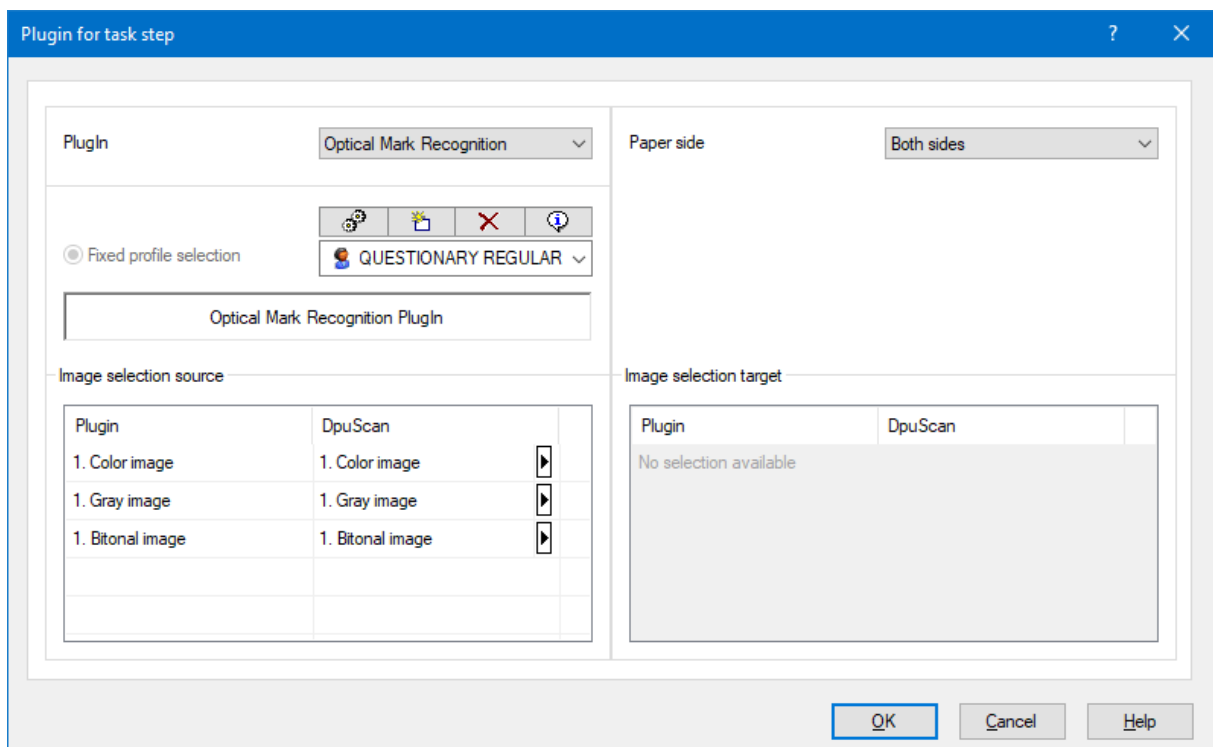


Image Selection Source

A bitonal image is required as the basis for the OMR. If there are only color images or grayscale images, these are automatically converted in the background.

If black and white is set as the only output format in the scanner, simply select the first 1st bitonal image on the DpuScan side as the 1st bitonal image on the plug-in side.

If you are scanning in color or in grayscale, enter the first color or gray image accordingly.

If you prepare the images from the scanner, e.g. by noise reduction, filtering or cutting, and save these improved images in addition, then there are several images of one type. Then choose the one that is most suitable, e.g. the 2nd bitonal image from which noise has been removed.

Als Basis für die OMR wird ein bitonales Bild benötigt. Falls es nur Farbbilder oder Graustufenbilder gibt, werden diese automatisch im Hintergrund umgewandelt.

Wenn Schwarzweiß als einziges Ausgabeformat im Scanner eingestellt ist, so wählen Sie als 1. Bitonalbild auf PlugIn-Seite einfach das erste 1. Bitonalbild auf DpuScan-Seite.

Wenn Sie farbig oder in Graustufen scannen, so geben Sie entsprechend das erste Farb- oder Graubild an.

Wenn Sie die Bilder vom Scanner aufbereiten, z.B. durch Rauschunterdrückung, Filterung oder Ausschneiden, und diese verbesserten Bilder zusätzlich speichern, so gibt es mehrere Bilder von

einer Sorte. Wählen Sie dann dasjenige, welches am besten geeignet ist, z.B. das 2. Bitonalbild, bei dem Rauschen entfernt wurde.

Bildauswahl Ziel

Diese Auswahl für dieses PlugIn ohne Bedeutung, da es die Bilder nur untersucht und keine zusätzlichen Bilder erzeugt.

Blattseite

Geben Sie hier an, ob das PlugIn mit dieser Konfiguration nur für die Vorderseite, nur für die Rückseite oder beide Seiten aufgerufen werden soll.

Wenn der Aufruf **nur für eine Seite** erfolgen soll, so beachten Sie bitte, dass Ergebnisse, die als I-Variablen gespeichert werden, auf das folgende Bild **vererbt** werden. Das heißt, sie sollten vor dem Aufruf des PlugIns diese Variablen **leer vorbesetzen**. So haben Sie auch dann einen gültigen Wert, wenn das PlugIn für diese Seite nicht aufgerufen wird.

Weitere Informationen finden sich bei der Taskkonfiguration.

1.3 The PlugIn in the Class Configuration

The PlugIn must be loaded and be configured within the Class. Open the **Class Configuration**, select the property sheet for **Process** and click the **PlugIns** button.

The **Add** button guides you to the selection of available PlugIns.

You must select the PlugIn called **JkpOmr**. Highlight its line by clicking into it and click the **Select** button.

The OMR PlugIn is not loaded for usage in this certain Class.

Don't forget to check the "PlugIns activated" box with its hook, as otherwise no PlugIns will be used.

The entry in the list as per the above illustration shows, in the **Process Mode** column, an activated check box, while the check box in the **Interactive Mode** column is not activated. This means that this PlugIn can be used exclusively in the Process Mode, during the scan process, but not in a scan pause or in the Edit Window.

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1.4 Return Values of the PlugIn

Additional to the defined ones the PlugIn returns some more variables which allow to draw conclusions from the run of the process.

%(JKPOMR_ALIGN_FOUND_COUNT)

Delivers the absolute number of retrieved alignment marks.

%(JKPOMR_ALIGN_FOUND_PERCENT)

Delivers the relative number of retrieved alignment marks, in relation to the number of defined alignment marks. The indications are made in percent.

%(JKPOMR_PROCESSTIME)

Delivers the duration of the entire process run. The indication is made in tenth milliseconds. This value is mainly used for analytical purposes during the OMR setup.

%(JKPOMR_THD_MIN_VALUE)

Delivers the smallest distance of the calculated black value from one of the defined thresholds. The minimum of all defined marks is returned. The indication is made in hundredth percent.

If, for example, the bottom threshold for a mark is set to 10% and a black value of 10.5% is found out, this variable will receive the value "50". Using this result, you might for example set a blue mark with an Event Rule so that the reading result can be verified manually in such a case.

%{JKPOMR_THD_COUNT}

Indicates the absolute number of marks whose determined black value deviates less than 2% from one of the defined thresholds.

If, for example, the determined black value for a frame is 58.1%, and the threshold for "demarking" (making a mark void by blackening its field) is set to 60%, this frame will also be counted for determining the value for JKPOMR_THD_COUNT.

%{JKPOMR_THD_PERCENT}

As JKPOMR_THD_COUNT, but the number is delivered in percent, relative to the number of all defined frames.

These variables allow for a better control of the optical mark recognition. Evaluation of these returned values inside the Event Rules makes it possible to recognize pages with insecure marks and to react to them, and also to create the base for statistical evaluations.

The variables created by the administrator are of two different types. Variables that are used to align the image, and variables that contain the search results.

Marks

Contains the results from the OMR for a defined area/frame.

The variables may have the following values:

- 1 frame found, not marked or blackened
(depending on further settings for the OMR)
- 2 frame found, marked
- 3 frame blackened
(depending on further settings for the OMR)

Alignment

These variables state whether the under-lying search pattern was found and whether thus a position correction for the image could be executed.

- 0 search pattern not found
- 2 search pattern found

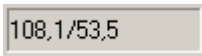
1.5 Configuration for OMR

When you click, on the General page, the button for **External Settings**, the following dialog displays, for the configuration of the OMR.

The left-hand half shows a preview window and control elements for loading an image and for setting frames. The other half offers the property pages for **Marks** and **Alignment** and the **Test**-page.



Opens the dialog for loading an image.



Shows the actual position of the mouse pointer in the preview window.



Adds a new frame.



Removes an existing frame.

Preview window

In the preview window, some functions are assigned to the mouse buttons:

Click left button zoom into the image

Click right button zoom out of the image

Frames can be spanned with the left mouse button pressed down

Selection of all elements inside the spanned frame

Move the mouse with right button pressed down:

Move the actually visible image section

Shift key pressed down:

Keep your left mouse button pressed down to directly span up a new frame.

Control key pressed down and clicking to individual frames:

Multi-selection of several frames.

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1.5.1 Property Page: Marks

Here, you define the areas where the OMR will search for marks. A frame must be defined for every single mark to be evaluated. The automatically pre-assigned features can be modified and adapted for each of these frames.

Frames:



Allows to directly select the already defined search areas. It is possible to select individually, or to make a multi-selection. Such multi-selection is done, Windows-conform, with pressed Shift or Control key.

Left:

Indicates the position of the left-hand edge of the frame. The value bases on the actual selection in the dropdown list **Position relative to:**.

Top:

Indicates the position of the top edge of the frame. The value bases on the actual selection in the dropdown list **Position relative to:**.

Width:	Defines the width of the frame.
Height:	Defines the height of the frame.
Tolerance:	Defines an area around the frame position, where the PlugIn will later try to find a mark. Depending on the quality of the feeder, the position of the frame to be evaluated will be more or less strongly shifted on subsequent images. The defined tolerance zone is graphically shown as hatch.
Position relative to:	Indicates the reference point for defining the frame position.

In case of a multi-selection, the topics **Left**, **Top**, **Width**, **Height** and **Tolerance** can be set in the same way, for all selected elements, for example for all marks in one line. For values that already are equal at the moment of selection, the edit box is active, so that the value can be altered.

The edit boxes of those values that are different for the selected element, can not be altered.

Only if the check box beside the edit box is enabled, you are allowed to enter values here; those will be taken over for all selected elements in the same way. This serves to prevent from unintended alterations.

Recognition:

Actual black value:	<p>Indicates a value for the actual mark.</p> <p>Depending on the set minimum and maximum values, and the setting in Search for box, a green symbol will display next to the percentage value that represents the status of recognition.</p> <p>An empty square means that no mark was recognized in the defined field; then the value of the according variable would be 1.</p> <p>A square with a cross-mark denominated a recognized mark, the value of the according variable would be 2.</p> <p>A filled-up square stands for a field whose mark was cancelled (that was demarked), for example by complete blackening. In this case, the value 1 will be returned to the variable.</p>
Minimum level:	Indicates the value, below which a field is said to be not marked.
Maximum level:	Indicates the value an, above which a field is said to be blackened.

Result

The result of the search is reported to DpuScan via a variable, also known as Percent Code. The names of the variables are proposed by the PlugIn when the search field is defined. The format is % (JKPOMR_MARKxx), where JKPOMR_MARK is the prefix and xx an incrementing number. The nomination can be over-written in order to, for example, get a "talking" name.

Options

The checkbox named **Treat invalidly marked fields like unmarked fields** rules the return value in case of a blackened marksfield.

If the black value exceeds the defined maximum level, the variable normally will contain a 3.

If this checkbox is active, 1 is returned .

Mark	Value of the variable with de activated option	Value of the variable with activated option
<input type="checkbox"/>	1	1
<input checked="" type="checkbox"/>	2	2
<input type="checkbox"/>	3	1

This option serves for compatibility to previous versions.

Please note: This checkbox will automatically be activated, if the configuration is based on a former version of the plugin. Before deactivating this checkbox, please adjust the event rules if necessary.

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1.5.2 Property Page: Fields

A field is a kind of table structured area and contain one or more values which shall be read with a single field definition. Using this field type a table can be read without the need of separate frame definitions for each table cell.

Frames:



Allows to directly select the already defined search areas. It is possible to select individually, or to make a multi-selection. Such multi-selection is done, Windows-conform, with pressed Shift or Control key.

Left:

Indicates the position of the left-hand edge of the frame. The value bases on the actual selection in the dropdown list **Position relative to:**.

Top:

Indicates the position of the top edge of the frame. The value bases on the actual selection in the dropdown list **Position relative to:**.

Width:

Defines the width of the frame.

Height:

Defines the height of the frame.

Tolerance:

Defines an area around the frame position, where the PlugIn will later try to find a mark. Depending on the quality of the feeder, the position of the frame to be evaluated will be more or less strongly shifted on subsequent images. The defined tolerance zone is graphically shown as hatch.

Position relative to:

Indicates the reference point for defining the frame position.

In case of a multi-selection, the topics **Left**, **Top**, **Width**, **Height** and **Tolerance** can be set in the same way, for all selected elements, for example for all marks in one line. For values that already are equal at the moment of selection, the edit box is active, so that the value can be altered.

The edit boxes of those values that are different for the selected element, can not be altered.

Only if the check box beside the edit box is enabled, you are allowed to enter values here; those will be taken over for all selected elements in the same way. This serves to prevent from unintended alterations.

Field:

Rows: Contains the number of rows for the field area.

Columns: Contains the number of columns for the field area.

Type: Defines the field type. Available types are:

m of n Horizontal
m of n Vertical
1 of n Horizontal
1 of n Vertical

If a random number of cells can be marked choose the one of the types "m of n Horizontal" or "m of n Vertical".

The return value contains the result for each cell of the table. The difference between these field types is the information order in the return value.

In the case of field type "m of n Horizontal" the variable contains first all values of the first row, separated by a comma. Then, separated by semicolons, the further rows follow.

In the case of field type "m of n Vertical" the variable contains first all values of the first column, separated by a comma. Then, separated by semicolons, the further columns follow.

If there is allowed exactly one single mark in each row or column the corresponding type "1 of n Horizontal" or "1 of n Vertical" can be chosen. In this case the return value contains only the position of the mark within the row/column. If there are unconfident results, e. g. multiple marks in a row or column, a zero will be returned.

Recognition:

Actual black value: Indicates a value for the actual mark.

Depending on the set minimum and maximum values, and the setting in Search for box, a green symbol will display next to the percentage value that represents the status of recognition.

An empty square means that no mark was recognized in the defined field; then the value of the according variable would be 1.

A square with a cross-mark denominated a recognized mark, the value of the according variable would be 2.

A filled-up square stands for a field whose mark was cancelled (that was demarked), for example by complete blackening. In this case, the value 1 will be returned to the variable.

Minimum level: Indicates the value, below which a field is said to be not marked.

Maximum level: Indicates the value an, above which a field is said to be blackened.

Result




The result of the search is reported to DpuScan via a variable, also known as Percent Code. The names of the variables are proposed by the PlugIn when the search field is defined. The format is % (JKPOMR_MARKxx), where JKPOMR_MARK is the prefix and xx an incrementing number. The nomination can be over-written in order to, for example, get a "talking" name.

Options

The checkbox named **Treat invalidly marked fields like unmarked fields** rules the return value in case of a blackened marksfield.

If the black value exceeds the defined maximum level, the variable normally will contain a 3.

If this checkbox is active, 1 is returned .

Mark	Value of the variable with de activated option	Value of the variable with activated option
	1	1
	2	2
	3	1

This option serves for compatibility to previous versions.

1.5.3 Property Page: Alignment

This property page is used to define fields that serve the PlugIn for alignment of the image. Many originals have positioning marks. The search fields for aligning the image are defined analog to the fields for Marks recognition.

Frames

Left: Indicates the position of the left-hand edge of the frame. The value bases on the actual selection in the dropdown list **Position relative to:**.

Top: Indicates the position of the top edge of the frame. The value bases on the actual selection in the dropdown list **Position relative to:**.

Width: Defines the width of the frame.

Height: Defines the height of the frame.

Tolerance: Defines an area around the frame position, where the PlugIn will later try to find a mark. Depending on the quality of the feeder, the position of the frame to be evaluated will be more or less strongly shifted on subsequent images. The defined tolerance zone is graphically shown as hatch.

Position relative to: Indicates the reference point for defining the frame position.

Search for Pattern

Here, you find the two color beams **Suitability** und **Recognizing**, which show the quality of the selected frame. In case of moving the frame or changing its dimension the indicators will be refreshed automatically. The user gets an immediate feedback on his operation.

The **Suitability** color beam informs about how well the mark can be recognized inside the actually selected frame. The Pattern should consist of horizontal or vertical streaks, respectively, and the frame must completely cover this mark. The mark inside the beam should be in the green area, so that the mark is suited for alignment.

The **Recognizing** color beam indicates how good the mark can be retrieved within the tolerance range. Also here, the mark must be in the green area of the beam.

After appropriate setting, the search pattern must be applied for every frame. This is done by clicking the **Apply pattern** button.

Result

Analog to the definitions on the **Marks** property page, a variable is established also here for every frame; it can later be used in the process.

Options

Don't use Alignment Here you can set that the automatic alignment shall not be used, however without the need to have to delete all entered values.

If no Alignment is found, search on rotated image If this option is selected, the search for alignment marks will again be executed on the image, but rotated by 180 degrees. It is not possible here to search with rotation angles of 90 degrees or 270 degrees.

Rotate image If the search on the rotated image was successful, you can use this option in order to reach that the rotation of the image is kept from now on. The image will then appear also on the DpuScan surface as rotated.

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1.5.4 Page: Test

In order to be able to check how the settings made will work with other images, you can load an image for test. The tab contains the following elements:



Click this button to reach a dialog for loading an image. After it is opened, the OMR will automatically be started, and the result is displayed in the preview field.

C:\Dokumente und Einstell...\OMRTEST_1.tif

The display field next to the button for opening the image file shows the path and file name of the actually opened file.

Options

Test automatically

Performs the test with the same parameters like in the process mode. If rotation is allowed in the process mode it will be done in the test if necessary.

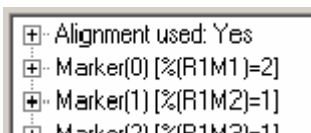
Test original image

Performs the test without any rotation.

Test 180° rotated image

Starts the test on a rotated image.

Note: The image will **not** be shown rotated in the preview window. Instead of this the position of the marks will be adapted.



The display field below the option group shows the result from the test in a tree view.

The branch "Alignment used: ..." allows to check which alignment marks were found and which image corrections were made. This includes Movement, Rotation, Distortion and Characteristic middle deviation.

A branch is added for every marker, the name of the relatively used variable and the reading result are displayed. Furthermore, the actually calculated black value is put out, and the threshold as defined for this frame.

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1.6 How to Use the OMR

Below, we describe the subsequent steps of a configuration.

First, you must scan some example documents and process them (deskew, alignment) in the way that they are suited for being used in the configuration.

Open the configuration of the Class where you want to work with the OMR. Select the **Process** property page and click the **Plugins** tool button.

Activate the **Plugins activated** check box. Click the **Add** tool button and then select the **JkpOmr** PlugIn.

Use the **Edit** tool button, or double-click the newly added line to enter the configuration dialog of the PlugIn. You must eventually execute your registration.

Click the ID button  to establish a new OMR configuration. First, you must define its name.


Use the **External Settings** tool button to start the definition for the search areas.

Now, the **Marks** property page is active, and you can define the marks to be evaluated.

First, you load a suitable image as the base for positioning the frame/s. Click to:



Switch to the **Alignment** tab. Add a frame for every alignment marker. Move the frame to the alignment marker and change its size until the entire marker is inside the frame. The two color beams now will indicate how good the marker is suited and how good it can be retrieved in its immediate environment. If both color beams are in their green area, the setting is saved by a click to the **Apply pattern** button.

Next, switch to the **Marks** tab. In order to add a new frame, click the  button. The automatically generated frame can be positioned and altered with the mouse. A new frame can also be spanned directly at the desired position, with the mouse and the Shift key held down. In the **Result** area, the PlugIn now proposes, in the **Percent code** box, a name for the selected field. You can keep this name, or enter a name of your own choice that will make more sense. Please obey the rules for names of variables or Percent codes.

For defining further frames, please repeat the above process.

Finally, you can check your setup – switch to the **Test** tab and load another image. The results from the optical marks recognition (OMR) will then be displayed in a tree view. Should it be necessary to correct the settings, you can again switch to the tabs for **Marks** and **Alignment**. There, you can alter and correct your settings and can immediately switch back to the **Test** tab. The OMR will be executed automatically with the new parameters, and the new result is displayed in the tree view.

This completes the definition phase.

Usage of the OMR Results

The OMR results can be used in the process by using the contents of the defined variables. So, for example, the results can be written into a Protocol File.

Example: The original sheet has three rows with five boxes each. The variables are defined accordingly as $\%(RxMy)$, where R is the row, the x stands for the number of the row, M means the mark, and the following y stands for the position of the mark in the relative row.

The Protocol File is defined in the Class definition as follows:

```
[03]%F
[03]Line1: %(R1M1)/%(R1M2)/%(R1M3)/%(R1M4)/%(R1M5)
[03]Line2: %(R2M1)/%(R2M2)/%(R2M3)/%(R2M4)/%(R2M5)
[03]Line3: %(R3M1)/%(R3M2)/%(R3M3)/%(R3M4)/%(R3M5)
```

Then, the Protocol File of our examples contains:

```
C:\SCAN\154054.124\00000000.TIF
Line1: 2/1/1/1/1
Line2: 1/1/2/1/1
Line3: 1/1/2/1/1
```


The result makes clear that - in the first line - the first group element and - in lines #2 and #3 – the third group element each is marked. As no 0 exists in the Protocol File, all check boxes were found.

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